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Digital, Vax, DCM/TCM, Encore, Bell Esssys 1977-1983

1.4 M words, *K pages, 5.7 MBytes

GBell 10/11/76 10/20/77

Name: FILE , # of Docs: 63, Blocks left: 38 (of 627)

Number	Name	Created	Modified	Size	Version	Last	Total
1		10/11/76	5/02/85 0:48	5	85	0:00	0:00
2	Stratton Mountain	10/11/76	10/11/76 11:05	6	1	0:00	0:00
3	Memory Hierarchies	10/11/76	10/12/76 2:31	5	2	0:00	0:00
4	Jega/Pulsar	10/11/76	10/12/76 2:31	2	2	0:00	0:00
5	Memory Hierarchy Costs	10/12/76	10/12/76 2:30	3	2	0:00	0:00
6	information/Microfilm	10/12/76	10/12/76 2:30	2	2	0:00	0:00
7	Extra Code	10/12/76	0/00/00 0:00	4	3	0:00	0:00
8	Visit/DiGuino	10/12/76	10/12/76 2:29	4	3	0:00	0:00
9	Eliashaoul/Model	10/12/76	10/12/76 2:28	2	2	0:00	0:00
10	Grant's Comments	10/12/76	10/12/76 2:28	3	2	0:00	0:00
11	Translation/Macro Code ..	10/12/76	10/12/76 2:27	3	2	0:00	0:00
12	Hardware/Software Activity ..	10/12/76	11/03/76 0:34	6	2	0:00	0:00
13	Classical Symmetric Multis ..	10/12/76	10/12/76 2:26	2	2	0:00	0:00
14	Microfilm Indexing ..	10/12/76	10/12/76 2:26	11	2	0:00	0:00
15	Fixed Applications ..	10/12/76	10/12/76 2:26	5	2	0:00	0:00
16	DECUS ..	10/12/76	10/12/76 2:01	4	1	0:00	0:00
17	Stone ..	10/12/76	10/12/76 2:25	8	2	0:00	0:00
18	Disk Controllers ..	10/12/76	10/12/76 2:25	3	3	0:00	0:00
19	Comm Products ..	10/12/76	10/12/76 2:02	5	1	0:00	0:00
20	Language Support ..	10/12/76	10/12/76 2:03	5	1	0:00	0:00
21	Nicoud Small System Activities	10/12/76	10/12/76 2:24	4	2	0:00	0:00
22	NATO Summer School ..	10/12/76	10/12/76 2:23	8	3	0:00	0:00
23	Peripheral Buy Out ..	10/12/76	10/12/76 2:04	5	1	0:00	0:00
24	Time Scale ..	10/12/76	10/12/76 2:19	3	1	0:00	0:00
25	CAD ..	10/12/76	10/12/76 2:19	5	1	0:00	0:00
26	Low End ..	10/12/76	10/12/76 2:19	14	2	0:00	0:00
27	Jungle Meeting Schedule ..	10/12/76	10/15/76 12:07	4	3	0:00	0:00
28	Data Tablets ..	10/15/76	10/15/76 11:55	4	1	0:00	0:00
29	Abstract ..	10/15/76	10/15/76 11:55	2	1	0:00	0:00
30	Update Index ..	10/15/76	3/17/80 12:12	4	2	0:00	0:00
31	F-11 Review ..	10/25/76	10/25/76 11:28	3	1	0:00	0:00
32	Allegheny ..	10/25/76	10/25/76 11:30	4	1	0:00	0:00
33	Market Maturity vs Geography ..	10/25/76	6/30/77 12:01	5	4	0:00	0:00
34	Intel Visit ..	11/16/76	11/16/76 11:19	14	1	0:00	0:00
35	LDP Review Schedule ..	11/16/76	6/30/77 12:01	3	2	0:00	0:00
36	Don McCoy ..	11/16/76	11/16/76 11:22	10	1	0:00	0:00
37	Consultants ..	11/16/76	6/30/77 12:00	9	2	0:00	0:00
38	Intel 16 Bitter ..	11/16/76	6/30/77 12:00	5	2	0:00	0:00
39	Computer Conferencing ..	11/16/76	6/30/77 12:00	9	2	0:00	0:00

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40  SRI Visit ..                                    11/16/76 11/16/76 11:24  8    1     0:00   0:00
41  Xerox ..                                        11/16/76 11/16/76 11:25  6    1     0:00   0:00
42  1977 Jungle Meetings ..                         11/16/76 11/16/76 11:28  5    1     0:00   0:00
43  Q1 Report ..                                    11/16/76 11/16/76 11:30  8    1     0:00   0:00
44  T-11 ..                                         11/16/76  6/30/77 11:59  7    2     0:00   0:00
45  Understanding Marketplace ..                    12/02/76  6/30/77 11:59  5    2     0:00   0:00
46  CMOS-8, 8080, LSI-11, F-11, T-1112/02/76  6/30/77 11:59  5    2     0:00   0:00
47  LDP Review Team Conclusions ..                  12/02/76 12/02/76 10:05  7    1     0:00   0:00
48  LDP-Future Computing in LAB ..                  12/02/76  6/30/77 11:59  25   3     0:00   0:00
49  Standard Office Copiers ..                      12/17/76 12/17/76  2:00  8    1     0:00   0:00
50  FY77 ..                                         12/17/76  6/30/77 11:58  7    2     0:00   0:00
51  FY78 ..                                         12/17/76  6/30/77 11:58  5    2     0:00   0:00
52  DCG Engineering Plan Discussion 12/17/76  6/30/77 11:58  15   4     0:00   0:00
53  Harold Stone/Bruce Arden ..                     12/17/76 12/17/76  2:05  18   1     0:00   0:00
54  National Science Foundation Rep  12/17/76 12/17/76  2:06  7    1     0:00   0:00
55  R&D Organizat Change/Charter ..                  12/17/76  6/30/77 11:58  5    2     0:00   0:00
56  VAX Marketing Group ..                           1/14/77  6/30/77 11:54  3    3     0:00   0:00
57  Computer Names Problem ..                        1/14/77  6/30/77 11:58  7    2     0:00   0:00
58  FY77 Budget Overrun-Concerns ..                  1/14/77  6/30/77 11:57  10   2     0:00   0:00
59  proposed ANSI BSR X3.67 spec ..                  9/08/77  9/08/77 13:52  67   1     0:00   0:00
60  Dertouzos ..                                     9/08/77  9/08/77 14:27  13   1     0:00   0:00
61  cmu interview--10/77 ..                         10/20/77 10/26/77  0:44  51   8     0:03   0:03
62  taxx ..                                         10/20/77 10/21/77  9:52  10   5     0:00   0:00
63  Index from CI/FILE ..                            3/29/78  3/29/78  2:23  20   1     0:00   0:001977
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GB Personal 3/09/77
Name: GBELL , # of Docs: 6, Blocks left: 526 (of 627)
-------------------------------------------------------------------------------
Number  Name     Created  Modified    Size Version  Last   Total
-------------------------------------------------------------------------------
 1                                 3/09/77  9/27/83  6:24  1    11    0:00   0:00
 2  publication/history index      3/09/77  5/04/77  3:00  30    9  0:00   0:00
 3  office file index              3/09/77  3/09/77 10:22  32    2  0:00   0:00
 4  bell vita-long                 4/29/77  2/05/79 11:07  24    8  0:01   0:04
 5  bell vita - 3/4 page           7/22/77  7/22/77  2:25  4     1  0:00   0:00
 6  Index from CI/GBELL            3/29/78  3/29/78  2:29  3     1  0:00   0:00
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GB Paper CACM CMU 3/24/77
Name: REPORT, # of Docs: 10, Blocks left: 305 (of 627)
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Number  Name     Created  Modified    Size Version  Last   Total
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 1                                 0/00/00  0/00/00  0:49  1    31    0:00   0:00
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2	cacm operating system sec 4	3/24/77	8/22/77 13:38	61	26	0:00	0:00
4	cmu lecture side 1	2/28/77	3/02/77 2:25	40	7	0:00	0:00
5	cmu lecture side 2	3/01/77	3/03/77 8:45	42	5	0:00	0:00
6	cmu lecture side 3	3/01/77	3/03/77 9:12	23	4	0:00	0:00
7	cacm hardware sec 5	3/15/77	8/22/77 13:43	46	19	0:00	0:00
8	cacm introduction sec 1	3/15/77	8/22/77 13:31	29	35	0:00	0:00
9	cacm isp sec 2	3/15/77	8/22/77 13:33	38	34	0:00	0:00
10	cacm pms sec 3	3/15/77	8/22/77 13:36	31	27	0:00	0:00
11	apology to reviewers	3/24/77	3/24/77 10:57	1	2	0:00	0:00

1978

GBell Papers 1/13/78

Name: SKT,$#, # of Docs: 6, Blocks left: 219 (of 627)

Number	Name	Created	Modified	Size	Version	Last	Total
1		0/00/00	3/29/78 2:36	1	33	0:00	0:00
2	Essay 1	0/00/00	1/13/78 8:50	140	58	0:00	0:00
3	List of Figures	10/29/76	5/12/77 12:55	3	4	0:00	0:00
4	The Marketplace	5/12/77	1/23/78 12:41	214	6	0:00	0:00
5	Essay 3	8/10/77	11/22/77 13:43	40	4	0:00	0:00
6	Index from CI/SKT,$#	3/29/78	3/29/78 2:36	3	1	0:00	0:00

Index 3/29/78

Name: INDEX , # of Docs: 3, Blocks left: 419 (of 627)

Number	Name	Created	Modified	Size	Version	Last	Total
1		7/25/78	3/29/78 3:00	1	22	0:00	0:00
2	Index from CI/INDEX	3/29/78	3/29/78 3:00	2	1	0:00	0:00
11	index.idx	7/27/78	7/27/78 6:29	202	3	0:54	0:54

Digital 4/26/78 7/06/78

Name: GORDON, # of Docs: 61, Blocks left: 128 (of 627)

Number	Name	Created	Modified	Size	Version	Last	Total
1		4/26/78	3/28/79 2:45	4	64	0:00	0:00
2	running 8's on 11's	4/26/78	4/28/78 10:48	2	2	0:02	0:04
3	high end vax-10s-20s-30s	4/26/78	4/28/78 10:52	4	4	0:01	0:05
4	rockwell/comm study	4/26/78	4/28/78 10:53	3	2	0:01	0:07
5	promo for vax/& ncc	4/26/78	4/28/78 10:59	4	2	0:05	0:12
6	esg marketplace	4/28/78	5/01/78 0:07	14	7	0:01	1:04

7	bus based chips/8086	5/01/78	5/02/78	4:35	14	6	0:01	1:08
8	sales offices impressions	5/01/78	5/12/78	1:55	44	9	0:03	2:23
9	icc bus	5/01/78	5/02/78	3:00	11	5	0:01	0:37
10	mccredie	5/01/78	5/02/78	2:11	6	5	0:02	0:26
11	comm/networks reorganization	5/01/78	5/02/78	4:32	15	6	0:00	0:39
12	traub/newell	5/01/78	5/02/78	11:32	11	6	0:00	0:35
13	phister	5/01/78	5/02/78	2:23	3	4	0:01	0:13
14	RAME goals and constraints	5/01/78	5/02/78	2:59	9	3	0:01	0:37
15	brooks	5/02/78	5/05/78	0:05	9	4	0:05	0:48
16	simulating computers	5/02/78	5/02/78	2:15	13	6	0:00	0:28
17	disk and crt area	5/03/78	7/05/78	11:20	3	3	0:01	0:05
18	next annual report	5/03/78	5/03/78	1:28	4	3	0:01	0:03
19	memory price disparity	5/08/78	5/10/78	10:36	4	4	0:01	0:08
20	terminals/11-based	5/08/78	5/10/78	10:48	12	5	0:04	0:38
21	system revenue 1980's	5/08/78	5/09/78	10:28	11	7	0:01	0:43
22	busses: help!	5/08/78	5/09/78	9:26	7	4	0:01	0:11
23	ood secretaries	5/11/78	6/01/78	9:33	2	3	0:02	0:22
24	technical director	5/12/78	5/16/78	2:31	6	4	0:01	0:29
25	hydra task force	5/12/78	5/12/78	1:32	3	1	0:10	0:10
26	sales support	5/12/78	5/15/78	9:21	4	4	0:02	0:05
27	cornell	5/15/78	5/16/78	2:32	2	2	0:01	0:10
28	slides	5/22/78	5/22/78	9:44	6	11	0:01	0:34
29	vax-11,11's,10's, vs 360/370	5/22/78	5/22/78	12:16	9	5	0:00	0:30
30	chu	5/23/78	5/23/78	10:03	2	1	0:05	0:05
31	portability/warterloo	5/26/78	5/31/78	1:01	10	6	0:09	1:02
32	fougere	5/31/78	6/01/78	9:00	3	2	0:00	0:05
33	pohlman	5/31/78	6/01/78	9:07	4	5	0:07	0:16
34	temp	5/31/78	7/06/78	2:28	2	4	0:00	0:09
35	mit program/demmer	6/19/78	6/19/78	14:04	3	4	0:01	0:05
36	budget cuts/physical changes	6/19/78	6/19/78	9:09	4	1	0:11	0:11
37	ROM/software	6/19/78	6/19/78	13:04	4	4	0:04	0:11
38	NCC attendees and supports	6/19/78	6/26/78	10:18	8	6	0:00	0:32
39	CAD strategy	6/19/78	6/19/78	11:58	4	2	0:02	0:07
40	8086-PDP-11 comparison	6/19/78	6/20/78	11:08	8	10	0:01	0:33
41	fortran	6/19/78	6/20/78	9:51	8	3	0:04	0:27
42	VLSI RAD Project	6/19/78	6/20/78	10:11	5	2	0:19	0:29
43	cca mail system	6/19/78	6/20/78	9:38	9	6	0:06	0:33
44	siewiorek	6/19/78	6/19/78	13:11	2	1	0:03	0:03
45	australian grants	6/20/78	6/20/78	10:59	2	3	0:00	0:03
46	computer engineering course	6/26/78	6/28/78	9:34	4	2	0:05	0:13
47	R80 and RL02	6/26/78	6/28/78	9:10	6	6	0:02	0:23
48	BLISS in Colorado	6/26/78	6/28/78	9:41	4	2	0:07	0:17
49	travel to colorado/teleconferencing	6/26/78	6/28/78	9:28	5	2	0:12	0:16
50	pickett	6/29/78	8/25/78	4:36	3	3	0:00	0:08

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51  typeset                                                 7/05/78  8/24/78  9:03  9    7  0:01   0:21
52  colorado/disk                                           7/05/78  8/24/78  9:02  14   7  0:01   0:28
53  esgwp                                                   7/05/78  7/17/78 10:34  19   7  0:00   0:23
54  org.changes                                             7/05/78  7/06/78  1:25  5    5  0:02   0:10
55  arvind                                                  7/05/78  7/06/78  2:24  3    4  0:06   0:18
56  hedges                                                  7/06/78  7/06/78  3:00  3    5  0:00   0:14
57  wecker                                                  7/06/78  7/06/78  3:01  2    2  0:00   0:04
58  engineering managers                                    7/06/78  7/06/78  2:34  21   4  0:01   0:01
59  karlstrom                                               7/06/78  7/06/78  3:00  2    3  0:01   0:07
60  dulchinos                                               7/06/78  7/06/78  2:48  2    1  0:04   0:04
61  Index from CI/GORDON                                    3/28/79  3/28/79  2:46  19   1  0:00   0:00


Digital TCM 6/28/78   4/06/83
Name: GB    , # of Docs: 12, Blocks left: 489 (of 627)
-------------------------------------------------------------------------------
Number  Name     Created  Modified    Size Version  Last   Total
-------------------------------------------------------------------------------
 1                                                      0/00/00  2/18/86  5:58  2    106   0:01   0:35
 2                                                      6/28/78  0/00/00  1:12  2    15    0:00   0:11
 3  terminal and terminal based sys alternatives (GB2.S7.11)       7/04/81  0/00/00  2:35  34   31    0:01
7:04
 4  COMPARATIVE MUSEUM STATISTICS--Gwen Museum          0/00/00  2/16/86  0:07  6    10    0:02   1:24
 5  PROCESS AND STRUCTURE OF M/E INTERFACE (GB2.S7.37   7/22/81  8/04/81 13:03  19   14    0:00   3:17
 6  venus DONE 11/81                                    0/00/00 10/18/82 10:15  12   15    0:01   2:07
 7  BELL-PORTNER CONTRACT (GB2.S7.12)                   0/00/00  0/00/00  0:08  7    23    0:04   1:51
 8  ENG FACTORY-SFT.ENG & PROD TECHNIQUES ON HRD ENG.(GB2.S7.36    7/22/81  8/04/81 13:08  17   13    0:01
3:14
 9  max mathews letter DONE 10/18/82 Mon 10:25          0/00/00 10/18/82 10:18  10   5  0:01   1:54
10  V2 slides for a 11/81 talk DONE 11/81               0/00/00 10/18/82 10:16  7    11    0:00   0:49
12  cluster, lan and wan def slides DONE 11/30/82 Tue 14:31       11/29/82 11/30/82 13:46  3    2  0:00
0:22
13  bi review                                           4/06/83  4/06/83  0:40  5    2  0:04   0:39


Digital 7/10/78
Name: LOUISE, # of Docs: 74, Blocks left: 47 (of 627)
-------------------------------------------------------------------------------
Number  Name     Created  Modified    Size Version  Last   Total
-------------------------------------------------------------------------------
 1                                                      7/10/78  5/02/85  0:48  4    106   0:00   0:03
 2  commission plan                                     7/10/78  7/10/78 13:36  7    5  0:00   0:14
 3  v11sys                                              7/10/78  7/10/78 12:50  8    4  0:01   0:10
```

4	chips	7/10/78	7/11/78	0:51	9	6	0:01	0:22
5	people	7/10/78	7/10/78	12:51	7	5	0:00	0:05
6	nds	7/10/78	7/10/78	12:52	6	4	0:01	0:15
7	info.arch	7/10/78	7/11/78	0:34	2	2	0:02	0:05
8	arpa/vlsi effort	7/10/78	7/11/78	0:31	4	4	0:01	0:09
9	toronto	7/10/78	7/10/78	12:52	2	3	0:00	0:05
10	cohen	7/10/78	7/12/78	14:00	6	5	0:01	0:36
11	8086	7/11/78	7/12/78	12:44	3	2	0:02	0:05
12	franklin	7/11/78	7/12/78	13:55	5	4	0:00	0:26
13	unibus/mini i/o	7/12/78	7/12/78	12:51	4	3	0:03	0:12
14	lindamood	7/13/78	7/13/78	11:45	8	8	0:00	0:32
15	labels form	7/14/78	7/14/78	12:50	1	2	0:01	0:01
16	OOD	7/14/78	10/23/78	5:08	1	6	0:00	0:01
17	mkt	7/14/78	7/14/78	12:10	1	2	0:00	0:00
18	plm	7/14/78	7/14/78	13:44	2	4	0:10	0:10
19	mj	8/01/78	8/14/78	2:56	11	5	0:01	0:35
20	temp	7/18/78	9/29/78	5:00	2	35	0:00	0:23
21	bell diary summer 78-Japan, Australia, Fiji	7/20/78	7/28/78	12:50	11	6	0:01	1:06
22	jones	7/20/78	7/21/78	3:00	2	2	0:00	0:04
23	flores	7/27/78	7/27/78	4:08	2	2	0:00	0:04
24	low power bipolar gate array	7/28/78	7/28/78	10:16	4	1	0:18	0:18
25	Fujitsu's M-200	7/28/78	1/24/79	3:11	6	5	0:00	0:14
26	commitment to nec	7/28/78	7/28/78	11:24	6	3	0:04	0:16
27	Bell Log II	7/28/78	10/12/78	11:11	84	21	0:00	6:54
28	smart/jones jobs	8/10/78	8/14/78	2:43	2	4	0:00	0:03
29	vms	8/14/78	1/24/79	3:10	3	4	0:00	0:08
30	clocks	8/14/78	8/15/78	10:00	4	3	0:03	0:19
31	rms	8/14/78	1/24/79	3:09	3	3	0:00	0:12
32	applications software	8/14/78	1/24/79	3:08	7	3	0:00	0:23
33	bad report	8/14/78	8/15/78	10:21	2	3	0:00	0:04
34	sony	8/14/78	8/15/78	9:54	6	4	0:08	0:23
35	kiviat graphs	8/15/78	8/15/78	12:52	2	1	0:04	0:04
36	nec	8/15/78	8/15/78	12:55	3	1	0:03	0:03
37	sight guide	8/15/78	8/15/78	12:59	3	1	0:04	0:04
38	cpu/system upgrades	8/15/78	8/23/78	0:35	3	2	0:01	0:06
39	rsts upgrade with vax	8/15/78	8/23/78	0:40	4	5	0:03	0:08
40	administrative unit	8/15/78	8/15/78	13:15	3	1	0:04	0:04
41	instructions	8/16/78	11/15/78	5:11	24	7	0:27	1:32
42	araki	8/17/78	8/17/78	13:00	2	3	0:00	0:07
43	SIGARCH list	8/17/78	8/17/78	10:13	4	1	0:41	0:41
44	first impressions--japan	8/22/78	2/01/79	3:27	67	15	0:00	4:08
45	dot matrix	9/06/78	1/24/79	3:07	3	3	0:00	0:06
46	abstract	9/06/78	9/14/78	12:05	5	9	0:00	0:29
47	corell/congratulations	9/06/78	1/24/79	3:02	6	6	0:01	0:36

48	iwama	9/06/78	9/11/78 9:03	3	5	0:01	0:19
49	far east mfg	9/06/78	9/08/78 10:39	9	7	0:01	0:26
50	jordan/wulf	9/06/78	9/08/78 11:47	5	3	0:00	0:12
51	external mfg go-away	9/06/78	1/24/79 3:05	4	3	0:00	0:26
52	japan trip diary index	9/06/78	10/12/78 11:13	11	9	0:01	0:36
53	COBOL specification	9/06/78	9/08/78 11:15	5	2	0:06	0:12
54	css controller for RL01	9/06/78	9/08/78 9:53	3	5	0:00	0:05
55	interaction with teradyne	9/13/78	9/15/78 11:50	4	4	0:01	0:24
56	goals/oc/new strategy	9/14/78	1/24/79 3:05	3	7	0:02	0:18
57	market domination	9/14/78	2/01/79 3:27	11	8	0:01	0:42
58	hamada	9/14/78	9/19/78 10:08	4	4	0:00	0:12
59	oc strategy presentation	9/15/78	9/17/78 13:36	6	7	0:03	0:26
60	floating point std	9/15/78	9/15/78 11:58	2	2	0:02	0:02
61	HSC50/NDS	9/15/78	9/17/78 13:32	3	3	0:01	0:09
62	rms/dcl compatibility	9/17/78	9/17/78 13:30	3	1	0:04	0:04
63	financial review	9/19/78	9/19/78 14:04	2	2	0:00	0:02
64	oc sec	9/20/78	9/20/78 8:52	3	2	0:01	0:02
65	slides dist	9/20/78	9/20/78 13:54	2	1	0:02	0:02
66	lou/mj/ohio	9/20/78	9/20/78 14:40	2	2	0:03	0:08
67	messages--9/21	9/21/78	9/21/78 14:39	6	1	0:16	0:16
68	messages 9/22	9/22/78	9/22/78 11:56	4	1	0:14	0:14
69	product managers memo	9/25/78	1/24/79 3:00	4	5	0:00	0:27
70	telephone 9/25	9/25/78	9/25/78 4:45	6	1	0:21	0:21
71	nsf workshop	9/29/78	9/29/78 2:21	6	2	0:22	0:22
72	melton	9/29/78	9/29/78 3:32	2	1	0:06	0:06
73	code listing	10/24/78	10/24/78 14:50	6	1	0:00	0:00
74	Index from CI/LOUISE	3/28/79	3/28/79 2:40	22	1	0:00	0:00

GBell Digital Slides 9/12/78
Name: SLIDES, # of Docs: 59, Blocks left: 284 (of 627)

Number	Name	Created	Modified	Size	Version	Last	Total
1		9/12/78	11/08/79 10:13	6	70	0:04	0:06
2	problem/eng.spending	9/12/78	9/12/78 15:43	3	2	0:00	0:00
3	market/product goals	9/12/78	7/08/80 11:23	3	2	0:00	0:01
4	premises/considerations	9/12/78	9/12/78 14:43	3	2	0:03	0:03
5	message 10/20	9/12/78	9/12/78 14:48	4	4	0:04	0:05
6	eight	9/12/78	9/12/78 14:58	2	3	0:01	0:05
7	micros-11	9/12/78	9/12/78 14:57	3	1	0:07	0:07
8	vax-11	9/12/78	9/12/78 0:30	2	4	0:00	0:02
9	unibus 11	9/12/78	9/12/78 0:31	3	4	0:01	0:08
10	viewgraph list	9/13/78	7/08/80 11:24	7	15	0:01	0:50

11	basic cpu/slide 1	9/13/78	9/15/78	9:28	7	5	0:01	0:22
12	basic software	9/13/78	9/13/78	9:32	5	1	0:11	0:11
13	storage	9/13/78	9/13/78	9:39	3	1	0:07	0:07
14	"gets" and cancel	9/13/78	9/14/78	12:35	6	4	0:01	0:20
15	slides--product strategy (81-82)	10/12/78	11/13/78	1:07	12	13	0:00	0:41
16	strategy to oc 12/11	12/09/78	12/18/78	0:04	10	5	0:00	0:27
17	HARDWARE/SOFTWARE SALES BY ARCH	12/09/78	12/09/78	1:09	10	6	0:01	0:27
18	hrdwr/sftwr sales by layer	12/09/78	12/09/78	3:32	10	4	0:00	0:18
19	software sales	12/09/78	12/09/78	1:30	10	2	0:18	0:19
20	memory sales	12/09/78	12/09/78	1:44	10	2	0:13	0:13
21	terminal sales	12/09/78	12/09/78	3:44	10	5	0:00	0:15
22	DEV INVESTMENT BY ARCHITECTURE	12/09/78	7/08/80	11:22	10	4	0:01	0:22
23	DEVELOPMENT INVESTMENT BY LAYER	12/09/78	7/08/80	11:22	12	5	0:00	0:23
24	development investment by architecture	12/09/78	12/09/78	3:37	10	2	0:01	0:17
25	strategy similar to ibm/1964-360	12/11/78	12/11/78	9:25	4	3	0:02	0:19
26	PRODUCT STRAGETY	12/11/78	7/08/80	11:21	6	9	0:00	0:25
27	(HOW) WIN AGAINST IBM	12/11/78	12/11/78	9:29	4	2	0:04	0:11
28	SOME STANDARDS QUESTIONS/SLIDES	2/07/79	2/13/79	12:11	2	7	0:03	0:12
29	INDUSTRIES INVOLVED IN (INCREASED) INFORMATION PROCESSING/SLIDES	2/07/79	2/07/79	12:01	2	3	0:00	0:07
30	LIMITS TO MICROSTRUCTURES/SLIDES	2/07/79	2/13/79	12:08	2	2	0:01	0:04
31	APPLICATIONS PROGRAMS POSSIBILITIES/SLIDES	2/07/79	2/07/79	12:06	4	2	0:00	0:18
32	DISCIPLINE AND ENVIRONMENT DEPENDENT/SLIDES	2/07/79	2/07/79	11:25	3	1	0:06	0:06
33	COMPUTERS ONLY THEME SUPPLEMENT (AND SUPPLANT)/SLIDES	2/07/79	2/13/79	12:06	2	6	0:01	0:13
34	Q1-Q5/SLIDES	2/07/79	2/07/79	17:12	4	5	0:00	0:15
35	COMMERCIAL PRODUCT PHILOSOPHY/MARCUS-CADY/SLIDES	2/08/79	2/08/79	13:35	2	2	0:01	0:06
36	COMMERCIAL PRODUCT PHILOSOPHY-B/MARCUS-CADY/SLIDES	2/08/79	2/08/79	13:31	2	4	0:00	0:04
37	COMMERCIAL PRODUCT PHILOSOPHY-C/MARCUS-CADY/SLIDES	2/08/79	2/08/79	13:40	4	3	0:01	0:06
38	COST* FOR VARIOUS MAIL SYSTEMS/SLIDES	2/13/79	2/13/79	12:22	2	3	0:01	0:08
39	PAPER COSTS (LAST 10 YEARS)/SLIDES	2/13/79	2/13/79	12:44	2	3	0:00	0:03
40	COMMUNICATIONS COSTS/SLIDES	2/13/79	2/13/79	12:37	3	3	0:00	0:07
41	BPO'S VIEWDATA/SLIDES	2/20/79	2/20/79	6:02	1	2	0:01	0:06
42	TECHNOLOGY PROGRESS/SLIDES	2/20/79	2/21/79	1:06	3	2	0:03	0:09
43	AT&T'S ADVANCED COMMUNICATIONS SERVICE (ACS)/SLIDES	2/20/79	2/20/79	6:26	2	1	0:03	0:03
44	FORMS OF PARALLELISM/SLIDES	2/20/79	2/21/79	1:02	1	2	0:07	0:10
45	SINGLE SITE PARALLELISM/SLIDES	2/20/79	2/21/79	0:53	3	2	0:02	0:06
46	WHY MULTIPROCESSORS HAVEN'T EMERGED YET/SLIDES	2/20/79	2/21/79	0:46	2	2	0:02	0:06
47	GROSCH'S LAW COULD HOLD/SLIDES	2/20/79	2/21/79	0:43	3	5	0:00	0:30
48	COSTS TO USE A COMPUTER/SLIDES	2/20/79	2/21/79	1:11	4	3	0:04	0:11
49	BASIC MODEL (1973) BIST/DIE/SLIDES	2/20/79	2/21/79	1:12	4	3	0:01	0:12
50	MANY WAYS TO DO INFORMATION STORAGE AND PROCESSING/SLIDES	2/20/79	2/21/79	1:13	2	2	0:00	0:02
51	THREE MULTIPROCESSOR COMPUTERS STRUCTURES/SLIDES	2/20/79	4/22/80	11:33	2	8	0:00	0:07
52	WHY COMPUTERS EVOLVE RAPIDLY/SLIDES	3/01/79	4/22/80	11:34	2	3	0:00	0:08

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53  BASIC INTERCOMMUNICATION (UNIBUS)/SLIDES           3/01/79  4/22/80 11:34  5    3  0:00   0:15
54  Index from CI/SLIDES                               4/04/79 11/14/79  8:58  20   5  0:00   0:00
55  VAX/VMS COMPUTING ENVIRONMENT FOR 80'S/90'S/36-BIT STMNT/OC/SLIDES   4/11/79  4/17/79  0:40  2    10
0:01   0:11
56  JAPAN TALK/DARTMOUTH/SLIDES                        4/13/79  4/13/79 14:21  9    10    0:00   1:60
57  DISTRIBUTED CROSSING SLIDE/SLIDES                 10/17/79  4/22/80 11:34  2    5  0:00   0:23
58  DP TALK SLIDES/SLIDES                             10/23/79  4/22/80 11:33  3    2  0:00   0:00
59  DISTRIBUTED PROCESSING TALK SLIDES/SLIDES         11/08/79  4/22/80 11:32  5    7  0:00   0:08



GBell Talk Abstracts 9/14/78
Name: TALKS , # of Docs: 13, Blocks left: 566 (of 627)
-------------------------------------------------------------------------------
Number  Name     Created  Modified    Size Version  Last   Total
-------------------------------------------------------------------------------
 1                                                 9/14/78  2/20/80 16:25  2    27    0:01   0:12
 2  ABSTRACT LIST /TALKS ,                         9/14/78  1/30/79 16:41  6    21    0:00   1:46
 3  VITA - 1 PAGE, UPDATED 2/22/79  /TALKS ,       2/22/79  3/23/79  0:44  4    2  0:01   0:12
 4  ABSTRACT--JAPANESE DISTRIBUTORS/CONCERN FOR COMPUTERS (LONG)/TALKS ,      9/14/78  2/22/79  0:13  5
6  0:00   0:01
 5  ABSTRACT LIST FORM  /TALKS ,                   9/14/78  4/25/80  2:15  1    5  0:00   0:05
 6  ABSTRACT LIST SPEC /TALKS ,                    9/14/78  9/14/78 12:11  1    1  0:00   0:00
 7  RESULT /TALKS ,                                9/14/78  9/14/78 16:03  6    9  0:00   0:01
 8  ABSTRACT--PDP-11 FAMILY & VAX 11/780 /TALKS ,  9/14/78  3/24/80  8:23  3    2  0:02   0:02
 9  TALK LIST (WITH NOTES ONLY) /TALKS ,           9/14/78  1/22/79 15:08  5    8  0:01   1:30
10  ABSTRACT--MINICOMPUTER ARCHITECTURE /TALKS ,   9/14/78  1/19/79  1:50  3    2  0:01   0:01
11  ABSTRACT--DISTRIBUTED PROCESSING/LIMITS TO ITS GROWTH /TALKS ,      1/19/79  4/25/80  2:03  4    7
0:00   0:07
12  ABSTRACT--JAPAN HAS TURNED US INTO DISTRIBUTORSHIP(SHORT)/TALKS ,    2/01/79  2/22/79  0:13  2    7
0:00   0:22
13  Index from CI/TALKS                            4/17/79  5/16/79  2:35  6    2  0:00   0:00


Digital 10/06/78
Name: LOUISE, # of Docs: 64, Blocks left: 53 (of 627)
-------------------------------------------------------------------------------
Number  Name     Created  Modified    Size Version  Last   Total
-------------------------------------------------------------------------------
 1                                                10/06/78  3/28/79  2:25  4    101   0:00   0:01
 2  resale of modems                              10/06/78  1/24/79  3:20  5    10    0:00   0:25
 3  LDP user's perspective                        10/06/78 10/10/78  9:23  15   11    0:00   1:13
 4  kruth                                         10/06/78 10/16/78  9:20  2    5  0:00   0:06
 5  idea on the 2020                              10/06/78  1/24/79  3:20  5    7  0:00   0:17
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6	boyd	10/06/78	10/10/78	9:26	2	3	0:00	0:08
7	patterson/NCAR	10/06/78	10/10/78	12:00	4	4	0:00	0:23
8	harper	10/06/78	10/10/78	10:54	3	3	0:06	0:12
9	vatche	10/06/78	10/10/78	9:57	5	5	0:01	0:20
10	low cost alphanumeric terminal	10/06/78	1/24/79	3:19	10	7	0:01	0:33
11	publication/comm in Japanese	10/06/78	2/01/79	3:21	4	3	0:00	0:08
12	Index from CI/LOUISE	3/28/79	3/28/79	2:26	19	1	0:00	0:00
13	richard watson LLL visit	10/10/78	10/16/78	9:32	3	2	0:01	0:08
14	cox	10/10/78	10/16/78	9:36	2	2	0:00	0:02
15	Baud/9600 is coming in terminals	10/10/78	1/24/79	3:17	4	4	0:00	0:07
16	plowman/software report	10/10/78	10/10/78	14:24	2	1	0:01	0:01
17	MSR11	10/10/78	3/26/80	11:53	2	2	0:00	0:02
18	basic strategy	10/16/78	0/00/00	1:15	18	9	0:01	1:02
19	lsivax	10/16/78	10/18/78	11:00	11	2	0:05	0:25
20	ocsp's	10/16/78	10/18/78	10:54	14	6	0:03	0:20
21	VAX/10/20 comparison	10/16/78	10/26/78	0:30	7	8	0:01	0:50
22	how fast can software be built	10/16/78	10/26/78	0:32	6	8	0:01	0:32
23	VAX-11	10/16/78	10/18/78	10:23	5	2	0:05	0:11
24	pascal/vax	10/16/78	10/18/78	11:23	2	2	0:01	0:04
25	arpa net	10/19/78	10/19/78	1:34	2	2	0:00	0:05
26	large systems strategy team	10/20/78	10/20/78	14:39	13	15	0:02	0:46
27	managers list	10/20/78	10/20/78	10:50	21	3	0:02	0:02
28	tape	10/20/78	10/23/78	6:06	66	4	0:40	3:11
29	thanks for talk	10/23/78	10/24/78	0:38	3	3	0:04	0:11
30	Grosch	10/23/78	10/23/78	2:13	13	1	0:01	0:01
31	Bill Johnson list	10/23/78	10/24/78	0:31	6	3	0:00	0:00
32	blum	10/24/78	11/20/78	11:01	4	7	0:01	0:26
33	ems dist list	10/24/78	10/27/78	0:19	4	3	0:00	0:11
34	tedhelp	10/25/78	10/30/78	1:14	6	5	0:00	0:41
35	CEcourse	10/25/78	10/30/78	1:17	5	5	0:01	0:24
36	cover	11/01/78	11/01/78	0:49	2	1	0:02	0:02
37	new cis & cobol on 10	10/30/78	10/30/78	6:28	2	2	0:02	0:07
38	rationale -- basic strategy	10/30/78	2/05/79	12:04	32	20	0:02	2:53
39	disks	10/30/78	10/31/78	1:18	14	3	0:14	0:17
40	ibm	10/30/78	10/31/78	0:56	8	4	0:03	0:05
41	lsicrit	10/30/78	10/30/78	2:30	12	5	0:17	0:19
42	blues	10/30/78	10/31/78	1:40	9	5	0:21	0:29
43	shoebox I,II,III products	11/02/78	1/24/79	3:15	2	2	0:00	0:01
44	sangster	11/02/78	3/13/79	3:50	2	3	0:00	0:10
45	ts04	11/03/78	11/03/78	4:56	5	5	0:01	0:17
46	basic product strategy	0/00/00	3/26/80	11:03	38	26	0:05	2:30
47	decus attendance/participation	11/06/78	11/10/78	11:10	5	5	0:00	0:07
48	sutherland	11/06/78	11/07/78	12:48	2	2	0:02	0:09
49	vax dmt, when?	11/07/78	11/07/78	12:03	3	1	0:14	0:14

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50  capabilities vs rings                               11/07/78 11/07/78 12:38  2    1  0:03   0:03
51  not emulating 360/370                               11/08/78 11/09/78  3:26  5    5  0:00   0:04
55  common bliss                                        11/13/78 11/13/78  3:17  4    3  0:01   0:17
58  oodprob                                             11/15/78 11/16/78  3:10  6    5  0:01   0:05
59  trax                                                11/15/78 11/16/78  3:12  3    4  0:00   0:04
60  unbundle                                            11/15/78 11/16/78  3:13  6    4  0:00   0:04
61  displays                                            11/15/78 11/16/78  3:17  5    3  0:03   0:09
62  budget/redbook                                      11/16/78 11/16/78  6:46  9    1  0:18   0:18
63  vms size/new goal                                   11/17/78 11/20/78  9:39  9    4  0:12   0:40
64  extending vax architecture for cobol                11/17/78 11/20/78  9:50  4    2  0:06   0:08
65  lcg funds                                           11/20/78 11/21/78 10:23  5    4  0:01   0:37
66  minnow, no/dolphin 10/20 vax sooner                 11/20/78 11/21/78 10:27  4    3  0:03   0:16
68  puffer FY80 memo to ood                             11/22/78 11/22/78  4:40  6    9  0:01   0:30
69  vrablik                                             11/22/78 11/22/78  4:47  5    5  0:00   0:12
70  vt162 and friends                                   11/22/78 11/22/78  4:44  4    2  0:01   0:05
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GBell Social 10/25/78
Name: SOCIAL, # of Docs: 9, Blocks left: 584 (of 627)
--------------------------------------------------------------------------------
Number  Name     Created  Modified    Size Version  Last   Total
--------------------------------------------------------------------------------
 1                                                  10/25/78  4/17/79  6:13  1    9  0:02   0:02
 2  entertainment list                              10/25/78 12/05/78  0:57  20   7  0:01   0:32
 3  spec entertainment                              10/25/78 10/26/78  2:05  1    4  0:02   0:03
 4  entertainment form/all functions                10/25/78 10/26/78  0:11  1    2  0:00   0:00
 5  entertainment form names only                   10/25/78 10/25/78  8:32  1    1  0:00   0:00
 6  entertainment form--who's coming                10/26/78 10/26/78  2:13  1    5  0:01   0:05
 7  results                                         10/26/78 10/26/78  2:10  3    8  0:03   0:05
 8  restaurant guide                                11/28/78 11/28/78 16:54  2    1  0:05   0:05
 9  INDEX FROM CI/SOCIAL                             4/17/79  5/16/79  2:28  4    2  0:00   0:00
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Digital Museum 11/27/78  3/28/79
Name: DOCNO7, # of Docs: 81, Blocks left: 59 (of 627)
--------------------------------------------------------------------------------
Number  Name     Created  Modified    Size Version  Last   Total
--------------------------------------------------------------------------------
 1                                                  11/27/78  3/28/79  2:11  5    101   0:01   0:03
 2  nsf microstructures conference                  11/27/78 11/27/78 14:07  25   6  0:01   1:00
 3  TEX                                             11/27/78  1/30/79 12:35  10   7  0:00   0:28
 4  ARPA/interconnect                               11/27/78 11/28/78 11:52  9    2  0:05   0:32
 5  Tops 20,30-bit address                          11/27/78 11/28/78 11:53  5    2  0:01   0:08
 6  VAX and Fortran                                 11/27/78  1/25/79 12:36  8    3  0:00   0:17
 7  ECL power supply                                11/27/78 11/27/78 13:45  4    2  0:01   0:05
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8	tom mcwilliams/vax-on-a-chip	11/27/78	1/30/79	12:34	5	3	0:01	0:07
9	nelson	11/27/78	11/28/78	12:46	2	2	0:00	0:03
10	nsf evaluation	11/29/78	11/29/78	14:07	2	1	0:18	0:18
11	tapes/6250 (via TU78)	12/04/78	12/05/78	1:35	3	3	0:02	0:13
12	dbms-11 user	12/04/78	1/11/79	11:37	3	4	0:00	0:06
13	review of all future terminals	12/04/78	12/05/78	1:32	3	2	0:05	0:08
14	Stanford 2060 grant	12/04/78	12/05/78	1:44	5	2	0:09	0:18
15	knuth	12/04/78	1/30/79	12:32	6	10	0:00	0:56
16	craig	12/05/78	12/29/78	1:53	5	7	0:00	0:34
17	temp	12/06/78	1/18/78	0:33	3	21	0:01	0:14
18	plm	12/06/78	12/06/78	9:03	2	2	0:00	0:00
19	extended pdp-11 instructions	12/06/78	12/08/78	1:42	6	4	0:03	0:18
20	PMS Architecture of VAX	12/06/78	1/25/79	12:36	5	5	0:00	0:19
21	recession	12/07/78	12/08/78	2:57	6	6	0:03	0:15
22	alden/doriot/janzen--essay	12/07/78	12/08/78	2:16	5	3	0:00	0:29
23	noyce	12/07/78	1/30/79	12:31	2	4	0:00	0:05
24	comet review	12/08/78	12/11/78	12:03	5	4	0:03	0:08
25	workbench on VAX	12/08/78	1/25/79	12:34	3	5	0:00	0:04
26	forms languages	12/08/78	12/11/78	12:17	4	3	0:00	0:11
27	computer business news	12/08/78	12/08/78	2:42	2	3	0:03	0:03
28	mccormick	12/11/78	1/11/79	10:22	4	4	0:00	0:07
29	toby	12/11/78	12/12/78	9:43	19	7	0:12	0:43
30	fall decus	12/11/78	12/21/78	0:58	9	7	0:00	0:28
31	decus attendance quotas & control	12/11/78	12/12/78	10:00	7	5	0:00	0:14
32	lassiter	12/11/78	1/10/79	11:34	2	4	0:00	0:05
33	goldenbee	12/11/78	12/12/78	10:25	2	2	0:00	0:03
34	eliminating fa&t	12/12/78	12/14/78	9:07	5	5	0:13	0:36
35	f/u notice	12/13/78	12/13/78	8:44	2	1	0:03	0:03
36	hydra	12/14/78	12/15/78	8:47	4	3	0:09	0:13
37	lsi	12/15/78	12/19/78	2:38	6	4	0:06	0:14
38	strategy & EDP & Mfg/breadboard	12/15/78	12/19/78	2:29	6	3	0:11	0:21
39	learning/acquiring TEX	12/15/78	12/19/78	2:31	6	5	0:00	0:28
40	dibol8-11	12/15/78	12/19/78	2:41	4	2	0:02	0:06
41	rx02 on pdt	12/19/78	12/19/78	2:46	3	2	0:00	0:03
42	DEcd standard busses	12/19/78	12/20/78	1:22	10	10	0:01	0:27
43	KL10's	12/19/78	12/19/78	2:51	7	4	0:01	0:22
44	zaks	12/19/78	12/19/78	2:52	2	2	0:00	0:07
45	rodgers	12/19/78	12/19/78	2:59	3	3	0:01	0:09
46	second memo fall DECUS	12/21/78	12/21/78	5:41	9	6	0:00	0:06
47	bit map terminal	12/28/78	12/29/78	1:58	2	2	0:00	0:02
48	problem list	12/28/78	12/29/78	1:05	10	5	0:02	0:24
49	couplers/modems/terminals	1/03/79	1/08/79	13:31	11	3	0:09	0:35
50	our OS:tree?	1/03/79	1/03/79	10:22	14	2	0:55	0:55
51	comments/att acs and us	1/03/79	1/08/79	13:44	10	5	0:02	0:26

52	vanroekens	1/03/79	1/03/79	11:36	2	1	0:01	0:01
53	horowitz	1/04/79	1/05/79	9:13	5	2	0:02	0:26
54	ortegren	1/04/79	3/20/79	9:34	2	4	0:01	1:03
55	low end comments	1/04/79	1/08/79	14:13	6	2	0:29	0:35
56	pusart--status?	1/04/79	1/05/79	8:52	4	3	0:05	0:11
57	museum update/fujitsu	1/08/79	1/15/79	8:55	8	2	0:00	0:13
58	kapoor	1/08/79	1/09/79	6:00	2	2	0:01	0:10
59	hp	1/08/79	1/09/79	0:57	5	5	0:09	0:22
60	palais	1/08/79	1/09/79	5:59	4	2	0:01	0:13
61	fonz	1/08/79	1/08/79	11:41	8	5	0:01	0:20
62	vms	1/08/79	1/08/79	11:12	9	6	0:02	0:23
63	gb	1/08/79	1/09/79	5:57	8	4	0:04	0:05
64	comments on cornell contribution	1/08/79	1/11/79	10:15	6	3	0:01	0:17
65	datamation software survey 1978	1/09/79	1/10/79	14:30	5	2	0:04	0:10
66	bill hogan	1/09/79	1/09/79	5:44	4	4	0:01	0:03
67	dolphin and venus	1/09/79	1/10/79	14:25	6	4	0:14	0:21
68	req. for data	1/09/79	1/31/79	11:21	13	6	0:01	0:24
69	follow up notice	1/11/79	1/25/79	12:44	5	3	0:01	0:06
70	Index from CI/DOCNO7	3/28/79	3/28/79	2:12	24	1	0:00	0:00
71	gb memo-graphics	1/15/79	1/25/79	11:11	9	7	0:01	0:30
72	engterm	1/15/79	1/25/79	12:35	5	6	0:01	0:10
73	harvard	1/15/79	1/17/79	12:28	7	3	0:06	0:14
74	lllbasic	1/15/79	1/17/79	12:03	5	4	0:02	0:08
75	royalty	1/15/79	1/16/79	9:18	5	3	0:06	0:14
76	brochure	1/15/79	1/16/79	9:37	6	3	0:12	0:16
77	monthly	1/15/79	1/16/79	9:44	5	5	0:01	0:06
78	max	1/15/79	1/16/79	9:12	3	3	0:00	0:02
79	gb memo-museum	1/15/79	1/15/79	10:21	7	2	0:07	0:07
80	nsf comments	1/15/79	1/19/79	0:30	8	7	0:01	1:01
81	christiansen	1/15/79	1/15/79	13:48	1	1	0:01	0:01

1979
Digital 1/16/79 3/28/79
Name: DOCNO8, # of Docs: 27, Blocks left: 487 (of 627)

Number	Name	Created	Modified		Size	Version	Last	Total
1				2:05	3	43	0:00	0:03
2	blake	1/16/79	1/17/79	12:39	2	5	0:00	0:06
3	gus ashton--ad	1/16/79	1/17/79	11:45	2	2	0:00	0:01
4	oc salary review	1/16/79	1/17/79	11:55	5	5	0:01	0:26
5	christiansen	1/16/79	1/16/79	11:47	2	2	0:01	0:02

6 editors   1/16/79 1/16/79 11:52 5   1 0:05   0:05
7 temp   1/16/79 2/16/79 12:38 4   20   0:01   0:20
8 follow up notice   1/17/79 2/02/79 10:03 6   3 0:02   0:07
9 arpa/halio/rupp   1/17/79 1/17/79 12:44 2   1 0:03   0:03
10 comm line/option handler problem   1/17/79 1/19/79 2:41 8   8 0:02   0:21
11 Professor Lee and China /Janzen, Carl/Johnson, Ted   1/19/79 1/24/79 1:11 4   2 0:03   0:10
12 Professor Lee's MIT LSI-11 Microcomputer Lab/China/Dist.   1/19/79 1/24/79 1:07 8   3 0:02
0:24
13 Consultant (no)/Hermann, T.S.   1/19/79 1/25/79 13:13 2   3 0:01   0:18
14 China Junket Opportunity -- To: OOD   1/19/79 1/22/79 9:20 4   7 0:00   0:03
15 TU59 Spec./Kevill, John   1/22/79 1/24/79 1:33 3   5 0:03   0:11
16 WS102 20   1/22/79 1/22/79 12:33 6   1 0:00   0:00
17 Aggressive 11/74mP PM and Support/Demmer, Bill/Lacroute, Bernie   1/24/79 1/26/79 10:07 3   3
0:09   0:15
18 Jean Bow's Support/Johnson, Ted/Janzen, Carl   1/24/79 1/29/79 10:04 2   3 0:01   0:08
19 mj   1/24/79 1/24/79 2:21 5   1 0:20   0:20
20 Old Mill Restaurant   1/24/79 2/02/79 8:39 3   2 0:04   0:09
21 People's Republic of China/Johnson,T./Janzen,C.   1/25/79 1/26/79 12:39 6   5 0:00   0:19
22 Pre-Computer Exhibit/Analog,Digital,Tabular Arith.Units   1/26/79 1/26/79 10:14 2   1 0:05
0:05
23 Technion Meeting/Shapiro   1/26/79 1/30/79 14:44 2   7 0:01   0:06
24 ENGINEERING STRATEGY PRESENTATION/COVER SHEET/DOCNO8   2/05/79 2/06/79 0:20 3   4 0:02   0:19
25 Manufacturing-Engineering Interface/OOD/Hindle/J.Smith   1/29/79 1/29/79 13:24 4   5 0:01   0:04
26 DCG & T/SS Eng. Conflict--We Want To Help Now/Clayton/Delagi   1/29/79 1/29/79 13:34 7   4 0:02
0:18
27 Index from CI/DOCNO8   3/28/79 3/28/79 2:05 10   1 0:00   0:00

Gbell Digital 1/30/79
Name: GB0001, # of Docs: 53, Blocks left: 76 (of 627)

Number Name   Created Modified   Size Version Last   Total
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1 1/30/79 5/14/79 3:22 7   104   0:00   1:33
2 LA120 & MEMORIES-LEAD IN PRICE/DELIVERIES/GUTMAN/COTTON/GB0001t1/30/79 3/28/79 3:27 6   6   0:13   0:28
3 JUNGLE IN JANUARY, WHAT I HEARD/OOD/GB0001   1/30/79 1/30/79 11:22 15   3   0:35   0:35
4 U OF WISCONSIN/MUCCI/GB0001   1/30/79 1/30/79 15:01 3   1   0:04   0:04
5 ECKERT-MAUCHLY AWARD/CMU-PROF. DOUG JENSEN/GB0001   2/01/79 2/01/79 2:56 10   5   0:02   0:18
6 CMU, SITUATION AT PER OUR CONVERSATION OF 2/6/79/McCREDIE/GB0001   2/07/79 2/14/79 14:16 11   9   0:02   0:55
7 XEROX - ETHERNET/PAKE, DR. GEORGE/CAMPBELL, JAMES/GB0001   2/07/79 8/06/79 14:02 7   16   0:00   0:30
8 VAX AT MIT FOLLOW UP NOTICE/MUMMOLO/GB0001   2/09/79 2/09/79 1:23 2   2 0:00   0:01
9 LLL-CDC6600, 7600, STAR/CRAY PIECES/MICHAELS, GEORGE/GB0001   2/09/79 2/09/79 1:56 2   1 0:02   0:02
10 VAX--SEGMENTING WHETHER/HOW 10/20 CUSTOMERS CAN USE/ULF/GB0001   2/12/79 2/14/79 14:11 11   7 0:02   0:25
11 PARABLE--TWO LIEUTENANTS: A PARABLE ON A PARABLE/GB0001/HOLD   2/12/79 2/25/79 3:22 5   4 0:00   0:03
12 POLICY ON 10'S, 20'S AND VAX'S WITHIN ENGINEERING/PUFFER/GB0001   2/12/79 2/25/79 3:26 7   6 0:00   0:10
13 CAD MACHINES AND PERSONAL VAX--THOUGHTS ON/PUFFER/LACROUTE/GB0001   2/12/79 2/14/79 13:41 14   5 0:04   0:46

14	U OF DELAWARE/WARTER, PETER/GB0001	2/12/79	2/14/79	14:09	7	3	0:02	0:13
15	tERADYNE/LASSITER, DR. JOSEPH/GB0001	2/12/79	2/14/79	14:14	4	3	0:03	0:05
16	IEEE-SPEAKER REQUEST AT SIGARCH.../PLOWMAN.../GB0001	2/12/79	2/13/79	11:18	8	5	0:01	0:19
17	STRATEGY & RATIONALE -- BASIC PRODUCT/REDBOOK/GB0001	2/14/79	8/13/79	3:00	71	25	0:01	1:48
18	ACS/AT&T/JONES/GB0001	2/25/79	2/25/79	5:57	3	4	0:00	0:09
20	POST OFFICE AND MAIL COLLECTOR/PLOWMAN,ALUSIC,CRAWFORD /GB0001	2/28/79	3/02/79	14:13	3	2	0:01	0:06
21	EBOD-NEXT GO AROUND DATA/TOMASIC, MIKE.../GB0001	2/28/79	6/19/79	6:44	23	12	0:00	1:58
22	VT162:POSSIBLE GATEWAY MODULE INTERFACE--UNIT RECORD DEVICES/GB0001	2/28/79	3/02/79	14:17	5	3	0:04	0:19
23	JAPAN ESSAY ENCLOSED+COMMENTS ON YOUR ARTICLE/MIT-TRIBUS/GB0001	2/20/79	2/22/79	9:01	15	9	0:03	0:45
24	JAPAN ESSAY SUBMISSION--FORTUNE MAGAZINE/DONOVAN/GB0001	2/20/79	3/29/79	12:30	5	7	0:00	0:11
25	VIEWGRAPHS CATEGORIES/SLIDES IN OVERHEAD BOOK FILE/GBOOO1	2/20/79	3/21/79	1:04	8	5	0:02	0:04
26	TRAX--WE'VE BLOWN HIS ONE/PORTNER/GB0001	2/20/79	2/22/79	8:47	4	3	0:04	0:07
27	STOCK OPTION PLAN FIXING BEFORE NEXT GRANT/DAVIS/HINDLE/GB0001	2/20/79	2/22/79	8:31	5	4	0:02	0:06
28	PRODUCT ANNOUNCEMENT/COMMITMENT POLICY/MKTG. COMM./GB0001	2/20/79	2/22/79	8:50	6	4	0:01	0:13
29	PDP-11/23 FONZ ANNOUNCEMENT/CLAYTON.../GB0001	2/22/79	2/28/79	4:06	3	3	0:01	0:24
30	NAE NOMINATION FORMS/CMU-DR. DANIEL BERG/GB0001	2/28/79	3/01/79	2:56	2	2	0:01	0:03
31	PRODUCTS -- HOSTILE FEELING OWARD OURS/OOD.../GB0001	2/28/79	3/02/79	14:28	8	6	0:01	0:21
32	PRODUCT MANAGER MANAGER & STRATEGY COORDINATOR /PUFFER /GB0001	2/28/79	2/28/79	15:33	6	1	0:11	0:11
33	PRODUCTS -- DILEMMA/GB0001	3/02/79	4/02/79	10:52	22	11	0:01	1:19
34	IBM'S GOT IT TOGETHER:TIME tO GET ORGANIZED/OOD.../GB0001	3/05/79	3/06/79	4:03	12	7	0:01	0:24
35	HSC50 APPROACH-SOME CONCERNS I HAVE ABOUT/KEVILL.../GB0001	3/05/79	3/06/79	5:00	13	3	0:08	0:26
36	INTERCONNECT, THE BACKBONE OF THE STRATEGY/BAUER.../GB0001	3/05/79	3/06/79	4:28	8	5	0:04	0:17
37	WHITE TORNADO/BUBBLES ...VS NEW EDITING TERMINAL/GILMORE.../GB0001	3/05/79	3/06/79	4:52	6	3	0:21	0:24
38	MRP ON VAX--WHAT'S THE STORY?/GRIMES/GB0001	3/05/79	3/06/79	4:29	2	2	0:01	0:02
39	IBM TRENDS--GETTING A GOOD TRACK OF/DICK CASE-ULF FAGERQUIST/GB0001	3/05/79	3/06/79	4:31	4	2	0:02	0:09
40	SUNY AT BINGHAMTON--REPLY TO U REQUEST/PROF.PHILIP KRAFT/GB0001	3/05/79	3/06/79	5:14	13	4	0:00	0:11
41	IBM WATCHERS/ALL ENGINEERING MGRS./GB0001	3/22/79	3/22/79	2:29	43	4	0:01	0:06
42	RED BOOK 2-YR PLAN, PROVIDE FINANCIAL DATA?/PMC/OOD/GB0001	3/12/79	3/13/79	3:16	9	7	0:01	0:44
43	PDP-11/70 CIS POST MORTEM/DEMMER, RODGERS/GB0001	3/12/79	3/13/79	3:14	4	2	0:00	0:03
44	DECUS LIBRARY GROUP MEETING/CHUCK CONLEY, PETER CONKLIN/GB0001	3/13/79	3/13/79	2:06	7	4	0:07	0:10
45	NEBULA PLAN--SERIOUS QUESTIONS/LOU PHILIPPON/GB0001	3/16/79	3/16/79	2:17	4	3	0:08	0:14
46	ARGUS INTERNATIONAL--POSSIBLE VENDOR/SLEPPIN/GB0001	3/16/79	3/16/79	0:34	3	2	0:02	0:12
47	DISKS -- ALTERNATIVE FOR MEDIUM SYSTEMS/DEMMER.../GB0001	3/16/79	3/16/79	2:09	4	2	0:02	0:06
48	JAPAN ESSAY COMMENTS/MIT-TRIBUS/GB0001	3/19/79	3/22/79	2:12	8	11	0:00	0:24
49	PRODUCTS OLD-- HELPING DIE/S.OLSEN,B.LANE,J.HOLMAN/GB0001	3/19/79	3/19/79	14:07	5	2	0:01	0:24
50	CAD TOOLS, SELLING/BJ.../GB0001	3/22/79	3/22/79	3:19	2	1	0:04	0:04
51	MASS STORAGE COST/SYS PRICE--RULES OF THUMB/REDBOOK,OOD.../GB0001	3/26/79	3/28/79	4:31	12	8	0:03	0:31
52	MAKE VS BUY GUIDELINES UPDATE (FROM 3/5/76)/OOD.../GB0001	3/26/79	3/28/79	4:34	9	4	0:02	0:23
54	JAPAN ESSAY ENCLOSED/MIT-MATTILL/GB0001	3/29/79	3/29/79	14:24	2	3	0:01	0:03
55	INDEX FROM CI/GB0001							

Digital 4/02/79 8/15/79
Name: GB0002, # of Docs: 70, Blocks left: 57 (of 627)

Number	Name	Created	Modified		Size	Version	Last	Total
1				11:44	10	137	0:01	2:09

2 GRAPHICS: WHY WE RECOMMEND WHAT WE'RE DOING/AK,WH/GB0002 4/02/79 6/01/79 0:43 11 7 0:01
0:28
3 PDP-11/70 WHY WE PROBABLY HAVE TO DO ON CHIP/MC,OOD.../GB0002 4/02/79 4/06/79 0:54 11 6 0:01
0:27
4 FUJITSU LITERATURE & PARTS/DR. F. KUROSAKI/GB0002 4/02/79 4/12/79 3:01 3 3 0:00 0:08
5 HIGH END CHARTER 3/27/79 MEETING/LENG,FAGERQUIST.../GB0002 4/03/79 5/11/79 1:52 11 5 0:00
0:30
6 INDEX FROM CI FOR DISKETTE:GB0002 /GB0002 4/04/79 5/17/79 2:25 24 11 0:04 0:18
7 IOWA STATE TESTIMONIAL AD/TOWLE, GIORDANO/GB0002 4/05/79 4/05/79 10:45 3 2 0:04 0:14
8 DECUS AUSTRIALIA/JOHN EDWARDS/GB0002 4/06/79 4/09/79 5:58 4 7 0:01 0:08
9 U OF WISCONSIN MADISON/MURRAY THOMPSON/GB0002 4/06/79 4/20/79 7:11 5 4 0:01 0:10
10 ST AGNES HOSPITAL/DR. JOSEPH GIARRATANO/GB0002 4/09/79 4/09/79 1:26 3 6 0:01 0:13
11 TEWKSBURY GROUP MORALE/DEMMER/GB0002 4/09/79 4/18/79 1:20 9 8 0:03 0:13
12 OREGON SOFTWARE MINICOMPUTER INC./WHITNEY/GB0002 4/09/79 4/10/79 0:56 2 2 0:03 0:09
13 ASI INVITATION/INSINGER/GB0002 4/09/79 4/23/79 3:04 2 2 0:00 0:04
14 NAVAL RESEARCH LABORATORY/SLAGLE/GB0002 4/09/79 4/10/79 0:52 2 2 0:01 0:04
15 BIT MAPS FOR PERSONAL VAX-BUY IT!/PARKE, MARSHALL/GB0002 4/09/79 4/10/79 2:13 5 8 0:01
0:30
16 CONSULTING ARRANGEMENT--PAUL PENFIELD-MIT/J.BELL.../GB0002 4/11/79 4/12/79 2:57 5 6 0:02
0:12
17 ARCHITECTURE IN TERMINALS/SMALL SYS/CLAYTON/DELAGI/GB0002 4/11/79 4/17/79 0:37 8 5 0:01
0:18
18 ECL FOR VENUS, GETTING THE POOP ON/BUSIEK,ULF.../GB0002 4/11/79 4/12/79 3:00 7 2 0:02
0:15
19 MINNOW, LET'S GO AHEAD!/GB0002 4/12/79 4/13/79 14:56 7 3 0:01 0:08
20 CONTRIBUTION OF COMPUTER TIME/KEN OLSEN.../GB0002 4/12/79 4/12/79 6:13 3 4 0:00 0:01
21 MUSEUM PROJECT/ROCKWELL--GOOD FILE/GB0002 4/12/79 4/12/79 6:15 2 2 0:00 0:00
22 CONTRIBUTION (CORP)OF COMPUTER TIME/K.OLSEN--GOOD FILE/GB0002 4/12/79 4/12/79 6:24 3 1
0:01 0:01
23 COMPUTER POWER (PERSONAL VISIT)--GOOD FILE/KAROLY/GB0002 4/12/79 5/02/79 3:13 2 3 0:00
0:01
24 CMU RESEARCH GRANT--CMU/CYERT/GB0002 4/13/79 4/13/79 9:52 3 1 0:03 0:03
25 JAPAN TALK-HARVARD, THANKS/ALDEN/GB0002 4/17/79 4/17/79 1:54 2 3 0:01 0:08
26 BTL-CONVERSATION ON MAX MATHEWS/CLAYTON.../GB0002 4/17/79 4/18/79 3:08 6 2 0:05 0:38
27 JAPAN ESSAY REQUEST - XEROX/WHITE/GB0002 4/18/79 4/18/79 0:48 2 1 0:03 0:03
28 BOOK REQUEST - DARTMOUTH/THOMAE/GB0002 4/18/79 4/18/79 0:51 2 1 0:02 0:02
29 DAVIS--PEOPLE GERALD DAVIS MET(HIS NOTES)/GB0002 0/00/00 0/00/00 4:31 14 6 0:00 0:61
30 CONTRIBUTION OF COMPUTER TIME--WE DO IT?/EMS-CRAWFORD/GB0002 4/20/79 4/23/79 7:18 19 9 0:01
0:01
31 CDC'S VISIT (TOM KAMPE)CROUSE, KEVILL.../GB0002 4/23/79 4/23/79 6:20 9 8 0:04 0:43
32 XEROX--MORE ON XEROX ORGANIZATION/KNOWLES.../GB0002 4/23/79 4/23/79 6:26 5 4 0:02 0:15
33 ORGANIZATION--THOUGHTS ON ASSOCIATE HEAD OF OOD/FILE/GB0002 4/23/79 5/02/79 2:32 7 5 0:01
0:07
34 MINNOW-NO/EMS-LENG, ULF/GB0002 4/23/79 4/23/79 4:54 3 2 0:00 0:01

35 LCG STRATEGY STATEMENT/EMS-LENG/HEBERT/GB0002   4/23/79 4/23/79 4:53 5   3 0:05   0:05
36 UNIT'S VIDEODISK WORK!/RIGGLE/GB0002   4/23/79 4/24/79 1:32 4   4 0:00   0:18
37 LOW END/S. OLSEN,CLAYTON,DELAGI/GB0002   4/23/79 4/26/79 0:46 8   7 0:03   0:51
38 VAX--GETTING ADEQUATE VAX'S THIS FISCAL YEAR/ULF,WD.../GB0002   4/26/79 4/27/79 0:33 8   6
0:15   0:35
39 CMU STRATEGY BACKGROUND 4/3079 MEET /EMS-WITMORE.../GB0002   4/26/79 4/26/79 7:54 52   10   0:00
0:09
40 REGARDING MCA'S, VENUS & 2080'S/RELIABILITY/HOFF.../GB0002   5/01/79 5/02/79 2:23 7   4 0:01
0:29
41 CMU ALLEN NEWELL'S COMMENTS ON MEETING/WITMORE.../GB0002   5/01/79 5/02/79 1:24 9   6 0:01
0:49
42 NEWELL, ALLEN - NAE NOMINATION/LIEBOWITZ/GB0002   5/01/79 5/01/79 2:57 3   1 0:13   0:13
43 CMU - VAX'S YOU ORDERED FOR CSD/ARPA-NEWELL/GB0002   5/01/79 5/01/79 7:09 2   1 0:07   0:07
44 SYSTEM INTERCONNECT AND TEWKSBURY CHARTER/DEMMER.../GB0002   5/02/79 5/02/79 2:54 5   5 0:02
0:17
45 HLL FOR USER MICROPROCESSOR PROGRAMS IN TERMINALS/GUTZ/GB0002   5/04/79 5/07/79 2:39 4   4
0:04   0:15
46 BUDGET FY80-81 ENG. REDISTRIBUTION & COMMENTS/EBOD,OOD/GB0002   5/07/79 6/19/79 6:44 24   12
0:01   1:00
47 WHITE TORNADO DESIGN FOR WORD PROCESSING/CLAYTON,S OLSEN/GB0   5/07/79 5/07/79 1:09 7   3 0:03
0:05
48 STOCKEBRAND IN ALBURQUERQUE FACTORS--EMS/JACK SMITH   5/07/79 5/07/79 0:49 3   2 0:00   0:00
49 IRCAM - POSSIBLE MEETING DURING MAY EUR. TRIP/CHOWNING/GB0002   5/07/79 5/07/79 0:49 3   4
0:00   0:07
50 CRT APPROVAL FOR VLSI ADV. DEV.--EMS/ULF/GB0002   5/07/79 5/07/79 0:49 3   4 0:01   0:01
51 TALK INVITATION - DIS. COM. SYSTEMS/VICK/GB0002   5/07/79 5/14/79 0:59 3   4 0:00   0:08
52 BUDGET ADJUSTMENTS-WANT BACK FAIR/SQUARE--EMS/THOMPSON/GB0002   5/08/79 5/09/79 0:11 4   4
0:01   0:01
53 LDP ON GRAPHICS SW INTERFACE--EMS/HALIO,MCBRIDE.../GB0002   5/08/79 5/09/79 0:14 4   2 0:00
0:00
54 BACKPLANE INTERCONNECT TASK FORCE--EMS/ROSING,PLATZ.../GB0002   5/08/79 6/27/79 7:19 16   9
0:00   0:02
55 VENUS,VAX,MCA DIRECTION & STRATEGY--EMS/DEMMER,HOFF/GB   5/09/79 5/09/79 0:12 10   4 0:00   0:00
56 ORGANIZATION ANNOUNCEMENT FOR OOD=LP+GB/ENG.MGRS/GB0002 5/10/79 5/17/79 4:41 8   12   0:00   0:63
57 CMU-SALE/PROJECT--EMS/WITMORE.../GB0002   5/10/79 5/10/79 0:21 6   1 0:00   0:00
58 DECNET ARTICLES/LOVELAND/GB0002   5/10/79 5/10/79 1:08 3   2 0:02   0:06
59 INTERFACES--LIST OF SIGNIFICANT ONES UNDER DESIGN/BJ/GB0   5/11/79 5/14/79 3:28 4   4 0:03
0:22
60 CALTECH-RE:FUNDING SILICON STRUCTURES(J.GRAY)/RC,RP.../GB0002   5/14/79 5/14/79 1:10 8   4
0:04   0:19
61 CUSTOMER - ANOTHER ASK-ANY-USER IDEA/LENG,WITMORE.../GB0002   5/14/79 5/14/79 1:05 5   4 0:03
0:15
62 11/23,11/24 BI=UNIBUS - '90/DEMMER,CLAYTON/GB0002   5/14/79 5/14/79 1:19 8   6 0:08   0:26
63 XTEN PETITION BY XEROX--EMS/CADY,MARCUS/GB0002   3/15/79 3/15/79 0:38 4   1 0:00   0:00

64 BSO INFORMATION--EMS-FILE/GB0002   3/15/79 3/15/79 0:43 4   1 0:00   0:00
65 CAD-YOUR SUGGESTION TO BREADBOARD PC LAYOUT--EMS/KUSIK/GB0002   3/15/79 3/15/79 0:49 5   1
0:00   0:00
66 INDEX FROM CI/GB0002   8/15/79 8/15/79 11:45 26   1 0:00   0:00
67 INTERCONNECT PROBLEM COMMITMENT WORK,SOLVE--EMS/WD,BJ/GB0002   1/15/79 1/15/79 6:18 3   1 0:00
0:00
68 CONSULTANT-HENDRICKS STUDY/ANALYSIS--EMS/CRAWFORD/GB0002   3/05/79 3/05/79 6:29 8   1 0:00
0:00
69 DIGITAL-PRESS PERMISSION REPRINT FROM C.E.--EMS/CM,MCN/GB0002   3/26/79 3/26/79 6:40 4   1
0:00   0:00
70 DISK CRISIS PRIORITIES IN UNDERSTANDING--EMS/KEVILL/GB0002   11/27/78 11/27/78 6:45 6   1 0:00
0:00

Digital 4/02/79 8/24/79
Name: GB0003, # of Docs: 73, Blocks left: 77 (of 627)

Number Name   Created Modified   Size Version Last   Total

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1   4/02/79 8/24/79 7:02 10   107   0:01   1:02
2 EMS-MUMPS PRODUCT STABILITY INFORMATION--EMS/CHRISTY/GB0003   4/02/79 6/12/79 17:02 4   3 0:01
0:01
3 INTERCONNECT NEW BUS--EMS/FULLER/GB0003   12/20/78 2/12/79 6:20 4   2 0:00   0:00
4 HYDRA-DISCUSSION WITH DAVE CUTLER--EMS/PORTNER/GB0003   1/10/79 2/12/79 6:20 4   2 0:00   0:00
5 EMS-MAIL AND JUNGUE MAIL--EMS/CRAWFORD/GB0003   1/13/79 2/12/79 6:20 5   2 0:01   0:02
6 DOLPHIN VS. MINNOW DILEMMA--EMS/FAGERQUIST/GB0003 11/18/78 2/12/79 6:19 6   2 0:00   0:00
7 INDEX FROM CI/GB0003   5/15/79 8/31/79 7:29 27   15   0:00   0:07
8 COMMERCIAL GROUP STRATEGIC PLANNING INFO--EMS/CADY/GB0003   5/16/79 2/12/79 6:19 10   2 0:01
0:02
9 HYDRA-IMPORTANCE OF--EMS/PORTNER/GB0003   5/16/79 2/12/79 6:18 4   2 0:00   0:00
10 HYDRA-INTEREST OUTSIDE TELCO--EMS/VAN ROEKENS/GB0003   5/16/79 5/17/79 2:35 3   8 0:01   0:03
11 IBM--JOSEPHSON DEVICE COMPUTER--EMS/CADY/GB0003   1/19/79 2/12/79 6:18 5   5 0:01   0:02
12 10/20 ITEMS FOR YOUR STAFF DECISION--EMS/LENG/GB0003   3/08/79 2/12/79 6:17 5   5 0:00   0:00
13 LSI VAX CHIP ANOTHER HIGHER PRIORITY PROJECT--EMS/RC/GB0003   11/27/78 2/12/79 6:17 2   3 0:00
0:00
14 MASS STORAGE-FUND,BAD DECISIONS-LETS' GET ON WITH IT/EMS-JK,GS/GB0003   3/02/79 2/12/79 6:00 17
2 0:01   0:01
15 MERCURY SUBSYSTEM + INTERCONNECT--EMS/MCNAMARA/GB0003   2/15/79 2/15/79 5:43 9   1 0:00   0:00
16 MINC PRIORITIES IN SYSTEMS--EMS/RC,MCBRIDE/GB0003 11/27/78 2/12/79 5:59 7   2 0:01   0:01
17 MERCURY + MULTIDROP--EMS/MCNAMARA/GB0003   4/02/79 2/12/79 5:58 2   2 0:00   0:00
18 11/74 STOP, MOVE AHEAD 11/70 MULTIPROCESSOR--EMS/WD/GB0003   2/12/79 2/12/79 6:04 4   1 0:00
0:00
19 STRATEGY (BASIC) AND TRANSITION MACHINE--EMS/CADY/GB0003   1/23/79 1/23/79 6:33 4   1 0:00
0:00

20 DOLPHIN, VENUS + SETTING PRIOIRITIES--EMS/ULF/GB0003   1/28/79 1/28/79 6:36 5   1 0:00   0:00
21 STRATEGY STATEMENT FOR DECUS--EMS/ULF,LENG,CADY/GB0003   4/04/79 4/04/79 6:40 4   1 0:00   0:00
22 STRATEGY-PROCESSORS (IE MR+TW)--EMS/WD,ULF/GB0003   3/30/79 8/08/79 11:32 4   2 0:00   0:00
23 GRAPHICS TERMINAL PROGRESS--EMS/HALIO/GB0003   1/13/79 1/13/79 6:55 5   1 0:00   0:00
24 U. WISCONSIN TREATING IN A HUMAN WAY--EMS/SCHWARTZ.../GB0003   3/02/79 3/02/79 6:59 4   2 0:00
0:00
25 INTERFACE TO VMS SOFTWARE DEVELOPERS UNIV.--EMS/LP/GB0003   3/02/79 3/02/79 7:02 4   1 0:00
0:00
26 LSI FOR VAX-USE HMOS--EMS/BJ/GB0003   11/16/78 8/07/79 4:28 3   3 0:00   0:00
27 MASS STORAGE FOR PERSONAL VAX--EMS/MARSHALL,SAVIERS/GB0003   2/28/79 2/28/79 7:10 5   1 0:00
0:00
28 UNIVERSITA' DI PISA - POSSIBLE JOINT EFFORT/MONTANARI/GB0003   5/17/79 5/17/79 4:44 3   4 0:02
0:19
29 EUROPEAN ENGINEERING-THOUGHTS/KELLEHER,PORTNER,MEYER.../GB0003   5/29/79 6/04/79 2:19 8   3
0:11   0:35
30 CSS VS. P/L (FOR PROCESS I/O) AND CEN. ENG./DEMMER.../GB0003   5/29/79 6/04/79 2:27 9   6 0:01
0:35
31 VAX - HI END PERIPHERALS ON VAX/DEMMER, ULF.../GB0003   5/29/79 6/04/79 1:53 6   4 0:03   0:30
32 LCG VERSUS P/L FOCUS IN EUROPE/PETERSCHMIDT,CHOONAVALA/GB0003   5/29/79 6/04/79 2:01 5   3
0:08   0:23
33 METRICATION - WHERE ARE WE?/TAYS/GB0003   5/29/79 5/30/79 8:39 3   4 0:01   0:08
34 PSI - ADDRESSING YOUR USERS IN BERLIN/JESCKE/GB0003   5/29/79 5/30/79 8:10 3   4 0:00   0:09
35 IRCAM - THANK YOU NOTE/BRIGETTE,CHOWNING,RISSELT/GB0003   5/29/79 6/04/79 6:31 3   6 0:00
0:26
36 ECO-GASTRONOMY: SYSTEM OF THE LOIRE,SPRING, AND BICYCLES/GB0003   5/30/79 6/01/79 5:01 38   9
0:00   2:61
37 CAMERA PASS/ALEXANIAN/GB0003   5/30/79 5/30/79 2:17 2   3 0:00   0:08
38 U OF WASHINGTON - VIEW OF POSSIBLE VAX11780'S/RITCHIE/GB0003   6/04/79 6/05/79 2:15 4   5 0:05
0:17
39 FUJITSU LABORATORIES LTD.--VISIT/ALSO TWX'D--KAWATO/GB0003   6/04/79 6/08/79 0:00 3   3 0:00
0:05
40 WATCHING STRATTON AND STRATEGIES VIDEOTAPES/MEYER/GB0003   6/04/79 0/00/00 0:47 3   4 0:01
0:04
41 DECAIR'S KAMIKAZEE FLIGHTS THAT SHOULDN'T BE SCHEDULED/PUFFER/GB0003   6/04/79 0/00/00 0:32 7
4 0:13   0:20
42 COMMENTS ON OUR DISCUSSION/WESLEY/GB0003   6/04/79 0/00/00 0:44 8   4 0:02   0:07
43 THANKS FOR STRATTON MOUNTAIN IV/TAYS/GB0003   6/04/79 0/00/00 0:42 6   5 0:10   0:16
44 THANK YOU LUNCH/DECNET PROGRAM CONTRIBUTORS/GB0003   6/05/79 6/12/79 17:07 7   7 0:01   0:37
45 DUPONT - REQUEST FOR DISTRIBUTED DATA PROCESSING/CULLEN/GB0003   6/06/79 6/06/79 4:30 3   5
0:02   0:09
46 DEC, A SHRINKING ECOLOGICAL NITCH/SIEWIOREK-CMU RAMP/GB0003   6/07/79 6/07/79 5:36 12   6 0:04
0:40
47 BACKPLANE INTERFACE - PAX PROBLEM/CLAYTON--EMS/GB0003   6/07/79 8/07/79 4:26 3   2 0:00   0:00
48 1990 CORE GROUP SPACE TASK FORCE/PORTNER--EMS/GB0003   6/07/79 6/07/79 4:57 2   1 0:00   0:00

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49  EUROPEAN EXPENSE/BERGER/GB0003                          6/08/79  6/08/79  5:07  3    1  0:00   0:00
50  STRATTON VIDEOTAPES/TAYS/GOOR/PEARSON/GALE/GB0003   6/11/79  6/12/79 17:12  6    6  0:02   0:23
51  CDC - WINSTON HODGE/FULLER,STRECKER,BINGHAM,OOD/GB0003   6/11/79  6/12/79 16:03  4    4  0:02   0:09
52  FUTURE TERMINALS ARCHITECTURE/CLAYTON,WILLIAMS,DELAGI.../GB0003      6/12/79  6/13/79 16:26  5    5
0:01   0:25
53  INFORONICS THANK YOU/BUCHLAND/GB0003                    6/13/79  8/21/79  1:02  3    3  0:07   0:30
54  BELL COLLECTION/MOSKOWITZ/GB0003                        6/14/79  6/14/79  3:34  3    4  0:00   0:07
55  THAYER SCHOOL OF ENGINEERING/DARTMOUTH/BOYLESTAD/GB0003        6/15/79  6/15/79  3:43  3    3  0:01
0:06
56  YOUR TRIP TO THE WEST/CLAYTON/GB0003                    6/19/79  6/19/79  1:19  14   6  0:00   0:15
57  COMPUTER ENGINEERING QUESTIONS/PHISTER/GB0003       6/19/79  0/00/00  0:42  4    4  0:00   0:11
58  SILICON STRUCTURE PROJECT/(PRES)&(DEAN)OF ENG. CALTECH   6/19/79  0/00/00  0:43  5    9  0:01   0:27
59  MUSEUM THOUGHTS/FILE/GB0003                             6/21/79  6/21/79  3:59  12   2  0:00   0:01
60  PICTUREPHONE MEETING SERVICE + OUR VIDEO CONF./BERTOCCHI.../GB0003   6/25/79  6/26/79 16:30  14   4
0:17   0:32
61  NETWORK + DDP PROTOCOL VERFICATION--EMS/PLOWMAN.../GB0003      6/25/79  6/25/79  6:52  3    1  0:00
0:00
62  SCS-11--EMS/MARCUS,CADY,JOHNSON/GB0003                  6/26/79  6/26/79 13:11  5    1  0:00   0:00
63  BTL VISIT (WIREWRAP & I/C SCHEME FOR C.S 6/22(EMS) /GB0003     6/26/79  7/10/79  4:43  7    3  0:00
64  BTL--THANK-YOU LETTER /SETHI/GB0003                     6/27/79  6/28/79 15:12  5    4  0:01   0:14
65  CROSS PRODUCT PROGRAMS/DISTRIBUTION/GB0003          7/03/79  7/06/79 16:06  11   8  0:01   0:34
66  MUSEUM PARTS FROM WOBURN/ROY/GB0003                     7/06/79  7/06/79 17:25  3    4  0:02   0:10
67  ALLOCATION "ENGINEERING" YOUR OFF-THE-WALL MEMO/OLSEN/GB0003   7/06/79  7/19/79  3:13  9    13    0:00
1:04
68  GOALS--FOR OOD FY80/OPERATIONS COMMITTEE/GB0003     7/09/79  8/08/79 10:22  8    11    0:03   0:43
69  BROWN U ACCEPTANCE TO DEPT OF COMP SCIENCE SYMPOSIUM/WEGNER    7/09/79  7/09/79  0:21  3    2  0:02
0:06
70  KEUFFEL + ESSER COMPANY/SALES DEPT./GB0003          7/09/79  8/01/79  2:13  4    5  0:02   0:26
71  APPLIANCE MANUFACTURER--CANCELLATION OF SUBSCRIPTION/KNAPP/GB0003    7/09/79  7/12/79 14:57  2    4
0:01   0:05
72  REVIEW/DP:WELLS,VARICK/ORIGINS OF COMPUTER INDUSTRY      7/10/79  7/23/79  0:26  36   22    0:13   4:27
73  BUDGET FOR FY80 (EMS)/SAVIERS/GB0003                    7/10/79  7/10/79  4:53  1    1  0:00   0:00


GB Paper Japan 5/14/79
Name: PAPER1, # of Docs: 8, Blocks left: 164 (of 627)
-------------------------------------------------------------------------------
Number  Name     Created  Modified    Size Version  Last   Total
-------------------------------------------------------------------------------
 1                                                      5/14/79 11/07/79  6:07  2    15    0:01   0:06
 2  JAPAN ESSAY--2ND VERSION--SENT OUT FOR POSSIBLE PUBLICATION/PAPER1   5/14/79 10/19/86  0:29  100  9
0:02   0:31
 3  JAPAN ESSAY--(FIRST VERSION) BEFORE 10/19/78 /PAPER1     5/14/79 11/07/79  5:46  115  3  0:00   0:06
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 4  JAPAN - INNOVATION IN JAPAN--A LESSON FOR US?/DARTMOUTH/PAPER1       6/15/79  6/15/79  2:27  39   16
0:01   1:14
 5  INDEX FROM CI/PAPER1                                6/28/79 10/29/79  0:34  4    2  0:00   0:00
 6  NATIONAL HIGH TECHNOLOGY, A COMPUTER INDUSTRY PAPER--DRAFT 2/PAPER1       10/26/79 10/26/79 10:52  70
1  0:03   0:03
 7  NATIONAL HIGH TECHNOLOGY, A COMPUTER INDUSTRY PAPER--DRAFT 1/PAPER1       10/26/79 10/26/79 10:55  50
1  0:02   0:02
 8  NATIONAL HIGH TECHNOLOGY, A COMPUTER INDUSTRY PAPER--DRAFT 3/PAPER1       10/26/79 10/26/79 11:48  74
1  0:03   0:03


Digital 10/11/79
-------------------------------------------------------------------------------
Number  Name     Created  Modified    Size Version  Last   Total
-------------------------------------------------------------------------------
 1                                                 10/11/79 11/20/79 10:39  8    104   0:05   1:09
 2  PBS - GB MAIL ANALYSIS/GB0005                   10/11/79 10/15/79  9:18  66   24    0:03   7:01
 3  BRITISH SCIENCE MUSEUM--SENDING -8/JANE RAIMES/GB0005   10/11/79 10/12/79  5:28  3    4  0:00   0:01
 4  ABSTRACT--PROFESSION BASED SYSTEM,CONSIDERATIONS ON THE DESIGN/GB0005     10/15/79 10/17/79 17:03  3
10    0:01   0:10
 5  FIELD MATRIX/DAVIS/GB0005                       10/15/79 10/17/79  8:37  2    6  0:00   0:11
 6  DIGITAL MORALE/OC,OOD/GB0005                    10/15/79 10/17/79  8:31  3    5  0:01   0:14
 7  MUSEUM COMMITTEE AGENDA/DISTRIBUTION/GB0005       10/15/79 10/31/79  4:34  4    4  0:07   0:30
 8  TERMINALS OBSOLETE TO TPL AND RIO/CROWTHER--EMS/GB0005  10/15/79 10/23/79 16:30  2    3  0:00   0:00
 9  DEC,VISITING(OVERSEAS)OFFICES,PLANTS,ENG./JOHNSON.../GB0005   10/15/79 10/17/79  8:45  6    7  0:00
0:26
10  BRAZIL - THANK YOU LETTER/STEINBERG/GB0005         10/15/79 11/02/79  5:37  5    4  0:00   0:34
11  PAPER, NATIONAL HIGH TECHNOLOGY, A C. INDUSTRY--OLD (10-15-79)      10/15/79  0/00/00  3:28  50   9
0:31   3:52
12  PERSONNEL, RESIGNATION--BRUCE HURWITZ/BJ,LP--EMS/GB0005       10/16/79 10/23/79 16:26  2    4  0:00
0:04
13  BRAZIL - THANK YOU LETTER/VISSER/GB0005           10/16/79 11/02/79  5:37  5    4  0:00   0:02
14  BRAZIL - UNIVERSITY OF SAO PAULO/MOSCATO/GB0005    10/17/79 11/08/79 11:05  5    10    0:01   0:29
15  BRAZIL - UNIVERSITY OF CAMPINAS/MACHADO/GB0005     10/17/79 10/17/79 14:23  3    2  0:02   0:05
16  BRAZIL - UNIVERSITY OF RIO/MARINHO/GB0005          10/17/79 11/06/79  6:56  4    6  0:00   0:19
17  2080 GOALS--EMS/FAGERQUIST,MCBRIDE.../GB0005       10/18/79 10/18/79 16:43  3    6  0:01   0:15
18  EMS (VS WPS) AND OUR FUTURE PRODUCT/OOD.../GB0005  10/18/79 10/23/79 16:27  9    15    0:00   0:29
19  PROMOTIONAL LITERATURE RESPONSIBILITY/KENT/GB0005  10/22/79 10/22/79  8:28  2    2  0:04   0:04
20  CI-HIGH COST OF THE CI-BUT KEEP GOING/RODGERS,FULLER...--EMS/GB0005       10/22/79 10/23/79 16:26  3
6  0:00   0:09
21  NAVAL RESEARCH LABORATORY/SLAGLE/GB0005            10/22/79 10/23/79 12:20  3    3  0:01   0:03
22  PAPER, NATIONAL HIGH TECHNOLOGY, A C. INDUSTRY--NEW (10-22-79)      10/22/79 10/22/79 15:30  70   1
0:04   0:04
23  BELL LABORATORIES--OLD/MCGILL/GB0005               10/22/79 10/22/79 16:19  4    2  0:03   0:03
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24 ENG. + MANUFACTURING ORGANIZED TO FACE FUTURE COMPETITORS/GB0005   10/22/79 12/04/79 2:55 12   12
0:01   0:59
25 BELL LABORATORIES--NEW/MCGILL/GB0005   10/23/79 10/23/79 10:01 10   4 0:05   0:13
26 RANDELL, RE YOUR CONSULTING/RANDELL/GB0005   10/23/79 10/23/79 16:08 7   4 0:01   0:04
27 DP BROCHURE AND PRESENTATION TO BOD/DEMMER,PLOWMAN.../GB0005 10/23/79 10/23/79 10:26 3   3 0:01
0:06
28 TERMINALS-COLOR AND THEIR USE IN CAD--EMS/GB0005   10/23/79 10/23/79 16:25 2   7 0:00   0:11
29 TEX--CONFIRMING YOUR STRATEGY TEX TYPESET SYS.--EMS/FORD/GB0005   10/23/79 10/23/79 14:27 2   4
0:00   0:05
30 JAWS--CONGRATULATIONS AT THIS DECISION POINT--EMS/CLAYTON/GB0005   10/24/79 10/25/79 17:05 2   5
0:01   0:04
31 TPS - YOUR TPS PRESENTATION/DALEY--EMS/GB0005   10/24/79 10/24/79 7:09 2   6 0:01   0:08
32 NEW 11/44 PROCESSOR--DRAFT/GB0005   10/26/79 12/04/79 3:22 22   9 0:01   0:02
33 PERSONNEL, KEEPING VERSUS RECRUITING--EMS/MEYER,DAVIS/GB0005 10/26/79 10/26/79 13:28 2   4 0:04
0:09
34 COST TARGETS--EMS/ROSING/GB0005   10/26/79 10/26/79 14:55 1   4 0:00   0:02
35 TRAX 1.5--CONGRATULATIONS--EMS/CADY/GB0005   10/29/79 10/29/79 5:34 2   4 0:00   0:07
36 L.COST (ICCS)--EMS/VAN ROEKENS.../GB0005   10/29/79 10/29/79 5:30 3   4 0:00   0:14
37 ETHERNET,XEROX-DEC ANNOUNCEMENT OF--EMS/CLAYTON,FULLER/GB0005   10/29/79 10/29/79 5:03 2   4
0:01   0:08
38 PBS - SLIDES/GB0005   10/29/79 10/31/79 6:18 20   10   0:04   0:61
39 PBS - SLIDES PART II/GB0005   10/29/79 10/31/79 6:14 18   13   0:04   2:43
40 11/24--EMS/CADY/GB0005   10/30/79 10/30/79 1:00 2   1 0:00   0:00
41 1990+ STRATEGY STATEMENT/FINN,CHAMBERLAIN/GB0005   10/30/79 11/02/79 0:02 8   9 0:01   0:53
42 VMS-DISTRIBUTING DEVELOPMENT--EMS/JOHNSON,HEFFNER,CARCHIDI/GB0005   10/30/79 10/31/79 2:08 3   6
0:00   0:09
43 PL/1--EMS/PORTNER,LYLE,JOHNSON/GB0005   10/31/79 10/31/79 2:07 1   5 0:01   0:04
44 PL/1 AT DECUS--EMS/CUTLER/GB0005   10/31/79 10/31/79 3:32 2   4 0:00   0:06
45 COMPENSATION--MONOTONICITY OF PAY-A PROBLEM?--EMS/OC,BURNS/GB0005   10/31/79 10/31/79 3:35 3   4
0:00   0:13
46 TRAX 1.5 PROPOSED DIRECTION--EMS/JOHNSON,DALY.../GB0005   10/31/79 11/01/79 11:47 3   6 0:00
0:15
47 DOD SOFTWARE PROGRAM--EMS/J.BELL/GB0005   11/01/79 11/01/79 1:27 2   6 0:01   0:17
48 1990 SPACE STRATEGY & PLAN/1990 COMMITTEE/GB0005   11/05/79 11/06/79 9:01 16   6 0:01   0:42
49 NI FOR INTERCONNECTING COMET/MERCURY--EMS/GILBERT,VANROEKENS/GB0005   11/05/79 11/06/79 0:58 1
5 0:00   0:02
50 VT78 FLOPPY-FAN IN--EMS/CLAYTON,SAVIERS,SMITH/GB0005   10/31/79 10/31/79 9:01 2   5 0:00   0:05
51 EMS DESIGNER/MUMPS PROJ. LEADER--EMS/JOHNSON,CRAWFORD.../GB0005   10/31/79 10/31/79 9:01 2   5
0:00   0:05
52 ETHERNET ADVANCED DEVELOPMENT--EMS/BELL,PORTNER/GB0005 10/31/79 10/31/79 9:01 2   6 0:00   0:06
53 IEEE - NATIONAL ENGINEERING FOUNDATION/WEINSCHEL/GB0005   11/05/79 11/09/79 0:33 16   14   0:03
1:10
54 VMS ON NEBULA--CONGRATULATIONS--EMS/SOFIO.../GB0005   11/07/79 11/07/79 1:05 3   5 0:01   0:14
55 OFFICE DESIGN--OFFICE OF CENTRAL ENGINEERING/GB0005   11/07/79 11/07/79 2:20 11   5 0:02   0:13

56 MUSEUM JOBS--DIGITAL COMPUTER MUSEUM - PHASE TWO/GB0005   11/07/79 11/07/79 2:45 14   5 0:00
0:22
57 SCIENCE MAGAZINE/ABELSON/GB0005   11/07/79 11/08/79 11:35 6   9 0:02   0:18
1/21/80 1/30/80 10:03 5   8 0:00   0:08
34 NATIONAL SCIENCE FOUNDATION/PASTA/GB1.S1   1/21/80 4/25/80 4:13 3   4 0:02   0:06
35 NAE--ABSTRACT OF ENGINEERING EDUCATION/BOLEY/GB1.S1   1/22/80 5/22/80 4:51 1   5 0:00   0:11
36 HARRIS SEMICONDUCTOR GROUP/DOBSON,PENNINGTON/GB1.S1   2/04/80 3/13/80 15:17 12   12   0:01   0:63
37 THANK YOU FOR UNDERWOOD TYPEWRITER/PANNELL/GB1.S1   1/22/80 1/22/80 12:20 3   1 0:04   0:04
38 LOWER COST SYS. ARE LIMITED--DISK ELECTRONICS/CLAYTON/GB1.S1   1/22/80 1/24/80 8:56 3   3 0:01
0:02
39 IEEE - PAPER ON INNOVATION.../WEINSCHEL/GB1.S1   1/23/80 1/25/80 16:21 2   2 0:00   0:06
40 SW ARCHITECTURE - DESIGN OF AN INTERCONNECT/STRECKER/GB1.S1   1/29/80 2/20/81 16:11 5   4 0:01
0:02
41 VT100--WINNING THE VT100 FAMILY/PICOTT,CLAYTON.../GB1.S1   1/30/80 7/02/80 10:11 4   5 0:01
0:17
42 NSF PERMISSION/GB1.S1   1/23/80 2/20/81 16:18 2   3 0:00   0:06
43 VT278 BUSINESS PLAN/COLE/GB1.S1   1/30/80 1/31/80 12:12 2   4 0:01   0:09
44 MEETING OUR COMMITTMENTS/OOD/GB1.S1   1/30/80 9/29/80 11:04 5   13   0:00   0:29
45 COMPTROLLER GENERAL/STAATS/GB1.S1   1/30/80 7/14/81 16:36 21   14   0:00   2:25
46 ANTIQUES-ANOTHER ARITHOMOMETER?/DELEHAR/GB1.S1   1/30/80 3/07/80 12:10 1   4 0:00   0:04
47 PRICE VS. FUNCTUALITY FACTS/CLATYON,CAMPBELL/GB1.S1   2/01/80 2/01/80 9:26 3   6 0:01   0:11
48 DIRECTION-MY UNDERSTANDING OF THE DIRCTION/CLAYTON/GB1.S1   2/01/80 9/29/80 11:06 9   2 0:01
0:01
49 APPROVAL OF PAPERS FOR VARIOUS/JIM BELL/GB1.S1   2/01/80 2/01/80 12:48 5   1 0:00   0:00
50 DP--MORE ON THE DEFINITION OF DP/GB1.S1   2/01/80 2/01/80 12:53 3   1 0:00   0:00
51 INTERFACE CHIP/ZEH/GB1.S1   2/01/80 2/01/80 12:55 3   1 0:00   0:00
52 INVITATION/GILMORE/GB1.S1   2/01/80 2/01/80 12:57 6   1 0:00   0:00
53 PUBLICATION POLICY/JIM BELL/GB1.S1   2/01/80 2/01/80 12:59 6   1 0:00   0:00
54 SOLID WIRE ON PEDESTAL 100'S/BUSIEK/GB1.S1   2/01/80 2/01/80 13:01 5   1 0:00   0:00
55 WS200 VS. WD200/STAN OLSEN,STEWART/GB1.S1   2/11/80 2/11/80 4:47 4   4 0:00   0:01
56 WPS-BRING IN ON AN 11 THAT'S COMPATIBLE WITH 8/WILLIS/GB1.S   2/07/80 2/08/80 11:22 24   7 0:04
0:25
57 METROPOLIS - ENJOYED ANNALS ARTICLE - GB/GB1.S1   2/08/80 2/08/80 12:05 5   1 0:01   0:01
58 UNIVERSITY OF MICHIGAN--PHOTOS REQUEST/GALLER/GB1.S1   2/08/80 3/28/80 9:10 5   2 0:00   0:01
59 KOSKO, DAVE/CARCHIDI/GB1.S1   2/11/80 2/11/80 4:48 3   3 0:00   0:01
60 ROM, A BIG ROM FOR ONE FLOPPY?/COLE/GB1.S1   2/12/80 2/25/80 14:00 3   5 0:01   0:13
61 CABINETS AND RL02'S/LACROUTE,GUTMAN/GB1.S1   2/12/80 2/12/80 15:53 2   6 0:00   0:06
62 VLSI-KEEPING PEOPLE THROUGHOUT SCORPIO/CLAYTON.../GB1.S1   2/11/80 2/11/80 4:47 2   5 0:00
0:01
63 SPACE PLANNING GUIDELINES/HOLMAN/GB1.S1   2/11/80 2/13/80 14:03 12   6 0:01   0:02
64 DIRECTIONS TO TEWKSBURY RE: GRAPHICS/PICOTT/GB1.S1   2/11/80 2/11/80 4:46 3   4 0:00   0:00
65 WANG, AN - NOMINATED FOR NAE/KEN OLSEN/GB1.S1   2/11/80 2/11/80 4:46 2   4 0:00   0:00
66 STRATEGIC SPACE PLANNING INTERACTION MATRIX/OOD/GB1.S1   2/13/80 2/13/80 12:42 9   8 0:00   0:56
67 PRODUCTS/INTRO STRATEGY--WRONG IN LE?/MACKEEN/GB1.S1   2/11/80 2/11/80 4:46 5   3 0:01   0:02

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68  TECHNICAL REVIEW ARTICLE/ALLEN/GB1.S1              2/13/80  2/13/80 14:42  1    3  0:00   0:07
69  PERSONAL VAX PROJECT--GET IT MOVING QUICKLY/THISSELL/GB1.S1    2/11/80  7/02/80 10:10  14   6  0:01
0:03
70  SOLAR THOUGHT FOR THE DAY/STOCKEBRAND/GB1.S1        2/11/80  2/11/80  4:44  3    4  0:00   0:00
71  DAVIS, SHEL--LETTER TO GWEN/GB1.S1                 2/15/80  2/20/81 16:20  4    5  0:00   0:13
72  BUDGET--WHY CE MUST INCREASE FOR FY81/GB1.S1        0/00/00 11/10/80 13:48  30   19    0:00   3:25
73  BAXTER ASSOCIATES, INC./GREATHOUSE/GB1.S1          2/15/80  2/15/80 11:21  2    2  0:08   0:08
74  FINISHING THE 74 PROPERLY/DEMMER/GB1.S1            2/11/80  2/15/80 11:28  3    3  0:00   0:00
75  WPS P/L AND PRODUCT DIRECTION/STEWART.../GB1.S1     2/15/80  2/15/80  4:39  4    5  0:01   0:11

GB Paper Computer Generations 11/07/79
Name: PAPER2, # of Docs: 5, Blocks left: 444 (of 627)
-------------------------------------------------------------------------------
Number  Name     Created  Modified    Size Version  Last   Total
-------------------------------------------------------------------------------
 1                                                 11/07/79  0/00/00  0:01  1    5  0:01   0:01
 2  NATIONAL HIGH TECHNOLOGY, A COMPUTER INDUSTRY PAPER--11/7/79-PAPER2       11/07/79  8/17/81 11:32  78
11    0:00   0:13
 3  INDEX FROM CI/PAPER2                           11/14/79  0/00/00  0:00  3    2  0:00   0:00
 4  PAPER--GENERATING COMPUTER GENERATIONS/PAPER2     10/13/80 10/13/80 10:33  90   11    0:04   0:51
 5  index from paper2                               0/00/00  0/00/00  0:01  3    1  0:00   0:00


Digital Mail logs 11/20/79  12/02/80
Name: MAIL-3, # of Docs: 16, Blocks left: 177 (of 627)
-------------------------------------------------------------------------------
Number  Name     Created  Modified    Size Version  Last   Total
-------------------------------------------------------------------------------
 1                                                 11/20/79  9/28/81  9:30  2    46    0:00   0:08
 2  NOVEMBER '79 MAIL-LOG/GB1.S10                  11/20/79  6/16/80 10:28  18   20    0:01   0:40
 3  INDEX FROM CI/GB1.S10                          11/21/79 12/13/79 10:38  3    4  0:00   0:01
 4  DECEMBER '79 MAIL-LOG/GB1.S10                  12/03/79  9/10/80 15:51  26   78    0:01   3:62
 5  JANUARY '80 MAIL-LOG/GB1.S10                    1/03/80  3/21/80 14:57  27   97    0:05   2:49
 7  FEBRUARY '80 MAIL-LOG/GB1.S10                   2/01/80  3/18/80 10:47  24   76    0:01   2:31
 8  MARCH '80 MAIL-LOG/GB1.S10                      3/03/80 11/10/80 15:53  34   113   0:01   3:39
 9  APRIL '80 MAIL-LOG/GB1.S10                      4/02/80  1/22/81 14:13  35   121   0:00   4:26
10  MAY '80 MAIL-LOG/GB1.S10                        5/02/80 11/04/80 11:24  38   115   0:03   4:30
11  JUNE '80 MAIL-LOG/GB1.S10                       6/02/80 11/04/80 11:21  36   100   0:01   4:59
12  JULY '80 MAIL-LOG/GB1.S10                       7/01/80 12/05/80  9:19  38   135   0:02   4:56
13  AUGUST '80 MAIL-LOG/GB1.S10                     8/01/80 12/05/80  9:17  25   88    0:00   3:30
14  SEPTEMBER '80 MAIL-LOG/GB1.S10                  9/02/80  2/19/81 16:55  37   105   0:01   3:41
15  OCTOBER '80 MAIL-LOG/GB1.S10                    9/30/80 12/05/80 13:31  40   95    0:02   4:17
16  NOVEMBER '80 MAIL-LOG/GB1.S10                  11/03/80  1/22/81 11:01  27   97    0:01   3:04
17  DECEMBER '80 MAIL-LOG/GB1.S10                  12/02/80  1/22/81 11:00  24   83    0:01   2:48
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Gordon 12/20/79
Name: SECT5 , # of Docs: 16, Blocks left: 95 (of 627)
------------------------------------------------------------------------------
Number  Name     Created  Modified    Size Version  Last   Total
------------------------------------------------------------------------------
 1                                                  12/20/79 11/26/80 14:22  2    97    0:01   0:12
 2  CALENDAR - GORDON                                9/30/80 12/29/80 14:34  57   902   0:01  57:05
 3  MESSAGE LIST - GORDON - FROM 10/17 TO PRESENT/RL0.S5    10/17/80 12/29/80 16:37  44   150   0:29   5:45
 4  PROBLEM TALK SCHEDULE FORM/RL0.S5               12/20/79  9/30/80 15:09  1    6  0:00   0:00
 5  PROBLEM/TALK/VISIT SPEC/RL0.S5                  12/20/79  3/17/80  9:36  1    7  0:01   0:02
 6  RESULT FILE/RL0.S5                              12/20/79  1/03/80  9:32  15   8  0:18   0:22
 7  PROBLEM/TALK/VISIT LIST/RL0.S5                   9/30/80  9/30/80 15:06  14   2  0:01   0:02
 8  PROBLEM FORM/RL0.S5                             10/17/80 10/17/80 13:26  3    1  0:01   0:01
 9  CALENDAR ARCHIVE - GORDON - FROM 9/29/80 TO ?/RL0.S5    10/17/80 12/29/80 14:35  43   23    0:01   0:47
10  MESSAGE LIST ARCHIVE - GORDON - FROM 4/80 TO 10/16/80 /RL0.S5      10/17/80  5/28/81 10:34  233  18
0:07   1:00
11  TELEPHONE BOOK - LIST - GB PERSONAL /RL0.S5       11/05/80 12/29/80  8:54  47   20    0:06   0:61
12  TALK SCHEDULE - GORDON /RL0.S5                  11/05/80 12/08/80 11:40  7    5  0:00   0:07
13  MEMO HEADER                                      2/25/80  2/25/80 12:54  2    4  0:00   0:01
14  slides                                          11/20/80 11/20/80  8:40  3    2  0:04   0:17
15  BOOKSHELF - REFERENCE MATERIAL, GB OFFICE /RL0.S5  11/26/80 11/26/80 14:22  10   1  0:01   0:01
16  BOOKSHELF - ORIGINALS, GB OFFICE /RL0.S5          11/26/80 11/26/80 14:23  33   1  0:01   0:01

Digital TCM 12/31/79
Name: SECT2 , # of Docs: 53, Blocks left: 240 (of 627)
------------------------------------------------------------------------------
Number  Name     Created  Modified    Size Version  Last   Total
------------------------------------------------------------------------------
 1                                                  12/31/79  9/22/80 11:07  6    145   0:01   1:02
 2  WPS - A SHARED BUYOUT?/STEWART.../GB1.S2          2/18/80  2/18/80 11:38  2    2  0:00   0:00
 3  MINUTES, RE: 11/FEB/80 MINUTES/PADERSON/GB1.S2    2/18/80  2/20/80 16:45  5    5  0:00   0:21
 4  PRODUCTS--DILEMMA--NEEDING MORE /SAVIERS.../GB1.S2       2/18/80  2/27/80  4:09  16   13    0:00   0:63
 5  K.PLI, WHAT'S A K.PLI?/LIGNOS.../GB1.S2           2/18/80  2/19/80 15:51  3    8  0:00   0:04
 6  FAT-WHY I WANT TO RESTRUCTURE THE FAT/SMITH/GB1.S2       2/18/80  2/20/80 16:04  18   10    0:01   2:06
 7  SYSTEMS TYPES,CATEGORIES OF /SMITH/GB1.S2         2/18/80  9/29/80 10:57  7    10    0:00   0:53
 8  BAUD (2400) SEEMS LIKE ENOUGH/CRAWFORD/GB1.S2     2/18/80  2/20/80 14:24  4    4  0:02   0:10
 9  LOW END SEMICONDUCTOR MAKE/BUY POLICY/PADERSON/GB1.S2    2/18/80  3/10/80  3:40  10   13    0:00   0:42
10  MIT/MOSES/GB1.S2                                  2/18/80  3/18/80 11:03  2    3  0:16   0:23
11  PEYSER (MINNA POST )AND ASSOCIATES/PEYSER/GB1.S2    2/19/80  2/20/80 13:40  2    2  0:01   0:07
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12 AAAS NOMINATION FOR FELLOW - GB VITA/GB1.S2 2/20/80 2/20/81 16:27 14 5 0:00 0:04
13 BUDGET - STRATEGY TO RAISE THE CE BUDGET/TOMASIC/GB1.S2 2/20/80 2/21/80 10:08 3 3 0:00
0:12
14 INFOTECH/MULLER/GB1.S2 2/20/80 2/21/80 10:39 1 2 0:00 0:01
15 INTERCONNECT MEETING/GB1.S2 2/22/80 4/04/80 9:20 4 6 0:00 0:05
16 APPLICATIONS, MICROCOMPUTER /ZARRELLA/GB1.S2 2/22/80 2/25/80 11:13 1 3 0:01 0:09
17 SYSTEMS 1970-1990/SMITH/GB1.S2 2/25/80 9/29/80 10:58 9 10 0:00 0:36
18 TERMINALS-SOLID WIRE ON PEDESTAL 100'S/BUSIEK/GB1.S2 2/25/80 7/02/80 10:11 6 7 0:00 0:04
19 TERMINALS PRODUCT DIRECTION/OLSEN, STAN/GB1.S2 2/25/80 9/29/80 10:56 9 4 0:01 0:11
20 WPS ORGANIZATION--LET'S WRAP UP TOMORROW/OLSEN, STAN/GB1.S2 2/25/80 2/25/80 4:25 4 2 0:01
0:01
21 NEBULA-GETTING SERIOUS WITH NEBULA/LACROUTE/GB1.S2 2/25/80 2/25/80 4:50 10 3 0:01 0:05
22 HARRIS/DOBSON, PENNINGTON/GB1.S2 2/25/80 3/05/80 12:06 5 8 0:00 0:10
23 R80 - YOUR NOTE/HINDLE/GB1.S2 2/25/80 2/25/80 4:56 7 2 0:02 0:02
24 BUDGET, FY81, 82, 83 BUDGET/CLAYTON/GB1.S2 2/25/80 2/25/80 4:59 3 3 0:00 0:01
25 MULTITERMINAL SYS. OLEH SPEAK GOOD WORDS/OLSEN, STAN/GB1.S2 2/25/80 2/25/80 5:02 10 2 0:03
0:03
26 VAX-PERSONAL PROJECT/CADY/GB1.S2 2/25/80 4/15/80 13:41 15 3 0:01 0:03
27 NOMENCLATURE PROGRAM/BENNETT/GB1.S2 2/25/80 2/25/80 5:09 11 2 0:02 0:02
28 EUROPEAN ENGINEERING LOCATION IN JAPAN/FROST/GB1.S2 2/25/80 2/25/80 5:10 4 2 0:00 0:00
29 TOUCH TONE--MORE ON THEM/JOHNSON/GB1.S2 2/25/80 2/25/80 5:12 2 2 0:00 0:00
30 BUDGET, PROPOSAL TO RAISE ENG. BUDGET/CLAYTON/GB1.S2 2/25/80 2/25/80 5:15 9 2 0:02 0:02
31 TELECONF. STRATTON V--PERMISSION TO LORRIN/PORTNER/GB1.S2 2/25/80 2/25/80 5:18 5 2 0:02
0:02
32 OCR'S BEING USED W/DEC WS'S,REQUEST INFO RE:/GILMORE/GB1.S2 2/25/80 4/11/80 11:29 2 4 0:00
0:02
33 MAKE BUY SPACE--PLEASE HELP/CROUSE/GB1.S2 2/25/80 3/10/80 3:40 5 3 0:00 0:00
34 TERMINALS & SMALL SYS ENGINEERING--LOCATION/CLAYTON/GB1.S2 2/27/80 9/29/80 10:56 5 5 0:00
0:22
35 HG, OR HGII/VAN ROEKENS,HASSETT/GB1.S2 2/27/80 2/28/80 13:35 2 6 0:00 0:11
36 COMPUTER CONSOLES INC. (CCI)/AFFEL,TAI/GB1.S2 2/27/80 3/03/80 15:44 2 4 0:00 0:11
37 VAX PARTY EXPENSES/GB1.S2 5/15/80 2/23/81 16:24 3 5 0:00 0:12
38 VAX PARTY FORM INVITATION/GB1.S2 3/04/80 2/23/81 16:24 2 20 0:00 0:13
39 VAX PARTY SPEC/GB1.S2 3/04/80 2/23/81 16:25 1 68 0:00 0:17
40 VAX PARTY FORM RSVP TALLY/GB1.S2 3/04/80 2/23/81 16:25 1 29 0:00 0:40
41 VAX PARTY LIST/GB1.S2 3/04/80 2/23/81 16:25 65 22 0:00 0:32
43 ARITHMOMETER PAYMENT, DELEHAR/BANK/GB1.S2 3/07/80 2/23/81 16:26 2 3 0:01 0:10
44 NATIONAL SCIENCE FOUNDATION/RESNIKOFF/GB1.S2 3/10/80 3/10/80 11:17 1 3 0:00 0:06
45 BACKPLANE, MERCURY/VAN ROEKENS.../GB1.S2 3/10/80 3/10/80 12:09 2 4 0:01 0:09
46 DATA FLOW MACHINE OPERATIONAL?/DICKMAN,FULLER/GB1.S2 3/10/80 3/10/80 12:05 2 8 0:00 0:05
47 UMASS--EVALUATION OF PROPOSAL/MORRIS/GB1.S2 3/11/80 5/22/80 4:51 2 3 0:00 0:09
48 TEXAS INSTRUMENTS/CRAGON/GB1.S2 3/10/80 3/10/80 12:01 1 3 0:00 0:02
49 DIBS III & FIXED PARAMETERIZED/ALGORITHMIC APPLIC./GB1.S2 3/11/80 3/11/80 15:27 11 2 0:02
0:02

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50  ARITHMOMETER/DELEHAR/GB1.S2                            3/12/80  3/12/80 11:23  1    3  0:01   0:03
51  TERMINALS BUSINESS LOCATION/SO,JS,RC/GB1.S2            3/14/80  2/23/81 16:29  6    11    0:00   0:23
52  LAWRENCE LIVERMORE LABORATORY/WOOD--GB/GB1.S2          3/14/80  3/14/80 11:32  3    1  0:02   0:02
53  RESULT                                                 3/20/80  4/04/80 15:24  2    18    0:00   0:04
54  VAX PARTY PROGRAM FORM/GB1.S2                          3/26/80  4/04/80  9:10  6    8  0:00   0:05

Digital 12/31/79
Name: SECT1 , # of Docs: 75, Blocks left: 98 (of 627)
--------------------------------------------------------------------------------
Number  Name     Created  Modified    Size Version  Last   Total
--------------------------------------------------------------------------------
 1                                                    12/28/79  9/27/83  6:19  9    223   0:01   2:19
 2  RANDELL BANK TRANSACTION FOR MILLIONAIRE/BANK/GB1.S1    12/31/79  2/25/80  4:37  4    6  0:00   0:26
 3  OFFICE OF CENTRAL ENGINEERING (OCE)/DIST/GB1.S1     0/00/00  2/01/80 13:19  13   11    0:00   1:62
 4  TERMINALS-ISSUES ON WHERE TERMINALS ARE HEADING/PICOTT/GB1.S1        1/07/80  9/29/80 10:52  19   14
0:01   1:15
 5  OCE AGENDA/DIST/GB1.S1                                 1/07/80  6/16/81 11:46  8    6  0:01   0:12
 6  OCE-DESIGN GOALS AND CONSTRAINTS/DIST/GB1.S1           1/07/80  6/16/81 11:47  15   8  0:00   0:12
 7  ROADRUNNER/EMS/BUFFET/GB1.S1                           1/07/80  2/01/80 11:45  2    5  0:00   0:07
 8  MFG/ENG REV. OF FY80 CHARTER/GOALS/OBJECTIVES/THOMPSON/GB1.S1        1/07/80  9/29/80 11:05  2    5
0:00   0:07
 9  CAMBRIDGE SCHOOL/YOUNGREN/GB1.S1                       1/08/80  1/23/80  9:06  2    4  0:00   0:10
10  DIGITAL STANDARD BUSSES INTERFACES/GB1.S1              1/14/80  1/14/80 14:47  3    1  0:00   0:00
11  INDIVIDUAL DEVELOPMENT PLANNING KICKOFF/OOD/GB1.S1        1/14/80  2/20/80 13:11  6    9  0:00   0:17
12  STORE PRODUCTS DIRECTION, WHY I'M OPPOSED/MOORE,LP,BJ/GB1.S1   1/14/80  2/20/81 16:03  11   16    0:03
0:30
13  INDUSTRIAL DESIGN/SCHNEIDER/GB1.S1                     1/15/80  2/29/80 11:30  17   7  0:00   0:51
14  DECUS DATA/HURLEY/GB1.S1                               1/15/80  1/15/80 16:00  2    1  0:04   0:04
15  MINC--CONGRATULATIONS ON DROP SHIPPING FR. WF/MCBRIDE/GB1.S1   1/15/80  1/16/80  8:48  2    4  0:01
0:10
16  STORE PRODUCTS DIRECTION...RULER CORRECTION            1/16/80  2/20/81 16:00  12   4  0:06   0:16
17  POPULATION FIGURES -URGENT- FROM AL PYFFER/GB1.S1      1/16/80  3/12/80 13:04  3    3  0:01   0:08
18  PRODUCT HISTORY DATA/GUTMAN,LACROUTE,PEARSON/GB1.S1       1/16/80  9/29/80 11:04  4    7  0:02   0:21
19  BUS SCHEDULE/GB1.S1                                    1/17/80  9/29/80 10:51  11   11    0:00   0:17
20  STRATEGY ISSUES - SLIDES/32 BIT REVIEW/GB1.S1          1/17/80  7/22/80  9:05  7    9  0:00   0:33
21  I/C EXHIBIT FOR YOUR AWARENESS PROGRAM/CUTLER/GB1.S1      1/17/80  1/31/80  4:36  6    6  0:05   0:45
22  BADGE--GWEN /GB1.S1                                    1/17/80  2/20/81 16:04  3    5  0:00   0:10
23  BUS SCHEDULE SLIDES FOR HANDOUT/GB1.S1.19              1/17/80  2/20/81 16:06  8    5  0:00   0:05
24  APPLICATIONS-RISK/APPROACHES OF BLDG IN 80'S/STONE/GB1.S1      1/17/80  2/25/80  4:41  5    8  0:00
0:25
25  THREE RIVERS PER Q - A THREAT, TREND?/FAGERQUIST/GB1.S1        1/17/80  1/23/80 13:55  3    8  0:01
0:15
26  STRATEGY ISSUE SLIDES FOR HANDOUTS/GB1.S1.20           1/17/80  2/01/80 15:03  6    4  0:00   0:05
27  WPS ENGINEERING INTO CE ANNOUNCEMENT/STAN OLSEN        1/18/80  2/08/80 11:27  6    17    0:00   0:26
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28  MARKETING COMMITTEE ANSWER/WITMORE/GB1.S1           1/18/80  2/25/80  4:37  2    5  0:00   0:07
29  DOCK MERGE/CUSTOMER MERGE/PROGRAM MANAGER/OOD/GB1.S1     1/18/80  2/01/80 13:17  4    8  0:00   0:29
30  CSS RE: CHARTER TO BE HW PRODUCT FOCUSSED/BUTLER/GB1.S1        1/18/80  2/01/80 13:17  3    6  0:00
0:18
31  BOROVOY, ROGER--CLASS OF '56/GB1.S1                 1/21/80  9/29/80 10:53  2    3  0:00   0:05
32  DARTMOUTH MEDICAL SCHOOL/STIBITZ/GB1.S1             1/21/80  1/23/80 12:43  4    6  0:00   0:14
33  BABBAGE, CHARLES, INSTITUTE/ARMER/GB1.S1
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1980

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Mary Jane 3/25/80
Name: MJF/GB, # of Docs: 12, Blocks left: 459 (of 627)
-------------------------------------------------------------------------------
Number  Name     Created  Modified    Size Version  Last   Total
-------------------------------------------------------------------------------
 0                                                        3/25/80 12/07/82  9:41  1    127   0:00   0:00
 2                                                        0/00/00  7/07/82  8:21  21   17    0:00   4:53
 3                                                       10/24/82 10/25/82  0:01  6    2  0:01   0:24
 4                                                        0/00/00  3/31/82 15:50  9    4  0:00   0:40
 5                                                        0/00/00  4/20/82 12:41  11   6  0:01   1:02
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Maru Jane 3/25/80
Name: MJF/GB, # of Docs: 12, Blocks left: 459 (of 627)
-------------------------------------------------------------------------------
Number  Name     Created  Modified    Size Version  Last   Total
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 0                                                        3/25/80 12/07/82  9:41  1    127   0:00   0:00
 2                                                        0/00/00  7/07/82  8:21  21   17    0:00   4:53
 3                                                       10/24/82 10/25/82  0:01  6    2  0:01   0:24
 4                                                        0/00/00  3/31/82 15:50  9    4  0:00   0:40
 5                                                        0/00/00  4/20/82 12:41  11   6  0:01   1:02
 6                                                        0/00/00 11/02/82 10:31  14   5  0:04   0:44
 7                                                       11/14/82 11/14/82  0:20  4    1  0:20   0:20
 8                                                       11/20/81 11/30/81 15:55  22   9  1:53   5:57
 9                                                       11/14/82 11/14/82  1:06  6    1  0:16   0:16
13                                                        0/00/00  5/21/82 11:34  49   21    0:33   7:20
14                                                        5/12/82  7/23/82  0:04  4    8  0:01   1:33
17                                                        0/00/00  5/21/82 10:57  4    2  0:00   0:12
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Digital 6/20/80

Name: SECT5 , # of Docs: 70, Blocks left: 66 (of 627)

Number	Name	Created	Modified	Size	Version	Last	Total
1		6/20/80	11/04/80 15:39	9	178	0:02	1:28
2	MFG./ENG. WOODS/SMITH/GB1.S5	6/20/80	6/20/80 13:05	5	1	0:00	0:00
3	SUVAX FOR UNIVERSITIES/ROSING/GB1.S5	6/20/80	7/11/80 1:12	2	3	0:00	0:00
4	VAX MEMORY--BUYING ADD ON/ECKHOUSE/GB1.S5	6/20/80	6/20/80 13:07	5	1	0:00	0:00
5	WPS STRATEGY, ESPECIALLY THE 200/BROOKS/GB1.S5	6/20/80	6/20/80 13:07	8	1	0:00	0:00
6	TERMINALS--WE NEED LOTS OF ARCHITECTURE/PICOTT/GB1.S5	6/20/80	6/14/83 0:29	5	2	0:01	0:01
7	PRODUCT STRATEGY VS. BUSINESS AS USUAL/O/C/GB1.S5	6/20/80	7/21/80 14:29	10	2	0:00	0:05
8	STIBITZ--LIST OF CIRCUIT DRAWINGS/GB1.S5	6/25/80	6/25/80 9:25	1	2	0:01	0:04
9	ENGINEERING ORGANIZATION/PORTNER/GB1.S5	6/26/80	6/27/80 15:02	5	7	0:00	0:25
10	VAX--SINGLE USER, WE NEED IT/KNOWLES.../GB1.S5	6/26/80	7/23/80 13:49	6	8	0:00	0:24
11	STANFORD UNIVERSITY--THANK YOU--LECTURE/FEIGENBAUM/GB1.S5	6/26/80	9/22/80 11:06	4	8	0:00	0:20
12	DATAQUEST RESEARCH NEWSLETTER--REQUEST/RILEY/GB1.S5	6/30/80	7/09/80 16:49	3	5	0:02	0:07
13	STANFORD VLSI PROGRAM/CUDMORE,CLAYTON/GB1.S5	6/30/80	7/09/80 16:49	8	8	0:00	0:17
14	UNIVERSITY OF CAMBRIDGE--YOUR ARRIVAL/WILKES/GB1.S5	6/30/80	7/09/80 16:50	6	5	0:01	0:08
15	FAIRCHILD CAMERA CORP.--REQUEST:PLS. SEND BOOK/HOGAN/GB1.S5	6/30/80	11/04/80 11:24	2	7	0:00	0:07
16	STATE UNIVERSITY OF NEW YORK AT ALBANY/ROBINSON/GB1.S5	6/30/80	11/04/80 11:24	2	6	0:00	0:09
17	WPS TREE/GILMORE.../GB1.S5	6/30/80	6/30/80 4:13	4	3	0:01	0:37
18	RUTHERFORD AND APPLETON LABORATORIES/HOPGOOD/GB1.S5	6/30/80	7/22/80 12:54	3	5	0:00	0:00
19	HUDSON LOBBY DISPLAY/COURTRIGHT/GB1.S5	7/01/80	7/01/80 10:29	5	5	0:02	0:17
21	HISTORICAL TECHNOLOGY ORDER/MOSKOWITZ/GB1.S5	7/09/80	8/18/80 11:27	4	5	0:01	1:02
22	SPECIALIZED BOOK SERVICE INC./SCHEER/GB1.S5	7/14/80	7/14/80 9:37	3	1	0:13	0:13
23	BRIEUX COLLECTION--MALASSIS CHAUVIN COLLECTION/GB1.S5	7/15/80	8/18/80 15:36	12	5	0:00	0:08
24	ATANASOFF, JOHN--PIONEER LECTURE/GB1.S5	7/15/80	2/09/81 12:58	5	5	0:00	0:01
25	ZUSE, KONRAD--THANKS FOR YOUR LETTER/GB1.S5	7/18/80	7/21/80 12:10	3	3	0:00	0:15
26	MUSEUM--WILKINSON INVITATION TO LECTURE/WILKINSON/GB1.S5	7/21/80	9/16/80 16:44	5	10	0:00	0:18
27	ESG'S PERSONAL WORKSTATION/HURLEY ET AL/GB1.S5	7/21/80	6/14/83 0:27	5	8	0:00	0:12
28	AZTEC EMS/ROSING/GB1.S5	7/21/80	8/05/80 9:48	3	6	0:00	0:11
29	VENUS/780 ARRAY PROCESSOR & KAHAN AS CONSULTANT/DEMMER/GB1.S5	7/23/80	7/23/80 16:57	5	2	0:00	0:00
30	INTEL--IMPRESSIONS ON VISITING/CLAYTON/GB1.S5	7/23/80	9/11/80 10:48	26	3	0:00	0:01
31	NEW YORK UNIVERSITY MEDICAL CENTER/EISENBUD/GB1.S5	7/22/80	7/22/80 14:02	2	3	0:01	0:06
32	NAE PEER COMMITTEE MEMBERS/GB1.S5	7/22/80	9/18/80 15:21	2	6	0:00	0:11
33	INTEL--A PATH TO FAST,CHEAP & GOOD NI,WHY NOT?/CLAYTON/GB1.S5	7/23/80	7/23/80 16:54	8	3	0:01	0:01
34	WEST COAST TRIP--CONCERNS/VIEWING MAYNARD FROM AFAR/OOD/GB1.S5	7/23/80	7/23/80 16:51	9	2	0:01	0:01

35 NI ON MERCURY VS.CI LONG INTERIM VS.SHORT RANGE/CARCHIDI/GB1.S5 7/23/80 7/23/80 16:50 6 2
0:01 0:01
36 WILKES, MAURICE--GETTING MOVE ARRANGED/BELL, J./GB1.S5 7/23/80 4/14/81 9:44 6 3 0:01 0:02
37 WPS--SLAVED TUBES ON WPS FOR FORGRD BACKGROUND/BROOKS/GB1.S5 7/23/80 7/23/80 16:48 6 2 0:01
0:01
38 SUVAXES--WHO ARE WE GOING TO WORK WITH/GLORIOSO,PEEBLES/GB1.S5 7/23/80 7/23/80 16:46 5 2
0:01 0:01
39 VENUS--CONGRATULATIONS ON THE PROGRESS/REPORT/FAGERQUIST/GB1.S5 7/23/80 7/23/80 16:45 3 2
0:01 0:01
40 CONGRATULATIONS JIM MILTON/WHAT'S THE CHARTER?/FITZGERALD/GB1.S5 7/23/80 8/05/80 9:49 4 3
0:00 0:01
41 TELECONFERENCING--I DOUBT DECISION WILL BE MADE/KOTOK/GB1.S5 7/23/80 7/23/80 16:42 28 2 0:02
0:02
42 DECISON MAKING TO ALAN--PLEASE HELP ME EXPLAIN/BERTOCCHI/GB1.S5 7/23/80 7/23/80 16:39 32 2
0:04 0:04
43 TELECONFERENCING DECISION--HIGH PRICED/KOTOK/GB1.S5 7/23/80 7/23/80 16:34 12 2 0:01 0:01
44 TELECONFERENCING--ALAN, YOU AND ??/BERTOCCHI/GB1.S5 7/23/80 7/23/80 16:33 6 2 0:01 0:01
45 TELECONFERENCING DECISIONS(OR LACK THEREOF)/BERTOCCHI/GB1.S5 7/23/80 7/23/80 16:32 15 2 0:03
0:03
46 TELECONFERENCING RESOLVE THIS CONFLICT/OLSEN, KEN/GB1.S5 7/23/80 7/23/80 16:27 5 2 0:02
0:02
47 MSD DIRECTIONS/DEMMER/GB1.S5 7/23/80 7/23/80 16:25 7 2 0:07 0:07
48 MERCURY ON NI/MCNAMARA/GB1.S5 7/23/80 7/23/80 16:18 5 2 0:01 0:01
49 DP QUALITY ACQUISITION--SOME QUICK (AND OTHERS)/KENAH/GB1.S5 7/23/80 7/23/80 16:16 6 2 0:01
0:01
50 SOFTWARE BLUEPRINT--BITTING OFF LESS/KENAH/GB1.S5 7/23/80 7/23/80 16:15 7 2 0:03 0:03
51 MINUTES--CONFIDENTIAL(7/10/80) MEETING,LP,JM,GB/PORTNER/GB1.S5 7/23/80 9/18/80 15:20 12 4
0:00 0:04
52 SEGMENTATION DIMENSIONS OF OUR PRODUCTS & WORK/(4)/OOD/GB1.S5 7/23/80 2/09/81 12:48 8 5
0:01 0:03
53 MFG/ENG/MKT SEGMENTATION--A BETTER ONE?/SMITH, JACK/GB1.S5 7/23/80 3/30/81 8:56 19 7 0:00
0:06
54 TIME ANALYSIS THESE DAYS/GB/GB1.S5 7/23/80 7/23/80 16:04 5 2 0:02 0:02
55 TIME ANALYSIS OF MY OWN NON-DISCRETIONARY TIME/OOD/GB1.S5 7/23/80 9/11/80 11:17 9 6 0:01
0:03
56 COMPETITIVE COMPARISON-DEC & WANG WPS BY B. ROSE/BROOKS/GB1.S5 7/23/80 7/23/80 15:58 5 2
0:01 0:01
57 MT. FUJI SNOW JOB TO FORD BOARD/OLSEN, KEN/GB1.S5 7/23/80 9/11/80 10:50 6 4 0:00 0:02
58 INTEL--GROVE MEETINGS/GETTING A POLICY/CLAYTON/GB1.S5 7/23/80 9/11/80 11:04 10 3 0:02 0:03
59 EMS PRODUCTS PLAN (7/18/80) BY PASLASKI/DALEY/GB1.S5 7/23/80 7/23/80 15:53 6 2 0:01 0:01
60 FAIRCHILD CAMERA CORP.--THANK YOU FOR THE BOOK/HOGAN/GB1.S5 7/24/80 9/18/80 15:18 5 9 0:00
0:21
61 INTEL--THANKS FOR THE VISIT/GROVE/GB1.S5 7/24/80 9/11/80 10:48 6 6 0:00 0:37

62 VMS DEMO--INFORMATIVE,IMPRESSIVE,MORE SOURCE/HAMILTON/GB1.S5   7/24/80 7/25/80 12:35 3   6 0:01
0:07
63 SUVAX NOMENCLATURE AND TARGET SCHEDULES/DEMMER/GB1.S5   7/25/80 7/28/80 9:59 5   6 0:01   0:25
64 BRIGHAM YOUNG UNIVERSITY--RE:STRETCH/GARDNER/GB1.S5   7/28/80 7/29/80 11:00 6   6 0:01   0:23
65 LONG RANGE PLAN--MUSEUM/GB1.S5   7/28/80 11/04/80 11:15 8   12   0:00   0:60
66 PINON AND R81 COMPATIBILITY/LIGNOS/GB1.S5   8/13/80 11/04/80 11:15 1   2 0:01   0:03
67 TU58 INVENTORIES:CAN WE REMOVE IT FROM MARKET?/SAVIERS../GB1.S5   8/13/80 11/04/80 11:14 2   3
0:00   0:06
68 WILKES HELP-WITH-VISA LETTER TO US EMBASSY,ENG./PELTIER/GB1.S5   8/15/80 4/14/81 9:44 10   7
0:00   0:16
69 PELTIER(RE:WILKES VISA/AM. EMBASSY, ENGLAND)TWX SENT 8/15/GB1.S9   8/15/80 11/04/80 11:14 10   6
0:00   0:08
70 MUSEUM RE ENIAC LECTURE/ECKERT/GB1.S5   8/15/80 9/17/80 14:49 6   5 0:00   0:07
71 MUSEUM PLAN FOR FY81--GKB & GB   8/21/80 9/04/80 16:54 9   7 0:00   0:58

TCM, Digital 8/25/80
Name: SECT6 , # of Docs: 63, Blocks left: 133 (of 627)

Number Name   Created Modified   Size Version Last   Total
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1   8/25/80 10/02/81 3:43 8   173   0:01   1:12
2 MUSUEM LECTURE SERIES/KILBURN/ARE YOU INTERESTED?/GB1.S6   8/25/80 8/26/80 15:00 3   3 0:01
0:06
3 MUSEUM--INFO (NEWSLETTER/BROCHURE)/HUSKEY/GB1.S6   8/25/80 9/19/80 15:17 4   7 0:00   0:08
4 ZUSE, KONRAD--THANK YOU/GB1.S6   8/25/80 8/26/80 10:56 3   4 0:01   0:13
5 BELL--MY ROLE, SIX MOST IMPORTANT ITEMS/OLSEN/GB1.S6   8/26/80 11/04/80 11:10 7   5 0:00   0:06
6 GOALS (AND OBJECTIVES) FY80 FOR OOD/OLSEN/GB1.S6   8/26/80 11/04/80 11:10 14   10   0:00   0:29
7 GLOSSARY OF OOD/GB1.S6   8/26/80 11/04/80 11:10 14   10   0:00   0:28
8 MFG. ENG. SEGMENTATION PITCH TO YOUR STAFF/SMITH/GB1.S6   8/27/80 2/09/81 12:33 3   11   0:00
0:05
9 VT278 SLIP/A NUDGE/OPPORTUNITY TO MOVE TO 11/DALEY/GB1.S6   8/27/80 8/27/80 14:09 3   2 0:02
0:02
10 MFG. ENG. SEGMENTATION/WHAT NEXT?/COLEMAN/GB1.S6   8/27/80 2/09/81 12:38 18   11   0:05   0:07
11 JAPANESE DISCUSSION AND WHAT TO BUILD/COLEMAN/GB1.S6   8/27/80 9/08/80 11:21 7   3 0:00   0:03
12 LA200/VT200 SPECS + SCHEDULE/WILLIAMS/GB1.S6   8/27/80 8/27/80 14:02 7   2 0:01   0:01
13 EMS PRODUCT PLAN/CHISHOLM/GB1.S6   8/27/80 9/25/80 16:36 10   3 0:00   0:02
14 SOFTWARE BEIGE BOOK/CHRISTY/GB1.S6   8/27/80 8/27/80 13:58 4   2 0:01   0:01
15 SYSTEMS + CCEG ENGINEERING CHARTERS/FITZGERALD/GB1.S6   8/27/80 8/27/80 13:57 12   2 0:02   0:02
16 SUVAX PROGRAM MANAGER ROLE/DEMMER/GB1.S6   8/27/80 8/27/80 13:55 4   2 0:01   0:01
17 TERMINALS/WE NEED CAPITAL,INTERNAL EQUIPMENT/PORTNER/GB1.S6   8/27/80 8/27/80 13:54 3   2 0:02
0:02

18 PUBLISH--TINY PERMISSION TO PUBLISH/CLAYTON,TITELBAUM/GB1.S6   8/27/80 8/27/80 13:52 2   2 0:01
0:01
19 PERSONNEL:SR CONSULTING ENG.PROMOTION(MUDGE)/TEICHER/GB1.S6   8/27/80 8/27/80 13:51 5   2 0:02
0:02
20 DIGITAL PRESS/COMPUTER ENGINEERING ROYALTIES/TECIHER/GB1.S6   8/27/80 8/27/80 13:48 3   2 0:02
0:02
21 SEMIS STRATEGY/TEICHER/GB1.S6   8/27/80 9/22/80 17:01 8   6 0:00   0:03
22 CORPORATE REPORT CARD/OLSEN, K./GB1.S6   8/27/80 9/08/80 11:07 25   6 0:01   0:07
23 KO--KNOCK OUT:AN APPLIC. TER/SM.SYS./OOD.../GB1.S6 8/28/80 5/03/82 8:57 21   7 0:01   0:03
24 UNITED STATES CONGRESS/PAYER,ALIC/GB1.S6   8/29/80 9/29/80 12:47 1   2 0:00   0:04
25 UNIVERSITY OF CALIF.--THANK YOU/LUEHRMANN/GB1.S6   8/29/80 9/29/80 12:54 3   3 0:00   0:11
26 UNIVERSITY OF CALIF.,SAN DIEGO--THANK YOU/REYNOLDS/GB1.S6   8/29/80 9/03/80 9:04 4   3 0:01
0:12
27 INTEL/THANK YOU/CARSTEN/GB1.S6   9/02/80 9/03/80 8:40 2   3 0:01   0:02
28 DIGITAL--READING, ENGLAND/RE:PDP-8/BUXTON/GB1.S6   9/02/80 9/02/80 16:29 3   7 0:00   0:06
29 AMERICAN EMBASSY--IMMIGRANT VISA'S/PELTIER/GB1.S6   9/02/80 9/02/80 16:27 4   3 0:00   0:11
30 ACM--SAN FRANCISCO TALK/THANK YOU FOR INVITATION/HUANG/GB1.S6   9/02/80 10/31/80 12:26 2   3
0:01   0:03
31 BEIGE BOOK-WHETTED APPETITE/OOD/GB1.S6   9/02/80 9/02/80 16:47 4   6 0:00   0:03
32 SEMIS--DRAFT OF BUYING STD. SEMIS/MOFFA/GB1.S6   9/02/80 9/08/80 11:14 8   5 0:03   0:04
33 OFIS ARCH. DRAFT FOR KO,WPS,EMS/DALEY,GILMORE.../GB1.S6   9/02/80 10/06/80 11:42 39   5 0:00
0:04
34 ENGINEERING/GB'S ANNUAL REVIEW--COVER SHEET/OC,BOD/GB1.S6   9/03/80 9/04/80 16:48 3   7 0:00
0:13
35 GOALS (AND OBJECTIVES) FY81 FOR OOD/OLSEN, KEN/GB1.S6   9/03/80 11/04/80 11:08 7   5 0:00   0:26
36 NAE ELECTION COMMITTEE/LIEBOWITZ/GB1.S6   9/08/80 9/11/80 8:36 21   7 0:00   1:35
37 NAE MEMBERS AND WHERE FOUND/GB1.S6   9/08/80 11/04/80 11:08 7   5 0:01   0:03
38 U. OF NEWCASTLE--WE ARE COMING TO VISIT/RANDELL/GB1.S6   9/15/80 10/02/80 13:50 3   6 0:00   0:03
39 KO FIRST MEETING 8/27/80/OLSEN, KEN/GB1.S6   9/16/80 5/03/82 8:56 3   4 0:00   0:01
40 COMMUNICATIONS--EXECUTING THE COMM.,NETWORKS/DEMMER.../GB1.S6   9/29/80 9/29/80 10:08 7   7
0:01   0:06
41 COMPETITION--SMALLTALK/XEROX BEING A SUBJECT/SAMBERG/GB1.S6   9/16/80 9/16/80 15:11 3   7 0:01
0:03
42 EMS ON VMS--BASING THE MAIL SYSTEM/TRAVIS/GB1.S6   9/16/80 9/16/80 15:10 8   8 0:00   0:02
43 ROI ISSUE/LYLE/GB1.S6   9/16/80 9/16/80 14:31 10   3 0:00   0:01
44 OFIS--TARGET ARCHITECTURE AND PRODUCTIVITY/DALEY/GB1.S6   9/16/80 9/16/80 14:30 4   4 0:00
0:01
45 BEIGE BOOK REVIEW/THOMPSON/GB1.6   9/18/80 9/18/80 11:41 3   5 0:00   0:07
46 SEMIS RE:CPU STRATEGY/DECISION METHODS/TEICHER/GB1.S6   9/16/80 9/16/80 14:30 5   4 0:01   0:02
47 DECMAIL SCHEDULE SANITY CHECK--EMS/WPS PROGRAMS/DALEY/GB1.S6   9/16/80 9/16/80 14:27 8   3 0:03
0:04
48 CMU--GB PERSONAL BOOKS/SIEWIOREK/GB1.S6   9/22/80 9/22/80 16:23 2   3 0:00   0:07
49 LOW END HELP/CLAYTON/GB1.S6   9/16/80 9/16/80 14:24 5   3 0:00   0:00

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50  DP REVIEWS--INTRODUCTION TO OFFICE AUTOMATION/KENAH/GB1.S6     9/16/80  9/16/80 14:24  10   3  0:01
0:02
51  KO COMPUTER/OLSEN/GB1.S6                                 9/16/80  5/03/82  8:55  6    4  0:01   0:01
52  KO EDITOR IDEAS/TRAVIS/GB1.S6                            9/16/80  5/03/82  8:55  2    4  0:00   0:01
53  STRATEGY--PLS CONSIDER VAX (NEBULA)/DEMMER/GB1.S6   9/16/80  9/16/80 14:23  5    4  0:01   0:01
54  VMS--SECURITY DEMO AND NEXT VERSIONS OF VMS/CARCHIDI/GB1.S6    9/16/80  9/16/80 14:22  5    4  0:00
0:01
55  SIEMENS--MUNICH INVITATION/BAUR/GB1.S6                   9/16/80  9/16/80 14:21  3    3  0:00   0:00
56  KO--WED. MORNING MEETING(9/10/80)/CLAYTON/GB1.S6    9/16/80  5/03/82  8:58  5    6  0:00   0:02
57  ABSTRACT--GENERATING COMPUTER GENERATIONS/GB1.S6    9/24/80 10/07/81 13:44  2    7  0:03   0:12
58  INTERCONNECT PROGRAM REVIEW ATTENDANCE/FULLER/GB1.S6     9/25/80 11/04/80 11:05  4    3  0:00   0:01
59  PDP-11 PROGRAM ENVIRONMENT ON VMS/DALEY,STEWART.../GB1.S6      9/29/80  9/29/80 10:20  8    6  0:01
0:10
60  KO BUS--THOUGHTS ON KO BUS/ADDITIONS QBUS/MILLER,GAUBATZ/GB1.S6      9/30/80  5/03/82  8:53  14   8
0:01   0:04
61  SLIDE--CRAYL,AMDAHLV6, TT9900/GB1.S6                     9/30/80 10/31/80 16:39  3    4  0:00   0:10
63  KO/VT200 ORG.--LET'S GET IT WRITTEN DOWN/CLAYTON/GB1.S6       10/01/80  5/03/82  8:58  3    5  0:00
0:02
64  NAE RANKING FOR 18TH ELECTION/PEER GROUP/GB1.S6    10/02/80 10/31/80 16:38  4    7  0:00   0:26

                                                      10/06/80 10/06/80 12:59  8    3  0:01   0:02
18  TELECONFERENCING/SAIA/GB1.S7                          10/06/80 10/29/80 15:14  4    4  0:00   0:01
19  EMS/VMS (LDP'S) VS. DECMAIL/MILESKI/GB1.S7           10/06/80 10/06/80 12:57  16   5  0:01   0:03
20  SUVAX/SMITH, PETER/GB1.S7                             10/06/80 10/31/80 12:42  6    4  0:00   0:00
21  MIT--ABYSMAL INTERFACE/ECKHOUSE/GB1.S7               10/06/80 12/04/80 16:36  5    5  0:00   0:01
22  EMS/VMS STEALTH MIRAGE FEASIBILITY APPROACH/DALEY/GB1.S7      10/06/80 10/29/80 15:33  12   7  0:00
0:02
23  VAX-11, PDP-11 ENVIRONMENT--ANOTHER LOW END TOOL/HEFFNER/GB1.S7     10/31/80 10/31/80 10:02  6    4
0:00   0:10
24  DECMAIL--GOALS,CONSTRAINTS,PLAN/STEWART/GB1.S7     10/06/80 10/31/80 16:34  4    4  0:00   0:01
25  TELEPHONE--AT&T SERVICE/FORBES/GB1.S7               10/06/80 10/31/80 16:34  9    5  0:00   0:01
26  JAPAN--FS STUDY--GET OTHERS TO HELP TOO/SENIOR/GB1.S7   10/31/80 10/31/80 10:01  17   3  0:00   0:01
27  IBM--RE:GUATELLI DOING WORK FOR MUSEUM/HADDAD/GB1.S7    10/09/80  1/08/81 14:56  3    10    0:01   0:10
28  IBM--RE:GUATELLI DOING WORK FOR MUSEUM/SULLIVAN/GB1.S7  10/09/80  1/08/81 14:54  3    9  0:01   0:10
29  IBM--RE:GUATELLI DOING WORK FOR MUSEUM/BRANSCOMB/GB1.S7       10/09/80  1/08/81 14:55  5    10    0:01
0:24
30  SIRIUS--INRIA MACHINES/POUZIN/GB1.S7                 10/10/80 10/13/80 13:11  2    2  0:01   0:06
31  TALK--GEORGE BALL - 10/13/80/GB1.S7                  10/13/80 10/31/80 16:33  15   13    0:00   0:59
32  UNIVERSITY OF MANCHESTER--LECTURE,DR. EDWARDS/KILBURN/GB1.S7  10/13/80 10/13/80  0:29  2    2  0:00
0:01
33  NATIONAL RESEARCH COUNCIL--DRAFT REPORT/GOODWIN/GB1.S7  10/13/80 10/13/80  0:55  3    4  0:01   0:05
34  ROSING--WHY HE WENT TO APPLE/OC/GB1.S7               10/14/80 10/14/80 17:04  12   5  0:01   0:11
35  ORGANIZATION GOALS AND CONSTRAINTS/GB1.S7            10/14/80 10/29/80 15:52  10   4  0:01   0:13
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36 ATANASOFF DISPLAY AGREEMENT & VISIT ARRANGEMENTS/GB1.S7   10/21/80 10/24/80 16:43 7   6 0:00
0:13
37 SOFTWARE ORGANIZATION ISSUES/OOD/GB1.S7   10/21/80 10/21/80 11:30 4   5 0:01   0:18
38 REFERENCE FOR DAVID ROBINSON UNIVERSITY OF DELAWARE/WARTER/GB1.S7   10/27/80 10/27/80 13:26 2   4
0:00   0:10
39 REFERENCE FOR DAVID PATTERSON CALIF.,BERKELEY/SEQUIN/GB1.S7   10/27/80 1/10/83 11:54 3   4 0:01
0:15
40 NAE PANEL TALK--ACADEME,INDUSTRY,& GOVERNMENT/GB1.S7   10/27/80 10/31/80 16:30 15   4 0:01   0:54
41 CMU--THANKS TO BILL KEATING ET AL/FULLER/GB1.S7   10/31/80 10/31/80 10:01 17   3 0:00   0:01
42 EMS/VMS--MAKING AVAILABLE VS. WAITING FOR DECMAIL/REYER/GB1.S7   10/29/80 10/29/80 16:21 5   3
0:01   0:02
43 OFIS--JULIUS' COMMENTS ON THE OFIS PROG./DALEY/GB1.S7   10/29/80 10/29/80 16:21 7   3 0:00   0:01
44 TU58/SAVIERS/GB1.S7   10/29/80 10/29/80 16:20 2   3 0:00   0:01
45 CMU--PLEASE HELP BILL WULF/FULLER/GB1.S7   10/29/80 10/29/80 16:20 30   3 0:00   0:01
46 OA:GIVE UP/ACT TOGETHER/BROOKS/GB1.S7   10/29/80 10/29/80 16:34 15   7 0:01   0:07
47 CHARTER DUTIES/STOCKEBRAND/GB1.S7   10/29/80 10/29/80 16:19 4   3 0:00   0:00
48 KO & LANGUAGES/SNYDER/GB1.S7   10/29/80 10/29/80 16:19 4   3 0:01   0:02
49 MERCURY/CARCHIDI/GB1.S7   10/29/80 10/31/80 12:41 5   5 0:00   0:01
50 NI--KEN'S MEMO, GOOD POINTS/MILLER/GB1.S7   10/31/80 10/31/80 10:00 3   3 0:00   0:01
51 NEBULA, SUVAX, APPLE/KNOWLES/GB1.S7   10/31/80 10/31/80 10:00 4   3 0:00   0:01
52 NEBULA--YOUR EMS/LACROUTE/GB1.S7   10/31/80 10/31/80 9:59 5   4 0:00   0:01
53 NI-BASED COMM--LET'S GO DIRECTLY/ADAMS/GB1.S7   10/31/80 10/31/80 9:59 10   3 0:01   0:02
54 SCORPIO--ENOUGH TO COMPETE WITH NEW 32-BIT MICROS?/CLAYTON/GB1.S7   10/31/80 10/31/80 9:58 6   3
0:01   0:01
55 KO AND LACK OF PROGRESS AGAIN GOALS/CLAYTON/GB1.S7   10/31/80 10/31/80 9:57 25   3 0:00   0:02
56 VT200--YOU ARE GOING TO FAIL,TOGETHER A CHANCE/CLAYTON/GB1.S7   10/31/80 10/31/80 9:56 5   3
0:01   0:01
57 GROUP (11)--GETTING TO A SINGLE 11 SYSTEMS GROUP/CLAYTON/GB1.S7   10/31/80 10/31/80 9:54 7   3
0:00   0:00

Digital TCM 10/06/80
Name: SECT7 , # of Docs: 57, Blocks left: 102 (of 627)

Number Name   Created Modified   Size Version Last   Total
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1   10/06/80 12/01/80 14:18 7   144   0:00   0:50
2 OFIS ARCHITECTURE COUPLING/PEEBLES/GB1.S7   10/06/80 10/06/80 13:13 9   3 0:00   0:01
3 VT200--SMALL SYSTEMS/OLSEN,KEN/GB1.S7   10/06/80 10/23/80 13:02 4   4 0:00   0:01
4 ORGANIZATION--AN EXPERIMENT TO REDUCE HASSLE/CUTLER/GB1.S   10/06/80 10/06/80 13:13 24   3 0:01
0:03
5 GRAPHICS--ARCHITECTURE & PRODUCTS FOR KO & SUVAX/PICOTT/GB1.S7   10/06/80 10/06/80 13:11 8   6
0:00   0:02
6 BUDGET--PARAMETERIZED SOFTWARE/MARCUS/GB1.S7   10/06/80 10/06/80 13:10 19   7 0:00   0:04

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 7  WPS/EMS/KO DIRECTION AND STATUS/BROOKS/GB1.S7      10/06/80 10/06/80 13:10  21   3  0:01   0:06
 8  KO BUS--DEFINING THE II VIS A VIS Q&Q DERIVATES/GEAGHAN/GB1.S7      10/06/80 10/06/80 13:08  7    5
0:01   0:01
 9  KO PACKAGE--GOALS/THOUGHTS--MODULE MODULARITY/CLAYTON/GB1.S7  10/06/80 10/06/80 13:06  12   3  0:01
0:02
10  KO--DISPLAY INDEPENDENCE/STRAUSS/GB1.S7           10/06/80 10/06/80 13:04  3    3  0:00   0:00
11  BUS--10/20/ENGINEERING POSITION/HINDLE/GB1.S7      10/06/80 10/06/80 13:03  6    3  0:00   0:01
12  KO BUS--MACHINE, QNI/UNI/LNI/NI/ROSING/GB1.S7      10/06/80 10/29/80 15:15  4    4  0:00   0:02
13  KO BUS--VIS A VIS MULTIBUS/MILLER/GB1.S7           10/06/80 10/10/80 10:46  3    4  0:00   0:02
14  OFIS/KO--OVERSPENDING/RELAX A LITTLE/FREEDMAN/GB1.S7    10/06/80 10/29/80 15:16  5    4  0:00   0:00
15  JAPAN--NOTE DEVELOPMENT BY MITSUBISHI/OOD/GB1.S7   10/06/80 10/06/80 13:00  4    3  0:00   0:01
16  OFIS--VLACH PRODUCT STRATEGY UPDATE--9/8/80/DALEY/GB1.S7      10/06/80 10/06/80 12:59  5    3  0:00
0:00
17  ORGANIZATION--ENGINEERING THOUGHTS/OOD/GB1.S7




Digital TCM 12/31/80
Name: SECT1 , # of Docs: 35, Blocks left: 97 (of 627)
--------------------------------------------------------------------------------
Number  Name     Created  Modified    Size Version  Last   Total
--------------------------------------------------------------------------------
 1                                                    12/31/80  9/27/83  6:16  5    97    0:01   0:28
 2  ECKERT-MAUCHLY AWARD--CLARK NOMINATION/STONE ET AL/GB2.S1     12/31/80 11/16/81 11:35  20   32    0:01
1:40
 3  CT'S,VT'S AND Q-BUS SYSTEMS--WHERE ARE WE GOING?/LYLE/GB2.S1   1/05/81  8/31/81 16:26  10   7  0:01
0:36
 5  MUSEUM--SUBMIT PAPER TO ANNALS/ATANASOFF/GB2.S1     1/05/81  1/05/81 14:37  9    3  0:00   0:21
 6  ASTC/GRINELL/GB2.S1                                 1/05/81  2/09/81  0:12  7    10    0:01   0:27
 7  PRINTER--SHEET FEED VS. ROLL OR FOLDED FORM/LYLE.../GB2.S1     1/05/81  1/07/81  9:38  4    6  0:01
0:06
 8  DIGITAL PRESS--STERN MANUSCRIPT REVIEW/KENAH,DUFFY/GB2.S1      1/06/81  2/15/83 11:27  92   11    0:00
0:17
 9  TERMINALS HOME QUIZ/OOD/GB2.S1                      1/08/81  1/08/81 15:38  4    2  0:05   0:18
10  SCOTT INSTRUMENTS--VOICE RECOGNITION/NIEDERHOFER/GB2.S1        1/09/81  1/26/81 11:34  3    4  0:00
0:06
11  REFERENCE FOR BILL MILLER/GINZTON/GB2.S1            1/13/81  2/03/81 12:51  1    3  0:00   0:03
12  CONSOLE--IN VENUS & JUPITER/FAGERQUIST/GB2.S1       1/12/81  1/12/81 12:09  3    6  0:01   0:05
13  HARVARD U.--WORKSHOP,COMM. NETWORK MANGE./OETTINGER/GB2.S1     1/16/81  4/15/81 11:25  3    5  0:01
0:13
14  TINY--SELLING, ESPECIALLY WITHIN DEC/LYLE.../GB2.S1      1/12/81  1/12/81 12:00  6    5  0:00   0:04
15  MUSEUM LECTURE/ZUSE, KONRAD/GB2.S1                  1/16/81  1/20/81  9:53  4    14    0:00   1:01
16  MUSEUM - SIEMENS' ZUSE --EXHIBIT/DATENTECHNIK/GB2.S1     1/16/81  2/03/81 12:41  3    7  0:00   0:01
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17 MUSEUM LECTURE AND ENIAC MATERIAL /BURKS/GB2.S1   1/16/81 2/03/81 12:50 6   9 0:01   0:04
18 DP BOOK--MICROPROC. LSI-11 (BY F. LEE--MIT)/MACKEEN/GB2.S1   1/12/81 2/03/81 12:38 5   6 0:00
0:05
19 MUSEUM LECTURE SCHEDULED/EDWARDS/GB2.S1   1/16/81 2/03/81 12:47 2   4 0:01   0:01
20 MUSEUM--DO WRITE ARTICLE FOR ASC/GALLER/GB2.S1   1/19/81 2/03/81 12:48 4   6 0:01   0:07
21 MUSEUM--GETTING ARTICLE TO GALLER/ATANASOFF/GB2.S1   1/19/81 1/20/81 9:38 3   5 0:03   0:06
22 MUSEUM--REPLICA OF SHICKARD MACHINE/TAYLOR/GB2.S1   1/19/81 2/02/81 9:16 2   8 0:00   0:08
23 ZEBCO--FISHING REEL/GB2.S1   1/20/81 1/22/81 13:48 2   2 0:00   0:02
24 DP - BOOK,"MICROPROCESSORS LSI-11/LEE/GB2.S1   1/20/81 1/20/81 11:28 3   2 0:01   0:07
25 MUSEUM--POSSIBLE LECTURE(COLOSSUS)/FLOWERS/GB2.S1   1/20/81 1/21/81 12:38 2   5 0:01   0:16
26 GENERATING COMPUTER GENERATIONS TALK AS OF 1/26/81/GB2.S1   1/26/81 2/09/81 14:54 124 5 0:02
0:10
27 ORGANIZATION - OOD RESTRUCTURED--1/23/81/GB2.S1   1/26/81 9/20/82 14:12 11   4 0:00   0:05
28 HSC-50 BUSINESS PLAN/GUTMAN/GB2.S1   2/02/81 2/13/81 13:24 5   3 0:01   0:02
29 MUSEUM--THANK YOU & PAYMENT FOR PASCAL/GUATELLI/GB2.S1   1/27/81 2/02/81 2:26 4   4 0:00   0:02
30 ATANASOFF - U. OF WISCONSIN-MADISON-- INFO./THOMPSON/GB2.S1   1/27/81 2/15/83 11:29 3   6 0:00
0:03
31 GENERATING COMPUTER GENERATIONS TALK AS OF 1/27/81/GB2.S1   1/27/81 2/09/81 14:50 124 6 0:03
0:13
32 SIEMENS--TERMINALS CONTACT/SCHWAB/GB2.S1   1/27/81 2/04/81 13:33 1   2 0:00   0:03
33 WPS PRODUCT LIST/OLSEN, KEN/GB2.S1   1/27/81 1/30/81 9:26 3   8 0:07   0:13
34 BOARDS RELAYOUT--MFG WILL PAY/OOD/GB2.S1   2/02/81 2/02/81 2:26 4   2 0:00   0:00
35 SUVAX: WHAT DO I TELL THIS TROOP/OLSEN, KEN/GB2.S1   2/02/81 2/02/81 2:29 6   2 0:01   0:01
36 FCC--I'M GOING AHEAD WITH BOYLSTON/OLSEN, KEN/GB2.S1   2/02/81 3/12/81 15:48 6   3 0:00   0:01

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1981
Sort 1/28/81
Name: SECT14, # of Docs: 7, Blocks left: 572 (of 627)
------------------------------------------------------------------------------
Number  Name     Created  Modified    Size Version  Last   Total
------------------------------------------------------------------------------
 1                                                     1/28/81 10/02/81 10:04  1    11    0:01   0:01
 2  LIST TO BE SORTED/GB2.S14                          1/28/81  6/23/81 16:09  20   12    0:00   0:22
 3  SPEC FOR SORT                                      1/28/81  1/28/81 17:48  2    72    0:00   0:04
 4  FORM FOR SORT                                      1/28/81  9/28/81  9:10  1    5  0:00   0:00
 5                                                     1/28/81  1/28/81 17:48  20   21    0:02   0:03
 6                                                     1/28/81  1/28/81 17:49  1    1  0:00   0:00
 7  GB2.S14 INDEX                                     10/02/81 10/02/81 10:04  3    1  0:00   0:00


TCM 2/13/81  3/02/86
Name: BLIST1, # of Docs: 13, Blocks left: 189 (of 627)
------------------------------------------------------------------------------
Number  Name     Created  Modified    Size Version  Last   Total
------------------------------------------------------------------------------
 1                                                     0/00/00  3/07/87  9:18  1    67    0:01   0:20
 2  $ FORM/BLIST                                       0/00/00  3/07/87  8:46  2    15    0:00   0:12
 3  Bell collection 200-249                            3/08/82  3/07/87  3:03  54   20    0:07   9:15
 5  B List 300-350                                     8/19/84  3/07/87  3:20  46   23    0:07   4:53
 8  FORM/BLIST                                         7/27/81  3/08/86  3:00  1    14    0:03   0:17
 9  SPEC/BLIST                                         0/00/00  3/07/87  8:25  1    20    0:00   0:02
11  OUTLINE GENEALOGY/BLIST                            0/00/00  3/07/87  0:12  10   19    0:01   2:43
13  BELL COLLECTION LIST - #1 THRU #49 (COMPLETE LIST)/BLIST       2/13/81  0/00/00  0:21  72   53    0:00
8:29
15  BELL COLLECTION LIST - #51 THRU #99 (COMPLETE LIST)/BLIST      2/13/81  3/07/87  2:29  44   34    0:29
4:38
17  BELL COLLECTION LIST - #c/13/81  3/07/87  3:08  48   38    0:04   4:32
18  BELL COLLECTION LIST - #150-199                    0/00/00  3/07/87  3:13  51   38    0:04  11:16
25                                                     3/07/87  3/07/87  9:17  46   4  0:01   0:05
35   B list 350-99                                     3/02/86  3/07/87  8:08  37   8  0:45   4:43

Digital GB Papers 3/17/81
Name: RL1.S4, # of Docs: 44, Blocks left: 97 (of 627)
------------------------------------------------------------------------------
Number  Name     Created  Modified    Size Version  Last   Total
------------------------------------------------------------------------------
 1                                                     3/17/81  8/21/81 14:35  6    110   0:01   0:57
 2  RANKING OF U.S. & WW SUPPLIERS/GB2.S4              3/17/81  5/12/81  8:55  6    11    0:01   1:07
 3  SLIDES -- TRANSITIONS(OC PRESENTATION)/GB2.S4      3/17/81  3/25/81 10:01  19   14    0:00   1:09
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4 COMPETITORS--ENG & MFG LIMITS--FUTURES/CLAYTON.../GB2.S4 3/17/81 5/12/81 8:57 12 10 0:02 0:07
5 HEURISTICS FOR BUILDING GREAT PRODUCTS/AOCW BOOK/GB2.S4 3/17/81 3/18/82 16:11 27 9 0:00 0:10
6 CURSORY THOUGHTS ON HIGH END DISKS/ENG STAFF/GB2.S4 3/17/81 3/31/81 12:42 24 15 0:00 0:31
7 ENIAC SLIDES, UNIVERSITY OF MICHIGAN--/BURKS/GB2.S4 3/23/81 4/17/81 14:43 2 5 0:02 0:06
8 AOCW BOOK--CHAPTER 1/GB2.S4 3/18/81 1/04/83 8:29 148 26 0:00 1:15
9 COVER SHEET--ENG. STRATEGY OVERVIEW/GB2.S4 3/18/81 3/31/81 12:49 1 4 0:01 0:03
10 NAUTILUS--MAKE/BUY TALLY SHEET/GB2.S4 3/19/81 3/31/81 12:47 9 9 0:01 0:42
11 CT FY'82 SHORTFALL (FUNDING)/JOHNSON, TED/GB2.S4 3/24/81 3/31/81 12:46 16 9 0:01 0:27
12 NAUTILUS--MAKE OR BUY A GATE ARRAY FROM TI/CUDMORE/GB2.S4 3/25/81 3/31/81 12:44 5 3 0:00 0:01
13 MILL--CLEAN UP CAMPAIGN!/FORBES/GB2.S4 3/25/81 3/31/81 12:44 6 3 0:00 0:00
14 J-11: AT BOARD, BOX AND SYSTEM/LYLE/GB2.S4 3/25/81 3/31/81 12:44 9 3 0:00 0:00
15 DP--THE STERN BOOK: HOLD THE PRESS/KENAH/GB2.S4 3/25/81 3/31/81 12:44 3 3 0:00 0:00
16 FCC--IF DON'T CONFORM, THEN NO ANNOUNCEMENT/BURNETT/GB2.S4 3/25/81 3/31/81 12:44 5 4 0:00 0:01
17 STRATEGY--THOUGHTS ON ENG. BUDGET AND STRATEGY/CORBEN/GB2.S4 3/25/81 3/31/81 12:42 15 3 0:01 0:01
18 WPS--GETTING CHARTERS/ORGANIZED TO SELL PRODUCTS/BROOKS/GB2.S4 3/25/81 3/31/81 12:41 10 3 0:00 0:01
19 TLC--DEMO/AVERY/GB2.S4 3/25/81 3/31/81 12:41 4 3 0:01 0:01
20 CT--AND 16 BIT ARCHITECTURE/CONKLIN/GB2.S4 3/25/81 3/31/81 12:40 8 6 0:00 0:04
21 SUVAX--PETER JANSEN & ECS/KNOWLES/GB2.S4 3/25/81 3/31/81 12:40 5 4 0:00 0:06
22 SUVAX--MISSING THE BOAT WITH SUVAX/KNOWLES/GB2.S4 3/25/81 3/31/81 12:39 3 3 0:00 0:01
23 SUVAX--ANDY'S SUGGESTION ON ALTERNATIVE STRATEGY/DEMMER/GB2.S4 3/25/81 3/31/81 12:38 4 5 0:01 0:02
24 CANADA--YOUR PROJECT/KNOWLES/GB2.S4 3/25/81 4/01/81 8:54 3 4 0:00 0:00
25 GIGI--USING IT TO MAKE BIG/GOOD SMART TERMINALS/KNOWLES/GB2.S4 3/25/81 3/31/81 12:36 5 3 0:00 0:01
26 WPS MARKET--COMMENTS/BROOKS/GB2.S4 3/25/81 3/25/81 15:46 9 2 0:00 0:00
27 SUVAX--WE GOT COMPETITION/DEMMER/GB2.S4 3/25/81 3/25/81 15:49 7 2 0:01 0:01
28 SUVAX AND ARPA/WEISS/GB2.S4 3/25/81 3/31/81 12:36 5 3 0:00 0:00
29 EUROPEAN ENGINEERING--SCOTLAND,FRANCE,GERMANY/DEMMER/GB2.S4 3/25/81 3/31/81 12:36 9 3 0:00 0:01
30 FACILITY--WEST COAST R&D FACILITY/ECKHOUSE/GB2.S4 3/25/81 3/31/81 12:35 5 3 0:00 0:00
31 SUVAX--FINDING MONEY FOR SUVAX/KUSIK/GB2.S4 3/25/81 3/31/81 12:35 4 3 0:00 0:00
32 CONSULTANTS--BOOZ ALLEN, BUYING (AND GIVING)/DELAGI/GB2.S4 3/25/81 3/31/81 12:35 7 3 0:01 0:01
33 DESIGN--MECHANICAL ELEGANCE-A FAST TRACK TO Q&P/ENG STAFF/GB2.S4 3/25/81 3/31/81 12:34 5 3 0:01 0:02
34 TERMINALS--LOW COST SYSTEMS/MKT. COMM./GB2.S4 3/25/81 3/31/81 12:33 7 3 0:00 0:00
35 COMPUTING & COMMUNICATION SUGGESTIONS/BERTOCCHI/GB2.S4 3/25/81 3/31/81 12:33 7 3 0:01 0:01
36 HARDWARE/TAXONOMY-- FULLER/GB2.S4 3/25/81 9/02/81 15:18 12 6 0:01 0:02

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37  CT--DISCLOSING/GVPC/GB2.S4                           3/25/81  3/31/81 12:32  2    3  0:00   0:01
38  OKI--STAY MANUFACTURER, NOT DISTRIBUTOR/BROOKS/GB2.S4    3/25/81  3/31/81 12:32  4    3  0:01   0:01
39  COMPUTER--DESK TOP (THE PROFESSIONAL MANAGERS)/JOHNSON,TED/GB2.S4    3/25/81  3/31/81 12:31  7    3
0:00   0:02
40  MUSEUM--LECTURE AT SPITBROOK?/FORRESTER/GB2.S4      3/27/81  3/27/81  8:44  4    2  0:05   0:06
41  INTEL--INTERFACE ETHERNET & BUYING FROM THEM/FEDERMAN/GB2.S4   3/30/81  3/31/81 10:22  15   7  0:00
0:24
42  SIEMENS--RE:VAX YOU PURCHASED/BAUR/GB2.S4           3/30/81  4/26/82 11:37  13   7  0:00   0:33
43  MUSEUM--CONFIRMATION OF LECTURE/BRAINERD/GB2.S4     3/30/81  3/31/81  9:01  6    2  0:03   0:07
44  CT ENGINEERING LOCATION /GB2.S4                     4/27/81  4/28/81 14:45  3    7  0:00   0:04
                                                       1/25/82  6/02/83 11:42  133  23    0:01   3:50


Digital Museum 4/06/81
Name: RL1S5 , # of Docs: 68, Blocks left: 122 (of 627)
---------------------------------------------------------------------------------
Number  Name     Created  Modified    Size Version  Last   Total
---------------------------------------------------------------------------------
 1                                                      3/31/81  9/14/81 16:12  9    131   0:00   1:33
 2  MUSEUM-SIEMENS LOA OF NEEDLE TELEGRAPH/JESSE/GB2.S5      3/31/81  7/20/81 13:39  5    8  0:00   0:10
 3  SIEMENS MUSEUM--THANKS--LOAN OF MATERIALS/GOETZELER/GB2.S5     3/31/81  5/20/81 14:54  8    10    0:00
0:15
 4  MEMORY VIEWS OF THE WEEK/SAVIERS/GB2.S5             4/06/81  4/08/81  8:10  2    4  0:00   0:13
 5  LAWRENCE LIVERMORE LAB--THANK YOU/MICHAEL/GB2.S5    4/06/81  4/08/81  8:10  2    4  0:00   0:05
 6  MCF--MILITARY COMPUTER FAMILY DRAFT STATEMENT/GB2.S5     4/06/81  5/29/81 12:17  4    8  0:00   0:22
 7  LLL--HIGH SPEED COMPUTING/ENG STAFF.../GB2.S5       4/06/81  5/20/81  9:32  30   25    0:02   2:50
 8  NAE PEER COMMITTEE/IVAN GETTING/GB2.S5              4/07/81  5/29/81 12:14  4    4  0:03   0:08
 9  MILITARY COMPUTER FAMILY--FORM LETTER/GB2.S5        4/08/81  5/15/81 12:34  2    6  0:00   0:03
10  MILITARY COMPUTER FAMILY LIST/GB2.S5                4/10/81  9/14/81 16:13  8    13    0:01   1:09
11  MILITARY COMPUTER FAMILY SPEC/GB2.S5                4/10/81  5/29/81 13:34  1    5  0:00   0:00
12  MILITARY COMPUTER FAMILY RESULTS/GB2.S5             4/10/81  6/02/81 13:48  2    10    0:00   0:03
13  REVIEW DRAFT REPORT--80S TRANSITIONS/ROBINSON/GB2.S5     4/13/81  5/29/81 12:32  2    4  0:01   0:05
14  REVIEW-RISC PAPER, UNIV. OF CALIFORNIA, BERKELEY--PATTERSON/GB2.S5   4/13/81  6/02/81 13:48  3    4
0:00   0:10
15  PRODUCT--RATIO OF DEV. COST/NOR ENG STAFF/GB2.S5    4/13/81  4/15/81 14:43  3    5  0:01   0:15
16  INFOTECH, PERGAMON--U OWE ME MONEY/C. BOON/GB2.S5   4/14/81  5/29/81 12:15  5    4  0:01   0:13
17  OFFICE PRODUCT ANNOUNCEMENT--KEN'S GRAND ONE/OC/GB2.S5   4/15/81  4/15/81 10:23  4    2  0:00   0:00
18  CT100 FUNDING/CAMPBELL/GB2.S5                       4/15/81  4/15/81 10:25  4    2  0:01   0:01
19  PRODUCTS--WINNING, GREAT PRODUCTS/ENG STAFF/GB2.S5      4/15/81 12/08/82 10:49  10   5  0:00   0:02
20  PRODUCTS--HEURISTICS FOR GREAT PRODUCTS/OLSEN, KEN/GB2.S5      4/15/81  4/15/81 10:32  24   2  0:02
0:02
21  TERMINALS MARKETING PLANS/LYLE/GB2.S5               4/15/81  5/29/81 12:17  4    3  0:01   0:02
22  GRAPHICS ARCHITECTURE--ALAN KAY VISIT/STRECKER/GB2.S5    4/15/81  4/15/81 10:37  3    2  0:01   0:01
23  PRODUCT PLACQUES AND OC WOODS COMMENTS/CORBEN/GB2.S5     4/15/81  5/29/81 12:27  13   3  0:00   0:01
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24 TRAINING--VLSI COURSE ENROLLMENT/CROXON/GB2.S5   4/15/81 4/21/81 8:13 4   3 0:00   0:01
25 ERGONOMETRICS--CONTINUING,DEC COMPUTER 278 TYPE/KO/GB2.S5   4/15/81 4/15/81 10:49 19   2 0:06
0:06
26 WPS 278 FIX MY PROBLEM/FORBES/GB2.S5   4/15/81 8/28/81 10:29 3   4 0:00   0:01
27 STRATEGY--CORPORATE FINANCIAL STRATEGY/BERTOCCHI/GB2.S5   4/15/81 4/28/81 14:55 4   3 0:00
0:00
28 LEADERSHIP 11/73 - LOW COST VAX FUNDING--DEMMER/GB2.S5   4/15/81 5/29/81 12:11 8   3 0:01   0:04
29 NI--MAKING IT WORK/KOTOK/GB2.S5   4/15/81 4/15/81 11:03 8   2 0:01   0:01
30 EUROPEAN ENGINEERING--IN AYR/LACROUTE/GB2.S5   4/15/81 4/15/81 11:04 4   2 0:00   0:00
31 DP--CONGRATULATIONS, GOOD LUCK, AND DUTIES/LACROUTE/GB2.S5   4/15/81 4/15/81 11:07 11   2 0:01
0:01
32 TERMINALS--WINNING COMPUTING TERMINALS/LYLE/GB2.S5   4/15/81 9/02/81 15:16 4   4 0:00   0:02
33 ORGANIZATIONAL--CHANGE-WHAT IT MIGHT LOOK COMMENTS/GVPC/GB2.S5   4/15/81 5/29/81 12:26 12   4
0:01   0:03
34 ENGINEERING/MANUFACTURING SEGMENTATION/GVPC/GB2.S5   4/15/81 9/02/81 15:07 20   4 0:02   0:07
35 MUSEUM AFIPS TAXONOMY (MUSEUM)/SAMMET/GB2.S5   4/21/81 5/19/81 9:00 4   8 0:00   0:09
36 MIT--COMMENTS ON MAURICE WILKES/MOSES/GB2.S5   4/21/81 5/04/81 13:06 3   6 0:00   0:13
37 STANFORD--RE:WILKINSON LECT. ON PILOT ACE TAPED?/FEIGENBAUM/GB2.S5   4/21/81 5/29/81 12:30 2   3
0:01   0:04
38 PERSONNEL REVIEWS FORM - ENG STAFF /GB2.S5   4/21/81 5/29/81 12:09 15   11   0:00   0:38
39 WPS COMMITMENTS (8-BASED)--OUR PERFORMANCE/STEWART/GB2.S5   4/22/81 5/29/81 12:43 3   8 0:06
0:18
40 CUSTOMER COMPLAINT U. OF CALIF., LA--VAX 780/POPEK/GB2.S5   4/22/81 5/29/81 12:36 2   8 0:01
0:11
41 UNIVERSITY OF TEXAS--RE:LIPOVSKI PROMOTION/BROWN/GB2.S5   4/27/81 5/29/81 12:37 5   4 0:01
0:07
42 CMU--RE: HONORARIUM CHECK/HABERMAN/GB2.S5   4/27/81 4/27/81 10:56 2   3 0:00   0:09
43 SUVAX DISPLAY AND ARPA DEMO/MARSHALL/GB2.S5   4/29/81 4/30/81 8:15 2   3 0:00   0:02
44 REFERENCE-STAMBAUGH TEACHING AT BOSTON UNIVERSITY/PADULA/GB2.S5   5/04/81 5/29/81 12:06 2   4
0:02   0:06
45 NORTHEASTERN CSD AND US/MEANY.../GB2.S5   5/04/81 5/04/81 11:45 14   6 0:01   0:09
46 CSS--SURVIVING BUILDING GM'S KLUDGE/BUTLER.../GB2.S5   5/04/81 5/08/81 9:55 3   4 0:00   0:11
47 FCC--BUBBLE INTO OPERATION/OC/GB2.S5   5/04/81 5/08/81 14:19 4   4 0:00   0:13
48 ENG. SECS   7/20/81 7/20/81 13:52 3   3 0:00   0:05
49 NEBULA--HOW GOOD AND TIMELY IS IT?/MARSHALL/GB2.S5   5/08/81 5/13/81 15:39 3   5 0:02   0:14
50 OFFICE OF INTERNAT. PUB. NIKKEI ELEC. TRANS./SHONYO/GB2.S5   5/11/81 12/30/81 9:10 3   5 0:03
0:16
51   5/11/81 5/29/81 12:04 2   5 0:00   0:10
52 STOCK GRANTS-REVIEW & RATIONALE/ENG STAFF/GB2.S5   5/11/81 5/29/81 12:31 3   3 0:01   0:06
53 SIEMENS AG--PHOTOS/GUMIN/GB2.S5   5/12/81 5/12/81 13:44 2   1 0:06   0:06
54 eng. staff and secs./gb2.s7   7/20/81 7/20/81 11:48 3   1 0:05   0:05
55 NAE--MY FEELINGS ON THE AHCOM/PERKINS/GB2.S5   5/18/81 5/21/81 15:21 13   9 0:00   0:32
56 COMET--UNDERSTANDING TO HELP VENUS & NAUTILUS/DEMMER.../GB2.S5   5/18/81 5/19/81 8:31 3   5
0:01   0:02

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57  PERSONNEL REVIEWS DIRECT REPORTS PROPOSAL/OC/GB2.S5      5/18/81  5/29/81 12:08  8    5  0:00   0:05
58  VENUS AND IT'S CONTINGENCIES/DEMMER.../GB2.S5       5/18/81  5/19/81  8:20  8    6  0:01   0:06
59  SIA--BECOMING A MEMBER/CUDMORE/GB2.S5               5/18/81  5/29/81 12:29  2    5  0:01   0:05
61  PERSONNEL--SOME FOLKS WE MIGHT GET TO WORK HERE/KO/GB2.S5      5/21/81  5/29/81 12:26  3    4  0:00
0:02
62  DECSET--A VERY NICE BASE/MITCHELL/GB2.S5            5/21/81  5/21/81 13:41  14   2  0:02   0:02
63  GENERATION--5TH GEN., A TRANSITION/CHRISTY/GB2.S5   5/21/81  5/21/81 13:46  19   2  0:00   0:00
64  WPS278--HAVE TO HAVE ONE WORKING BEFORE WE SHIP/COLE/GB2.S5    5/21/81  7/22/81 15:22  13   3  0:00
0:02
65  FINANCE--ACTUAL PRODUCT DATA VS. BURP PLANS/CLINTON/GB2.S5     5/21/81  5/21/81 13:57  8    2  0:01
0:01
66  MUSEUM--WILKINSON TALKS/EBOD MEMBERS/GB2.S5         5/21/81  5/21/81 13:59  3    2  0:01   0:01
67  WPS278--NOVEMBER 5-YEAR PLAN MEETING/OLSEN/GB2.S5   5/21/81  5/21/81 14:01  8    2  0:01   0:01
68  GIGI--VK100 INCOMPATIBILITIES WITH VMS/JANSEN/GB2.S5     5/21/81  5/21/81 14:04  3    2  0:00   0:00
69  FCC--MORE ON THE 11C03/CREASER/GB2.S5               5/21/81  5/21/81 14:06  3    2  0:01   0:01
Gordon Bell Personal 5/04/81  4/25/82 2/16/86
Name: GORDON, # of Docs: 8, Blocks left: 110 (of 627)
--------------------------------------------------------------------------------
Number  Name     Created  Modified    Size Version  Last   Total
--------------------------------------------------------------------------------
 1                                                  0:01  1    84    0:01   0:06
 2  EM talk outline                                 3/20/82  2/16/86  0:01  20   8  0:00   3:19
 3  fortune (PROCESSED)                             0/00/00  2/16/86  0:02  6    5  0:01   1:38
 4  process forum talk                              4/11/83  2/16/86  0:03  7    3  0:01   0:43
 5  PROCESS REQUIRED TO GENERATE A COMPUTER AS OF 4/9/82     4/09/82  2/16/86  0:03  150  38    0:00   9:29
 6  Compcon script                                  1/28/84  2/04/84  0:03  85   13    0:01  22:45
 8  ARCH. & IMPL. WITHOUT BRACKETED AREAS - 4/22/82     4/23/82  4/26/82 13:42  115  12    0:00   5:20
 9  sunday backup                                   4/25/82  13:43  119  4  0:01   0:09
TCM 5/18/81  6/06/83
Name: DMCAT1, # of Docs: 12, Blocks left: 283 (of 627)
--------------------------------------------------------------------------------
Number  Name     Created  Modified    Size Version  Last   Total
--------------------------------------------------------------------------------
 1                                                  5/18/81  6/06/83  8:52  1    29    0:01   0:03
 2  MANUAL AGE/DMCAT1                               5/18/81  9/05/81  0:08  8    17    0:08   1:01
 3  LETTER/PERRY/GB                                 6/05/83  6/06/83  8:57  4    6  0:00   0:54
 4  MECHANICAL GENERATION/DMCAT1                    8/12/81  9/07/81 11:19  109  13    1:12   3:37
 5  ELECTRO-MECHANICAL GENERATION/DMCAT1            9/08/81  9/23/81 18:28  29   5  0:02   1:26
 6  INTRODUCTION TO DIGITAL COMPUTER MUSEUM CATALOG/DMCAT1   0/00/00  6/23/82 11:31  47   28    0:01   4:50
 7  taxonomy tables                                 8/28/81  6/23/82  9:58  13   6  0:01   0:50
 8  CRAFT GENERATION--FROM BACKUP FLOPPY (7/30/80/DMCAT1     8/10/81 11/11/81 13:22  91   20    0:07   4:22
 9  LETTER/SAFFORD/GB                               6/06/83  6/06/83  8:50  4    1  0:01   0:01
10  contents & foreword                             9/06/81  6/23/82  9:42  9    5  0:01   1:00
11  prospectus                                      9/06/81  9/07/81  0:03  3    3  0:03   0:33
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12 LETTER/RANDELL/GB

Digital 5/21/81
Name: RL1S6 , # of Docs: 74, Blocks left: 48 (of 627)

Number Name Created Modified Size Version Last Total
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1 5/21/81 9/28/81 15:10 10 155 0:00 1:57
2 FCC--MINC, 11C03, ETC./BROWN/GB2.S6 5/21/81 6/10/81 11:34 3 4 0:01 0:01
3 WPS 278 AND 11/23--FUTURE PACKAGING/OLSEN, KEN/GB2.S6 5/21/81 9/28/81 9:22 5 10 0:00 0:01
4 CT REVIEW AND APPROVAL/OLSEN, KEN/GB2.S6 5/21/81 6/11/81 9:30 5 3 0:00 0:01
5 WPS 278--NOTE ON CONTROL OF THE 278/STONE/GB2.S6 5/21/81 6/05/81 12:19 3 4 0:00 0:00
6 TRAINING--VLSI COURSES/ENG STAFF/GB2.S6 5/21/81 9/28/81 15:10 2 4 0:00 0:00
7 VT134--BRIAN'S COMMENTS/MILLER/GB2.S6 5/21/81 5/21/81 14:20 7 2 0:02 0:02
8 CT/VT FAMILY--OC REVIEW/BROOKS/GB2.S6 5/21/81 5/21/81 14:22 6 2 0:01 0:01
9 CT--KNOCK OUT AND ORIGINAL GOALS/BROOKS/GB2.S6 5/21/81 5/21/81 14:33 23 2 0:07 0:07
10 SCORPIO--REVIEWS AND METHODOLOGY/TEICHER/GB2.S6 5/21/81 5/21/81 14:35 5 2 0:00 0:00
11 CT--4/28/81 DISCUSSION/OLSEN, KEN/GB2.S6 5/21/81 6/11/81 9:12 4 3 0:00 0:00
12 SCORPIO REVIEW--IT LOOKS VERY GOOD/TEICHER/GB2.S6 5/21/81 5/21/81 14:42 7 3 0:00 0:00
13 QUALITY AND PRODUCTIVITY--WHAT'S THE ANSWER?/HANSON/GB2.S6 5/21/81 7/22/81 15:57 7 3 0:00
0:01
14 VK100--FIX OR VMS (W/O VK100)/CARCHIDI/GB2.S6 5/21/81 5/21/81 14:54 21 2 0:07 0:07
15 IBM/JAPAN--EVANS TALK ON JAPANESE SEMICONDUCTORS/ENG STAFF/GB2.S6 5/21/81 7/08/81 9:19 7 6
0:00 0:00
16 QUALITY PROGRAM/HINDLE/GB2.S6 5/21/81 5/21/81 14:58 3 2 0:01 0:01
17 CT ENGINEERING LOCATION/OPERATIONS COMMITTEE/GB2.S6 5/21/81 5/21/81 14:59 3 2 0:00 0:00
18 UNIVERSITY OF SASKATCHEWAN--PERSONAL UNIX/KAVANAUGH/GB2.S6 5/26/81 9/28/81 9:21 3 5 0:00
0:12
19 JAPAN-REFLECTIONS ON FACTORY MGMT. PAPER/ENG. STAFF/GB2.S6 6/03/81 6/12/81 16:15 19 10 0:02
1:19
20 ENG. PROCESS--QUALITY & PRODUCTIVITY/ENG STAFF/GB2.S6 5/26/81 9/02/81 15:10 10 8 0:00 0:45
21 MOSTEK SELLING TINY CHIPS AS LICENSEE/GB2.S6 6/04/81 6/08/81 8:43 8 3 0:00 0:01
22 KEYBOARD--INTELLIGENT KEYBOARD AS A COMPONENT/MILLER/GB2.S6 5/26/81 5/27/81 13:39 3 6 0:00
0:11
23 CAD--OUR KEY TO SURVIVAL & WHO CAN MANAGE IT?/PEG/GB2.S6 6/08/81 6/09/81 9:46 3 4 0:01
0:05
24 ETHERNET--OUT AND STANDARDIZE IT/LACROUTE/GB2.S6 5/27/81 5/28/81 14:07 3 3 0:00 0:12
25 STANDARDS--WHAT'S OUR POSITION/FULLER,WHITE/GB2.S6 5/27/81 5/27/81 16:26 5 5 0:01 0:21
26 WPS-LOW COST-LA'S & COMPUTING KEYBOARD/STEWART ET AL/GB2.S6 6/08/81 6/09/81 9:08 8 5 0:03
0:10
27 WPS 278 ORG. LOW COST COMPUTING KEYBOARD/GUTMAN/GB2.S6 6/08/81 6/09/81 9:32 3 5 0:01 0:07
28 MOSTEK--THANK YOU FOR OUR VISIT/PROTHRO/GB2.S6 6/08/81 6/08/81 13:07 6 8 0:01 0:23

29 CT BREADBOARD AVAILABILITY FOR PROGRAM DEV./MILLER/GB2.S6   6/08/81 6/09/81 9:41 2   4 0:01
0:03
30 VT125 GRAPHICS PRODUCT VS. CUTTING MFG./PICOTT/GB2.S6   6/08/81 6/09/81 9:24 5   6 0:01   0:08
31 VENUS DOCUMENTS--STATE OF THE DESIGN/GB2.S6   6/08/81 12/03/81 14:21 9   3 0:00   0:06
32 VAX'S--LOW COST/CARCHIDI/GB2.S6   6/09/81 6/09/81 14:16 8   2 0:02   0:02
33 SEMIS--ANDY'S SUGGESTION ABOUT SEMIS - JAPAN/O.C./GB2.S6   6/09/81 6/09/81 14:32 4   2 0:00
0:00
34 WPS 278--WHAT COST, WHAT PAYOFF, WHAT RISK/KNOLL/GB2.S6   6/09/81 6/09/81 14:41 16   2 0:03
0:03
35 FCC BUBBLE-CONGRATULATIONS/KIRK/GB2.S6   6/09/81 6/09/81 14:44 4   2 0:00   0:00
36 CT FOR WPS?--CAN WE GET THE 278 BETTER/MILLER/GB2.S6   6/09/81 6/09/81 14:47 6   2 0:00   0:00
37 WPS 278--KHO'S MAY 4 MEMO (278 PROPOSAL)/JOHNSON, TED/GB2.S6   6/09/81 6/09/81 14:50 5   2 0:00
0:00
38 CT CONNECTORS--USING MOUDLAR JACKS/MILLER/GB2.S6   6/09/81 6/09/81 14:52 4   2 0:00   0:00
39 PDP-11/23--KEN'S COMMERCIAL PACKAGE/SHANZER/GB2.S6   6/09/81 6/09/81 14:55 4   2 0:00   0:00
40 VISICALC--ON VAX FOR INTERNAL THEN EXTERNAL/JOHNSON,BILL/GB2.S6   6/09/81 6/09/81 14:58 4   2
0:01   0:01
41 DP--COMMENTS ON STRATEGY AND MINI SERIES/KENAH/GB2.S6   6/09/81 6/09/81 15:03 12   2 0:01   0:01
42 VENUS: NOW WHAT?/FAGERQUIST/GB2.S6   6/09/81 6/23/81 16:09 6   3 0:00   0:01
43 TECHNICAL LEADERSHIP/WILKES/GB2.S6   6/11/81 6/11/81 14:45 2   5 0:01   0:08
44 LOW END GROUP TEAM PROPOSAL/GB2.S6   6/16/81 11/09/81 12:07 18   11   0:01   0:30
45 APPOLLO/AVERY/GB2.S6   6/11/81 6/11/81 14:24 3   5 0:01   0:24
46 NAUTILUS--THE NEXT STEP/CROXON/GB2.S6   6/11/81 6/11/81 10:34 6   2 0:01   0:01
47 BOARDS--ONE WEEK PROTO BOARDS/HOMAN/GB2.S6   6/11/81 6/11/81 10:39 3   2 0:02   0:02
48 VENUS--ONE WEEK TURNAROUND / EXTRA KL10'S THIS QTR./DEMMER/GB2.S6   6/11/81 6/11/81 10:43 6   2
0:02   0:02
49 FCC--11/C03/SMITH, PETER/GB2.S6   6/11/81 6/11/81 10:45 2   2 0:00   0:00
50 PDP-11/780 USE MCA'S,NEW TTL/FASTLOGIC/DEMMER/GB2.S6   6/11/81 6/11/81 10:48 4   3 0:00   0:01
51 AWARDS--FLEECE OR FAMINE/THOMPSON/GB2.S6   6/11/81 6/11/81 10:50 4   2 0:00   0:00
52 DEC-WEST--PEOPLE FOR/CUTLER/GB2.S6   6/11/81 9/09/81 15:49 3   3 0:00   0:01
53 DISTRIBUTED SYSTEMS--HARDWARE DEVELOPMENT IN NH/DALEY/GB2.S6   6/11/81 6/11/81 15:57 3   3 0:01
0:01
54 P&Q--PROJECT TO DEMO. QUALITY AND PRODUCIBILITY/OLSEN, KEN/GB2.S6   6/11/81 6/11/81 10:58 13   2
0:02   0:02
55 TERMINALS ARCHITECTURE--AND COMPATIBIILTY/CRAWFORD/GB2.S6   6/11/81 6/11/81 11:01 7   2 0:01
0:01
56 REWARD/PENALTY--SYSTEM IN ENGINEERING/MANUFACTURING/CROXON/GB2.S6   6/11/81 6/11/81 11:03 4   2
0:01   0:01
57 SUPPORTING 16-BIT--PRODUCTS AND DOING EXEMP. ENG./OLSEN/GB2.S6   6/11/81 6/11/81 11:05 6   2
0:00   0:00
58 TEST   6/23/81 6/23/81 10:50 5   3 0:06   0:07
59 ZILOG CHIPS TO IMPLEMENT VAX/AK ET AL/GB2.S6   6/24/81 6/24/81 8:33 10   1 0:00   0:00
60 CAD-HIGH PRIORITY-VT125'S FOR CAD & STD CAD WKSTNS/GB2.S6   6/24/81 6/25/81 16:05 3   4 0:02
0:25

61	AT&T PRESENTATION LEVEL PROTOCOL MANUAL	6/25/81	6/29/81 15:50	2	3	0:00	0:07
62	MIT INDUSTRIAL LIAISON BOOK/PROF.DERTOUGOUS/GB2.S6	6/29/81	6/30/81 14:19	2	3	0:03	0:10
63	ORG.DOMAIN/BELL/PORTNER/GB2.S6	6/30/81	9/28/81 9:23	14	9	0:00	0:57
64	ALTERNATIVES FOR TERM. & TERM. BASED COMP. SYSTEM/OLSEN/GB2.S6	7/06/81	6/09/83 7:18	35	6	0:00	0:07
65	CT/OFIS-STEWART'S & MY ISSUES/BJ/GB2.S6	7/06/81	7/07/81 12:36	3	4	0:04	0:16
66	PERSONNEL--16-BIT PROG. OFFICE MGR./ENG. STAFF/GB2.S6	7/08/81	7/08/81 9:41	5	2	0:00	0:00
67	SCORPIO--PLANNIING, ARCHITECTURE, IMPLEMENT/CUTLER/GB2.S6	7/08/81	7/08/81 9:46	4	2	0:00	0:00
68	VENUS AND OTHER VAXES--BUILDING/DEMMER/GB2S.6	7/08/81	7/08/81 9:49	3	2	0:00	0:00
69	SCORPIO--MANAGEMENT/TEICHER/GB2.S6	7/08/81	7/08/81 9:51	5	2	0:00	0:00
70	ORGANIZATION--SOME THOUGHTS ON CONTINUED.../ENG. STAFF/GB2.S6	7/08/81	7/08/81 9:53	5	2	0:01	0:01
71	XEROX--MAY BE A COMPETITOR.../BUZZ BROOKS/GB2.S6	7/08/81	7/08/81 9:56	11	2	0:01	0:01
72	MOSTEK--SELLING TINY CHIPS WITH.../MACKENZIE/GB2.S6	7/08/81	7/08/81 9:59	8	2	0:01	0:01
73	CONTRACT--BELL/PORTNER RESPONSIBILITY/GB2.S6	9/28/81	2/10/82 14:04	6	2	0:00	0:04
74	ORGANIZATIN ALTERNATIVES FOR ENG/OC SLIDES/GB2.S6	9/28/81	9/28/81 9:30	18	2	0:00	0:01

6		0/00/00	11/02/82 10:31	14	5	0:04	0:44
7		11/14/82	11/14/82 0:20	4	1	0:20	0:20
8		11/20/81	11/30/81 15:55	22	9	1:53	5:57
9		11/14/82	11/14/82 1:06	6	1	0:16	0:16
13		0/00/00	5/21/82 11:34	49	21	0:33	7:20
14		5/12/82	7/23/82 0:04	4	8	0:01	1:33
17		0/00/00	5/21/82 10:57	4	2	0:00	0:12

		6/06/83	6/06/83 8:52	7	1	0:00	0:00

GB Messages 7/17/81

Name: MESSGB, # of Docs: 3, Blocks left: 529 (of 627)

Number	Name	Created	Modified	Size	Version	Last	Total
1		7/17/81	3/09/82 13:08	1	6	0:00	0:01
2	MESSAGES FROM 4/80 TO 12/31/80 MESSGB	7/17/81	7/28/81 15:11	42	5	0:01	0:59
3	MESSAGE LOG FROM 10/1/81 THRU 1/31/81/MESSGB	3/09/82	3/09/82 13:08	52	2	0:01	0:12

TCM 7/28/81

Name: BLISTR, # of Docs: 6, Blocks left: 251 (of 627)

Number	Name	Created	Modified	Size	Version	Last	Total

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 1                                                       7/28/81  3/02/86  0:02  1    25    0:01   0:01
 2  BELL LIST 100-199                                    7/28/81  0/00/00  1:36  187  19    0:03   1:30
 3  unrefined donors list                                0/00/00  0/00/00  0:02  65   30    0:00   9:46
 4  Shopping list                                        1/24/83  0/00/00  0:02  7    4  0:01   1:02
 5  Bell Catalog 200-399                                 0/00/00  0/00/00  3:28  90   12    0:01   0:62
 9  GALLER                                               0/00/00  0/00/00  0:38  9    1  0:38   0:38
```

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TCM 7/28/81
Name: BLISTR, # of Docs: 6, Blocks left: 164 (of 627)
------------------------------------------------------------------------------
Number  Name     Created  Modified    Size Version  Last   Total
------------------------------------------------------------------------------
 1                                                       7/28/81  3/07/87  8:22  1    40    0:01   0:05
 2  BELL LIST 100-199                                    7/28/81  0/00/00  0:12  184  22    0:11   1:42
 4  Shopping list                                        1/24/83  0/00/00  3:57  48   36    1:43   9:40
 5  Bell Catalog 200-399                                 0/00/00  3/07/87  8:23  146  30    0:01   2:22
 6  Value Listing                                        4/07/84  0/00/00  1:49  72   31    1:45   2:38
82  Museum gifts                                         3/07/87  3/07/87  8:20  5    1  0:05   0:05
Digital TCM 9/02/81
Name: SECT8 , # of Docs: 44, Blocks left: 343 (of 627)
------------------------------------------------------------------------------
Number  Name     Created  Modified    Size Version  Last   Total
------------------------------------------------------------------------------
 1                                                       9/02/81 10/02/81 10:19  5    102   0:07   0:16
 2  TEST                                                 9/02/81  9/22/81 10:23  1    3  0:00   0:12
 3  THANK YOU FOR LETTER/STANISLOW BUDKOWSKI/GB2.S8      9/10/81  9/24/81 15:57  2    6  0:00   0:28
 4  DECWORD ANNOUNCEMENT/GB2.S8                          9/11/81  9/11/81 15:26  2    1  0:04   0:04
 5  SLIDES--CT,VAX,278, FOR BOD MEETING/9/14/81/GB2.S8       9/14/81  9/14/81  8:49  9    1  0:00   0:00
 6  EMS--RX50B, TEAC/RX50 AND ENGINEERING IN JAPAN/LYLE/GB2.S8     9/14/81  9/16/81 14:08  4    9  0:01
0:19
 7  RUSS DOURNE                                          9/22/81  9/24/81 10:44  1    3  0:01   0:02
 8  WHAT I LEARNED ABOUT DP FROM JAMES MARTIN/OLSEN/GB2.S8   9/22/81  3/23/82  9:05  3    4  0:00   0:12
 9  EMS--CAN GEORGE CHAMPINE BE ON OSS?/LIGNOS/GB2.S8    9/21/81  9/24/81 10:44  2    3  0:00   0:07
10  EMS--ROBOTS                                          9/21/81  9/21/81  8:25  7    8  0:00   0:08
11  EMS--WOODS                                           9/21/81  9/21/81  8:25  7    7  0:00   0:05
12  EMS--GUTMAN                                          9/21/81  9/21/81  8:26  4    6  0:01   0:04
```

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13  FORTUNE                                              9/21/81  9/21/81  8:19  6    2  0:00   0:00
14  HEURISTICS FOR BUILDING GRAT PRODUCTS/GB2.S8         9/21/81  3/23/82  9:05  26   3  0:00   0:01
15  WORLTON LECTURES/JACK WORLTON/GB2.S8                 9/24/81  9/24/81 14:19  1    2  0:00   0:03
16  JAMES MARTIN SEMINAR/MARTIN/GB2.S8                   9/24/81  9/24/81 15:04  2    2  0:01   0:04
17  PROFESSOR MURRAY/GB2.S8                              9/25/81 10/05/81 13:25  3    3  0:01   0:12
18  INDEX                                               10/02/81 10/02/81 10:01  13   1  0:00   0:00
19  INDEXES                                             10/02/81 10/02/81 10:01  2    1  0:00   0:00
20  GB2.S10 INDEX                                       10/02/81 10/02/81 10:02  2    1  0:00   0:00
21  LOW END--OC WOOD DISCUSSION AND ACTION ITEMS/PEG/GB2.S8       10/01/81 10/01/81  8:41  8    2  0:00
0:00
22  ROBOTICS--COMPUTER SCIENCE BOARD REVIEW OF../CADY/GB2.S8      10/01/81 10/01/81  8:45  8    2  0:01
0:01
23  LOW END--AN AGGRESSIVE VT AND SET OF LOW.../AVERY/GB2.S8      10/01/81 11/09/81 11:58  7    3  0:01
0:01
24  XEROX--THE 820, A LOW COST ETHERNET.../AVERY/GB2.S8     10/01/81 10/01/81  8:49  5    2  0:00   0:00
25  SEMICONDUCTORS--PESENTATION OF.../CUDMORE/GB2.S8   10/01/81 10/01/81  8:58  11   2  0:01   0:01
26  TERMINALS--GETTING VT'S,LA'S,ROBIN AND CT OU..AVERY/GB2.S8    10/01/81 10/01/81  9:01  10   2  0:01
0:01
27  ROBIN--3 WEEK CAT SCHEDULE IS GR.../FOLSOM/GB2.S8  10/01/81 10/01/81  9:03  4    2  0:01   0:01
28  ROBIN--3 WEEK CAT SCHEUDLE IS GREAT, BUT.../FOLSOM/GB2.S8     10/01/81 10/01/81  9:04  4    2  0:00
0:00
29  LOW END---INTELLIGENT AND COMPUTER TERMINAL../AVERY/GB2.S8    10/01/81 10/01/81  9:08  15   2  0:02
0:02
30  PACKAGE--KEN'S ALTERNATIVE MONITOR FOR THE.../AVERY/GB2.S8    10/01/81 10/01/81  9:20  7    2  0:00
0:00
31  JAPAN--VERTICALLY INTEGRATED SEMIS/ENG.STAFF/GB2.S8     10/01/81 10/01/81  9:22  7    2  0:00   0:00
32  PLAN--HOW CAN WE GET A REALISTIC GEMINI/DEMMER/GB2.S8   10/01/81 10/01/81  9:25  11   2  0:01   0:01
33  VT134--BILL, THESE FOLKS WORK FOR YOU/AVERY/GB2.S8      10/01/81 10/01/81  9:27  3    2  0:01   0:01
34  PAPER--ISSCC- J-11/COURTRIGHT/GB2.S8                10/01/81 10/01/81 10:01  3    2  0:00   0:00
35  VT200--KEN'S SUGGESTIONS ABOUT/AVERY/G2.S8          10/01/81 10/01/81 10:03  3    2  0:01   0:01
36  NEBULA--A $3B PRODUCT THAT HAS TO.../DEMMER/GB2.S8      10/01/81 10/01/81 10:04  5    2  0:00   0:00
37  GB2.S11 INDEX                                       10/02/81 10/02/81 10:02  6    1  0:00   0:00
38  GB2.S12 INDEX                                       10/02/81 10/02/81 10:03  6    1  0:00   0:00
39  GB2.S13 INDEX                                       10/02/81 10/02/81 10:03  2    1  0:00   0:00
40  GB2.S15 INDEX                                       10/02/81 10/02/81 10:05  4    1  0:00   0:00
41  GB2.S14 INDEX                                       10/02/81 10/02/81 10:05  3    1  0:00   0:00
42  GB2.S9 INDEX                                        10/02/81 10/02/81 10:18  2    1  0:00   0:00
43  RL1.S10 INDEX                                       10/02/81 10/02/81 10:19  2    1  0:00   0:00
44  RL1.S13 INDEX                                       10/02/81 11/09/81 12:01  2    4  0:00   0:01
TCM Generations 9/24/81  9/25/81
Name: DMCAT2, # of Docs: 7, Blocks left: 408 (of 627)
-------------------------------------------------------------------------------
Number  Name     Created  Modified    Size Version  Last   Total
-------------------------------------------------------------------------------
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 1                                                     9/24/81  3/02/86  0:03  1    7  0:00   0:00
 2  ELECTRONIC GENERATION/DMCAT2                       9/24/81  9/24/81  8:27  14   1  0:01   0:01
 3  TRANSISTOR GENERATION/DMCAT2                       9/24/81  9/28/81 15:13  80   5  0:01   0:36
 4  IC GENERATION/DMCAT2                               9/24/81  9/24/81  8:31  23   1  0:01   0:01
 5  LSI GENERATION/DMCAT2                              9/24/81  9/24/81  8:31  15   1  0:00   0:00
 6  NEW PIONEER/DMCAT2                                 9/24/81  9/24/81  8:34  74   1  0:02   0:02
 7  CDC                                                9/25/81  9/27/81  0:11  4    3  0:11   0:43
Digital 10/05/81
Name: SECT1 , # of Docs: 57, Blocks left: 139 (of 627)
-------------------------------------------------------------------------------
Number  Name     Created  Modified    Size Version  Last   Total
-------------------------------------------------------------------------------
 1                                                    10/05/81  6/07/82 15:19  8    271   0:04   2:49
 2  INDEXXES                                           6/07/82  6/07/82 15:19  21   1  0:00   0:00
 3  CMU JOINT PROP. FOR DEV. OF PERSONAL C./SLIDES/ GB3.S1  10/16/81  5/27/82 10:04  5    8  0:01   0:03
 4  COMMUNICATIONS, COMPETITIVE RESP./DEMMER ET AL/GB3.S1   10/05/81  5/12/82 11:27  5    4  0:00   0:02
 5  DPD,  HERE IS A FRANK APPRAISAL/ABBOTT/GB3.S1      10/05/81  5/12/82 11:54  2    4  0:01   0:03
 6  THANKS: MURRAY, DR. JOHN, TEACHING VLSI/GB3.S1     10/19/81  5/12/82 11:52  2    5  0:00   0:16
 7  MUSEUM: REQUEST FOR DEUCE DRUM PROF. MURRAY ALLEN/GB3.S1      10/19/81  5/12/82  9:50  3    5  0:00
0:09
 8  PHILIPS, THANKS-HOSP. IN EINDHOVEN/DRS. TEER & BOSMA/GB3.S1   10/05/81  4/30/82 12:54  2    13    0:01
0:13
 9  PHILIPS, THANK YOU/MR. HOFF/GB3.S1                10/05/81  5/12/82 17:03  3    7  0:01   0:11
10  ROYALTY PAYMENTS-CARNEGIE MELLON/OBRIEN/GB3.S1     10/05/81  5/12/82 17:09  2    5  0:00   0:00
11  PHILIPS, THANKS-HOSPITALITY IN EINDHOVEN/PENNENBORG/GB3.S1    10/06/81  5/12/82 17:02  5    20    0:01
0:51
14  FLOPPY, DISCLOSURE OF ELEC. FLOPPY/SAVIERS ET AL/GB3.S1       11/12/81  5/12/82 11:50  2    7  0:02
0:04
15  PRODUCT DIFFERENTIATION FOR STORES-11/23/GUTMAN/GB3.S1  10/06/81  1/21/82  9:17  2    4  0:03   0:04
16  VT102 REPLACEMENT PACKAGING/OLSEN/GB3.S1           10/07/81 11/22/82  9:28  9    14    0:00   0:54
17  CONTRIBUTION: C. IN SCI&TECH CENTERS-MUSEUM/CONT.CO /GB3.S1   11/02/81  5/12/82 11:44  5    7  0:02
0:62
18  IBM COMMITMENT WHAT THEY'RE DOING/WHAT WE SHOULD DO/GB3.S1    11/12/81  5/12/82 11:53  6    7  0:01
0:07
19  CMU JOINT PROP. DISC.-DOUG VAN HOUWELLING/FULLER/GB3.S1       11/17/81 12/29/81 10:59  7    3  0:00
0:01
20  DAWN, DECISION TO CONTINUE/WILL T./GB3.S1          10/08/81  4/30/82 12:36  2    8  0:00   0:04
22  CMU JOINT VENTURE DISC. WITH ALLEN NEWELL/FULLER/GB3.S1       11/17/81 12/29/81 10:59  6    3  0:01
0:02
23  CMU PROC. AHEAD-EXPL THE CMU/DEC RES. PROP./FULLER/GB3.S1     11/17/81  2/23/82 10:26  3    4  0:00
0:01
24  VENDOR: RIXON INTERFACE W/DEC SENT TO BERNIE/BERNIE/GB3.S1    10/10/81  5/12/82 17:09  4    7  0:00
0:08
25  CMU SUPPORTING MARIO'S PROMOTION/HABERMANN/GB3.S1  10/10/81  4/30/82 12:24  4    4  0:01   0:01
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26 CMU JONT VENTURE INTO TOTAL ENVIRONMENTAL COMPUTING/GB3.S1 11/17/81 12/29/81 10:58 5 3 0:00 0:01
27 SERVER, GETTING A PERSONAL COMPUTER/GUTMAN/GB3.S1 11/17/81 2/23/82 10:25 5 4 0:03 0:05
28 CMU PROPOSAL--US AND THE NEXT ENG. SITE/FULLER/GB3.S1 11/17/81 1/08/82 12:33 4 5 0:00 0:03
29 SUVAX, MEETING ON TERMINALS STATUS/CHAMPINE/GB3.S1 11/17/81 12/29/81 10:57 5 3 0:00 0:00
30 MUSEUM: FLOWERS LECTURE-OCT. 15 AT MUSEUM/ENG. USERS/GB3.S1 11/17/81 12/29/81 11:30 3 4 0:00 0:00
31 BUSSES, WILL OURS DRIVE US OUT OF BUSINESS/FULLER/GB3.S1 11/17/81 11/17/81 15:03 5 2 0:01 0:01
32 PLUTO, GETTING A REAL START ON /LACROUTE/GB3.S1 11/17/81 12/29/81 11:28 5 3 0:01 0:02
33 CMU PROPOSAL FOR JOINT DEV. OF PERSONAL COMP./FULLER/GB3.S1 11/03/81 5/12/82 12:55 5 5 0:01 0:03
34 MUSEUM: OREGON MUS. OF SCI & TECH TEMPLETON/GB3.S1 11/03/81 5/12/82 12:58 2 6 0:02 0:13
35 INVITATION NO: CAN'T SUPPT. VAX/780 COMP LAB/PROF PEASE/GB3.S1 11/03/81 4/30/82 12:53 5 4 0:02 0:15
36 SEMICONDUCTOR, YOUR FAULTY PERCEPTION RE SELLING TINY/TJ/GB3.S1 11/17/81 6/01/82 16:35 8 4 0:00 0:01
38 QBUS, USING IT FOR BUILDING COMM SYSTEMS/BUTLER/GB3.S1 11/17/81 12/29/81 11:31 6 4 0:00 0:00
39 TAIWAN, CT05-ENGINEERING/TETSCHNER/GB3.S1 11/17/81 11/17/81 15:13 3 2 0:00 0:00
40 RECOGNITION: TURNER'S ARTICLE ON IBM AWARD/DELAGI/GB3.S1 11/17/81 11/17/81 15:15 3 2 0:01 0:01
41 EQUIPMENT NEEDED FOR GUARANTE/CHARLIE ROSE/GB3.S1 11/18/81 4/30/82 13:28 3 4 0:01 0:07
43 RENTAL CAR FOR HOOPER/GB3.S1 11/20/81 3/04/82 12:39 3 4 0:04 0:16
44 INVITATION NO: BUTLER, COST & PARTNERS CAN'T ATTEND/GB3.S1 11/20/81 5/12/82 11:08 1 4 0:01 0:06
45 HERTZ, FOUNDATION-RE: TOM MCWILLIAMS/TALLEY/GB3.S1 11/23/81 5/12/82 12:25 2 3 0:02 0:07
46 HERTZ, CONGRATULATIONS FOUNDATION/MCWILLIAMS/GB3.S1 11/23/81 5/12/82 12:26 2 2 0:01 0:10
47 HOROWITZ RESPONSE/I FEEL THE SAME WAY/GB3.S1 11/23/81 5/27/82 10:01 1 5 0:00 0:10
48 ORGANIZATIONS, THOUGHTS ON EVOLVING/ENG. STAFF/GB3.S1 1/11/82 1/11/82 15:03 15 6 0:01 0:27
49 EMS RESPONSE TO INTERNAL IMPLEMENTATION/CRAWFORD 1/11/82 1/11/82 16:13 3 3 0:01 0:14
50 ORGANIZATIONS EVOLVING/ENG STAFF/GB3.S1 1/12/82 5/27/82 9:59 15 2 0:01 0:01
53 SEMICONDUCTOR STRATEGY, CAN WE ARRIVE AT?/GB3.S1 1/12/82 1/12/82 10:02 7 1 0:00 0:00
54 CONTRIBUTION: U OF NC FUNDING HELP/CHAMBERLAIN/CAPOWSKI/GB3.S1 11/30/81 5/12/82 11:10 2 4 0:02 0:09
59 STATE OF THE DESIGN-WHAT WE HAVE-WHAT WE WANT/GB3.S1 12/03/81 5/12/82 17:15 9 5 0:01 0:07
61 HEURISTICS FOR BUILDING GREAT PRODUCTS/GB3.S1 1/12/82 2/02/82 10:38 31 15 0:13 3:13
62 REFERENCE: FOR DR. MORRIS' PROMO-YES I AGREE/RIORDON/GB3.S1 12/04/81 5/12/82 17:09 2 5 0:01 0:10
64 INVITATION NO: INMOS ARCHITECUTRE /BARRON /GB3.S1 12/08/81 6/01/82 15:38 3 6 0:01 0:11
65 GEMINI SIMULATION (COMMENTS ON YOUR STATUS RPT)/KUSIK/GB3.S1 1/14/82 1/14/82 9:14 2 1 0:05 0:05
67 THANKS: BOOK-BIRTHPLACES OF EUROPEAN SCI./HARRY GRAY/GB3.S1 8/14/81 5/12/82 12:44 4 9 0:01 0:18
69 MCF PETITION TO STOP MCF /LOWELL WOOD/GB3.S1 1/15/82 5/27/82 9:56 4 5 0:01 0:11

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72  DAVIS, GERALD SUMMARY MEMO TO GBELL RE: DEC MARKETS ETC        1/19/82  6/01/82 14:40  15   7  0:00
1:17
73  DAVIS, GERALD THANK YOU FOR DINNER /GB3.S1          1/22/82  6/01/82 14:40  2    5  0:01   0:17
79  ETHERNET, UNIBUS OF FIFTH GENERATION/GB3.S1




Paper Computer Generations 12/15/81
Name: CGEN.., # of Docs: 5, Blocks left: 453 (of 627)
--------------------------------------------------------------------------------
Number  Name     Created  Modified    Size Version  Last   Total
--------------------------------------------------------------------------------
 1                                                      12/15/81  1/30/86  0:02  1    6  0:00   0:00
 2  PAPER-GENERATING COMPUTER GENERATIONS AS OF 3/9/81/CGEN..     12/15/81  1/30/86  0:23  148  3  0:01
0:16
 3  letter                                             1/29/86  1/30/86  0:23  8    4  0:00   0:51
 4  Culler                                             1/29/86  1/30/86  0:27  3    2  0:04   0:05
 5  Solomonson                                         1/30/86  1/30/86  0:21  4    2  0:01   0:12



1982
GB Paper Heuristics, Digital 2/01/82
Name: HEURIS, # of Docs: 10, Blocks left: 438 (of 627)
--------------------------------------------------------------------------------
Number  Name     Created  Modified    Size Version  Last   Total
--------------------------------------------------------------------------------
 1                                                     2/01/82  0/00/00  0:00  1    16    0:00   0:02
 2  HEURISTICS UPDATE                                  2/01/82  0/00/00  0:04  43   32    0:04   5:57
 3  short heuristics                                   2/27/82  2/27/82 18:08  12   6  0:02   0:28
 4  slides heuristics                                  2/27/82  3/15/82 10:41  28   19    0:13   4:51
 5  backup heuristics                                  3/13/82  0/00/00  1:45  44   5  0:50   0:60
 6  SLIDES - HEURISTICS - EDITED FOR PROJECTION        3/16/82  3/28/82  0:01  29   3  0:01   0:03
 7  test                                               0/00/00  8/04/82 13:22  1    2  0:00   0:00
 8  Japan advantages DUPLICATE OF ABOVE - DONE 5/3/82  5/02/82  5/03/82 13:20  6    6  0:00   2:20
 9  japs  - DONE 5/3/82                                5/02/82  5/03/82 13:20  6    2  0:00   0:04
10  gate array ems done 8/4/82 Wed 13:21               0/00/00  8/04/82 13:18  4    3  0:01   0:20

Digtal Talks, ethernet, heuristics, 2/2/82
Name: SECT2 , # of Docs: 58, Blocks left: 105 (of 627)
--------------------------------------------------------------------------------
Number  Name     Created  Modified    Size Version  Last   Total
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 1                                                    1/29/82  0/00/00  0:01  8    132   0:01   1:62
 2  INDEXXES                                          6/07/82 10/19/82  9:02  22    4  0:00   0:00
 4  CUSTOMER: DUPONT (PENSAK)FOR GOOD RELATIONS-ACT NOW/GB3.S2     2/02/82  6/01/82 17:09  7    5  0:00
0:08
 5  HEURISTICS FOR BUILDING GREAT PRODUCTS-PRELIM. DRAFT/GB3.S2    2/02/82 11/30/82 11:45  43   16    0:02
0:39
 6  MOTO-OKA THANKS FOR PRES. 5TH GEN. RESEARCH PROG/MOTO OKA/GB3.S2     2/02/82  8/10/82  9:41  4    10
0:00   0:03
 7  MOTO-OKA HELP, THANKS/DERTOUZOUS AND PENNFIELD/GB3.S2    2/02/82  5/12/82 11:48  3    8  0:01   0:14
 9  ETHERNET SPEECH-PRESS CONFERENCE/GB3.S2           2/08/82  6/02/83 11:43  79   11    0:00   1:09
10  MOCW AGENDA/ENG STAFF/GB3.S2                      3/11/82  6/01/82 16:54  8    7  0:00   1:43
11  WPS8-DILEMA OF INTRODUCING 3 P.C.'S/AVERY ET AL/ GB3.S2        4/08/82  6/01/82 16:53  7    6  0:00
1:10
13  AUBURN UNIVERSITY EXEC REPORT OF NO VALUE/PROF LINK/GB3.S2     8/11/82  4/30/82 13:05  2    3  0:00
0:05
14  THANKS: FOR TEACHING COURSE/CARVER MEAD/ GB3.S2     2/12/82  5/12/82 11:18  5    7  0:08   0:12
15  ENGINEERING SPECIFIC ORGANIZATION IDEAS/OC/GB3.S2   2/16/82  5/12/82 17:13  5    4  0:01   0:02
16  ENGINEERING ORGANIZATIONS/GB3.S2                  2/16/82  6/01/82 16:56  5    9  0:01   0:07
17  DEC2080 SLIP CAN'T MEAN NI & PLUTO WILL SLIP/GB3.S2      2/16/82  3/01/82  4:03  6    9  0:00   0:07
18  ETHERNET PRESENTATION IN NY - THANK YOU/GB3.S2      2/16/82  2/23/82 10:41  5    8  0:01   0:09
19  BELL: WHAT GORDON LIKES AND DISLIKES/GB3.S2        2/16/82  9/30/82  4:50  7    10    0:01   0:29
20  VENDOR FEEDBACK--COMMENTS ON OUR MKTING FOLKS/ENG.STAFF/GB3.S2       2/16/82  5/12/82 11:27  5    8
0:02   0:07
21  ECKERT MAUCHLEY AWARD GIVEN FOR PATTERSON WRITEUP/GB3.S2       2/16/82  6/01/82 17:07  4    10    0:01
0:17
22  VT278, CONGRATULATIONS/GB3.S2                     2/16/82  3/01/82  3:59  2    3  0:00   0:01
23  PERSONNEL: INDIVIDUAL CONTRIBUTOR (LIST OF NAMES)/OC/GB3.S2    2/16/82  8/10/82 15:52  5    8  0:01
0:05
24  PC TIME SHARING CENTRAL/GROUP/PERSONAL DEFINITIONS/GB3.S2      2/16/82  3/01/82  3:58  5    3  0:00
0:02
25  PERSONNEL: BJ, NOMINATION FOR VP/OC/GB3.S2         2/16/82  5/12/82 12:42  9    6  0:01   0:18
29  SUVAX AS COMP.PROD. IN OUR LIFETIMES/11/81/GB3.S2   2/19/82  2/26/82  3:58  5    3  0:00   0:01
30  CAD BUDGET XTRA 600K MULTI YEAR MULTIWIRE SUPPORT/11/5/81/GB3.S2     2/19/82  2/26/82  3:59  3    3
0:01   0:02
31  VAX, PROMOTING FOR PERSONAL COMP. SUPPORT DEV./11/5/81/GB3.S2        2/19/82  2/26/82  3:59  3    4
0:00   0:01
32  LNI REPEATER BY THANKSGIVING/11/6/81/GB3.S2        2/19/82  2/26/82  3:59  2    3  0:00   0:01
33  VENUS, GORDON'S VISIT TO MARLBORO/11/8/81/GB3.S2    2/19/82  2/26/82  4:00  8    4  0:00   0:01
34  SUVAX INTERIM-IN MY LIFETIME-FOR MAY ANNOUNCEMENT/11/81/GB3.S2       2/19/82  2/26/82  4:00  4    4
0:00   0:01
35  GIGI SUPPORT-DON'T DO THIS/AVERY/11/8/81/GB3.S2     2/19/82  5/12/82 12:28  3    4  0:01   0:03
36  MUSEUM: COMPUTER SCIENCE & TECHNOLOGY CENTERS/11/10/81/GB3.S2       2/19/82  5/12/82 12:53  5    4
0:01   0:02
```

37 SANDIA AND LASL--VAX, LAN, OFFICE & V18X/AVERY ET AL/GB3.S2   2/19/82 5/12/82 17:11 12   4 0:00
0:03
38 CMU JOINT VENTURE PROPOSAL-WOULD LIKE YOUR SUPPORT/11/81/GB3.S2   2/26/82 2/26/82 4:02 5   3
0:00   0:01
39 ETHERNET, ICL PRES WILMOT ON USING ETH./LACROUTE/11/81/GB3.S2   2/26/82 5/12/82 12:39 8   4
0:01   0:02
40 MUSEUM: WES CLARK DESCRIBES LINC @ MUSEUM/11/14/81/GB3.S2.39   2/26/82 2/26/82 4:03 4   3 0:01
0:01
41 TERMINALS THOUGHTS ON FOR DUMB, WPS & TECH. USE/11/81/GB3.S2   2/26/82 2/22/83 13:46 12   4 0:01
0:02
42 VS11, SUDS AVAILABILITY/11/21/81/GB3.S2   2/26/82 2/26/82 4:03 4   3 0:00   0:00
43 SCORPIO, DISCUSSION AT GVPC/11/21/81/GB3.S2   2/26/82 2/26/82 4:04 5   3 0:01   0:02
44 NAUTILUS CONCERNS/11/23/81/BOB STEWART/GB3.S2   2/26/82 5/12/82 12:56 7   4 0:01   0:01
45 MICRO, TASK FORCE ON A COMPETITIVE MICROPROCESSOR/12/81/GB3.S2   2/26/82 2/26/82 4:04 10   3
0:00   0:00
46 SUVAX, STATUS AS OF 3:45 P.M. 12/2/81/GB3.S2   2/26/82 2/26/82 4:05 5   3 0:01   0:01
47 MICROS, RILEY'S COMMENTS ON THE 11, 16- & 32-BIT/12/81/GB3.S2   2/26/82 2/26/82 4:05 17   3
0:00   0:02
48 REVIEW ENGINEERING MARCH. REVIEW THOSE WHO NEED/12/81/GB3.S2   2/26/82 2/26/82 4:05 8   3 0:00
0:00
49 DG, OUR VAX STRATEGY AND THE NEXT DG MACHINES/12/81/GB3.S2   2/26/82 2/26/82 4:06 5   3 0:01
0:02
50 VAX, WHAT WOULD A SIMPLER VAX ACCOMPLISH/12/81/GB3.S2   2/26/82 2/26/82 4:06 8   3 0:00   0:02
51 CHRISTMAS CARD, TYPE CHRISTMAS=MERRY; NEW_YEAR/12/81/GB3.S2   2/26/82 2/26/82 4:08 3   3 0:02
0:03
52 CHIPS, THIS AIN'T GOOD ENOUGH/CUDMORE/12/82/GB3.S2   2/26/82 5/12/82 11:19 5   4 0:01   0:01
53 MASS STORAGE AND BUILDING LOW END PRODUCTS/12/81/GB3.S2   2/26/82 2/26/82 4:09 6   2 0:01
0:01
54 EDUCATION: CS GOING INTO C. ENG ED. BUSINESS/12/81/KO/GB3.S2   2/26/82 5/12/82 11:47 5   5 0:03
0:04
55 ENG. PROJECTS STRUCTURING (DRAFT)/1/11/82/CORBEN/GB3.S2   2/26/82 5/12/82 12:03 6   6 0:00
0:01
56 TOOMBE, DEAN (TI) PHONE CALL OF 1/14/82/1/14/82/GB3.S2   2/26/82 2/26/82 4:13 4   4 0:02   0:02
57 MOTO-OKA PRESENTS 5TH GEN. PROJ./1/82/ENG USERS/GB3.S2   2/26/82 5/12/82 12:52 5   4 0:01   0:02
58 OFFICE APPLICATION--APPROACH TO DOING/1/16/82/GB3.S2   2/26/82 2/26/82 4:14 4   3 0:00   0:00
59 REVIEW ENGINEERING NON-PRODUCT GROUPS 1/82/ENG STAFF/GB3.S2   2/26/82 5/12/82 12:03 8   4 0:02
0:04
60 NETWORK SERV BUS--USING ENG AS A PROTOTYPICAL/GB3.S2 1/26/82   2/26/82 12/08/82 13:26 3   5 0:00
0:00
61 JAPAN, DOMINATE COMP BY 1990 IF 5G EFF SUCCEEDS/ENG STAFF/GB3.S2   2/26/82 5/12/82 12:41 6   4
0:00   0:02
62 CONTRIBUTION: PLS FUND HAROLD COHEN / COMMITTEE/ 1/30/82/GB3.S2   2/26/82 2/26/82 4:16 8   3
0:00   0:01

Number	Name	Created	Modified	Size	Version	Last	Total
63	TERMINALS, GETTING ARCH. SPECIFIED /AVERY ETAL/1/30/82/GB3.S2	2/26/82	2/22/83 13:47	4	6	0:01	0:02
64	COMMITTEE: COMP. FOR SCI. ADV COMM FRIEDLAND&FIEGENBAUM/GB3.S2	*3/01/81*	*5/12/82 11:35*	*7*	*4*	*0:08*	*0:1*
		5/18/82	6/25/82 10:55	2	3	0:05	0:12
		8/10/82	8/16/82 16:13	7	12	0:00	0:50
		11/23/82	12/10/82 13:59	14	4	0:10	0:52

Digital Mail 3/15/82

Name: MAILOG, # of Docs: 2, Blocks left: 234 (of 627)

Number	Name	Created	Modified	Size	Version	Last	Total
1		3/15/82	3/15/82 15:36	1	1	0:00	0:00
2	MAIL LOG 1981	3/15/82	4/01/82 14:39	389	3	0:05	0:40

Index 3/30/82

Name: FILE I, # of Docs: 5, Blocks left: 273 (of 627)

Number	Name	Created	Modified	Size	Version	Last	Total
1		3/30/82	4/29/83 2:09	1	25	0:00	0:01
2	SORTED INDICES FOR GB3.S1 THRU S10	1/06/83	1/06/83 11:40	155	6	0:03	0:03
3	SORT SPEC	4/02/82	1/06/83 0:20	1	5	0:00	0:02
4	BELL MASTER INDEX - JAN THRU MARCH 83, GB4S1 THRU GB4.S3/FILE 1	4/29/83	4/29/83 2:12	29	2	0:00	0:02
5	INPUT DOCUMENT TO BE SORTED FOR GB3.S1-S10 FOR FILE INDICES	6/07/82	1/06/83 0:37	154	11	0:03	0:21

Digital, TCM 4/26/82

Name: SECT4 , # of Docs: 37, Blocks left: 77 (of 627)

Number	Name	Created	Modified	Size	Version	Last	Total
1		4/21/82	6/07/82 16:43	5	107	0:00	1:11
2	CMU RE YOUR PROPOSAL ON ? /JORDAN,GRANGER/GB3.S4	4/26/82	6/22/82 11:38	3	13	0:02	0:26

3 BOOK: SOFTWARE ENGINEERING, WANT TO WRITE?/ANKLAN/GB3.S4 5/04/82 5/05/82 14:41 6 8 0:01 0:08
4 MUSEUM: SYMBOL, NEW HOME FOR /PROF. STEWART,IOWA STATE/GB3.S4 5/04/82 8/10/82 9:42 3 7 0:01 0:17
5 SIEMENS, NICE TO MEET YOU HERE/GRASSMAN/GB3.S4 4/26/82 4/30/82 10:51 3 3 0:06 0:14
6 ORGANIZATION CHART (ENGINEERING) SHOWING NEW EMC/GB3.S4 5/21/82 10/13/82 14:22 8 16 0:00 0:31
7 INDEXXES 6/07/82 6/07/82 15:22 14 1 0:00 0:00
8 VT200, WHY ISN'T OPAL THE VT200?/CHAMPINE/GB3.S4 5/03/82 5/18/82 14:15 4 7 0:00 0:22
9 U OF TEXAS-MAKING SCHOOL OF ENG PROF'NL/WOODSON,GLOYNA/GB3.S4 5/03/82 5/19/82 12:37 3 6 0:01 0:17
10 ECKERT-MAUCHLY AWARD, THANKS FOR INTRO /PATTERSON /GB3.S4 5/03/82 5/04/82 12:09 5 9 0:01 0:27
11 LISP AND AI MARKET-HIGH PERFORMANCE AI/GB3.S4 5/03/82 5/04/82 11:10 3 2 0:02 0:15
12 BELL: REPLACEMENT COST FOR RADIO/GB3.S4 5/03/82 5/14/82 16:55 2 6 0:01 0:18
15 TALK: PROCESS REQUIRED TO GENERATE A COMPUTER/SPEECH/GB3.S4 5/04/82 9/20/82 13:49 148 3 0:00 0:05
16 TALK/BOOK: ARCH. & IMPL. WITHOUT BRACKETED AREAS/GB3.S4 5/04/82 6/01/82 10:24 115 2 0:01 0:05
17 JAPANESE ADVANTAGE: IS IT REAL?/BOD,OC/GB3.S4 5/05/82 6/07/82 16:43 7 7 0:00 0:02
20 MCE ALPHA OMEGA DRAFT TO DELAGI/GB3.S4 5/10/82 5/24/82 9:32 37 4 0:10 0:14
21 FIFTH GEN. PROG. INTEREST LETTER TO YAMAMOTO/GB3.S4 5/11/82 6/10/82 12:03 3 7 0:00 0:10
23 LATTICE LOGIC--USING CMOS GATE ARRAY DES SYS/LIPPERT/GB3.S4 5/13/82 5/18/82 16:35 7 3 0:00 0:01
24 ECKERT-MAUCHLY AWARD, THANKS TO JACK LIPOVSKI/GB3.S4 5/12/82 5/12/82 14:32 2 2 0:00 0:00
26 OFIS AND CT/WPS SOFTWARE/AVERY/GB3.S4 5/13/82 5/13/82 11:30 10 2 0:01 0:01
27 WORLD COMPUTER CENTER--RECOMMENDATION OF EQUIPMENT/OC/GB3.S4 5/17/82 9/24/82 13:16 23 3 0:00 0:02
28 COMET MCA/DEMMER/GB3/S4 5/17/82 5/19/82 12:17 6 3 0:00 0:00
29 NBS MAIL--STANDARD/OC/GB3S.4 5/17/82 5/19/82 12:30 5 3 0:00 0:01
30 MANUFACTURING MKT--WILL IT BE NEXT MKT WE COVET/CADY/GB3.S4 5/17/82 5/19/82 12:30 7 4 0:00 0:04
31 PERSONNEL: HIRING WITHIN/WITHOUT, OUT-PLACE/BORNSTEIN/GB3.S4 5/17/82 8/26/82 11:51 5 6 0:00 0:00
32 MCE (MICROELECTRONIC C. ENTERPRISE) TF MTG/CHENAIL/GB3.S4 5/17/82 5/18/82 11:55 6 4 0:00 0:01
33 CRAY GROUP WHO WANTS TO BUILD A VAX/DEMMER/GB3.S4 5/17/82 8/13/82 14:32 12 4 0:02 0:04
34 KEYBOARD DAISY CAD AND OUR KEYBOARD/AVRAM/GB3.S4 5/17/82 5/18/82 16:33 5 5 0:00 0:01
35 INVESTMENT & COMPLEXITY FOR GUIDING ENG/DEMMER/GB3.S4 5/17/82 6/03/82 15:46 11 5 0:01 0:02
36 BUDGETS AND (EMC) ENG. MGMT COMMITTEE /FULLER/GB3.S4 5/17/82 6/03/82 15:45 5 4 0:00 0:01
37 PRODUCT LINE MANAGERS--DATA ON REASON FOR/HINDLE/GB3.S4 5/17/82 5/18/82 16:32 5 4 0:00 0:06
38 ETHERNETS STARS FOR ENG & TYPESETTING REV/ENG STAFF/GB3.S4 5/17/82 5/18/82 16:32 7 3 0:00 0:01

39 PLUTO GREAT.SELL WIDELY AS COMM C./JOHN ADAMS/GB3.S4   5/17/82 5/19/82 8:47 5   4 0:00   0:00
40 ETHERNET--KEN'S PRES:HELP AND COMMENTS/JOHN ADAMS/GB3.S4   5/17/82 5/18/82 16:31 11   3 0:00
0:01
41 ORGANIZATION--ENG. CHANGES/ENG STAFF/GB3.S4   5/17/82 10/13/82 13:34 6   5 0:00   0:00
42 TMS/AVRAM/GB3.S4   5/17/82 5/19/82 12:06 4   4 0:01   0:03
44 ABSTRACT: ETHERNET AND THE FIFTH GENERATION/GB3.S4

Digital, Japan, Museum 5/20/82 10/13/82
Name: EMPTY , # of Docs: 68, Blocks left: 65 (of 627)

Number Name   Created Modified   Size Version Last   Total
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 1   5/20/82 10/13/82 13:26 9   145   0:01   0:40
 2 CALTECH: FASTER VAXS & SCIENTIFIC COMPUTNG AT/STRECKER /GB3.S5   5/24/82 6/14/82 11:25 7   8
0:00   0:33
 3 CALTECH VISITING COMMITTEE TRIP REPORT/STRECKER/GB3.S5   5/24/82 5/26/82 11:07 7   8 0:01   0:45
 4 DECMATE I & II VS THE WANGWRITER - THE KEY /OC/GB3.S5   5/24/82 8/17/82 15:27 3   6 0:00   0:08
 5 JAPAN: CONTACTS SUMMER OF 1978 (JULY)/GB3.S5   10/13/82 7/17/84 0:02 7   3 0:01   0:02
 6 VAX'S - MARKETING (& DEVELOPING) TO SAVE US/SMITH ET AL/GB3.S5   5/24/82 9/18/82 13:09 5   6
0:00   0:26
 7 CALTECH EXPENSES PLUS HONORARIUM DONATION TO MUSEUM/GB3.S5   5/25/82 5/25/82 12:42 3   2 0:07
0:07
 8 DEC REIMBURSEMENT $514. FOR CALIF. TICKET/CARLA MASON/GB3.S5   5/26/82 5/26/82 8:55 3   1 0:14
0:14
 9 INVITATION-NO-J. RUSSELL NELSON,ARIZONA STATE UNIV./GB3.S5   6/02/82 6/18/82 9:50 1   2 0:00
0:02
10 BRUCE?/THANKS FOR PRES. WOULD YOU CARE TO LECTURE/GB3.S5   6/01/82 6/02/82 15:33 4   6 0:00
0:05
11 NYIT DR. SHURE: THANKS FOR HOSPITALITY/GB3.S5   6/01/82 6/02/82 14:46 4   5 0:00   0:06
12 NASA-NO RE SPACE SHUTTLE EXPERIMENT CANNISTER/ TZANNOS/GB3.S5   6/01/82 6/01/82 14:46 2   2
0:01   0:04
13 BOB SPENCE: RECOGNITION LETTER/GB3.S5   6/02/82 6/02/82 15:32 2   3 0:01   0:08
14 TOM KIMBLE RECOGNITION LETTER/GB3.S5   6/02/82 6/09/82 15:58 2   3 0:00   0:02
15 U OF CONNECTICUT: CORP. CONT. MAY HELP/PETE MCFADDEN/GB3.S5   6/04/82 6/23/82 13:15 4   4 0:00
0:15
16 TSONGAS - TRANSMITTAL LETTER RE HIS GLOBE EDITORIAL/GB3.S5   6/09/82 6/09/82 11:13 7   4 0:01
0:12
17 TSONGAS - COMMENTS ON YOUR GLOBE EDITORIAL/GB3.S5   6/09/82 6/09/82 13:56 23   6 0:01   0:19
18 ADS - VAX OFFICE WORKER /OC, BERUBE /GB3.S5   6/10/82 11/22/82 8:26 8   7 0:00   0:00
19 MANUFACTURING: MEETING TO LAYOUT.../OLSEN/GB3.S5   6/09/82 6/09/82 14:26 5   2 0:01   0:01
20 JAPANESE: THE ADVANTAGE:IS IT REA.../BOD/DEMO/GB3.S5   6/09/82 11/22/82 8:33 7   8 0:00   0:01
21 BROWN: TREATING WITH RESPECT/CHAMPINE/GB3.S5   6/09/82 6/09/82 14:30 6   2 0:00   0:00

22 VAX/VMS: RELEASE 1 BOOK/ORPHAN/ANKLAN @CNS1/GB3.S5 6/09/82 6/09/82 14:33 6 2 0:01 0:01
23 VT200: WHY ISN'T OPAL THE VT200?/AVERY/GB3.S5 6/09/82 7/23/82 10:26 4 4 0:00 0:01
24 LISP: LISP AND THE MARKET/CHAMPINE/GB3.S5 6/09/82 6/09/82 14:39 4 2 0:01 0:01
25 LECTURE SERIES: DEC TECNICAL LECTURE SERIES FOR../PEG/GB3.S5 6/09/82 6/09/82 14:41 5 2 0:00 0:00
26 ETHERNET: DEC'S BACKBONE NETWORK AND ET.../DENNY BJORK/GB3.S5 6/09/82 11/17/82 12:10 7 3 0:01 0:03
27 DECSIM: MAKE VS BUY AND SELLING.../GOLDFEIN/GB3.S5 6/09/82 6/11/82 14:07 5 3 0:00 0:00
28 QUALITY PROGRAM AND INSPECTORS VE.../BJ/GB3.S5 6/09/82 6/09/82 14:51 5 2 0:01 0:01
29 RISC/MAURICE WILKES/GB3.S5 6/09/82 6/11/82 14:07 5 4 0:01 0:01
30 EDUCATION: MANAGEMENT IIA: WHAT IS IT?/BERNSTEIN/GB3.S5 6/09/82 6/09/82 14:58 12 2 0:00 0:00
31 PRODUCT LAYERS: WHERE EVERY GROUP.../HENRY ANCONA/GB3.S5 6/09/82 6/09/82 15:03 9 2 0:03 0:03
32 EDUCATIONAL COMPUTER: EDU MARKET../AVRAM/GB3.S5 6/09/82 6/09/82 15:06 6 2 0:01 0:01
33 PRODUCTIVITY: RE SW PROD. AND A JOB SHOP.../KEATING/GB3.S5 6/09/82 6/09/82 15:08 5 2 0:00 0:00
34 CLUSTERS: YOU MAY NOT HAVE GOTTEN THIS IDEA../DEMMER/GB3.S5 6/09/82 6/09/82 15:10 6 2 0:00 0:00
35 HIERARCHIES/MAURICE WILKES/GB3.S5 6/09/82 6/09/82 15:12 5 2 0:01 0:01
36 NATIONAL: CHIPS AS MICROVAX.../EMC/GB3.S5 6/09/82 6/09/82 15:27 14 2 0:09 0:09
37 MICROVAX: THE BOTTOM LINE.../OC/GB3.S5 6/09/82 6/09/82 15:31 2 2 0:00 0:00
38 EDUCATIONAL COMPUTER: IDEA, CUT A.../AVER/GB3.S5 6/09/82 6/09/82 15:33 4 2 0:00 0:00
39 MUSUEM: GETTING SYMBOL FROM ROY ZINGG, IO../DCM/GB3.S5 6/09/82 6/09/82 15:37 4 2 0:00 0:00
40 PRODUCTIVITY VIA FEWER BUT HIGHER QUALITY MESSAGES/OC /GB3.S5 6/10/82 8/25/82 12:03 6 5 0:00 0:03
41 ITINERARY: JAPAN/TAIWAN JUNE 19 THRU JULY 8/GB3.S5 6/17/82 7/14/82 8:10 14 10 0:00 0:17
42 EDUCATION: ENGINEERING SUMMER SCHOOL 6/11/82 7/28/82 13:04 5 3 0:00 0:01
43 PC'S: MAKING COST-EFFECTIVE PC'S. LIKE.../KALB/GB3.S5 6/11/82 6/11/82 9:34 5 3 0:00 0:01
44 SACRED COWS: AND GOLDEN CALVES/OLSEN/GB3.S5 6/11/82 6/11/82 9:37 8 2 0:01 0:01
45 SIGNAL INTEGRITY: DON MARSHALL.../METZGER/GB3.S5 6/11/82 8/17/82 16:47 4 5 0:00 0:00
46 KEYBOARD: WHAT DO YOU THINK ABOUT .../RON HAM/GB3.S5 6/11/82 6/11/82 9:43 5 2 0:01 0:01
47 VS100 AS THE FIRST VT200 (COULD I.../HUETTNER/GB3.S5 6/11/82 6/11/82 9:46 3 2 0:01 0:01
48 CT: YOUR FIRST CT & MARKETING/AVRAM/GB3.S5 6/11/82 6/11/82 10:06 3 2 0:01 0:01
49 CALTECH: FASTER VAXES AND SCIENTIFIC COMPU/BASKETT/GB3.S5 6/11/82 6/11/82 10:08 8 2 0:00 0:00
50 VAX MARKETING: (& DEV.) VAX'S/CADY/GB3.S5 6/11/82 6/11/82 10:10 6 2 0:00 0:00
51 DECMATE I & II: VS THE WANGWRITER/CIOFFI/GB3.S5 6/11/82 6/11/82 10:20 4 3 0:00 0:00
52 REVIEW OF PRODUCTS AND PROJECTS.../BRENDER/GB3.S5 6/11/82 6/11/82 14:08 6 5 0:00 0:01
53 CALTECH: VISITING COMMITTEE TRIP../DEMMBER/GB3.S5 6/11/82 6/11/82 10:21 8 2 0:01 0:01
54 UNIX: SUPPORT/EMC:/GB3.S5 6/11/82 6/11/82 10:23 4 2 0:00 0:00
55 MANUFACTURING A/D AND MANUFACTURING../CLAYTON/GB3.S5.55 6/11/82 6/11/82 10:28 5 2 0:00 0:00
56 VT201: AND VS100/VT200 SERIES: ../AVERY/GB3.S5 6/11/82 6/11/82 10:31 5 2 0:01 0:01

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57  NYIT: VIEWING THE NYIT FILM ON COMP..../OC/GB3.S5   6/11/82  6/11/82 10:33  4    2  0:01   0:01
58  REVIEW: MORE ON WHAT NOT TO DO/CORBEN/GB3.S5        6/11/82  6/11/82 10:35  8    2  0:01   0:01
59  VAX-11: PERFORMANCE DATA ON VAX-11.../CUTLER/GB3.S5      6/11/82  6/11/82 14:06  4    2  0:01   0:01
60  U OF NEWCASTLE, DISCLOSURE FOR SECURE DIST SYS/STRECKER/GB3.S5       6/14/82  6/14/82 11:44  4    2
0:04   0:04
61  MCC PRESENTATION-GOALS/OBJECTIVES BY PRICE/BELL/GB3.S6  10/13/82 10/13/82 13:26  4    1  0:00   0:00
68  MCC RESEARCH PROGRAM & LASL /OC/GB3.S5              6/15/82  8/18/82 10:59  6    5  0:00   0:03
69  MCC RESEARCH PROGRAM LASL: DR. ROBERT EWALD/GB3.S5       6/15/82  8/18/82 11:23  5    18    0:01   0:09
72  JAPAN: COMPANY/PEOPLE VISITED HISTORY/INDEX, 6/82 /GB3   7/12/82  7/17/84  0:01  61   24    0:01   5:23
73  JAPAN: THANK YOU TO MR. T. KUROKI DEC JAPAN/GB3     7/12/82  7/19/82 16:24  1    3  0:01   0:05
74  JAPAN: THOUGHTS ON GREAT PORT TERM/PERS COMP/OLSEN/GB3   7/12/82 10/05/82 16:47  40   16    0:01   2:22
75  JAPAN: TOKYO PRESS CONF.+DEC HISTORY PERSPECTIVES 6/24/82/GB3.S5     7/12/82 10/12/82  8:58  26   18
0:01   0:52
76  AFIPS CALL FOR PAPER ON LINC & PDP-8/GALLER/GB3.S5       7/14/82  8/11/82 14:50  3    6  0:03   0:35


Digital MCC 6/17/82
Name: SECT14, # of Docs: 15, Blocks left: 522 (of 627)
-------------------------------------------------------------------------------
Number  Name     Created  Modified    Size Version  Last   Total
-------------------------------------------------------------------------------
 1                                                  6/17/82  9/27/83  6:21  2    26    0:01   0:03
 2  CITIBANK LITERATURE/GB3.S14                     6/17/82  7/23/82  8:28  1    3  0:15   0:20
 3  LASL TRANSMITTAL LETTER OF JAPAN PAPER/BUZBEE/GB3.S14    6/18/82  7/23/82  8:11  1    3  0:00   0:02
 4  MIT ALUMNI NOMINATION--NO /PICARDI/GB3.S14          7/23/82  7/23/82  8:12  2    1  0:00   0:00
 5  SRC-REPLACE GB WITH KALB/SUMNEY/GB3.S14             7/23/82  7/23/82 12:23  3    2  0:01   0:11
 6  NYIT-- JOHN COLOMBO REG. TRANSPORTATION/NYIT LECTURE/GB3.S14   7/27/82  7/27/82 10:19  3    4  0:01
0:09
 7  DELAHAR ANTIQUES - CHECK PLUS PICKUP INFO/GB3.S14   8/10/82  8/10/82  9:44  3    3  0:21   0:23
 8  LIST OF NAMES FOR 25TH ANNIVERSARY POSTERS/GB3.S14       8/11/82  8/23/82  3:45  8    7  0:02   0:06
 9  DEC-GENERAL FILES GB3.S14                       8/11/82  8/11/82 15:42  15   2  0:01   0:02
10  MCC: ALPHA OMEGA DISTRIBUTION LIST/GB3.S14          8/13/82  8/16/82 10:02  18   11    0:02   0:47
11  MCC: ALPHA OMEGA LIST - SORTED/GB3.S14              8/16/82  1/11/83 12:18  19   23    0:01   0:28
12  MCC: ALPHA OMEGA SPEC/GB3.S14                       8/16/82  8/18/82 13:45  1    7  0:00   0:02
13  MCC: ALPHA OMEGA FORM/GB3.S14                       8/16/82  8/16/82 13:36  1    3  0:03   0:04
14  MICROFILM OF GB PAPERS/GB3.S14                      8/24/82  8/24/82  8:43  6    1  7:45   7:45
15  INDEX GB3S14                                        8/31/82  8/31/82 10:26  6    2  0:01   0:01
Gbell 7/13/82
Name: SECT6 , # of Docs: 45, Blocks left: 169 (of 627)
-------------------------------------------------------------------------------
Number  Name     Created  Modified    Size Version  Last   Total
-------------------------------------------------------------------------------
 1                                                  6/07/82  1/07/83 10:46  6    121   0:00   0:22
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 2  JAPAN THANK YOU 6 LETTERS 7/82 TRIP/GB3.S6          7/14/82  1/11/83 11:55  26   25    0:01   0:31
 3  JAPAN THANK YOU 12 LETTERS 7/82 TRIP/GB3.S6         7/14/82  8/02/82 16:31  47   22    0:00   0:56
 4  JAPAN CHART COMPANY/PRODUCT COMPETITIVE MATRIX/GB3.S6    7/14/82 11/24/82 11:12  33   22    0:00   0:55
 6  CHALLENGES FOR IN THE NEXT 0 TO 5 YEARS /GB3.S6     7/19/82 10/05/82 16:53  18   6  0:00   0:03
 7  REFERENCE: RAJ REDDY /GB3.S6                        7/19/82  7/21/82 15:45  3    2  0:00   0:00
 8  JAPAN COMPANY/PRODUCT COMPETITIVE MATRIX MEMO/GB3.S6     7/19/82  8/24/82 13:47  3    9  0:01   0:13
 9  JAPAN: CHINA COMPANY THANK YOU /GB3.S6              7/20/82  7/20/82 14:07  8    3  0:03   0:11
10  JAPAN: WATANABE THANKS/GB3.S6                       7/20/82  7/21/82  9:15  4    4  0:00   0:08
11  JAPAN: MORIZONA THANK YOU/GB3.S6                    7/20/82  8/17/82  8:39  2    7  0:00   0:04
12  JAPAN: SONY THANK YOU /GB3.S6                       7/20/82  9/09/82 10:42  5    15    0:01   0:09
13  JAPAN: NTT WE'D LIKE TO BE A SUPPLIER /GB3.S6       7/20/82  7/20/82 14:27  3    3  0:06   0:09
14  JAPAN: FUJITSU & MITI THANK YOU /GB3.S6             7/20/82  8/02/82 16:30  3    8  0:01   0:12
15  JAPAN: U OF TOKYO/DR. GOTO /GB3.S6                  7/20/82  9/07/82 14:56  4    8  0:00   0:05
16  JAPAN: FUCHI THANKS /GB3.S6                         7/20/82  1/11/83 11:58  4    9  0:01   0:06
17  JAPAN: MITSUI THANKS/GB3.S6                         7/20/82  7/21/82  9:17  4    6  0:00   0:04
18  ITINERARY SAN FRANCISCO, MCC MEETING, 7/25 &26/GB3.S6    7/20/82  7/30/82  8:51  2    9  0:00   0:36
19  TAIWAN: THANKS 5 LETTERS 7/82 TRIP/GB3.S6           7/20/82  8/02/82 16:31  27   9  0:00   0:28
21  JAPAN IMPRESSIONS / OC + PEG /GB3.S6                7/20/82 10/05/82 16:54  12   15    0:01   0:42
22  JAPAN: ENGINEERING IN--LET'S MOVE/GB3.S6            7/21/82 10/05/82 16:57  27   6  0:02   0:49
23  JAPAN: NOTES ON VARIOUS COMPANIES/RESEARCH ORGS/PEG:/GB3.S6    7/21/82 11/15/82 18:02  10   13    0:00
0:47
24  KEYBOARD, CAN WE BUY THE BROTHER? /AVERY/GB3.S6     7/26/82  7/26/82 13:32  7    1  0:00   0:00
25  PROJECTS: WHICH TO DO, READING OF MCNAMARA /GB3.S6       7/26/82  7/26/82 14:38  8    1  0:00   0:00
27  PROLOG TODAY! / ECKHOUSE /GB3.S6                    7/26/82  7/26/82 14:49  2    1  0:00   0:00
28  MARKETING: ISSUES ABOUT DOING THE BASICS/ KC /GB3.S6     7/26/82  7/26/82 14:54  9    1  0:00   0:00
29  LATTICE LOGIC, WORKING WITH /BHALERAO /GB3.S6       7/26/82  7/26/82 15:01  6    1  0:00   0:00
30  MARKETING: LET'S DEFINE BY REVIEWING AND BY EXAMPLE /KO/GB3.S6       7/26/82  7/26/82 15:06  6    1
0:00   0:00
31  PRODUCTIVITY VIA FEWER BUT HIGHER QUALITY MESSAGES/BERUBE/GB3.S6     7/26/82  7/26/82 15:11  7    1
0:00   0:00
32  GATE ARRAYS, CMOS: WHO,HOW AND NEED TO VLSI?/BASKETT/GB3.S6    7/26/82  8/06/82 14:33  7    2  0:00
0:00
33  MCC: MORE ON MCE PRESENTATION BY CDC /EMC:/GB3.S6   7/26/82  7/26/82 15:19  6    1  0:00   0:00
34  MARKETING: PROPOSED ADS FOR COMMERCIAL USERS/BERUBE/GB3.S6     7/26/82  9/22/82  8:59  15   2  0:01
0:01
35  DESIGNING: TRAINING FOR NAUTILUS DOING REAL DESIGNS/CROXON/GB3.S6    7/26/82  7/26/82 15:44  6    1
0:00   0:00
36  CM'S AS PERFORMANCE ALTERNATIVE TO BIG MACHINES/FULLER/GB3.S6        7/26/82  7/26/82 16:02  7    1
0:00   0:00
37  MARKETING: COMMERCIAL/KO/GB3.S6                     7/26/82  7/26/82 16:08  8    1  0:00   0:00
38  UNIX STANDARDS, BRITISH POLICY /CARCHIDI /GB3.S6    7/26/82  7/26/82 16:12  5    1  0:00   0:00
39  VAX: COMPETITIVENESS NOW AND IN FUTURE, HIGH PERF/KC /GB3.S6   7/28/82  8/19/82 11:26  14   12    0:00
0:05
40  ITINERARY: PARIS/LONDON, 8/24/82 THRU 9/9 /GB3.S6   7/28/82  8/27/82 16:58  9    27    0:00   2:17
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41 ITINERARY: CALIFORNIA 8/8/82 TO 8/11 WITH KALB/GB3.S6   7/28/82 8/10/82 13:22 2   7 0:01   0:20
42 DARTMOUTH - THANKS FOR THE COURSE/RICHMOND/GB3.S6   7/28/82 7/28/82 13:17 6   6 0:05   0:10
46 NYIT - THANKS FOR COMING/SHURE/GB3.S6   8/02/82 8/11/82 14:43 3   4 0:05   0:11
47 MCC: MCC REQUEST FOR SUPPORT FROM DEC / OC /GB3.S6   8/02/82 9/24/82 11:25 7   18   0:01   0:17
48 MCC: ALPHA OMEGA SUPPORT MEMO/PEG ET AL/GB3.S6   8/02/82 9/24/82 11:27 5   17   0:01   0:22
49 MCC: MOTIVATION FOR ALPHA OMEGA/GB3.S6   8/02/82 11/16/82 10:37 7   7 0:00   0:06
52 JAPAN: FUJITSU, CONFIDENTIAL INFO/YASAFUKU/GB3.S6   8/02/82 9/14/82 16:09 3   6 0:00   0:10
60 MUSEUM: BUILDING/HOME COMMITTEE/BLOCH,/GB3.S6

MCC, GBell Papers Digital 8/11/82
Name: SECT7 , # of Docs: 54, Blocks left: 57 (of 627)

Number Name   Created Modified   Size Version Last   Total
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1   8/11/82 11/24/82 11:17 8   116   0:00   0:12
2 ITINERARY: MCC MEETING DENVER, 8/19/82 /GB3.S7   8/11/82 9/28/82 13:08 4   14   0:00   0:62
3 MCC: ALPHA OMEGA PROPOSAL/GB3.S7   8/12/82 10/04/82 9:47 145 35   0:00   8:42
4 MCC: ALPHA OMEGA PROPOSAL TRANSMITTAL LETTER /AO COMMITTEE/GB3.S7   8/16/82 11/23/82 8:33 4   30
0:01   0:23
5 ECOLE POLYTECHNIQUE: RESPONSE TO JEAN-DANIEL NICOUD/GB3.S7   8/17/82 9/01/82 10:33 2   5 0:00
0:24
6 EMS REG. ISI ENVIRONMENT   8/16/82 9/24/82 11:54 4   6 0:00   0:24
7 JUPITER PRIORITIES/HJERPPE/GB3.S7   8/19/82 8/19/82 11:00 5   1 0:00   0:00
8 JAPAN: CONTINUING TO BUILD JAPANESE PROFILES/KOBAYASHI/GB3.S7   8/19/82 8/19/82 11:07 4   1
0:00   0:00
9 JAPAN: MISC. MSGS. FROM JAPAN & ENG/KOBAYASHI/GB3.S7   8/19/82 8/19/82 11:10 11   1 0:00   0:00
10 STRATEGY: SOME CHALLENGES IN THE NEXT 0-5 YEARS/OLSEN/GB3.S7   8/19/82 5/12/83 9:11 18   3 0:00
0:00
11 TERMINAL: WHY WE MUST BUILD GREAT PORTABLE/AVERY/GB3.S7   8/19/82 2/22/83 13:59 19   2 0:02
0:02
12 PRINTER: FINDING $'S TO BREADBRD LQP/SHEET FEED/AVERY/GB3.S7   8/19/82 8/30/82 14:07 3   3 0:00
0:00
13 VT192: PUTTING THE MODEM OPTION BACK IN/AVERY/GB3.S7   8/19/82 8/19/82 11:21 4   1 0:00   0:00
14 VT192: FINALIZING SPEC BEFORE WE SLIP SCHED./AVERY/GB3.S7   8/19/82 9/14/82 16:09 6   4 0:00
0:01
15 SUMNEY/TECH. POS. OF US COMP. SEMICOMP. CO./GB3.S7   8/23/82 9/28/82 11:56 3   4 0:00   0:14
16 TOM FORTUNE,FRESNO CA;TO KO REG CITIZEN & GOV'T COMM/GB3.S7   8/23/82 8/24/82 14:40 2   4 0:00
0:08
17 ABSTRACT: LOCAL AREA NETS, DISTR.PROCESSING & 5TH GEN/GB3.S7   8/24/82 9/07/82 9:17 2   7 0:00
0:08
18 WCC:THANK YOU: JJ SERVENT-SCHEINER & N NEGROPONTE/GB3.S7   9/10/82 9/22/82 9:24 5   12   0:03
0:40
19 U OF CAMBRIDGE THANK YOU/DR. HOPPER & HERBERT/GB3.S7   9/10/82 9/13/82 12:06 5   4 0:01   0:22

20 VT:OVERFUNDING-HUETTNER/AVERY/SMITH GB3.S7 9/10/82 10/06/82 13:05 4 7 0:01 0:19
21 LA100:WHAT'S THE STORY?-SMITH/AVERY/RING GB3.S7 9/10/82 9/13/82 14:47 1 5 0:01 0:06
22 APPLICATIONS PRODUCTS: DOING THEM RIGHT-OC, PEG... GB3.S7 9/10/82 10/06/82 12:57 17 11 0:01 1:31
23 WCC:WORLD COMPUTER CENTER AND WPS-SOURNAC GB3.S 9/10/82 11/16/82 14:31 7 9 0:00 0:39
24 FOUR WHEELS:OF REINCARNATION--PEG, RAD, TMC,... GB3.S7 9/10/82 8/16/82 9:25 28 15 0:01 2:20
25 OPPENHEIMER:EXCERPT FROM AN OPPEN. PROSPECTUS/OC, PEG... GB3.S7 9/13/82 9/13/82 15:45 3 3 0:00 0:10
27 CLARK:RECOMMENDATION LETTER\MACARTHUR FOUNDATION GB3.S7 9/13/82 9/13/82 13:40 5 6 0:01 0:15
28 CRAPPY PRODUCTS:THE SIDE EFFECTS OF SLIPS AND VOIDS/OC + GB3.S7 9/13/82 10/13/82 12:17 10 5 0:01 0:10
29 ALPHA-OMEGA:ALPHA-OMEGA AND CFM/HUSTVEDT,LIPCON,POE,MACK GB3.S7 9/13/82 9/17/82 13:10 2 3 0:01 0:09
30 LETTER:PER BRINCH-HANSEN GB3.S7 9/15/82 11/22/82 11:08 2 4 0:01 0:06
32 MCC TRANSMITTAL LETTER, $4K FOR INCORPORATION/GB3.S7 9/17/82 11/22/82 12:19 2 5 0:03 0:09
33 ITINERARY: AUSTRALIA 12/12/82 THRU 1/1/83/GB3.S7 9/18/81 12/10/82 11:38 4 13 0:14 2:48
34 ITINERARY - LASL, 10/5 & 6/1982, AO/GB3.S7 9/18/81 10/01/82 9:27 3 6 0:01 0:13
40 ALPHA OMEGA AGENDA, 10/5&6, LOS ALAMOS/GB3.S7 9/23/82 9/23/82 0:03 9 6 0:01 0:12
41 AI SOFTWARE IDEA FOR ADVERTISING 9/24/82 9/27/82 8:31 3 2 0:01 0:13
43 CFM: CYLES FOR THE MASSES, EMS 8/22/82 /CHRISTY ET AL/GB3.S7 9/27/82 9/27/82 16:59 18 1 0:00 0:00
44 VAX EXTENDED, DUCHAMP'S VECTOR INSTRUC. EMS 8/21/FULLER/GB3.S7 9/27/82 9/27/82 17:02 5 1 0:00 0:00
45 WPS-CT300 PHASE 0 OF POINT PRODUCT, EMS 8/21/DOCKSER ET AL/GB3.S7 9/27/82 9/27/82 17:04 5 1 0:00 0:00
46 COMPUTERS FOR MANUFACTURING, EMS 8/21/82 /CADY /GB3.S7 9/27/82 9/27/82 17:06 6 1 0:00 0:00
47 ISI, ENVIRONMENT (TALK W BALZER) EMS 8/18/ CHAMPINE ET AL/GB3.S7 9/27/82 9/27/82 17:09 5 1 0:00 0:00
48 MULTICOMPUTERS, CONSTRUCTING EXPERIMENT,EMS 8/16/FULLER/GB3.S7 9/27/82 9/27/82 17:12 4 1 0:00 0:00
49 CFM PRODUCTS AND A/D TO GET MORE, EMS 8/14,CHRISTY ET AL/GB3.S7 9/27/82 9/27/82 17:14 8 1 0:00 0:00
50 ICL COLLABORATION TO ESTABLISH MAIL STD,EMS 8/14/LACROUTE/GB3.S7 9/27/82 9/27/82 17:16 4 1 0:00 0:00
51 WORKSATIONS ON A WINNING TRACK, EMS 8/14/SMITH/GB3.S7 9/27/82 9/27/82 17:17 4 1 0:00 0:00
52 ALPHA OMEGA...SEMINAR TO PRESENT/GET IDEAS,EMS 8/12/FULLER+/GB3.S7 9/27/82 9/27/82 17:20 5 1 0:00 0:00
53 GATE ARRAYS, BETTER PRODUCTS THROUGH,EMS 8/9,FOLSOM+/GB3.S7 9/27/82 9/27/82 17:24 25 1 0:00 0:00
54 VT192 - SCHEDULE, EMS 8/9 /AVERY+/GB3.S7 9/27/82 9/27/82 17:26 7 1 0:00 0:00
55 BUS, GETTING A WINNING STRATEGY, EMS 8/7, DEMMER+/GB3.S7 9/27/82 9/27/82 17:28 10 1 0:00 0:00
56 VS100 AND PERSONLA NEBULA, EMS 8/7, CHAMPINE+/GB3.S7 9/27/82 9/27/82 17:33 8 1 0:00 0:00

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57  MARKETING ADS CONTENT, EMS 8/4, HINDLE+/GB3.S7      9/27/82  9/27/82 17:36  12   1  0:00   0:00
58  MARKETING OUR OFFICE PRODUCTS, EMS 8/4, SPENCER+/GB3.S7        9/27/82  9/27/82 17:38  19   1  0:00
0:00
59  ALPHA OMEGA...DRAFT FOR COMMENTS, EMS 8/4, DELAGI+/GB3.S7      9/27/82  9/27/82 17:39  4    1  0:00
0:00
60  BUDGET PROBLEM, DEALING WITH, EMS 8/2, EMC:/GB3.S7       9/27/82  9/27/82 17:43  5    1  0:00   0:00
61  VS200, GET COLOR QUICK,EMS 8/2,BUTLER+/GB3.S7       9/27/82  9/27/82 17:44  3    1  0:00   0:00
62  OA,RE-CENTRALIZED ORDER PROCESSING, EMS 8/1,BJORK/GB3.S7       9/27/82  9/27/82 17:45  5    1  0:00
0:00


Index 8/31/82  9/27/83
Name: GB3S13, # of Docs: 2, Blocks left: 621 (of 627)
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Number  Name     Created  Modified    Size Version  Last   Total
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 1                                                  8/31/82  9/27/83  6:22  1    3  0:01   0:02
 2  INDEX GB3S13                                    8/31/82  8/31/82 10:08  2    2  0:01   0:01


Digital TCM 10/04/82
Name: SECT8 , # of Docs: 60, Blocks left: 113 (of 627)
------------------------------------------------------------------------------
Number  Name     Created  Modified    Size Version  Last   Total
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 1                                                 10/04/82 11/30/82 13:09  8    171   0:00   0:28
 2  TSONGAS LETTER RE MIT MEETING/GB3.S8           10/04/82 10/18/82  9:07  8    13    0:01   0:13
 3  ARPA - /LETTER TO DR. LEVINTHAL ET AL VIA ARPANET  10/04/82 11/05/82 13:37  5    13    0:00   0:17
 4  TECKNOLWEDGE BOD, NOTES RE FEIGENBAUM/GB3.S8       10/04/82 11/18/82 16:28  4    4  0:01   0:02
 5  LASL THANKS FOR HOSPITALITY/EWALD,BUZBEE/GB3.S8    10/11/82 10/11/82 13:10  3    4  0:00   0:01
 8  VAX PERFORMANCE, EFFORT TO IMPROVE/EMS:DEMMER ETAL/GB3.S8     10/13/82 10/25/82  8:59  7    2  0:00
0:00
 9  AO DISCUSSION WITH FERNBACH&FEIGENBAUM/EMS:FULLER/GB3.S8      10/13/82  4/06/83 16:20  6    2  0:00
0:00
10  VENUS REVIEW CONGRATS...SINCE 5/81/EMS:GLORIOSO+/GB3.S8       10/13/82 10/13/82 11:56  5    1  0:00
0:00
11  A1 DEMO THANKS--BE #1 IN OFFICE SALES/EMS:WYMAN+/GB3.S8       10/13/82 10/13/82 12:04  6    1  0:00
0:00
12  OFIS DISCUSSION WITH DAVIES NOT GOOD/EMS:DOCKSER/GB3.S8       10/13/82 10/13/82 12:12  12   1  0:00
0:00
13  NYIT, MORE COLLABORATION + A PRO/EMS:BENIGNI,AK/GB3.S8  10/13/82 11/08/82 14:05  7    3  0:00   0:00
14  KO:SOCIAL ECOLOGY RESEARCH /THORSHEIM&ROBERTS/ GB3.S8.14      10/14/82 10/14/82 14:24  3    5  0:00
0:14
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15 KO:IPA-PAPER-IMPROVE R & D PRODUCTION/SZAKANGI/GB3.S8.15   10/14/82 10/25/82 15:16 2   7 0:10
0:18
16 ORG CHART--ENGINEERING/GB3.S8.16   10/14/82 12/01/82 9:29 10   16   0:03   0:54
17 ANTIQUE PAYMENT, PLANIMETER/M.KENNEDY/GB3.S8   10/15/82 11/30/82 13:30 2   6 0:00   0:12
18 MUSEUM: DONATE LAND AS ENDOWMENT/MATHEWS/GB3.S8   10/18/82 10/19/82 8:46 11   14   0:01   0:30
19 MUSEUM: CANADIAN AN/FSQ7 FIELD TRIP REPORT/GB3.S8 10/18/82 4/06/83 16:23 35   6 0:02   0:05
20 LETTER TO DR. ARNOLD WEBER--CONGRATULATIONS GB3.S8.20   10/18/82 11/22/82 8:34 2   4 0:00   0:05
21 ITINERARY: MINN/SF/10/27/82--ALPHA OMEGA,TECKNOWLEDGE/GB3.S8 10/22/82 10/25/82 4:59 4   7 0:00
0:22
24 TRAINING:ENGINEERING OBSOLESENCE/REYNOLDS/GB3.58   10/25/82 10/27/82 10:12 10   11   0:00   0:26
25 Training: Eng. Obsolescence Transmittal Memo/GB3.S8   10/26/82 10/26/82 8:22 3   3 0:00   0:06
27 Training: Over 40 Engineers (GB3.S8)   10/26/82 10/26/82 12:06 6   5 0:00   0:08
31 VAX11 USER'S GUIDE: LTR DENNIS GELLER,BABSON/11-2/GB3.S8   11/01/82 11/23/82 13:00 2   3 0:02
0:07
32 INTERRUPTS: LTR HARVEY CRAGON/11-2/GB3.S8   11/01/82 11/23/82 12:58 5   4 0:01   0:04
35 TEKNOWLEDGE BOD:/LTR ED FEIGENBAUM/11-2/GB3.S8   11/02/82 11/23/82 12:12 3   5 0:01   0:15
36 ITINERARY: 11/7 THRU 11/13, SF&OREGON/GB3.S8   11/05/82 1/25/83 12:43 5   9 0:00   0:38
37 PRODUCTS: COMPETITIVE/MEMO/11-8/OC,EMC,PEG/GB3.S8 11/08/82 11/23/82 12:10 16   6 0:01   0:21
38 ITINERARY: ALPHA OMEGA, MINN. 11/21-23/GB3.S8   11/18/82 11/19/82 14:44 2   8 0:00   0:08
40 AI & Expert Sys:LISP,PRODUCTS,NEEDS &MKTG./WEISS ET AL/GB3.S8   11/15/82 11/30/82 11:54 18   4
0:01   0:02
43 SRI, Alpha Omega + Join Museum?/Miller/GB3.S8   11/15/82 11/15/82 11:19 4   3 0:01   0:01
44 LLL-Multiprocessor Work/Michaels/GB3.S8   11/15/82 11/15/82 11:48 4   5 0:01   0:09
45 FPS - thanks + OA Ideas/Turner/GB3.S8   11/15/82 11/15/82 12:04 5   9 0:01   0:17
46 LLL-thanks & Good Luck on IIA/Wood M.Williams/GB3.S8   11/15/82 11/24/82 12:18 5   5 0:00   0:15
47 FPs-Join Museum?/Winningstad/GB3.S8   11/15/82 11/15/82 12:11 3   1 0:02   0:02
48 Japan-More Thoughts/Aguero/GB3.S8   11/15/82 11/30/82 11:56 14   9 0:01   0:26
49 VAX,Implementation when hardwired & Microprogrammed/EMC/GB3.S8   11/15/82 12/06/82 16:35 31   8
0:01   0:31
50 LBL/Speaker/Consultant/GB3.S8   11/15/82 11/16/82 11:42 5   4 0:03   0:14
51 STANDARDS/SEMIS & SYSTEMS DESIGN/PRAKASH BHALERAO,GB3.S8   11/15/82 11/15/82 13:40 3   2 0:00
0:11
52 DEC 10/20 BUSINESS/KNOWLES/GB3.S8   11/15/82 11/15/82 14:03 16   3 0:03   0:04
53 VENUS: NEED, LLL MULTIPROCESSORS/EMS/11-16/DEMMER ET AL/GB3.S8   11/15/82 11/23/82 11:33 12   6
0:02   0:55
54 WRL:CHARTER/EMS/11-16/FULLER,BASKETT/GB3.S8   11/15/82 11/23/82 11:25 7   8 0:03   0:25
57 EDUCATION: MIT lifetime program,EMS-10/4/EMC/GB3.S8   11/18/82 11/22/82 12:14 7   3 0:01   0:02
58 SPEECH: KEN'S DATA FOR KO/EMS-10/3/A.CRAWFORD/GB3.S8   11/18/82 11/18/82 11:55 10   2 0:01   0:01
60 YALE: CS DEPT. VISIT/EMS/11-16/MARCUS,FULLER/GB3.S8   11/15/82 11/23/82 11:22 10   11   0:01   0:37
61 SHARED:LPC(F&J VERSIONS) VS PC'S/EMS-10/9/M.GUTMAN/GB3.S8   11/18/82 11/18/82 11:53 7   3 0:00
0:01
62 SHARED:11'S, SOME SPT FOR LOW END/EMS-10/10/GUTMAN,MARCUS/GB3.S8   11/18/82 11/18/82 11:49 5   3
0:00   0:01

63 VAX ARCHITECTURE:EXTENDING-NAME/EMS-10/10/D.BHANDARKAR/GB3.S8   11/18/82 11/18/82 11:48 7   2
0:01   0:01
64 VAX:VIA MICROPROGRAMMING/EMS-10/10/D.BHANDARKAR/GB3.S8 11/18/82 11/18/82 11:47 5   2 0:01   0:01
65 MIT:NEC IN NE,POOR RELATIONSHIP/EMS-10/11/KEILLOR/GB3.S8   11/18/82 11/18/82 11:46 6   4 0:00
0:04
66 IBM'S:AGGRESSIVE BEHAV.W/UNIV. & RSCH/EMS-10/11/OC,BUTLER/GB3.S8   11/18/82 11/18/82 11:41 6   3
0:01   0:02
67 ANNOUNCEMENT: RECOMMEND ARCH/EMS-10/11/U.FAGERQUIST/GB3.S8   11/18/82 11/18/82 11:08 10   2 0:01
0:01
68 TECH COMP CENTER:BENCHMARK & EXPERIMENT/EMS-10/13/GANNON/GB3.S8   11/18/82 11/18/82 11:07 7   2
0:01   0:01
69 Q VS BI REPORT:THANKS/EMS-10/16/DEMMER,JESSEL,STRECKER/GB3.S8   11/18/82 11/18/82 11:06 5   2
0:01   0:01
70 CMU LOSS:WHY SIGNIFICANT & NEXT STEP/EMS-10/18/AVERY,OC/GB3.S8   11/18/82 11/18/82 11:05 9   3
0:00   0:01
71 VAX CENTER: ZK FOR PARALLEL.&EXT./EMS-10/19/CARCHIDI/GB3.S8   11/18/82 11/18/82 11:04 4   3 0:00
0:00
72 MIT:MTG. TO PROPOSE A PC PLAN/EMS-10/20/SAM,WIN,BJ/GB3.S8   11/18/82 11/18/82 11:04 3   3 0:01
0:02
73 AI:MKT. & PRODUCTS-LET'S GO AFTER/EMS-10/12/ABEL,FULLER/GB3.S8   11/18/82 11/18/82 11:03 6   5
0:00   0:03
74 VAX ARCHITECTURAL: EXTEN.&REDUCTIONS/EMS-10/24,DILEEP/GB3.S8 11/18/82 11/18/82 10:27 17   3 0:01
0:02
75 TAIWAN: VERSUS AUTOMATION FOR COST/EMS-10/24/KO,J.SMITH/GB3.S8   11/18/82 11/18/82 10:28 6   3
0:00   0:01
76 VAX & PRIORITIES:PRODUCTS CHARTS & REORG/EMS-10/26/BJ/GB3.S8 11/18/82 11/18/82 10:23 5   2 0:02
0:02

GBell Mail 11/22/82
Name: SECT13, # of Docs: 15, Blocks left: 88 (of 627)

Number	Name	Created	Modified		Size	Version	Last	Total
1		12/30/80	11/23/82	15:05	2	36	0:00	0:08
2	FILE INDEX - DEC GENERAL FILEs/GB3.S14.9	11/22/82	12/10/82	14:05	6	9	0:01	0:12
3	MAIL TICKLER FORM FOR TRACKING LIST/GB2.S13	6/11/81	11/01/82	8:52	1	5	0:00	0:02
4	FILE INDEX - GB PERSONAL/GB3.S9	11/22/82	11/23/82	16:36	11	8	0:00	0:11
5	FILE INDEX - ALPHA EXTERNAL FILES/RLO.S9	11/23/82	12/10/82	14:32	8	7	0:01	0:09
6	MAY TO DATE/MASTER '81 MAIL-LOG + TICKLER LIST/GB2.S13	5/04/81	12/10/82	15:53	468	2016	0:02	31:28
7	MAIL TICKLER FORM/GB2.S13	5/29/81	11/01/82	8:54	1	20	0:00	0:18
8	MAIL TICKLER SPEC /GB2.S13	5/29/81	11/23/82	11:07	1	41	0:00	0:19
9	MAIL TICKLER LIST/GB2.S13	6/11/81	11/01/82	8:51	1	16	0:00	0:06
10	MAIL TICKLER RESULT/RL1:SECT13	6/10/81	9/01/81	11:02	2	46	0:01	0:26

11	DK FOR MAIL TICKLER/GB1.S13	6/11/81	6/11/81 9:54	2	3	0:01	0:08
12	MAIL SUMMARY SPEC	3/04/82	7/14/82 11:26	1	11	0:00	0:04
13	MAIL SUMMARY FORM (DAILY)	3/04/82	3/04/82 15:52	2	8	0:00	0:52
14	LOAN OUT LOG	6/18/82	11/05/82 8:52	2	29	0:01	0:31
15	FILE INDEX - TECHNICAL						

TCM Gwen 12/13/82

Name: MARIE , # of Docs: 24, Blocks left: 357 (of 627)

Number	Name	Created	Modified	Size	Version	Last	Total
1		12/13/82	2/09/83 13:35	2	40	0:00	0:00
2	DAVID	12/22/82	1/11/83 15:23	24	6	0:29	3:29
3	cover memo	12/13/82	12/13/82 3:47	3	1	0:16	0:16
4	QUESTIONAIRE	12/13/82	2/02/83 13:46	2	5	0:01	1:26
5	REFERENCE MANUAL INFO	12/14/82	2/02/83 12:33	6	7	0:01	2:41
6	MISCELLANEOUS INFO	12/14/82	1/11/83 14:01	9	4	0:01	1:00
7	GREGOR	12/20/82	2/09/83 11:40	8	7	0:00	1:04
8	Meredith	1/05/82	1/05/82 3:25	4	2	0:20	0:21
9	DEBBIE	12/21/82	12/27/82 15:16	4	4	0:02	0:53
10	CHRIS	12/27/82	1/04/83 11:07	8	2	0:57	1:25
11	JAMIE	12/27/82	1/05/83 0:07	7	3	0:07	1:20
12	GERI	1/03/83	1/05/83 0:49	8	3	0:32	1:17
13	CAROLE	1/03/83	2/02/83 10:41	9	10	0:08	2:01
14	ARCHIVIST/REGISTRAR	1/04/83	2/09/83 11:40	10	8	0:01	1:09
15	BILL	1/05/83	1/11/83 15:45	1	2	0:01	0:04
16	DUMMY DOCUMENT	1/12/83	1/12/83 11:04	5	5	0:00	0:16
17	DUMMY2	1/12/83	1/12/83 11:07	8	4	0:03	0:21
18	GWEN	0/00/00	0/00/00 0:17	3	1	0:16	0:16
19	FINAL DRAFT	2/01/83	2/09/83 15:12	80	39	0:09	8:35
20	SECRETARU	2/01/83	2/01/83 4:16	6	2	0:03	0:28
21	Part Two Draft	2/02/83	2/09/83 15:31	15	18	0:01	1:16
22	TABLE OF CONTENTS	2/02/83	2/09/83 11:05	5	18	0:12	1:16
23	DOCUMENT LIBRARY	1/21/83	2/02/83 13:47	11	15	0:00	0:19
24	ABBREVIATION FILE	1/21/83	2/02/83 15:18	1	17	0:01	0:10

Digital, Museum, 12/21/82 9/27/83

Name: 0 , # of Docs: 34, Blocks left: 373 (of 627)

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--------------------------------------------------------------------------------
Number  Name     Created  Modified    Size Version  Last   Total
--------------------------------------------------------------------------------
 1                                                  12/21/82  9/27/83  6:23  4    36    0:01   0:01
 2  INDEX                                           12/21/82 12/21/82 11:15  2    1  0:00   0:00
 3  UNIX:More Competitive/EMS-11/1-COURTIN/OC-GB3.S10  12/28/82 12/28/82 15:35  4    3  0:00   0:01
 4  MIT:AN OPPORTUNITY/EMS/11-1/AVERY/KO/J.SMITH/GB3.S10    12/28/82 12/28/82 15:35  4    3  0:00   0:01
 5  MCWILLIAMS,TOM: LLL/EMS-11/13-BASKETT-GB3.S10      12/28/82 12/28/82 15:45  9    1  0:00   0:00
 6  COGNITIVE SYSTEMS:USE AI/EMS-11/2-HUGHES/GB3.S10   12/28/82 12/28/82 15:35  6    3  0:00   0:01
 7  MUSEUM:MANUALS,SOFTWARE/EMS-11/3-MUSEUM-GB3.S10    12/28/82 12/28/82 15:35  4    3  0:00   0:00
 8  MILL:WALK-THROUGH/EMS-11/3-BJ,SMITH-GB3.S10        12/28/82 12/28/82 15:35  5    3  0:01   0:02
 9  CMU:SPICE & YALE & PPA/EMS-11/3-BJ,FULLER/GB3.S10  12/28/82 12/28/82 15:34  5    3  0:00   0:01
10  LA12 VS ROBIN:EMS-11/3-AVERY-GB3.S10               12/28/82  2/22/83 13:52  8    5  0:00   0:02
11  ARPA HELP IN H/S SEMIS:EMS-11/3-GLORIOSO-GB3.S10   12/28/82 12/28/82 15:34  5    2  0:02   0:02
12  BERKELEY:ETHERNET/EMS-11/3-STEVE DAVIS/GB3.S10     12/28/82 12/28/82 15:36  4    2  0:01   0:01
13  UNIX:MORE COMPETITIVE/EMS-11/8-J.SHIELDS/GB3.S10   12/28/82 12/28/82 15:37  3    2  0:00   0:00
14  SALES: PRODUCT LINE SUPPORT/EMS-11/13-OLSEN-GB3.S10     12/28/82 12/28/82 16:16  5    2  0:01   0:01
15  MUSEUM:PETROFSKY/EMS-11/13-BERUBE/GB3.S10          12/28/82 12/28/82 16:17  9    2  0:01   0:01
16  AI:EXPERT SYSTEMS:LISP/EMS-11/14-ABEL,PATEL/GB3.S10     12/28/82 12/28/82 16:21  19   2  0:04   0:04
17  PRODUCTS:WINNING HIGH END CPU'S/EMS-11/14/KOTOK/GB3.S10       12/28/82 12/28/82 16:22  9    2  0:01
0:01
18  VOICE:PLAYBACK/EMS-11/14-AVERY-GB3.S10             12/28/82 12/28/82 16:23  4    2  0:01   0:01
19  MIT:PC/EMS-11/15/FULLER,CHAMPINE/GB3.S10           12/28/82 12/28/82 16:26  4    3  0:00   0:01
20  SABBATICALS:SHOULD WE?/EMS-11/16/EMC/GB3.S10       12/28/82 12/28/82 16:27  3    2  0:01   0:01
21  LBL:SPEAKER/CONSULTANT-EMS/11-16-CFM TF/GB3.S10    12/28/82 12/29/82  8:42  6    4  0:00   0:01
22  COGNITIVE SYSTEMS:R.SHANK/EMS-11/19/BOB NOLIN/GB3.S10   12/29/82 12/29/82  8:45  18   2  0:02   0:02
23  MIT: EMS-11/20-JAY HAIRE-GB3.S10                   12/29/82 12/29/82  8:46  5    2  0:01   0:01
24  UNIX POLICY:EMS-11/22-BILL JOHNSON-GB3.S10         12/29/82 12/29/82  8:47  3    2  0:01   0:01
25  VAX:HELP ON IMPROVING/EMS-11/24/BOB ROCKWELL/GB3.S10    12/29/82 12/29/82  8:49  4    3  0:00   0:01
26  BOOK:EMS-11/27-FULLER,STRECKER/GB3.S10             12/29/82 12/29/82  8:56  5    3  0:01   0:02
27  WC FIELD (LASL WC11 COMPUTER)/EMS-12/3-AVERY/GB3.S10    12/29/82 12/29/82  8:57  7    2  0:01   0:01
28  ARTIFICIAL INTELLIGENCE:EMS-12/3-B.JOHNSON/GB3.S10      12/29/82 12/29/82  9:00  7    2  0:03   0:03
29  HARDWARE:PRODUCTS FOR AP/EMS-12/4/G.BUTLER/GB3.S10      12/29/82 12/29/82  9:14  7    3  0:00   0:01
30  DATAFLOW:RESEARCH/EMS-12/4/FULLER/GB3.S10          12/29/82 12/29/82  9:19  11   3  0:00   0:05
31  DATAFLOW:GOING TO ARPA/EMS-12/4/FULLER/GB3.S10     12/29/82 12/29/82  9:20  4    2  0:01   0:01
32  WORKSTATION:EMS-12/6-B.CROXON/GB3.S10              12/29/82 12/29/82  9:21  8    3  0:00   0:01
33  RESEARCH GROUP:EMS-12/6-FULLER-GB3.S10             12/29/82 12/29/82  9:22  5    2  0:01   0:01
34  SCORPIO:ORGANIZATION REVIEW/EMS-12/6/DEMMER,BJ/GB3.S10  12/29/82 12/29/82  9:24  13   3  0:00   0:02
1983

Digital 1/03/83  2/17/83
Name: 00    , # of Docs: 40, Blocks left: 200 (of 627)
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Number  Name     Created  Modified    Size Version  Last   Total
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1		1/03/83	3/04/83	10:25	5	102	0:00	0:13
2	Interview	1/03/83	2/24/83	11:58	152	24	0:00	7:49
3	DISTRIBUTED COMPUTING:Ltr,Bardsley,U of Pittsburgh/1-3/GB4.S1	1/03/83	2/14/83	9:15	2	10	0:00	0:04
4	IEEE MEETING:LTR/DAVID ZEIN/1-3/GB4.S1	1/03/83	1/11/83	9:15	2	4	0:00	0:03
5	AUSTRALIAN: VAX-VMS/DECNET INPUT-EMS-1/3-GB4.S1	1/03/83	2/18/83	15:47	5	5	0:01	0:12
6	AUSTRALIA:THANKS/EMS-FRANK WROE-1/3-GB4.S1.6	1/03/83	2/18/83	15:47	7	5	0:00	0:14
7	WANG: LOCAL AREA NETS/EMS/1-3/LACROUTE,OC/GB4.S1	1/03/83	2/18/83	15:42	5	7	0:00	0:10
8	INDUSTRIAL TERMINALS:EMS/1-3/KO,HINDLE,MARCUS/GB4.S1	1/03/83	2/22/83	13:55	5	8	0:00	0:13
9	CHIPS: 100K TRANSISTOR/SEG MGRS-GB4.S1	1/03/83	2/18/83	15:45	5	5	0:00	0:07
10	DECMAIL:EMS/1-3/DOCKSER,ANCONA,MARCUS/GB4.S1	1/03/83	1/03/83	15:12	4	3	0:01	0:05
11	TEST	1/06/83	1/06/83	15:05	2	6	0:01	0:09
12	DESIGN:QUALITY METHODOLOGY/EMS/1-4/AVERY/GB4.S1	1/04/83	2/18/83	15:39	18	3	0:00	0:03
13	BOOK: OUTLINE II/ EMS-1/7-STRECKER,FULLER/GB4.S1	1/07/83	2/18/83	15:50	4	6	0:00	0:01
14	SIEWIOREK REFERENCE:TERMAN AWARD/DIRECTOR/GB4.S1	1/10/83	1/10/83	8:41	3	2	0:01	0:01
15	MUDGE REFERENCE:PROMO TO RSCH.SCIENTIST/PHILIP/GB4.S2	1/10/83	1/10/83	11:34	5	5	0:00	0:03
16	MUDGE:100K TRANSISTOR CHIP/LTR/GB4.S1	1/10/83	4/05/83	13:41	4	3	0:00	0:00
17	NYU PROPOSAL	1/10/83	1/10/83	11:40	4	3	0:00	0:01
18	SEYMOUR CRAY:NAE FOUNDERS AWARD/LTR/ABRAMSON/1-26/GB4.S1	1/26/83	1/26/83	11:39	2	4	0:00	0:04
20	BUS:BUILD,USE,SELL/EMS/1-17/OC,PEG,MFG,PLM/GB4.S1	1/17/83	3/08/83	16:11	10	17	0:01	0:59
21	R & D TAX:COST-SHARING-REGS/EMS/CHAMBERLAIN/1-25/GB4.S1	1/25/83	2/18/83	16:17	11	8	0:00	0:09
22	FACTORY: PROPOSAL, LABORATORY HDWE./EMS/GB4.S1	1/20/83	2/18/83	16:02	4	7	0:01	0:09
23	U.S.EXPORT LAWS:APPLICATION/EMS/ENGR USERS/1-25/GB4.S1	1/25/83	2/18/83	16:19	21	8	0:01	0:19
24	CFM: COST PERFORMANCE/EMS/2-15/OC/GB4.S1	2/15/83	2/16/83	9:03	11	9	0:01	0:61
25	SYSTEM DEV. FOUNDATION:MTG. 3-13/KEN/1-27/GB4.1	1/27/83	1/27/83	14:29	2	3	0:00	0:06
26	Scorpio Organization Review	1/28/83	1/28/83	16:28	10	2	0:00	0:11
27	CSIRO:100K GATE CHIP/MARCUS PALTRIDGE/2-1/GB4.S1	2/01/83	2/15/83	9:40	2	3	0:01	0:09
28	VAX: COMPUTATIONAL QUALITY AD/2-9/BERUBE, B. RYAN/GB4.S1	2/09/83	2/09/83	11:32	3	3	0:05	0:06
29	CFM: COST-PERFORMANCE/EMS/2-14/CFM GROUP,BJ,OC/GB4.S1	2/14/83	2/15/83	11:20	9	8	0:06	1:13
30	MICROVAX:68,000 LANDSLIDE/EMS/2-14/OLSEN/GB4.S1	2/14/83	2/15/83	11:00	6	4	0:05	0:10
31	HISTORY:LEARNING FROM CDC-CRAY/EMS/2-14/PEG,TMC,OC/GB4.S1	2/14/83	2/15/83	10:51	10	8	0:01	0:49
32	MANAGEMENT PROBS 0 & 1/EMS/2-14/PEG,TMC,OC/GB4.S1	2/14/83	2/15/83	10:38	8	4	0:07	0:21
33	TEKNOWLEDGE:TECHNOLOGY BOARD/EMS/2-14/PATEL,ABEL/GB4.S1	2/14/83	2/15/83	13:34	6	3	0:28	0:37
34	STANFORD: PROF. BOB WHITE/2-15/GB4.S1	2/15/83	2/15/83	13:01	2	3	0:01	0:04
35	CDC: LTR TO NEIL LINCOLN/2-15/GB4.S1	2/15/83	2/15/83	16:17	3	4	0:00	0:09
36	MCC SITE: COLOCTION W/HPP CENTER/BOB INMAN/2-15/GB4.S1	2/15/83	2/16/83	11:02	3	2	0:02	0:10
37	COMPRESSION:LABS,INC.OPPORTUNITIES/EMS/CRAWFORD/2-15/GB4.S1	2/15/83	2/16/83	8:49	6	4	0:04	0:19

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38  PRINT SERVER: EMS-RON CRISS-REPLY BY GORDON-2/16-GB4.S1        2/16/83  2/18/83  9:35  5    7  0:00
0:07
39  COMPRESSION LABS:LTR TO JOHN TYSON/2-16/GB4.S1      2/16/83  2/16/83  9:47  3    1  0:06   0:06
40  SCHLUMBERGER:EMS-SKIP GARVIN-2/14-GB4.S1            2/17/83  2/17/83 10:48  12   3  0:00   0:00
42  PC MICROVAX: EMS-2-17-OLSEN,SHIELDS,HINDLE-GB4.S1   2/17/83  2/18/83 13:22  6    4  0:00   0:13

GB Digital 3/24/83
Name: FIXED, # of Docs: 72, Blocks left: 67 (of 779)
-------------------------------------------------------------------------
Number  Name                     Created  Modified       Size Version  Last   Total
------------------------------------------------------------------------1           3/09/83  9/12/83  1:37
9    142      0:01   0:24
2  ORGANIZATION CHART-ENGINEERING LONG-ENGINEERING SHORT   3/24/83  4/21/83 10:39  16   11    0:00   0:37
3  REFERENCE:COHEN, HAROLD/LTR/4-7/GB5.3                   3/06/83  3/08/83 11:30  3    4  0:00   0:07
4  DRS.THURMAN & ELLIOT/THANK YOU/4-7/GB5.4                4/06/83  4/06/83 16:09  3    5  0:00   0:24
5  THANKS/DR. LARRY TICE/4-7/GB5.5                         4/06/83  4/06/83 16:08  3    3  0:00   0:27
6  MUSEUM:DIANA HUMPHREY,CONTROL DATA/4-7/GB5.6            4/06/83  4/06/83 16:13  4    4  0:00   0:55
7  SIMS SCHOLARSHIP FUND: DEL. STATE/4-7/GB5.7             4/07/83  4/27/83 11:29  1    3  0:00   0:05
8  LISA: COLLOQUIM AT HARVARD/EMS/4/11/83/GB5.8            4/11/83  4/11/83 13:58  7    2  0:01   0:11
9  G.BELL: BIOGRAPHY/4-11/GB5.9                            4/11/83 10/06/83  6:44  6    2  0:00   0:13
10  HISTORY: LARRY PRESS/LETTER/4-11/GB5.10                4/11/83  4/11/83 15:45  3    2  0:18   0:22
11  PRODUCTS: MUST,SQUEEZE,DROP/4-20/GB5.11                4/20/83  4/20/83 12:52  24   5  0:00   0:55
12  BUDGET CRIB SHEET/4-20/GB5.12                          4/19/83  4/20/83 13:32  30   6  0:01  11:54
13  MAP TO GORDON'S HOUSE/GB5.13                           4/21/83  4/22/83  8:17  7    8  0:14   1:13
14  SENATOR KENNEDY/TELEGRAM/FUNDING NSF/4-25/GB5.14       4/25/83  4/25/83 11:29  8    4  0:01   0:02
15  ARPANET MESSAGES                                       4/25/83  6/17/83 12:17  2    13    0:00   0:09
16  INFORMATION FUTURES LTD/BOON/4-27/GB5.16               4/27/83  4/27/83  9:06  1    3  0:00   0:02
17  IEEE SPECTRUM:SORRY BUT WILL REVIEW/TORRERO/4-27/GB5.17 4/27/83  5/20/83 12:05  2    3  0:00   0:04
18  messages                                               4/28/83  5/04/83 14:03  1    2  0:00   0:01
19  PPA:COST,PERFORMANCE/$-EMS-4-27-GB5.19                 4/27/83  5/05/83 15:12  18   9  0:01   0:06
20  PRINT SERVER:REDUNDANT EFFORTS-NOD/EMS 5-5/CUDMORE/GB5  5/04/83  6/06/83 10:31  4    5  0:01   0:12
21  SYSTEMS: PHYSICAL SIZE.21                              4/29/83  4/29/83 10:57  3    4  0:00   0:07
22  OFFICE REVIEW/EMS/DOCKSER,MARCUS/4-29/GB5.22           4/29/83  4/29/83 13:18  15   3  0:00   0:03
23  JUPITER/EMS/ROSEANN,KC,BJ,ULF/4-29/GB5.23              4/29/83  5/02/83 14:27  21   5  0:01   0:09
24  BUS/EMS/BJ,CUDMORE/4-29/GB5.24                         4/29/83  5/05/83 15:07  10   6  0:02   0:03
25  VLSI-Micro Stratton?/EMS/5-3/FULLER,KALB,DEMMER,,BJ/GB  5/03/83  5/03/83 13:51  7    2  0:04   0:04
26  PPA:DISCUSSION WITH RAJ/EMS4-2/FULLER/GB5.26           5/04/83  5/04/83 14:07  6    2  0:00   0:00
27  MICROVAX:PLAN TO TAKE CARE OF/EMS 4-2/OLSEN/GB5.27     5/04/83  5/05/83 15:03  11   4  0:01   0:03
28  MICROVAX:QBUS CONTROLLERS FOR/EMS 4-2/FULLER/GB5.28    5/04/83  5/04/83 14:06  16   2  0:03   0:03
29  HONORARIUM & THANKS/DAVIES/5-5/GB5.29                  5/05/83  5/05/83  9:31  2    1  0:03   0:03
30  REFERENCE:BURKS/PROF.HANDLER/5-5/GB5.30                5/05/83  5/05/83  9:37  4    1  0:05   0:05
31  MUSEUM INVITATION TO JOIN/PROF.DR.HANDLER/5-5/GB5.31   5/05/83  5/05/83  9:40  3    3  0:00   0:02
32  TECHNICAL ABSTRACT/GILLIES LECTURE/5-5-83/GB5.32       5/05/83  5/05/83 10:04  2    1  0:01   0:01
33  POPULAR ABSTRACT/GILLIES LECTURE/5-5-83/GB5.33         5/05/83  5/05/83 10:10  3    2  0:00   0:02
```

34	HARVARD: PLS HANDLE/SPADI/5-5/GB5.34	5/05/83	5/05/83 14:31	3	5	0:02	0:07
35	test	0/00/00	5/18/83 14:58	1	4	0:01	0:03
36	HISTORY: BERNIE GALLER,UNIV.OF MICHIGAN/5-12/GB5.36	5/12/83	5/12/83 2:56	4	2	0:01	0:01
37	USE.IT HOS/M.HAMILTON/5-12/GB5.37	5/12/83	5/12/83 7:28	5	5	0:00	0:17
38	JUPITER:SORRY NO DECUS MESSAGE/EMS/5-8/GB5.38	5/12/83	5/12/83 5:03	5	3	0:01	0:01
39	QUALITY: DICK AS VP OF/EMS/EMC/5-8/GB5.39	5/12/83	5/12/83 5:02	7	2	0:02	0:02
40	HISTORY:DIGITAL ARTIFACTS/EMS/OLSEN/5-9/GB5.40	5/12/83	5/12/83 5:04	10	2	0:01	0:01
41	ITINERARY:STANFORD,COLORADO/EMS/OLSEN/5-9/GB5.41	5/12/83	5/12/83 5:05	12	2	0:01	0:01
42	MANCHESTER U: AGREEMENT WITH/EMS/CESSFORD/5-9/GB5.42	5/12/83	5/16/83 9:30	4	3	0:01	0:02
43	JUPITER	5/17/83	5/17/83 12:22	4	1	1:10	1:10
44	press rel jup	5/17/83	5/17/83 13:23	3	2	0:04	0:31
45	WORKHORSES FOR OFFICE LOGS	5/26/83	5/26/83 13:04	2	1	0:09	0:09
46	REFERENCE:John McCarthy,Marconi Award/6/1-GB5.46	6/01/83	6/01/83 12:39	4	2	0:01	0:14
47	JAPAN: NTT/ECL'S AI PROJECT-EMS-6/1-KOBAYASHI-GB5.47	6/01/83	6/01/83 13:16	3	2	0:06	0:06
48	PPA: 784/PPA AT STANFORD-EMS-FULLER,GANNON ET AL-6/1	6/01/83	6/01/83 13:42	7	4	0:01	0:13
49	APPLE & J9bs: VISIT (WHY THEY'LL BEAT US)/EMS/6-1/GB5	6/01/83	6/06/83 16:00	19	9	0:09	1:19
50	stanford:thanks/feigenbaum/6-2/gb5.50	6/02/83	6/10/83 8:46	5	4	0:01	0:15
51	STANFORD:THANKS/FEIGENBAUM/HENNESSY/ULLMAN/6-2/GB5.51	6/02/83	6/03/83 11:58	3	2	0:02	0:07
52	CLUSTERS, CI, OUR HOTTEST PRODUCT/EMS/6-6/KRAMER,SHIEL	6/06/83	6/06/83 16:23	7	4	0:00	0:03
53	THANKS DELAGI.../EMS/6-2/GB5.53	6/02/83	6/03/83 11:51	4	3	0:00	0:14
54	COLORADO VISIT (COMMENTS)/EMS/6-2/BURNEICE,RIGGLE/GB5.	6/02/83	6/06/83 9:05	8	3	0:10	0:29
55	IBM AT UNIVERSITIES/EMS/6-2/KRAMER/GB5.55	6/02/83	6/06/83 9:40	5	4	0:01	0:14
56	WCRL:THANKS FOR HOSPITALITY/EMS/6-2/BASKETT/GB5.56	6/02/83	6/06/83 9:55	6	3	0:13	0:22
57	DECWEST:IDEAS APPLICABLE HERE?/EMS/6-6/EMC/GB5	6/06/83	6/16/83 8:11	16	5	0:00	0:14
58	AI:ACTIVITY UPDATE NEAR & FAR/EMS/6-6/PATEL/GB5	6/06/83	6/07/83 11:08	30	9	0:01	0:25
59	CLUSTERS:WHERE WE ARE & WHERE ARE WE GOING/EMS/6-6/BJ/	6/06/83	6/06/83 13:46	8	3	0:01	0:04
60	NAMING: LET'S USE SUPERMICRO/EMS/6-6/MOFFA/GB5	6/06/83	6/06/83 16:21	5	3	0:00	0:00
61	PROF. ZYSMAN:BRIE CONFERENCE/6-7/GB5	6/07/83	6/07/83 16:34	7	5	0:02	0:19
62	SI VALLEY:ENGR/MFG.DIV RFP/EMS/PSC/6-7/GB5.62	6/07/83	6/08/83 11:10	22	7	0:00	0:43
63	dd Catalog Letter	6/07/83	6/07/83 12:36	1	1	0:02	0:02
64	KEVIN'S MEMO	6/09/83	6/09/83 13:36	2	1	0:09	0:09
65	PRINT STATION: WE MUST REDIRECT IT/CUDMORE+/GB5	6/13/83	6/13/83 9:38	21	2	0:01	0:02
66	dd wang offered to join mcc/inman/gb5	6/13/83	6/13/83 8:41	1	1	0:02	0:02
67	DD COLUMBIA U RE SPEAKING/TRAUB/GB5	6/13/83	6/13/83 8:50	3	1	0:08	0:08
68	SIGMA XI NATIONAL LECTURER, NOT NOW/MOORE/GB5	6/13/83	6/13/83 9:08	3	2	0:01	0:05
69	dd los alamos conference invitation - no/worlton/gb5	6/13/83	6/13/83 9:14	3	1	0:05	0:05
70	envelopes	6/14/83	6/14/83 0:10	4	1	0:02	0:02
71	INDEX	9/12/83	9/12/83 1:37	26	1	0:00	0:00
72	TALK: ENGR. & EDUCATION/ROCHESTER/GB5	6/21/83	5/07/84 3:27	30	3	0:02	0:03

MCC 3/30/83
Name: MCC&AO, # of Docs: 12, Blocks left: 640 (of 779)

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Number  Name     Created  Modified    Size Version  Last   Total
--------------------------------------------------------------------------------
 1                                                    3/30/83  6/27/83 13:57  1    14    0:01   0:01
 3  SORT SPEC                                         4/21/83  5/24/83  2:27  1    2  0:01   0:02
 4  SORT OUTPUT                                       4/21/83  5/24/83  3:17  33   15    0:05   0:24
 5  FORM DOCUMENT FOR LP                              4/21/83  5/24/83  2:32  1    4  0:02   0:22
 6  SELECTION SPECIFICATION FOR LP                    4/21/83  4/21/83 13:28  1    1  0:01   0:01
 7  MCC-TAB form document                             5/24/83  5/24/83  3:12  1    3  0:02   0:08
 8  SPEC FOR MCC-TAB                                  5/24/83  6/09/83  9:14  2    5  0:00   0:02
 9  mcc-tab output list                               5/24/83  5/26/83  8:23  5    13    0:00   0:08
10  AO - HOW ARE YOU DOING/WHY NOT USING LETTER/MJ5    5/31/83  6/22/83 12:16  2    10    0:00   0:47
11  AO ELECTRONIC MAIL LETTER                         6/09/83  6/09/83 15:55  32   6  0:01   0:10
12  mcc sort (whole list)                             6/22/83  6/22/83 11:22  1    1  0:01   0:01
13  output document (MCC whole list)                  6/22/83  6/27/83 14:00  35   9  0:00   0:43



xxx
Digital 4/28/83  9/12/83
Name: GB4/83, # of Docs: 26, Blocks left: 449 (of 779)
--------------------------------------------------------------------------------
Number  Name     Created  Modified    Size Version  Last   Total
--------------------------------------------------------------------------------
 1                                                    4/28/83  9/12/83  1:48  4    76    0:00   0:26
 2  historical exhibit and paper DONE 5/9/83 Mon 9:10:19     5/08/83  5/09/83  7:10  9    3  0:03   0:53
 3  ci clusters DONE 6/6/83                           5/04/83  6/06/83 11:09  4    3  0:00   0:47
 4  cutler's group  DONE 6/6/83                       5/04/83  6/06/83 10:48  13   5  0:00   1:57
 5  si valley engineering DONE 6/6/83                 5/04/83  6/06/83 11:00  20   5  0:11   1:53
 6  supermicro (see the memo for title) DONE 6/6/83    5/04/83  6/06/83 11:05  4    3  0:01   0:30
 7  AI, LISP, Visit at Stanford, and us. DONE 6/6/83   5/04/83  6/06/83 12:43  27   7  0:00   3:44
 8  A microvax pc clusters group needs to be formed DONE 6/6/83    5/04/83  6/18/83  6:27  7    5  0:00
0:43
 9  Why you'd think twice about working in the low end HOLD 6/13   6/11/83  6/18/83  0:09  3    5  0:08
0:26
10  Why we must enter into arrangement w trilogy HOLD 6/13/83      6/11/83  6/24/83  0:12  8    9  0:11
1:31
11  PAPER: DIGITAL ENVIRONMENT FOR COMPUTING, 6/18 /GB4     10/20/83 10/20/83 13:49  25   1  0:01   0:01
12  PAPER: DIGITAL ENVIRONMENT FOR COMPUTING AS OF 10/17/83 /GB4  10/20/83 10/20/83 13:52  41   2  0:00
0:03
13  NOTE TO SAM WIN, JACK RE DEC PRODUCTS... /GB4      10/20/83 10/20/83 13:54  9    1  0:01   0:01
14  LASL letter DONE 6/14/83                          6/11/83  6/13/83  7:08  3    3  0:00   0:18
15  Wheel of reincarnation paper HOLD 6/13/83         6/11/83  6/13/83  7:11  1    3  0:00   0:09
16  Print Station: We must redirect it DONE 6/13/83 Mon      6/11/83  6/13/83  9:46  20   7  0:00   4:45
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Number	Name	Created	Modified	Size	Version	Last	Total
17	QVSS DONE 6/13/83 Mon	6/11/83	6/13/83 7:06	6	2	0:01	0:40
18	we have to sell pro's and ci clusters DONE 6/13/83 Mon	6/11/83	6/13/83 7:00	6	3	0:01	0:31
19	let's hire david warren DONE 6/13/83 Mon	6/12/83	6/13/83 7:07	3	3	0:01	0:15
20	crisis in engineering training DONE 6/13/83 Mon	6/12/83	6/13/83 6:40	6	3	0:06	0:48
21	why a head count freeze would be good (facilitator/processors versus content folks) HOLD 6/13/83	6/12/83	6/13/83 7:11	3	2	0:01	0:18
22	are we fragmenting ourselves too much HOLD 6/13/83	6/12/83	6/13/83 7:10	1	2	0:00	0:10
23	proposal: I would make BI an industry standard bus	6/18/83	6/18/83 4:04	1	1	0:04	0:04
24	INDEX	9/12/83	9/12/83 1:49	10	1	0:00	0:00
25	the stations DONE	6/19/83	10/20/83 13:43	15	2	0:00	2:10
26	dean's talk DONE 6/21/83	6/20/83	10/20/83 13:43	29	4	0:01	2:41

Encore and TCM 6/20/83 12/14/83

Name: BUDGET, # of Docs: 30, Blocks left: 449 (of 779)

Number	Name	Created	Modified	Size	Version	Last	Total
1		6/20/83	9/12/83 1:34	3	46	0:01	0:03
10	STOCK OPTION EXTENSION TO CURE RULE 16B/SCHWARTZ +	7/18/83	7/18/83 17:38	1	1	0:03	0:03
11	ITINERARY - MCC/AUSTIN - 8/3/83 /GB7	8/01/83	10/03/83 15:12	3	3	0:00	0:13
12	EXPENSE VOUCHER, WE:7/23/83 /GB7	8/01/83	8/03/83 1:00	32	10	0:04	1:13
13	PRODUCT INFO REQUEST LETTER/GROVE,SPORCK ETAL/GB7	9/14/83	11/08/83 9:13	6	15	0:07	0:55
14	ILLINOIS THANK YOU - DR. SNYDER /GB7	9/29/83	10/03/83 14:19	15	15	0:00	1:38
15	EMMERICH, OFFER LETTER/GB7	9/16/83	9/16/83 0:51	2	4	0:01	0:15
16	DENELCOR, DR. BURTON SMITH, PLS SEND INFO/GB7	9/20/83	9/22/83 10:49	2	3	0:01	0:17
17	MUSEUM FORM LETTER - DINNER INVITATION DATES/GB7	10/03/83	10/27/83 11:25	20	8	0:01	1:07
18	PUBLICATION & FILE GUIDE - GB/GB7	10/12/83	10/12/83 13:16	30	1	0:02	0:02
19	SERVICE ORGANIZATION, SOFTWARE ONLY/GB7	10/06/83	10/06/83 2:45	2	2	0:00	0:04
20	MARTIN, NANCY, SOME BACKGROUND INFO FOR HER VISIT/GB7	10/06/83	10/06/83 4:33	2	2	0:03	0:06
21	WHITE BOARD NOTES/ORG COURSE FROM FRAMINGHAM/GB7	10/12/83	10/12/83 14:21	3	1	0:00	0:00
22	WOHL, AMY, THANKS FOR LETTER PLS SEND MORE INFO/GB7	10/17/83	10/18/83 10:29	3	2	0:01	0:08
23	INTEL, THANKS PLUS SEND INFO RE MULTIBUS II /PANDITI /GB7	10/27/83	6/06/84 4:55	3	4	0:33	0:38
24	DAVIES, DONALD, YES TO TALK IN MARCH 84/GB7	11/01/83	11/01/83 0:04	3	3	0:00	0:06
25	MUSEUM, YES TO COHOST/DRANE /GB7	11/03/83	11/03/83 10:47	2	4	0:01	0:19
26	PRODUCT STRATEGY BASED ON STANDARD MICROPROCESSORS /GB7	11/09/83	12/01/83 8:37	47	9	0:00	0:49
27	SILICON GRAPHICS, EMS, KGF & PG/GB7	12/01/83	11/04/83 0:58	3	2	0:01	0:09
28	ENCORE COMPUTING ENVIRONMENT: WE NEED IT!	12/05/83	12/05/83 15:52	5	2	0:01	0:11
29	VLSI DESIGN THANKS FOR INTERVIEW/GB7	12/14/83	12/14/83 1:13	2	2	0:10	0:13
30	INDEX	9/12/83	9/12/83 1:34	11	1	0:00	0:00

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TCM GB Letters asking for money 10/27/83  through 12/84
Name: GB13  , # of Docs: 77, Blocks left: 47 (of 779)
-------------------------------------------------------------------------------
Number  Name        Created  Modified    Size Version  Last   Total
-------------------------------------------------------------------------------
 1                                              10/27/83 12/08/84  0:29  7    115   0:00   0:15
 2  brook byers                                 10/27/83 10/28/83 12:54  6    4     0:01   0:42
 3  andy: why a museum?                         10/30/83  0/00/00  0:20  29   12    0:01   4:25
 4  IEEE/STANFORD, MUSEUM TALK /ALLISON/Nov 22    11/01/83  5/20/84  0:04  4    6     0:00   0:20
 5  arthur collins letter                       10/05/83 12/17/83  0:07  3     2     0:01   0:09
 6  HOLLander letter--- urgent to get this out!   3/08/84  4/23/84  1:49  6    7     0:00   0:44
 7  tx-0 reunion notes                          11/13/83 11/14/83 10:05  10   3     0:01   0:37
 8  Andy Knowles                                11/14/83  6/12/84  0:03  5    7     0:00   0:31
 9  why support the museum letter,5/17/84 final   11/27/83  5/17/84  6:06  22   17    0:06   2:51
10  letter of why support the museum, Boston ver  12/13/83 12/13/83  0:10  21   1     0:01   0:01
11  NOYCE, THANKS FOR HOSPITALITY /GB13 12/14/83   12/14/83  3:27  5    4     0:01   0:14
12  Olsen letter about DEC Museum SENT   4/11/84   3/16/84  1:44  13   3     0:05   1:44
13  Cohen letter re Moroe book SENT    4/07/84    4/23/84  1:50  24   9     0:01   0:48
14  dear john (opel) ...catharsis to hold forever 4/22/84  4/23/84  6:01  24   12    0:05   6:14
15  pc exhibit thoughts                         5/13/84  6/17/84  5:55  11   6     0:00   1:56
16  dan Gregory, Greylock DONE 6/18/84    6/17/84 6/24/84  2:53  5    6     0:01   0:52
17  ben rosen letter hold TRANSFERRED TO VAX, SENT  5/14/84  6/13/84  1:29  6    7     0:00   4:17
18  B Gordon letter, please send with 9 SENT      5/17/84  5/18/84  1:14  9    6     0:02   1:03
19  bob metcalfe ethenet letter DONE            5/18/84  5/18/84  1:07  6    3     0:02   1:08
20  bob Metcalfe Museum sollicitation DONE      5/18/84  5/18/84  1:05  9    5     0:01   0:27
21  anals review on moreau                      5/19/84  6/17/84  9:01  41   15    0:00   6:52
22  TROPP, MOREAU REVIEW TRANSMIT LTR    6/07/84  6/07/84  6:42  2    2     0:00   0:06
23  l j sevin letter TRANSFERRED TO VAX - SENT    6/12/84  6/13/84  1:06  6    6     0:02   1:04
24  Allan Wallach DONE 6/18/84                  6/16/84  6/18/84  6:52  4    3     0:06   0:31
25  Tom Perkins DONE 6/18/84                    6/16/84     6/18/84  6:46  3    2     0:01   0:06
26  habrecht DONE 6/18/84                       6/16/84  6/18/84  6:45  3    2     0:01   0:07
27  Bill Perry DONE 6/18/84                     6/16/84  6/18/84  6:42  3    4     0:02   0:18
28  Gil Decker, TRW DONE 6/18/84                6/16/84  6/18/84  6:31  3    3     0:08   0:20
29  gomory DONE 6/18/84                         6/16/84  6/18/84  6:22  4    4     0:03   0:11
30  fred brooks DONE 6/18/84                    6/16/84  6/18/84  6:18  3    2     0:02   0:03
31  branscomb DONE 6/18/84                      6/16/84  6/18/84  6:15  5    5     0:00   0:23
32  B. O Evans DONE 6/18/84                     6/16/84  6/18/84  6:10  3    3     0:01   0:31
33  sperry DONE 6/18/84                         6/16/84  6/22/84  3:08  7    9     0:01   3:30
34  symbolics DONE 6/18/84                      6/16/84  6/18/84  6:06  3    5     0:01   1:07
35  Steve Swerling DONE 6/18/84                 6/17/84  6/18/84  5:53  4    5     0:09   0:23
36  paul Severino DONE 6/18/84                  6/17/84  6/18/84  4:20  4    6     0:05   0:51
37  alan shughart DONE 6/18/84                  6/17/84  6/19/84  0:58  6    6     0:02   0:55
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38	Steve Yau DONE 6/18/84	6/17/84	6/18/84	1:54	2	2	0:07	0:19
39	bill gates DONE	6/24/84	7/02/84	0:09	5	5	0:02	0:31
40	charlie sporck DONE	6/24/84	7/02/84	11:18	5	9	0:00	0:36
41	gordon moore DONE	6/24/84	7/02/84	11:18	5	4	0:00	0:16
42	Max Palevsky DONE	7/02/84	7/02/84	9:43	5	3	0:02	0:23
43	ken thompson DONE 7/10/84	7/02/84	7/10/84	11:08	9	11	0:01	1:48
44	Dr. Irwin Dorros DONE 7/10/84	7/02/84	7/10/84	11:05	9	9	0:00	0:12
45	Vyssotsky DONE 7/10/84	7/02/84	7/10/84	11:03	9	6	0:00	0:10
46	Max Matthews DONE 7/10/84	7/04/84	7/10/84	11:02	10	3	0:00	0:08
47	Hank MacDonald DONE 7/10/84	7/04/84	7/10/84	10:58	10	4	0:00	0:15
48	Robert W lucky DONE 7/10/84	7/04/84	7/10/84	10:56	7	3	0:00	0:16
49	W O Baker DONE 7/10/84 ```	7/04/84	7/10/84	10:54	10	3	0:00	0:07
50	Dr. R. W. Hamming DONE 7/10/84	7/04/84	7/10/84	10:52	9	3	0:01	0:09
51	felker DONE 7/10/84	7/09/84	7/10/84	10:48	10	5	0:00	0:07
52	Dr. John Pierce DONE 7/10/84	7/09/84	10/22/84	0:01	9	6	0:00	0:15
53	paul spillane, sperry	10/04/84	10/04/84	7:12	7	2	0:19	0:57
54	norm winningstaad, chairman fps	10/22/84	11/24/84	0:24	4	3	0:01	1:01
55	Gerry Probst CORRECTED/SENT VAX	10/28/84	10/29/84	2:05	6	5	0:01	0:46
56	text for simulated computer	11/11/84	11/11/84	1:00	7	1	0:60	0:60
57	Names for Museum Lectures	11/18/84	11/24/84	4:00	12	4	0:26	4:58
58	Norris thank you letter	11/24/84	11/26/84	3:38	5	6	0:04	1:56
59	Stan Olsen 11/25/84	11/26/84	3:34	5	3	0:00	0:37	
60	Doug and Sandra Drane	11/25/84	11/26/84	3:43	5	3	0:01	0:04
61	Steve Jobs thank you	11/25/84	11/26/84	3:33	5	5	0:02	0:13
62	metcalfe	11/25/84	11/26/84	3:31	5	3	0:01	0:07
63	Noyce thanks	11/25/84	11/26/84	3:29	5	4	0:01	0:08
64	Sporck thank you	11/25/84	11/26/84	3:28	5	3	0:01	0:05
65	regis Mckenna	11/25/84	11/26/84	3:27	5	2	0:01	0:03
66	devitry thanx	11/25/84	11/26/84	3:25	5	2	0:02	0:06
67	forrester	11/25/84	11/26/84	3:21	5	2	0:01	0:05
68	lewis branscomb	11/25/84	11/26/84	3:19	5	2	0:01	0:12
69	erich bloch	11/25/84	11/26/84	3:18	5	2	0:01	0:11
70	alexander shure	11/25/84	11/26/84	4:53	5	3	0:00	0:08
71	michael schuloff sony	11/25/84	11/26/84	2:53	5	2	0:02	0:05
72	ken olsen thanks	11/28/84	11/28/84	9:49	6	3	0:19	0:36
73	knowles thank you	11/28/84	11/28/84	9:29	5	2	0:01	0:05
74	dan bricklin	11/30/84	0/00/00	0:01	6	2	0:01	0:22
75	decasto letter	12/08/84	12/10/84	0:13	5	2	0:03	0:17
76	interlan severino	12/08/84	12/10/84	4:37	5	4	0:01	0:13
77	afips request campaign	12/08/84	12/10/84	0:08	2	2	0:01	0:05

```
GBell personal 11/14/83
Name: TEMP  , # of Docs: 20, Blocks left: 394 (of 779)
-------------------------------------------------------------------------------
Number  Name     Created  Modified    Size Version  Last   Total
-------------------------------------------------------------------------------
 1                                                       9/14/83  1/06/85  0:00  2    39    0:00   0:04
 2  parallelism MASTER TRANSFERRED TO GB7 11/9/83      11/08/83 11/09/83  8:31  46   9  0:01  12:54
 3  bob rau startup DONE 11/14/83 Mon                  11/13/83 11/14/83 10:19  4    4  0:00   0:15
 4  ARPA MESSAGES AS OF 10/25/83                       10/25/83 11/07/83  0:37  164  4  0:32   0:35
 5  to do 14 nov                                       11/14/83  4/01/84  0:49  4    10    0:01   1:41
 6  Bill Grinker letter--DONE SENT FROM VAX             1/05/84  1/06/83  2:21  5    2  0:00   0:27
 7  C/P taxonomy--FOR SLIDES-DONE                       1/07/84  9/09/84  0:02  13   12    0:01   4:37
 8  levels of parallel computing--SLIDES-DONE           1/07/84  1/09/83  2:41  7    11    0:01   2:40
 9  arvind letter of recommendation EDITED/SENT FROM VAX 2/15/84   2/14/84  2/15/84  2:28  5    4  0:07
3:19
10  Thoughts on why Slumberger should buy ecc           2/25/84  5/14/84  1:51  10   4  0:01   1:46
11  strecker ieee recommendation DONE                   3/15/84  3/21/84  1:03  18   10    0:02   4:24
12  Poduska IEEE Fellow recomendation DONE              4/08/84  0/00/00  6:10  14   7  0:02   3:03
13  cragon letter of rec SENT 5/14/84                   5/13/84  5/14/84  1:49  4    4  0:00   1:37
14  taxonomy figure for micros paper                    6/02/84  6/03/84  8:38  11   6  0:01   3:19
15  ralston recomendation letter for nae DONE 6/13/84   6/12/84  6/13/84  1:20  2    2  0:00   0:17
16  wulf nae recommendation DONE                        6/28/84  0/00/00  4:32  5    3  0:01   0:34
17  darpa people proposal                              10/16/84  0/00/00  0:16  16   4  0:11   3:08
18  Museum walkabout                                   11/27/84 11/27/84  1:14  4    2  0:13   0:13
19  letter to Fortune editor re Multi picture/article  11/27/84 12/18/84  0:58  3    2  0:01   0:19
20  comments on CM* book                                1/06/85  1/07/85  0:21  5    4  0:01   0:27
```

```
GBell Encore, DARPA 12/19/83
Name: TRANSP, # of Docs: 12, Blocks left: 480 (of 779)
-------------------------------------------------------------------------------
Number  Name     Created  Modified    Size Version  Last   Total
-------------------------------------------------------------------------------
 1                                                     11/30/83 10/04/84  7:29  2    26    0:01   0:04
 2  schanin memo/ DONE Mon                             12/18/83 12/19/83  0:42  7    3  0:00   0:29
 3  DARPA/SIEWIOREK/bell proposal SENT 3/10/84 (+ON VAX)     3/07/84  3/24/84  0:25  55   14    0:08  11:20
 4                                                      6/30/84  6/30/84  0:14  2    1  0:07   0:07
 5  MORBY, TA ASSOCIATES letter to Ms. VC SENT FROM VAX      6/09/84  6/11/84  2:51  12   13    0:10   3:43
 6  critique of NRC Supercomputer Report                8/18/84  9/22/84  3:16  62   16    0:02  12:09
 7  PFIAD recommendations on vlsi, effective sc use, vhsic, poor efforts       9/22/84  9/28/84  7:33  30
11    0:01   9:10
 8  DARPA proposal claims (has to be 1 page)            9/27/84  9/30/84  0:35  7    15    0:02   3:20
 9  Technical Volume                                    9/27/84 10/05/84  0:54  85   29    0:00  34:52
```

10	Taxonomy section of the technical volume	9/27/84	9/27/84	18:26	2	2	0:01	0:36
11	Outine for Executive Summary and Technical Volumes	9/30/84	10/01/84	0:43	6	5	0:01	1:09
12	index	10/04/84	10/04/84	7:29	5	1	0:00	0:00

Encore 9/09/84
Name: GB18 , # of Docs: 9, Blocks left: 702 (of 779)

Number Name Created Modified Size Version Last Total

1		9/09/84	11/30/84	2:06	2	10	0:00	0:00
2	GB18 GB Consulting	9/09/84	0/00/00	2:06	1	2	0:00	0:03
3	gsg letter and bill	9/09/84	9/12/83	7:27	5	4	0:01	1:63
4	Mrs. Bellisario	9/09/84	9/12/83	7:25	5	4	0:02	0:30
5	INDEX	9/12/83	9/12/83	1:08	3	1	0:00	0:00
6	MUDGE CONSULTATION LETTER	10/12/84	0/00/00	1:34	24	8	0:09	3:51
7	Admiral Inman	10/13/84	0/00/00	2:20	6	5	0:15	1:61
8	swern expenses letter CORRECTED/SENT VAX	10/28/84	0/00/00	1:26	4	2	0:03	0:33
9	on embargoing ibm pc's &use micros for super computers SENT VAX	11/29/84	1/25/85	7:33	9	5	0:00	0:51

Encore paper slides 12/04/84
Name: GB9A , # of Docs: 4, Blocks left: 687 (of 779)

Number Name Created Modified Size Version Last Total

1		12/04/84	1/25/85	0:57	1	7	0:00	0:00
2	NCC STEVE'S VERSION 12/4, GB REWRITE	12/04/84	1/25/85	1:12	73	3	0:00	0:01
3	slides--ECC DUE DILIGENCE MEETING	1/25/85	1/25/85	1:32	4	3	0:01	0:45
4	SLIDE - DUE DILIGENCE MEETING 1/26/85	1/25/85	1/25/85	1:31	6	2	0:00	0:13

Table of contents II

Name: BLIST1, # of Docs: 13, Blocks left: 189 (of 627)

Number	Name	Created	Modified		Size	Version	Last	Total
1		0/00/00	3/07/87	9:18	1	67	0:01	0:20
2	$ FORM/BLIST	0/00/00	3/07/87	8:46	2	15	0:00	0:12
3	Bell collection 200-249	3/08/82	3/07/87	3:03	54	20	0:07	9:15
5	B List 300-350	8/19/84	3/07/87	3:20	46	23	0:07	4:53
8	FORM/BLIST	7/27/81	3/08/86	3:00	1	14	0:03	0:17
9	SPEC/BLIST	0/00/00	3/07/87	8:25	1	20	0:00	0:02
11	OUTLINE GENEALOGY/BLIST	0/00/00	3/07/87	0:12	10	19	0:01	2:43
13	BELL COLLECTION LIST - #1 THRU #49 (COMPLETE LIST)/BLIST	2/13/81	0/00/00	0:21	72	53	0:00	8:29
15	BELL COLLECTION LIST - #51 THRU #99 (COMPLETE LIST)/BLIST	2/13/81	3/07/87	2:29	44	34	0:29	4:38
17	BELL COLLECTION LIST - #101 THRU #149 (COMPLETE LIST)/BLIST	2/13/81	3/07/87	3:08	48	38	0:04	4:32
18	BELL COLLECTION LIST - #150-199	0/00/00	3/07/87	3:13	51	38	0:04	11:16
25		3/07/87	3/07/87	9:17	46	4	0:01	0:05
35	B list 350-99	3/02/86	3/07/87	8:08	37	8	0:45	4:43

Name: BLISTR, # of Docs: 6, Blocks left: 251 (of 627)

Number	Name	Created	Modified		Size	Version	Last	Total
1		7/28/81	3/02/86	0:02	1	25	0:01	0:01

2	BELL LIST 100-199	7/28/81	0/00/00	1:36	187	19	0:03	1:30
3	unrefined donors list	0/00/00	0/00/00	0:02	65	30	0:00	9:46
4	Shopping list	1/24/83	0/00/00	0:02	7	4	0:01	1:02
5	Bell Catalog 200-399	0/00/00	0/00/00	3:28	90	12	0:01	0:62
9	GALLER	0/00/00	0/00/00	0:38	9	1	0:38	0:38

Name: BLISTR, # of Docs: 6, Blocks left: 164 (of 627)

Number	Name	Created	Modified		Size	Version	Last	Total
1		7/28/81	3/07/87	8:22	1	40	0:01	0:05
2	BELL LIST 100-199	7/28/81	0/00/00	0:12	184	22	0:11	1:42
4	Shopping list	1/24/83	0/00/00	3:57	48	36	1:43	9:40
5	Bell Catalog 200-399	0/00/00	3/07/87	8:23	146	30	0:01	2:22
6	Value Listing	4/07/84	0/00/00	1:49	72	31	1:45	2:38
82	Museum gifts	3/07/87	3/07/87	8:20	5	1	0:05	0:05

Name: BUDGET, # of Docs: 30, Blocks left: 449 (of 779)

Number	Name	Created	Modified		Size	Version	Last	Total

1		6/20/83	9/12/83	1:34	3	46	0:01	0:03
10	STOCK OPTION EXTENSION TO CURE RULE 16B/SCHWARTZ +	7/18/83	7/18/83	17:38	1	1	0:03	0:03
11	ITINERARY - MCC/AUSTIN - 8/3/83 /GB7	8/01/83	10/03/83	15:12	3	3	0:00	0:13
12	EXPENSE VOUCHER, WE:7/23/83 /GB7	8/01/83	8/03/83	1:00	32	10	0:04	1:13
13	PRODUCT INFO REQUEST LETTER/GROVE,SPORCK ETAL/GB7	9/14/83	11/08/83	9:13	6	15	0:07	0:55
14	ILLINOIS THANK YOU - DR. SNYDER /GB7	9/29/83	10/03/83	14:19	15	15	0:00	1:38
15	EMMERICH, OFFER LETTER/GB7	9/16/83	9/16/83	0:51	2	4	0:01	0:15
16	DENELCOR, DR. BURTON SMITH, PLS SEND INFO/GB7	9/20/83	9/22/83	10:49	2	3	0:01	0:17
17	MUSEUM FORM LETTER - DINNER INVITATION DATES/GB7	10/03/83	10/27/83	11:25	20	8	0:01	1:07
18	PUBLICATION & FILE GUIDE - GB/GB7	10/12/83	10/12/83	13:16	30	1	0:02	0:02
19	SERVICE ORGANIZATION, SOFTWARE ONLY/GB7	10/06/83	10/06/83	2:45	2	2	0:00	0:04
20	MARTIN, NANCY, SOME BACKGROUND INFO FOR HER VISIT/GB7	10/06/83	10/06/83	4:33	2	2	0:03	0:06
21	WHITE BOARD NOTES/ORG COURSE FROM FRAMINGHAM/GB7	10/12/83	10/12/83	14:21	3	1	0:00	0:00
22	WOHL, AMY, THANKS FOR LETTER PLS SEND MORE INFO/GB7	10/17/83	10/18/83	10:29	3	2	0:01	0:08
23	INTEL, THANKS PLUS SEND INFO RE MULTIBUS II /PANDITI /GB7	10/27/83	6/06/84	4:55	3	4	0:33	0:38
24	DAVIES, DONALD, YES TO TALK IN MARCH 84/GB7	11/01/83	11/01/83	0:04	3	3	0:00	0:06
25	MUSEUM, YES TO COHOST/DRANE /GB7	11/03/83	11/03/83	10:47	2	4	0:01	0:19
26	PRODUCT STRATEGY BASED ON STANDARD MICROPROCESSORS /GB7	11/09/83	12/01/83	8:37	47	9	0:00	0:49
27	SILICON GRAPHICS, EMS, KGF & PG/GB7	12/01/83	11/04/83	0:58	3	2	0:01	0:09
28	ENCORE COMPUTING ENVIRONMENT: WE NEED IT!	12/05/83	12/05/83	15:52	5	2	0:01	0:11
29	VLSI DESIGN THANKS FOR INTERVIEW/GB7	12/14/83	12/14/83	1:13	2	2	0:10	0:13

Number	Name	Created	Modified	Size	Version	Last	Total
30	INDEX	9/12/83	9/12/83 1:34	11	1	0:00	0:00

Document 12 comment:
WPSMATH
END

Name: CGEN.., # of Docs: 5, Blocks left: 453 (of 627)

Number	Name	Created	Modified	Size	Version	Last	Total
1		12/15/81	1/30/86 0:02	1	6	0:00	0:00
2	PAPER-GENERATING COMPUTER GENERATIONS AS OF 3/9/81/CGEN..	12/15/81	1/30/86 0:23	148	3	0:01	0:16
3	letter	1/29/86	1/30/86 0:23	8	4	0:00	0:51
4	Culler	1/29/86	1/30/86 0:27	3	2	0:04	0:05
5	Solomonson	1/30/86	1/30/86 0:21	4	2	0:01	0:12

Name: DMCAT1, # of Docs: 12, Blocks left: 283 (of 627)

Number	Name	Created	Modified	Size	Version	Last	Total
1		5/18/81	6/06/83 8:52	1	29	0:01	0:03
2	MANUAL AGE/DMCAT1	5/18/81	9/05/81 0:08	8	17	0:08	1:01
3	LETTER/PERRY/GB	6/05/83	6/06/83 8:57	4	6	0:00	0:54
4	MECHANICAL GENERATION/DMCAT1	8/12/81	9/07/81 11:19	109	13	1:12	3:37
5	ELECTRO-MECHANICAL GENERATION/DMCAT1						

Number	Name	Created	Modified	Size	Version	Last	Total
		9/08/81	9/23/81 18:28	29	5	0:02	1:26
6	INTRODUCTION TO DIGITAL COMPUTER MUSEUM CATALOG/DMCAT1	0/00/00	6/23/82 11:31	47	28	0:01	4:50
7	taxonomy tables	8/28/81	6/23/82 9:58	13	6	0:01	0:50
8	CRAFT GENERATION--FROM BACKUP FLOPPY (7/30/80/DMCAT1	8/10/81	11/11/81 13:22	91	20	0:07	4:22
9	LETTER/SAFFORD/GB	6/06/83	6/06/83 8:50	4	1	0:01	0:01
10	contents & foreword	9/06/81	6/23/82 9:42	9	5	0:01	1:00
11	prospectus	9/06/81	9/07/81 0:03	3	3	0:03	0:33
12	LETTER/RANDELL/GB	6/06/83	6/06/83 8:52	7	1	0:00	0:00

<n>CDC <#>7<>
<n>NEW PIONEER/DMCAT2 <#>6<>
<n>LSI GENERATION/DMCAT2 <#>5<>
<n>IC GENERATION/DMCAT2 <#>4<>
<n>TRANSISTOR GENERATION/DMCAT2 <#>3<>
<n>ELECTRONIC GENERATION/DMCAT2 <#>2<>

Name: DMCAT2, # of Docs: 7, Blocks left: 408 (of 627)

Number	Name	Created	Modified	Size	Version	Last	Total
1		9/24/81	3/02/86 0:03	1	7	0:00	0:00
2	ELECTRONIC GENERATION/DMCAT2	9/24/81	9/24/81 8:27	14	1	0:01	0:01
3	TRANSISTOR GENERATION/DMCAT2	9/24/81	9/28/81 15:13	80	5	0:01	0:36
4	IC GENERATION/DMCAT2	9/24/81	9/24/81 8:31	23	1	0:01	0:01
5	LSI GENERATION/DMCAT2	9/24/81	9/24/81 8:31	15	1	0:00	0:00
6	NEW PIONEER/DMCAT2	9/24/81	9/24/81 8:34	74	1	0:02	0:02

7	CDC	9/25/81	9/27/81 0:11	4	3	0:11	0:43

Name: DOCNO7, # of Docs: 81, Blocks left: 59 (of 627)

Number	Name	Created	Modified	Size	Version	Last	Total
1		11/27/78	3/28/79 2:11	5	101	0:01	0:03
2	nsf microstructures conference	11/27/78	11/27/78 14:07	25	6	0:01	1:00
3	TEX	11/27/78	1/30/79 12:35	10	7	0:00	0:28
4	ARPA/interconnect	11/27/78	11/28/78 11:52	9	2	0:05	0:32
5	Tops 20,30-bit address	11/27/78	11/28/78 11:53	5	2	0:01	0:08
6	VAX and Fortran	11/27/78	1/25/79 12:36	8	3	0:00	0:17
7	ECL power supply	11/27/78	11/27/78 13:45	4	2	0:01	0:05
8	tom mcwilliams/vax-on-a-chip	11/27/78	1/30/79 12:34	5	3	0:01	0:07
9	nelson	11/27/78	11/28/78 12:46	2	2	0:00	0:03
10	nsf evaluation	11/29/78	11/29/78 14:07	2	1	0:18	0:18
11	tapes/6250 (via TU78)	12/04/78	12/05/78 1:35	3	3	0:02	0:13
12	dbms-11 user	12/04/78	1/11/79 11:37	3	4	0:00	0:06
13	review of all future terminals	12/04/78	12/05/78 1:32	3	2	0:05	0:08
14	Stanford 2060 grant	12/04/78	12/05/78 1:44	5	2	0:09	0:18
15	knuth	12/04/78	1/30/79 12:32	6	10	0:00	0:56
16	craig						

12/05/78 12/29/78 1:53 5 7 0:00 0:34
17 temp
12/06/78 1/18/78 0:33 3 21 0:01 0:14
18 plm
12/06/78 12/06/78 9:03 2 2 0:00 0:00
19 extended pdp-11 instructions
12/06/78 12/08/78 1:42 6 4 0:03 0:18
20 PMS Architecture of VAX
12/06/78 1/25/79 12:36 5 5 0:00 0:19
21 recession
12/07/78 12/08/78 2:57 6 6 0:03 0:15
22 alden/doriot/janzen--essay
12/07/78 12/08/78 2:16 5 3 0:00 0:29
23 noyce
12/07/78 1/30/79 12:31 2 4 0:00 0:05
24 comet review
12/08/78 12/11/78 12:03 5 4 0:03 0:08
25 workbench on VAX
12/08/78 1/25/79 12:34 3 5 0:00 0:04
26 forms languages
12/08/78 12/11/78 12:17 4 3 0:00 0:11
27 computer business news
12/08/78 12/08/78 2:42 2 3 0:03 0:03
28 mccormick
12/11/78 1/11/79 10:22 4 4 0:00 0:07
29 toby
12/11/78 12/12/78 9:43 19 7 0:12 0:43
30 fall decus
12/11/78 12/21/78 0:58 9 7 0:00 0:28
31 decus attendance quotas & control
12/11/78 12/12/78 10:00 7 5 0:00 0:14
32 lassiter
12/11/78 1/10/79 11:34 2 4 0:00 0:05
33 goldenbee
12/11/78 12/12/78 10:25 2 2 0:00 0:03
34 eliminating fa&t
12/12/78 12/14/78 9:07 5 5 0:13 0:36
35 f/u notice
12/13/78 12/13/78 8:44 2 1 0:03 0:03
36 hydra
12/14/78 12/15/78 8:47 4 3 0:09 0:13
37 lsi

		12/15/78	12/19/78	2:38	6	4	0:06	0:14
38	strategy & EDP & Mfg/breadboard							
		12/15/78	12/19/78	2:29	6	3	0:11	0:21
39	learning/acquiring TEX							
		12/15/78	12/19/78	2:31	6	5	0:00	0:28
40	dibol8-11							
		12/15/78	12/19/78	2:41	4	2	0:02	0:06
41	rx02 on pdt							
		12/19/78	12/19/78	2:46	3	2	0:00	0:03
42	DEcd standard busses							
		12/19/78	12/20/78	1:22	10	10	0:01	0:27
43	KL10's							
		12/19/78	12/19/78	2:51	7	4	0:01	0:22
44	zaks							
		12/19/78	12/19/78	2:52	2	2	0:00	0:07
45	rodgers							
		12/19/78	12/19/78	2:59	3	3	0:01	0:09
46	second memo fall DECUS							
		12/21/78	12/21/78	5:41	9	6	0:00	0:06
47	bit map terminal							
		12/28/78	12/29/78	1:58	2	2	0:00	0:02
48	problem list							
		12/28/78	12/29/78	1:05	10	5	0:02	0:24
49	couplers/modems/terminals							
		1/03/79	1/08/79	13:31	11	3	0:09	0:35
50	our OS:tree?							
		1/03/79	1/03/79	10:22	14	2	0:55	0:55
51	comments/att acs and us							
		1/03/79	1/08/79	13:44	10	5	0:02	0:26
52	vanroekens							
		1/03/79	1/03/79	11:36	2	1	0:01	0:01
53	horowitz							
		1/04/79	1/05/79	9:13	5	2	0:02	0:26
54	ortegren							
		1/04/79	3/20/79	9:34	2	4	0:01	1:03
55	low end comments							
		1/04/79	1/08/79	14:13	6	2	0:29	0:35
56	pusart--status?							
		1/04/79	1/05/79	8:52	4	3	0:05	0:11
57	museum update/fujitsu							
		1/08/79	1/15/79	8:55	8	2	0:00	0:13
58	kapoor							

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                        1/08/79  1/09/79  6:00  2    2         0:01   0:10
59      hp
                        1/08/79  1/09/79  0:57  5    5         0:09   0:22
60      palais
                        1/08/79  1/09/79  5:59  4    2         0:01   0:13
61      fonz
                        1/08/79  1/08/79 11:41  8    5         0:01   0:20
62      vms
                        1/08/79  1/08/79 11:12  9    6         0:02   0:23
63      gb
                        1/08/79  1/09/79  5:57  8    4         0:04   0:05
64      comments on cornell contribution
                        1/08/79  1/11/79 10:15  6    3         0:01   0:17
65      datamation software survey 1978
                        1/09/79  1/10/79 14:30  5    2         0:04   0:10
66      bill hogan
                        1/09/79  1/09/79  5:44  4    4         0:01   0:03
67      dolphin and venus
                        1/09/79  1/10/79 14:25  6    4         0:14   0:21
68      req. for data
                        1/09/79  1/31/79 11:21  13   6         0:01   0:24
69      follow up notice
                        1/11/79  1/25/79 12:44  5    3         0:01   0:06
70      Index from CI/DOCNO7
                        3/28/79  3/28/79  2:12  24   1         0:00   0:00
71      gb memo-graphics
                        1/15/79  1/25/79 11:11  9    7         0:01   0:30
72      engterm
                        1/15/79  1/25/79 12:35  5    6         0:01   0:10
73      harvard
                        1/15/79  1/17/79 12:28  7    3         0:06   0:14
74      lllbasic
                        1/15/79  1/17/79 12:03  5    4         0:02   0:08
75      royalty
                        1/15/79  1/16/79  9:18  5    3         0:06   0:14
76      brochure
                        1/15/79  1/16/79  9:37  6    3         0:12   0:16
77      monthly
                        1/15/79  1/16/79  9:44  5    5         0:01   0:06
78      max
                        1/15/79  1/16/79  9:12  3    3         0:00   0:02
79      gb memo-museum
```

```
                              1/15/79  1/15/79 10:21  7    2        0:07   0:07
 80     nsf comments
                              1/15/79  1/19/79  0:30  8    7        0:01   1:01
 81     christiansen
                              1/15/79  1/15/79 13:48  1    1        0:01   0:01

Document 35 comment:
   cx send eol cr wait lf


Name: DOCNO8, # of Docs: 27, Blocks left: 487 (of 627)
-------------------------------------------------------------------------------
Number  Name                    Created  Modified       Size Version  Last   Total
-------------------------------------------------------------------------------
  1
                              1/16/79  3/28/79  2:05  3    43       0:00   0:03
  2     blake
                              1/16/79  1/17/79 12:39  2    5        0:00   0:06
  3     gus ashton--ad
                              1/16/79  1/17/79 11:45  2    2        0:00   0:01
  4     oc salary review
                              1/16/79  1/17/79 11:55  5    5        0:01   0:26
  5     christiansen
                              1/16/79  1/16/79 11:47  2    2        0:01   0:02
  6     editors
                              1/16/79  1/16/79 11:52  5    1        0:05   0:05
  7     temp
                              1/16/79  2/16/79 12:38  4    20       0:01   0:20
  8     follow up notice
                              1/17/79  2/02/79 10:03  6    3        0:02   0:07
  9     arpa/halio/rupp
                              1/17/79  1/17/79 12:44  2    1        0:03   0:03
 10     comm line/option handler problem
                              1/17/79  1/19/79  2:41  8    8        0:02   0:21
 11     Professor Lee and China /Janzen, Carl/Johnson, Ted
                              1/19/79  1/24/79  1:11  4    2        0:03   0:10
 12     Professor Lee's MIT LSI-11 Microcomputer Lab/China/Dist.
                              1/19/79  1/24/79  1:07  8    3        0:02   0:24
 13     Consultant (no)/Hermann, T.S.
                              1/19/79  1/25/79 13:13  2    3        0:01   0:18
 14     China Junket Opportunity -- To: OOD
                              1/19/79  1/22/79  9:20  4    7        0:00   0:03
```

15	TU59 Spec./Kevill, John	1/22/79	1/24/79	1:33	3	5	0:03	0:11
16	WS102 20	1/22/79	1/22/79	12:33	6	1	0:00	0:00
17	Aggressive 11/74mP PM and Support/Demmer, Bill/Lacroute, Bernie	1/24/79	1/26/79	10:07	3	3	0:09	0:15
18	Jean Bow's Support/Johnson, Ted/Janzen, Carl	1/24/79	1/29/79	10:04	2	3	0:01	0:08
19	mj	1/24/79	1/24/79	2:21	5	1	0:20	0:20
20	Old Mill Restaurant	1/24/79	2/02/79	8:39	3	2	0:04	0:09
21	People's Republic of China/Johnson,T./Janzen,C.	1/25/79	1/26/79	12:39	6	5	0:00	0:19
22	Pre-Computer Exhibit/Analog,Digital,Tabular Arith.Units	1/26/79	1/26/79	10:14	2	1	0:05	0:05
23	Technion Meeting/Shapiro	1/26/79	1/30/79	14:44	2	7	0:01	0:06
24	ENGINEERING STRATEGY PRESENTATION/COVER SHEET/DOCNO8	2/05/79	2/06/79	0:20	3	4	0:02	0:19
25	Manufacturing-Engineering Interface/OOD/Hindle/J.Smith	1/29/79	1/29/79	13:24	4	5	0:01	0:04
26	DCG & T/SS Eng. Conflict--We Want To Help Now/Clayton/Delagi	1/29/79	1/29/79	13:34	7	4	0:02	0:18
27	Index from CI/DOCNO8	3/28/79	3/28/79	2:05	10	1	0:00	0:00

Name: FILE I, # of Docs: 5, Blocks left: 273 (of 627)

Number	Name	Created	Modified		Size	Version	Last	Total
1		3/30/82	4/29/83	2:09	1	25	0:00	0:01
2	SORTED INDICES FOR GB3.S1 THRU S10	1/06/83	1/06/83	11:40	155	6	0:03	0:03
3	SORT SPEC	4/02/82	1/06/83	0:20	1	5	0:00	0:02
4	BELL MASTER INDEX - JAN THRU MARCH 83, GB4S1 THRU GB4.S3/FILE 1	4/29/83	4/29/83	2:12	29	2	0:00	0:02
5	INPUT DOCUMENT TO BE SORTED FOR GB3.S1-S10 FOR FILE INDICES							

```
                         6/07/82  1/06/83  0:37  154  11       0:03   0:21


Name: GB    , # of Docs: 12, Blocks left: 489 (of 627)
-------------------------------------------------------------------------------
Number  Name                     Created  Modified       Size Version  Last   Total
-------------------------------------------------------------------------------
  1
                         0/00/00  2/18/86  5:58  2    106      0:01   0:35
  2
                         6/28/78  0/00/00  1:12  2    15       0:00   0:11
  3     terminal and terminal based sys alternatives (GB2.S7.11)
                         7/04/81  0/00/00  2:35  34   31       0:01   7:04
  4     COMPARATIVE MUSEUM STATISTICS--Gwen Museum
                         0/00/00  2/16/86  0:07  6    10       0:02   1:24
  5     PROCESS AND STRUCTURE OF M/E INTERFACE (GB2.S7.37
                         7/22/81  8/04/81 13:03  19   14       0:00   3:17
  6     venus DONE 11/81
                         0/00/00 10/18/82 10:15  12   15       0:01   2:07
  7     BELL-PORTNER CONTRACT (GB2.S7.12)
                         0/00/00  0/00/00  0:08  7    23       0:04   1:51
  8     ENG FACTORY-SFT.ENG & PROD TECHNIQUES ON HRD ENG.(GB2.S7.36
                         7/22/81  8/04/81 13:08  17   13       0:01   3:14
  9     max mathews letter DONE 10/18/82 Mon 10:25
                         0/00/00 10/18/82 10:18  10   5        0:01   1:54
 10     V2 slides for a 11/81 talk DONE 11/81
                         0/00/00 10/18/82 10:16  7    11       0:00   0:49
 12     cluster, lan and wan def slides DONE 11/30/82 Tue 14:31
                        11/29/82 11/30/82 13:46  3    2        0:00   0:22
 13     bi review
                         4/06/83  4/06/83  0:40  5    2        0:04   0:39


Name: GB0002, # of Docs: 70, Blocks left: 57 (of 627)
-------------------------------------------------------------------------------
Number  Name                     Created  Modified       Size Version  Last   Total
-------------------------------------------------------------------------------
  1
                         4/02/79  8/15/79 11:44  10   137      0:01   2:09
  2     GRAPHICS: WHY WE RECOMMEND WHAT WE'RE DOING/AK,WH/GB0002
                         4/02/79  6/01/79  0:43  11   7        0:01   0:28
  3     PDP-11/70 WHY WE PROBABLY HAVE TO DO ON CHIP/MC,OOD.../GB0002
```

4/02/79 4/06/79 0:54 11 6 0:01 0:27

4 FUJITSU LITERATURE & PARTS/DR. F. KUROSAKI/GB0002

4/02/79 4/12/79 3:01 3 3 0:00 0:08

5 HIGH END CHARTER 3/27/79 MEETING/LENG,FAGERQUIST.../GB0002

4/03/79 5/11/79 1:52 11 5 0:00 0:30

6 INDEX FROM CI FOR DISKETTE:GB0002 /GB0002

4/04/79 5/17/79 2:25 24 11 0:04 0:18

7 IOWA STATE TESTIMONIAL AD/TOWLE, GIORDANO/GB0002

4/05/79 4/05/79 10:45 3 2 0:04 0:14

8 DECUS AUSTRIALIA/JOHN EDWARDS/GB0002

4/06/79 4/09/79 5:58 4 7 0:01 0:08

9 U OF WISCONSIN MADISON/MURRAY THOMPSON/GB0002

4/06/79 4/20/79 7:11 5 4 0:01 0:10

10 ST AGNES HOSPITAL/DR. JOSEPH GIARRATANO/GB0002

4/09/79 4/09/79 1:26 3 6 0:01 0:13

11 TEWKSBURY GROUP MORALE/DEMMER/GB0002

4/09/79 4/18/79 1:20 9 8 0:03 0:13

12 OREGON SOFTWARE MINICOMPUTER INC./WHITNEY/GB0002

4/09/79 4/10/79 0:56 2 2 0:03 0:09

13 ASI INVITATION/INSINGER/GB0002

4/09/79 4/23/79 3:04 2 2 0:00 0:04

14 NAVAL RESEARCH LABORATORY/SLAGLE/GB0002

4/09/79 4/10/79 0:52 2 2 0:01 0:04

15 BIT MAPS FOR PERSONAL VAX-BUY IT!/PARKE, MARSHALL/GB0002

4/09/79 4/10/79 2:13 5 8 0:01 0:30

16 CONSULTING ARRANGEMENT--PAUL PENFIELD-MIT/J.BELL.../GB0002

4/11/79 4/12/79 2:57 5 6 0:02 0:12

17 ARCHITECTURE IN TERMINALS/SMALL SYS/CLAYTON/DELAGI/GB0002

4/11/79 4/17/79 0:37 8 5 0:01 0:18

18 ECL FOR VENUS, GETTING THE POOP ON/BUSIEK,ULF.../GB0002

4/11/79 4/12/79 3:00 7 2 0:02 0:15

19 MINNOW, LET'S GO AHEAD!/GB0002

4/12/79 4/13/79 14:56 7 3 0:01 0:08

20 CONTRIBUTION OF COMPUTER TIME/KEN OLSEN.../GB0002

4/12/79 4/12/79 6:13 3 4 0:00 0:01

21 MUSEUM PROJECT/ROCKWELL--GOOD FILE/GB0002

4/12/79 4/12/79 6:15 2 2 0:00 0:00

22 CONTRIBUTION (CORP)OF COMPUTER TIME/K.OLSEN--GOOD FILE/GB0002

4/12/79 4/12/79 6:24 3 1 0:01 0:01

23 COMPUTER POWER (PERSONAL VISIT)--GOOD FILE/KAROLY/GB0002

4/12/79 5/02/79 3:13 2 3 0:00 0:01

24 CMU RESEARCH GRANT--CMU/CYERT/GB0002

4/13/79 4/13/79 9:52 3 1 0:03 0:03

25 JAPAN TALK-HARVARD, THANKS/ALDEN/GB0002

4/17/79 4/17/79 1:54 2 3 0:01 0:08

26 BTL-CONVERSATION ON MAX MATHEWS/CLAYTON.../GB0002

4/17/79 4/18/79 3:08 6 2 0:05 0:38

27 JAPAN ESSAY REQUEST - XEROX/WHITE/GB0002

4/18/79 4/18/79 0:48 2 1 0:03 0:03

28 BOOK REQUEST - DARTMOUTH/THOMAE/GB0002

4/18/79 4/18/79 0:51 2 1 0:02 0:02

29 DAVIS--PEOPLE GERALD DAVIS MET(HIS NOTES)/GB0002

0/00/00 0/00/00 4:31 14 6 0:00 0:61

30 CONTRIBUTION OF COMPUTER TIME--WE DO IT?/EMS-CRAWFORD/GB0002

4/20/79 4/23/79 7:18 19 9 0:01 0:01

31 CDC'S VISIT (TOM KAMPE)CROUSE, KEVILL.../GB0002

4/23/79 4/23/79 6:20 9 8 0:04 0:43

32 XEROX--MORE ON XEROX ORGANIZATION/KNOWLES.../GB0002

4/23/79 4/23/79 6:26 5 4 0:02 0:15

33 ORGANIZATION--THOUGHTS ON ASSOCIATE HEAD OF OOD/FILE/GB0002

4/23/79 5/02/79 2:32 7 5 0:01 0:07

34 MINNOW-NO/EMS-LENG, ULF/GB0002

4/23/79 4/23/79 4:54 3 2 0:00 0:01

35 LCG STRATEGY STATEMENT/EMS-LENG/HEBERT/GB0002

4/23/79 4/23/79 4:53 5 3 0:05 0:05

36 UNIT'S VIDEODISK WORK!/RIGGLE/GB0002

4/23/79 4/24/79 1:32 4 4 0:00 0:18

37 LOW END/S. OLSEN,CLAYTON,DELAGI/GB0002

4/23/79 4/26/79 0:46 8 7 0:03 0:51

38 VAX--GETTING ADEQUATE VAX'S THIS FISCAL YEAR/ULF,WD.../GB0002

4/26/79 4/27/79 0:33 8 6 0:15 0:35

39 CMU STRATEGY BACKGROUND 4/3079 MEET /EMS-WITMORE.../GB0002

4/26/79 4/26/79 7:54 52 10 0:00 0:09

40 REGARDING MCA'S, VENUS & 2080'S/RELIABILITY/HOFF.../GB0002

5/01/79 5/02/79 2:23 7 4 0:01 0:29

41 CMU ALLEN NEWELL'S COMMENTS ON MEETING/WITMORE.../GB0002

5/01/79 5/02/79 1:24 9 6 0:01 0:49

42 NEWELL, ALLEN - NAE NOMINATION/LIEBOWITZ/GB0002

5/01/79 5/01/79 2:57 3 1 0:13 0:13

43 CMU - VAX'S YOU ORDERED FOR CSD/ARPA-NEWELL/GB0002

5/01/79 5/01/79 7:09 2 1 0:07 0:07

44 SYSTEM INTERCONNECT AND TEWKSBURY CHARTER/DEMMER.../GB0002

5/02/79 5/02/79 2:54 5 5 0:02 0:17

45 HLL FOR USER MICROPROCESSOR PROGRAMS IN TERMINALS/GUTZ/GB0002

5/04/79 5/07/79 2:39 4 4 0:04 0:15

46 BUDGET FY80-81 ENG. REDISTRIBUTION & COMMENTS/EBOD,OOD/GB0002

5/07/79 6/19/79 6:44 24 12 0:01 1:00

47 WHITE TORNADO DESIGN FOR WORD PROCESSING/CLAYTON,S OLSEN/GB0

5/07/79 5/07/79 1:09 7 3 0:03 0:05

48 STOCKEBRAND IN ALBURQUERQUE FACTORS--EMS/JACK SMITH

5/07/79 5/07/79 0:49 3 2 0:00 0:00

49 IRCAM - POSSIBLE MEETING DURING MAY EUR. TRIP/CHOWNING/GB0002

5/07/79 5/07/79 0:49 3 4 0:00 0:07

50 CRT APPROVAL FOR VLSI ADV. DEV.--EMS/ULF/GB0002

5/07/79 5/07/79 0:49 3 4 0:01 0:01

51 TALK INVITATION - DIS. COM. SYSTEMS/VICK/GB0002

5/07/79 5/14/79 0:59 3 4 0:00 0:08

52 BUDGET ADJUSTMENTS-WANT BACK FAIR/SQUARE--EMS/THOMPSON/GB0002

5/08/79 5/09/79 0:11 4 4 0:01 0:01

53 LDP ON GRAPHICS SW INTERFACE--EMS/HALIO,MCBRIDE.../GB0002

5/08/79 5/09/79 0:14 4 2 0:00 0:00

54 BACKPLANE INTERCONNECT TASK FORCE--EMS/ROSING,PLATZ.../GB0002

5/08/79 6/27/79 7:19 16 9 0:00 0:02

55 VENUS,VAX,MCA DIRECTION & STRATEGY--EMS/DEMMER,HOFF/GB0002

5/09/79 5/09/79 0:12 10 4 0:00 0:00

56 ORGANIZATION ANNOUNCEMENT FOR OOD=LP+GB/ENG.MGRS/GB0002

5/10/79 5/17/79 4:41 8 12 0:00 0:63

57 CMU-SALE/PROJECT--EMS/WITMORE.../GB0002

5/10/79 5/10/79 0:21 6 1 0:00 0:00

58 DECNET ARTICLES/LOVELAND/GB0002

5/10/79 5/10/79 1:08 3 2 0:02 0:06

59 INTERFACES--LIST OF SIGNIFICANT ONES UNDER DESIGN/BJ/GB0

5/11/79 5/14/79 3:28 4 4 0:03 0:22

60 CALTECH-RE:FUNDING SILICON STRUCTURES(J.GRAY)/RC,RP.../GB0002

5/14/79 5/14/79 1:10 8 4 0:04 0:19

61 CUSTOMER - ANOTHER ASK-ANY-USER IDEA/LENG,WITMORE.../GB0002

5/14/79 5/14/79 1:05 5 4 0:03 0:15

62 11/23,11/24 BI=UNIBUS - '90/DEMMER,CLAYTON/GB0002

5/14/79 5/14/79 1:19 8 6 0:08 0:26

63 XTEN PETITION BY XEROX--EMS/CADY,MARCUS/GB0002

3/15/79 3/15/79 0:38 4 1 0:00 0:00

64 BSO INFORMATION--EMS-FILE/GB0002

3/15/79 3/15/79 0:43 4 1 0:00 0:00

65 CAD-YOUR SUGGESTION TO BREADBOARD PC LAYOUT--EMS/KUSIK/GB0002

3/15/79 3/15/79 0:49 5 1 0:00 0:00

66 INDEX FROM CI/GB0002

Number	Name	Created	Modified	Size	Version	Last	Total
		8/15/79	8/15/79 11:45	26	1	0:00	0:00
67	INTERCONNECT PROBLEM COMMITMENT WORK,SOLVE--EMS/WD,BJ/GB0002	1/15/79	1/15/79 6:18	3	1	0:00	0:00
68	CONSULTANT-HENDRICKS STUDY/ANALYSIS--EMS/CRAWFORD/GB0002	3/05/79	3/05/79 6:29	8	1	0:00	0:00
69	DIGITAL-PRESS PERMISSION REPRINT FROM C.E.--EMS/CM,MCN/GB0002	3/26/79	3/26/79 6:40	4	1	0:00	0:00
70	DISK CRISIS PRIORITIES IN UNDERSTANDING--EMS/KEVILL/GB0002	11/27/78	11/27/78 6:45	6	1	0:00	0:00

Name: GB0003, # of Docs: 73, Blocks left: 77 (of 627)

Number	Name	Created	Modified	Size	Version	Last	Total
1		4/02/79	8/24/79 7:02	10	107	0:01	1:02
2	EMS-MUMPS PRODUCT STABILITY INFORMATION--EMS/CHRISTY/GB0003	4/02/79	6/12/79 17:02	4	3	0:01	0:01
3	INTERCONNECT NEW BUS--EMS/FULLER/GB0003	12/20/78	2/12/79 6:20	4	2	0:00	0:00
4	HYDRA-DISCUSSION WITH DAVE CUTLER--EMS/PORTNER/GB0003	1/10/79	2/12/79 6:20	4	2	0:00	0:00
5	EMS-MAIL AND JUNGUE MAIL--EMS/CRAWFORD/GB0003	1/13/79	2/12/79 6:20	5	2	0:01	0:02
6	DOLPHIN VS. MINNOW DILEMMA--EMS/FAGERQUIST/GB0003	11/18/78	2/12/79 6:19	6	2	0:00	0:00
7	INDEX FROM CI/GB0003	5/15/79	8/31/79 7:29	27	15	0:00	0:07
8	COMMERCIAL GROUP STRATEGIC PLANNING INFO--EMS/CADY/GB0003	5/16/79	2/12/79 6:19	10	2	0:01	0:02
9	HYDRA-IMPORTANCE OF--EMS/PORTNER/GB0003	5/16/79	2/12/79 6:18	4	2	0:00	0:00
10	HYDRA-INTEREST OUTSIDE TELCO--EMS/VAN ROEKENS/GB0003	5/16/79	5/17/79 2:35	3	8	0:01	0:03
11	IBM--JOSEPHSON DEVICE COMPUTER--EMS/CADY/GB0003	1/19/79	2/12/79 6:18	5	5	0:01	0:02
12	10/20 ITEMS FOR YOUR STAFF DECISION--EMS/LENG/GB0003	3/08/79	2/12/79 6:17	5	5	0:00	0:00
13	LSI VAX CHIP ANOTHER HIGHER PRIORITY PROJECT--EMS/RC/GB0003	11/27/78	2/12/79 6:17	2	3	0:00	0:00

14	MASS STORAGE-FUND,BAD DECISIONS-LETS' GET ON WITH IT/EMS-JK,GS/GB0003	3/02/79	2/12/79	6:00	17	2	0:01	0:01
15	MERCURY SUBSYSTEM + INTERCONNECT--EMS/MCNAMARA/GB0003	2/15/79	2/15/79	5:43	9	1	0:00	0:00
16	MINC PRIORITIES IN SYSTEMS--EMS/RC,MCBRIDE/GB0003	11/27/78	2/12/79	5:59	7	2	0:01	0:01
17	MERCURY + MULTIDROP--EMS/MCNAMARA/GB0003	4/02/79	2/12/79	5:58	2	2	0:00	0:00
18	11/74 STOP, MOVE AHEAD 11/70 MULTIPROCESSOR--EMS/WD/GB0003	2/12/79	2/12/79	6:04	4	1	0:00	0:00
19	STRATEGY (BASIC) AND TRANSITION MACHINE--EMS/CADY/GB0003	1/23/79	1/23/79	6:33	4	1	0:00	0:00
20	DOLPHIN, VENUS + SETTING PRIOIRITIES--EMS/ULF/GB0003	1/28/79	1/28/79	6:36	5	1	0:00	0:00
21	STRATEGY STATEMENT FOR DECUS--EMS/ULF,LENG,CADY/GB0003	4/04/79	4/04/79	6:40	4	1	0:00	0:00
22	STRATEGY-PROCESSORS (IE MR+TW)--EMS/WD,ULF/GB0003	3/30/79	8/08/79	11:32	4	2	0:00	0:00
23	GRAPHICS TERMINAL PROGRESS--EMS/HALIO/GB0003	1/13/79	1/13/79	6:55	5	1	0:00	0:00
24	U. WISCONSIN TREATING IN A HUMAN WAY--EMS/SCHWARTZ.../GB0003	3/02/79	3/02/79	6:59	4	2	0:00	0:00
25	INTERFACE TO VMS SOFTWARE DEVELOPERS UNIV.--EMS/LP/GB0003	3/02/79	3/02/79	7:02	4	1	0:00	0:00
26	LSI FOR VAX-USE HMOS--EMS/BJ/GB0003	11/16/78	8/07/79	4:28	3	3	0:00	0:00
27	MASS STORAGE FOR PERSONAL VAX--EMS/MARSHALL,SAVIERS/GB0003	2/28/79	2/28/79	7:10	5	1	0:00	0:00
28	UNIVERSITA' DI PISA - POSSIBLE JOINT EFFORT/MONTANARI/GB0003	5/17/79	5/17/79	4:44	3	4	0:02	0:19
29	EUROPEAN ENGINEERING-THOUGHTS/KELLEHER,PORTNER,MEYER.../GB0003	5/29/79	6/04/79	2:19	8	3	0:11	0:35
30	CSS VS. P/L (FOR PROCESS I/O) AND CEN. ENG./DEMMER.../GB0003	5/29/79	6/04/79	2:27	9	6	0:01	0:35
31	VAX - HI END PERIPHERALS ON VAX/DEMMER, ULF.../GB0003	5/29/79	6/04/79	1:53	6	4	0:03	0:30
32	LCG VERSUS P/L FOCUS IN EUROPE/PETERSCHMIDT,CHOONAVALA/GB0003	5/29/79	6/04/79	2:01	5	3	0:08	0:23
33	METRICATION - WHERE ARE WE?/TAYS/GB0003	5/29/79	5/30/79	8:39	3	4	0:01	0:08
34	PSI - ADDRESSING YOUR USERS IN BERLIN/JESCKE/GB0003	5/29/79	5/30/79	8:10	3	4	0:00	0:09

35	IRCAM - THANK YOU NOTE/BRIGETTE,CHOWNING,RISSELT/GB0003	5/29/79	6/04/79	6:31	3	6	0:00	0:26
36	ECO-GASTRONOMY: SYSTEM OF THE LOIRE,SPRING, AND BICYCLES/GB0003	5/30/79	6/01/79	5:01	38	9	0:00	2:61
37	CAMERA PASS/ALEXANIAN/GB0003	5/30/79	5/30/79	2:17	2	3	0:00	0:08
38	U OF WASHINGTON - VIEW OF POSSIBLE VAX11780'S/RITCHIE/GB0003	6/04/79	6/05/79	2:15	4	5	0:05	0:17
39	FUJITSU LABORATORIES LTD.--VISIT/ALSO TWX'D--KAWATO/GB0003	6/04/79	6/08/79	0:00	3	3	0:00	0:05
40	WATCHING STRATTON AND STRATEGIES VIDEOTAPES/MEYER/GB0003	6/04/79	0/00/00	0:47	3	4	0:01	0:04
41	DECAIR'S KAMIKAZEE FLIGHTS THAT SHOULDN'T BE SCHEDULED/PUFFER/GB0003	6/04/79	0/00/00	0:32	7	4	0:13	0:20
42	COMMENTS ON OUR DISCUSSION/WESLEY/GB0003	6/04/79	0/00/00	0:44	8	4	0:02	0:07
43	THANKS FOR STRATTON MOUNTAIN IV/TAYS/GB0003	6/04/79	0/00/00	0:42	6	5	0:10	0:16
44	THANK YOU LUNCH/DECNET PROGRAM CONTRIBUTORS/GB0003	6/05/79	6/12/79	17:07	7	7	0:01	0:37
45	DUPONT - REQUEST FOR DISTRIBUTED DATA PROCESSING/CULLEN/GB0003	6/06/79	6/06/79	4:30	3	5	0:02	0:09
46	DEC, A SHRINKING ECOLOGICAL NITCH/SIEWIOREK-CMU RAMP/GB0003	6/07/79	6/07/79	5:36	12	6	0:04	0:40
47	BACKPLANE INTERFACE - PAX PROBLEM/CLAYTON--EMS/GB0003	6/07/79	8/07/79	4:26	3	2	0:00	0:00
48	1990 CORE GROUP SPACE TASK FORCE/PORTNER--EMS/GB0003	6/07/79	6/07/79	4:57	2	1	0:00	0:00
49	EUROPEAN EXPENSE/BERGER/GB0003	6/08/79	6/08/79	5:07	3	1	0:00	0:00
50	STRATTON VIDEOTAPES/TAYS/GOOR/PEARSON/GALE/GB0003	6/11/79	6/12/79	17:12	6	6	0:02	0:23
51	CDC - WINSTON HODGE/FULLER,STRECKER,BINGHAM,OOD/GB0003	6/11/79	6/12/79	16:03	4	4	0:02	0:09
52	FUTURE TERMINALS ARCHITECTURE/CLAYTON,WILLIAMS,DELAGI.../GB0003	6/12/79	6/13/79	16:26	5	5	0:01	0:25
53	INFORONICS THANK YOU/BUCHLAND/GB0003	6/13/79	8/21/79	1:02	3	3	0:07	0:30
54	BELL COLLECTION/MOSKOWITZ/GB0003	6/14/79	6/14/79	3:34	3	4	0:00	0:07
55	THAYER SCHOOL OF ENGINEERING/DARTMOUTH/BOYLESTAD/GB0003	6/15/79	6/15/79	3:43	3	3	0:01	0:06

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 56     YOUR TRIP TO THE WEST/CLAYTON/GB0003
                             6/19/79  6/19/79  1:19  14   6        0:00   0:15
 57     COMPUTER ENGINEERING QUESTIONS/PHISTER/GB0003
                             6/19/79  0/00/00  0:42  4    4        0:00   0:11
 58     SILICON STRUCTURE PROJECT/(PRES)&(DEAN)OF ENG. CALTECH/GB0003
                             6/19/79  0/00/00  0:43  5    9        0:01   0:27
 59     MUSEUM THOUGHTS/FILE/GB0003
                             6/21/79  6/21/79  3:59  12   2        0:00   0:01
 60     PICTUREPHONE MEETING SERVICE + OUR VIDEO CONF./BERTOCCHI.../GB0003
                             6/25/79  6/26/79 16:30  14   4        0:17   0:32
 61     NETWORK + DDP PROTOCOL VERFICATION--EMS/PLOWMAN.../GB0003
                             6/25/79  6/25/79  6:52  3    1        0:00   0:00
 62     SCS-11--EMS/MARCUS,CADY,JOHNSON/GB0003
                             6/26/79  6/26/79 13:11  5    1        0:00   0:00
 63     BTL VISIT (WIREWRAP & I/C SCHEME FOR C.S 6/22(EMS) /GB0003
                             6/26/79  7/10/79  4:43  7    3        0:00   0:00
 64     BTL--THANK-YOU LETTER /SETHI/GB0003
                             6/27/79  6/28/79 15:12  5    4        0:01   0:14
 65     CROSS PRODUCT PROGRAMS/DISTRIBUTION/GB0003
                             7/03/79  7/06/79 16:06  11   8        0:01   0:34
 66     MUSEUM PARTS FROM WOBURN/ROY/GB0003
                             7/06/79  7/06/79 17:25  3    4        0:02   0:10
 67     ALLOCATION "ENGINEERING" YOUR OFF-THE-WALL MEMO/OLSEN/GB0003
                             7/06/79  7/19/79  3:13  9    13       0:00   1:04
 68     GOALS--FOR OOD FY80/OPERATIONS COMMITTEE/GB0003
                             7/09/79  8/08/79 10:22  8    11       0:03   0:43
 69     BROWN U ACCEPTANCE TO DEPT OF COMP. SCIENCE SYMPOSIUM/WEGNER/GB0004
                             7/09/79  7/09/79  0:21  3    2        0:02   0:06
 70     KEUFFEL + ESSER COMPANY/SALES DEPT./GB0003
                             7/09/79  8/01/79  2:13  4    5        0:02   0:26
 71     APPLIANCE MANUFACTURER--CANCELLATION OF SUBSCRIPTION/KNAPP/GB0003
                             7/09/79  7/12/79 14:57  2    4        0:01   0:05
 72     REVIEW/DP:WELLS,VARICK/ORIGINS OF COMPUTER INDUSTRY/GB0003
                             7/10/79  7/23/79  0:26  36   22       0:13   4:27
 73     BUDGET FOR FY80 (EMS)/SAVIERS/GB0003
                             7/10/79  7/10/79  4:53  1    1        0:00   0:00


Name: EMPTY , # of Docs: 68, Blocks left: 65 (of 627)
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Number  Name                    Created  Modified       Size Version  Last   Total
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  1
                             5/20/82 10/13/82 13:26  9    145      0:01   0:40
  2     CALTECH: FASTER VAXS & SCIENTIFIC COMPUTNG AT/STRECKER /GB3.S5
                             5/24/82  6/14/82 11:25  7    8        0:00   0:33
  3     CALTECH VISITING COMMITTEE TRIP REPORT/STRECKER/GB3.S5
                             5/24/82  5/26/82 11:07  7    8        0:01   0:45
  4     DECMATE I & II VS THE WANGWRITER - THE KEY /OC/GB3.S5
                             5/24/82  8/17/82 15:27  3    6        0:00   0:08
  5     JAPAN: CONTACTS SUMMER OF 1978 (JULY)/GB3.S5
                            10/13/82  7/17/84  0:02  7    3        0:01   0:02
  6     VAX'S - MARKETING (& DEVELOPING) TO SAVE US/SMITH ET AL/GB3.S5
                             5/24/82  9/18/82 13:09  5    6        0:00   0:26
  7     CALTECH EXPENSES PLUS HONORARIUM DONATION TO MUSEUM/GB3.S5
                             5/25/82  5/25/82 12:42  3    2        0:07   0:07
  8     DEC REIMBURSEMENT $514. FOR CALIF. TICKET/CARLA MASON/GB3.S5
                             5/26/82  5/26/82  8:55  3    1        0:14   0:14
  9     INVITATION-NO-J. RUSSELL NELSON,ARIZONA STATE UNIV./GB3.S5
                             6/02/82  6/18/82  9:50  1    2        0:00   0:02
 10     BRUCE?/THANKS FOR PRES. WOULD YOU CARE TO LECTURE/GB3.S5
                             6/01/82  6/02/82 15:33  4    6        0:00   0:05
 11     NYIT DR. SHURE: THANKS FOR HOSPITALITY/GB3.S5
                             6/01/82  6/02/82 14:46  4    5        0:00   0:06
 12     NASA-NO RE SPACE SHUTTLE EXPERIMENT CANNISTER/ TZANNOS/GB3.S5
                             6/01/82  6/01/82 14:46  2    2        0:01   0:04
 13     BOB SPENCE: RECOGNITION LETTER/GB3.S5
                             6/02/82  6/02/82 15:32  2    3        0:01   0:08
 14     TOM KIMBLE RECOGNITION LETTER/GB3.S5
                             6/02/82  6/09/82 15:58  2    3        0:00   0:02
 15     U OF CONNECTICUT: CORP. CONT. MAY HELP/PETE MCFADDEN/GB3.S5
                             6/04/82  6/23/82 13:15  4    4        0:00   0:15
 16     TSONGAS - TRANSMITTAL LETTER RE HIS GLOBE EDITORIAL/GB3.S5
                             6/09/82  6/09/82 11:13  7    4        0:01   0:12
 17     TSONGAS - COMMENTS ON YOUR GLOBE EDITORIAL/GB3.S5
                             6/09/82  6/09/82 13:56  23   6        0:01   0:19
 18     ADS - VAX OFFICE WORKER /OC, BERUBE /GB3.S5
                             6/10/82 11/22/82  8:26  8    7        0:00   0:00
 19     MANUFACTURING: MEETING TO LAYOUT.../OLSEN/GB3.S5
                             6/09/82  6/09/82 14:26  5    2        0:01   0:01
 20     JAPANESE: THE ADVANTAGE:IS IT REA.../BOD/DEMO/GB3.S5
                             6/09/82 11/22/82  8:33  7    8        0:00   0:01
 21     BROWN: TREATING WITH RESPECT/CHAMPINE/GB3.S5
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                        6/09/82  6/09/82 14:30  6    2        0:00   0:00
22     VAX/VMS: RELEASE 1 BOOK/ORPHAN/ANKLAN @CNS1/GB3.S5
                        6/09/82  6/09/82 14:33  6    2        0:01   0:01
23     VT200: WHY ISN'T OPAL THE VT200?/AVERY/GB3.S5
                        6/09/82  7/23/82 10:26  4    4        0:00   0:01
24     LISP: LISP AND THE MARKET/CHAMPINE/GB3.S5
                        6/09/82  6/09/82 14:39  4    2        0:01   0:01
25     LECTURE SERIES: DEC TECNICAL LECTURE SERIES FOR../PEG/GB3.S5
                        6/09/82  6/09/82 14:41  5    2        0:00   0:00
26     ETHERNET: DEC'S BACKBONE NETWORK AND ET.../DENNY BJORK/GB3.S5
                        6/09/82 11/17/82 12:10  7    3        0:01   0:03
27     DECSIM: MAKE VS BUY AND SELLING.../GOLDFEIN/GB3.S5
                        6/09/82  6/11/82 14:07  5    3        0:00   0:00
28     QUALITY PROGRAM AND INSPECTORS VE.../BJ/GB3.S5
                        6/09/82  6/09/82 14:51  5    2        0:01   0:01
29     RISC/MAURICE WILKES/GB3.S5
                        6/09/82  6/11/82 14:07  5    4        0:01   0:01
30     EDUCATION: MANAGEMENT IIA: WHAT IS IT?/BERNSTEIN/GB3.S5
                        6/09/82  6/09/82 14:58  12   2        0:00   0:00
31     PRODUCT LAYERS: WHERE EVERY GROUP.../HENRY ANCONA/GB3.S5
                        6/09/82  6/09/82 15:03  9    2        0:03   0:03
32     EDUCATIONAL COMPUTER: EDU MARKET../AVRAM/GB3.S5
                        6/09/82  6/09/82 15:06  6    2        0:01   0:01
33     PRODUCTIVITY: RE SW PROD. AND A JOB SHOP.../KEATING/GB3.S5
                        6/09/82  6/09/82 15:08  5    2        0:00   0:00
34     CLUSTERS: YOU MAY NOT HAVE GOTTEN THIS IDEA../DEMMER/GB3.S5
                        6/09/82  6/09/82 15:10  6    2        0:00   0:00
35     HIERARCHIES/MAURICE WILKES/GB3.S5
                        6/09/82  6/09/82 15:12  5    2        0:01   0:01
36     NATIONAL: CHIPS AS MICROVAX.../EMC/GB3.S5
                        6/09/82  6/09/82 15:27  14   2        0:09   0:09
37     MICROVAX: THE BOTTOM LINE.../OC/GB3.S5
                        6/09/82  6/09/82 15:31  2    2        0:00   0:00
38     EDUCATIONAL COMPUTER: IDEA, CUT A.../AVER/GB3.S5
                        6/09/82  6/09/82 15:33  4    2        0:00   0:00
39     MUSUEM: GETTING SYMBOL FROM ROY ZINGG, IO../DCM/GB3.S5
                        6/09/82  6/09/82 15:37  4    2        0:00   0:00
40     PRODUCTIVITY VIA FEWER BUT HIGHER QUALITY MESSAGES/OC /GB3.S5
                        6/10/82  8/25/82 12:03  6    5        0:00   0:03
41     ITINERARY: JAPAN/TAIWAN JUNE 19 THRU JULY 8/GB3.S5
                        6/17/82  7/14/82  8:10  14   10       0:00   0:17
42     EDUCATION: ENGINEERING SUMMER SCHOOL
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                         6/11/82  7/28/82 13:04  5    3        0:00   0:01
43     PC'S: MAKING COST-EFFECTIVE PC'S.  LIKE.../KALB/GB3.S5
                         6/11/82  6/11/82  9:34  5    3        0:00   0:01
44     SACRED COWS: AND GOLDEN CALVES/OLSEN/GB3.S5
                         6/11/82  6/11/82  9:37  8    2        0:01   0:01
45     SIGNAL INTEGRITY: DON MARSHALL.../METZGER/GB3.S5
                         6/11/82  8/17/82 16:47  4    5        0:00   0:00
46     KEYBOARD: WHAT DO YOU THINK ABOUT .../RON HAM/GB3.S5
                         6/11/82  6/11/82  9:43  5    2        0:01   0:01
47     VS100 AS THE FIRST VT200 (COULD I.../HUETTNER/GB3.S5
                         6/11/82  6/11/82  9:46  3    2        0:01   0:01
48     CT: YOUR FIRST CT & MARKETING/AVRAM/GB3.S5
                         6/11/82  6/11/82 10:06  3    2        0:01   0:01
49     CALTECH: FASTER VAXES AND SCIENTIFIC COMPU/BASKETT/GB3.S5
                         6/11/82  6/11/82 10:08  8    2        0:00   0:00
50     VAX MARKETING: (& DEV.) VAX'S/CADY/GB3.S5
                         6/11/82  6/11/82 10:10  6    2        0:00   0:00
51     DECMATE I & II: VS THE WANGWRITER/CIOFFI/GB3.S5
                         6/11/82  6/11/82 10:20  4    3        0:00   0:00
52     REVIEW OF PRODUCTS AND PROJECTS.../BRENDER/GB3.S5
                         6/11/82  6/11/82 14:08  6    5        0:00   0:01
53     CALTECH: VISITING COMMITTEE TRIP../DEMMBER/GB3.S5
                         6/11/82  6/11/82 10:21  8    2        0:01   0:01
54     UNIX: SUPPORT/EMC:/GB3.S5
                         6/11/82  6/11/82 10:23  4    2        0:00   0:00
55     MANUFACTURING A/D AND MANUFACTURING../CLAYTON/GB3.S5.55
                         6/11/82  6/11/82 10:28  5    2        0:00   0:00
56     VT201: AND VS100/VT200 SERIES: ../AVERY/GB3.S5
                         6/11/82  6/11/82 10:31  5    2        0:01   0:01
57     NYIT: VIEWING THE NYIT FILM ON COMP..../OC/GB3.S5
                         6/11/82  6/11/82 10:33  4    2        0:01   0:01
58     REVIEW: MORE ON WHAT NOT TO DO/CORBEN/GB3.S5
                         6/11/82  6/11/82 10:35  8    2        0:01   0:01
59     VAX-11: PERFORMANCE DATA ON VAX-11.../CUTLER/GB3.S5
                         6/11/82  6/11/82 14:06  4    2        0:01   0:01
60     U OF NEWCASTLE, DISCLOSURE FOR SECURE DIST SYS/STRECKER/GB3.S5
                         6/14/82  6/14/82 11:44  4    2        0:04   0:04
61     MCC PRESENTATION-GOALS/OBJECTIVES BY PRICE/BELL/GB3.S6
                        10/13/82 10/13/82 13:26  4    1        0:00   0:00
68     MCC RESEARCH PROGRAM & LASL /OC/GB3.S5
                         6/15/82  8/18/82 10:59  6    5        0:00   0:03
69     MCC RESEARCH PROGRAM LASL: DR. ROBERT EWALD/GB3.S5
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                          6/15/82  8/18/82 11:23  5    18       0:01   0:09
 72     JAPAN: COMPANY/PEOPLE VISITED HISTORY/INDEX, 6/82 /GB3
                          7/12/82  7/17/84  0:01  61   24       0:01   5:23
 73     JAPAN: THANK YOU TO MR. T. KUROKI DEC JAPAN/GB3
                          7/12/82  7/19/82 16:24  1    3        0:01   0:05
 74     JAPAN: THOUGHTS ON GREAT PORT TERM/PERS COMP/OLSEN/GB3
                          7/12/82 10/05/82 16:47  40   16       0:01   2:22
 75     JAPAN: TOKYO PRESS CONF.+DEC HISTORY PERSPECTIVES 6/24/82/GB3.S5
                          7/12/82 10/12/82  8:58  26   18       0:01   0:52
 76     AFIPS CALL FOR PAPER ON LINC & PDP-8/GALLER/GB3.S5
                          7/14/82  8/11/82 14:50  3    6        0:03   0:35
```

Document 60 comment:
   To: Husvedt, strecker, lipner, fuller, bob McKenzie,
strecker cc: heffner, bj, carchidi, wilkes, siekman, Peter
lee
Subject: Disclosure for reliable/secure distributed systems

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Name: 0     , # of Docs: 34, Blocks left: 373 (of 627)
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Number  Name                     Created  Modified       Size Version  Last   Total
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  2     INDEX
                         12/21/82 12/21/82 11:15  2    1        0:00   0:00
  3     UNIX:More Competitive/EMS-11/1-COURTIN/OC-GB3.S10
                         12/28/82 12/28/82 15:35  4    3        0:00   0:01
  4     MIT:AN OPPORTUNITY/EMS/11-1/AVERY/KO/J.SMITH/GB3.S10
                         12/28/82 12/28/82 15:35  4    3        0:00   0:01
  5     MCWILLIAMS,TOM: LLL/EMS-11/13-BASKETT-GB3.S10
                         12/28/82 12/28/82 15:45  9    1        0:00   0:00
  6     COGNITIVE SYSTEMS:USE AI/EMS-11/2-HUGHES/GB3.S10
                         12/28/82 12/28/82 15:35  6    3        0:00   0:01
  7     MUSEUM:MANUALS,SOFTWARE/EMS-11/3-MUSEUM-GB3.S10
                         12/28/82 12/28/82 15:35  4    3        0:00   0:00
  8     MILL:WALK-THROUGH/EMS-11/3-BJ,SMITH-GB3.S10
                         12/28/82 12/28/82 15:35  5    3        0:01   0:02
  9     CMU:SPICE & YALE & PPA/EMS-11/3-BJ,FULLER/GB3.S10
                         12/28/82 12/28/82 15:34  5    3        0:00   0:01
 10     LA12 VS ROBIN:EMS-11/3-AVERY-GB3.S10
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                         12/28/82  2/22/83 13:52  8    5        0:00   0:02
11     ARPA HELP IN H/S SEMIS:EMS-11/3-GLORIOSO-GB3.S10
                         12/28/82 12/28/82 15:34  5    2        0:02   0:02
12     BERKELEY:ETHERNET/EMS-11/3-STEVE DAVIS/GB3.S10
                         12/28/82 12/28/82 15:36  4    2        0:01   0:01
13     UNIX:MORE COMPETITIVE/EMS-11/8-J.SHIELDS/GB3.S10
                         12/28/82 12/28/82 15:37  3    2        0:00   0:00
14     SALES: PRODUCT LINE SUPPORT/EMS-11/13-OLSEN-GB3.S10
                         12/28/82 12/28/82 16:16  5    2        0:01   0:01
15     MUSEUM:PETROFSKY/EMS-11/13-BERUBE/GB3.S10
                         12/28/82 12/28/82 16:17  9    2        0:01   0:01
16     AI:EXPERT SYSTEMS:LISP/EMS-11/14-ABEL,PATEL/GB3.S10
                         12/28/82 12/28/82 16:21  19   2        0:04   0:04
17     PRODUCTS:WINNING HIGH END CPU'S/EMS-11/14/KOTOK/GB3.S10
                         12/28/82 12/28/82 16:22  9    2        0:01   0:01
18     VOICE:PLAYBACK/EMS-11/14-AVERY-GB3.S10
                         12/28/82 12/28/82 16:23  4    2        0:01   0:01
19     MIT:PC/EMS-11/15/FULLER,CHAMPINE/GB3.S10
                         12/28/82 12/28/82 16:26  4    3        0:00   0:01
20     SABBATICALS:SHOULD WE?/EMS-11/16/EMC/GB3.S10
                         12/28/82 12/28/82 16:27  3    2        0:01   0:01
21     LBL:SPEAKER/CONSULTANT-EMS/11-16-CFM TF/GB3.S10
                         12/28/82 12/29/82  8:42  6    4        0:00   0:01
22     COGNITIVE SYSTEMS:R.SHANK/EMS-11/19/BOB NOLIN/GB3.S10
                         12/29/82 12/29/82  8:45  18   2        0:02   0:02
23     MIT: EMS-11/20-JAY HAIRE-GB3.S10
                         12/29/82 12/29/82  8:46  5    2        0:01   0:01
24     UNIX POLICY:EMS-11/22-BILL JOHNSON-GB3.S10
                         12/29/82 12/29/82  8:47  3    2        0:01   0:01
25     VAX:HELP ON IMPROVING/EMS-11/24/BOB ROCKWELL/GB3.S10
                         12/29/82 12/29/82  8:49  4    3        0:00   0:01
26     BOOK:EMS-11/27-FULLER,STRECKER/GB3.S10
                         12/29/82 12/29/82  8:56  5    3        0:01   0:02
27     WC FIELD (LASL WC11 COMPUTER)/EMS-12/3-AVERY/GB3.S10
                         12/29/82 12/29/82  8:57  7    2        0:01   0:01
28     ARTIFICIAL INTELLIGENCE:EMS-12/3-B.JOHNSON/GB3.S10
                         12/29/82 12/29/82  9:00  7    2        0:03   0:03
29     HARDWARE:PRODUCTS FOR AP/EMS-12/4/G.BUTLER/GB3.S10
                         12/29/82 12/29/82  9:14  7    3        0:00   0:01
30     DATAFLOW:RESEARCH/EMS-12/4/FULLER/GB3.S10
                         12/29/82 12/29/82  9:19  11   3        0:00   0:05
31     DATAFLOW:GOING TO ARPA/EMS-12/4/FULLER/GB3.S10
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                          12/29/82 12/29/82  9:20  4    2        0:01   0:01
 32     WORKSTATION:EMS-12/6-B.CROXON/GB3.S10
                          12/29/82 12/29/82  9:21  8    3        0:00   0:01
 33     RESEARCH GROUP:EMS-12/6-FULLER-GB3.S10
                          12/29/82 12/29/82  9:22  5    2        0:01   0:01
 34     SCORPIO:ORGANIZATION REVIEW/EMS-12/6/DEMMER,BJ/GB3.S10
                          12/29/82 12/29/82  9:24  13   3        0:00   0:02


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  2     INDEX GB3S13
                           8/31/82  8/31/82 10:08  2    2        0:01   0:01


Name: 00    , # of Docs: 40, Blocks left: 200 (of 627)
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-------------------------------------------------------------------------------
  1
                           1/03/83  3/04/83 10:25  5    102      0:00   0:13
  2     Interview
                           1/03/83  2/24/83 11:58  152  24       0:00   7:49
  3     DISTRIBUTED COMPUTING:Ltr,Bardsley,U of Pittsburgh/1-3/GB4.S1
                           1/03/83  2/14/83  9:15  2    10       0:00   0:04
  4     IEEE MEETING:LTR/DAVID ZEIN/1-3/GB4.S1
                           1/03/83  1/11/83  9:15  2    4        0:00   0:03
  5     AUSTRALIAN: VAX-VMS/DECNET INPUT-EMS-1/3-GB4.S1
                           1/03/83  2/18/83 15:47  5    5        0:01   0:12
  6     AUSTRALIA:THANKS/EMS-FRANK WROE-1/3-GB4.S1.6
                           1/03/83  2/18/83 15:47  7    5        0:00   0:14
  7     WANG: LOCAL AREA NETS/EMS/1-3/LACROUTE,OC/GB4.S1
                           1/03/83  2/18/83 15:42  5    7        0:00   0:10
  8     INDUSTRIAL TERMINALS:EMS/1-3/KO,HINDLE,MARCUS/GB4.S1
                           1/03/83  2/22/83 13:55  5    8        0:00   0:13
  9     CHIPS: 100K TRANSISTOR/SEG  MGRS-GB4.S1
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                     1/03/83  2/18/83 15:45  5    5        0:00   0:07
10     DECMAIL:EMS/1-3/DOCKSER,ANCONA,MARCUS/GB4.S1
                     1/03/83  1/03/83 15:12  4    3        0:01   0:05
11     TEST
                     1/06/83  1/06/83 15:05  2    6        0:01   0:09
12     DESIGN:QUALITY METHODOLOGY/EMS/1-4/AVERY/GB4.S1
                     1/04/83  2/18/83 15:39  18   3        0:00   0:03
13     BOOK: OUTLINE II/ EMS-1/7-STRECKER,FULLER/GB4.S1
                     1/07/83  2/18/83 15:50  4    6        0:00   0:01
14     SIEWIOREK REFERENCE:TERMAN AWARD/DIRECTOR/GB4.S1
                     1/10/83  1/10/83  8:41  3    2        0:01   0:01
15     MUDGE REFERENCE:PROMO TO RSCH.SCIENTIST/PHILIP/GB4.S2
                     1/10/83  1/10/83 11:34  5    5        0:00   0:03
16     MUDGE:100K TRANSISTOR CHIP/LTR/GB4.S1
                     1/10/83  4/05/83 13:41  4    3        0:00   0:00
17     NYU PROPOSAL
                     1/10/83  1/10/83 11:40  4    3        0:00   0:01
18     SEYMOUR CRAY:NAE FOUNDERS AWARD/LTR/ABRAMSON/1-26/GB4.S1
                     1/26/83  1/26/83 11:39  2    4        0:00   0:04
20     BUS:BUILD,USE,SELL/EMS/1-17/OC,PEG,MFG,PLM/GB4.S1
                     1/17/83  3/08/83 16:11  10   17       0:01   0:59
21     R & D TAX:COST-SHARING-REGS/EMS/CHAMBERLAIN/1-25/GB4.S1
                     1/25/83  2/18/83 16:17  11   8        0:00   0:09
22     FACTORY: PROPOSAL, LABORATORY HDWE./EMS/GB4.S1
                     1/20/83  2/18/83 16:02  4    7        0:01   0:09
23     U.S.EXPORT LAWS:APPLICATION/EMS/ENGR USERS/1-25/GB4.S1
                     1/25/83  2/18/83 16:19  21   8        0:01   0:19
24     CFM: COST PERFORMANCE/EMS/2-15/OC/GB4.S1
                     2/15/83  2/16/83  9:03  11   9        0:01   0:61
25     SYSTEM DEV. FOUNDATION:MTG. 3-13/KEN/1-27/GB4.1
                     1/27/83  1/27/83 14:29  2    3        0:00   0:06
26     Scorpio Organization Review
                     1/28/83  1/28/83 16:28  10   2        0:00   0:11
27     CSIRO:100K GATE CHIP/MARCUS PALTRIDGE/2-1/GB4.S1
                     2/01/83  2/15/83  9:40  2    3        0:01   0:09
28     dd VAX: COMPUTATIONAL QUALITY AD/2-9/BERUBE, B. RYAN/GB4.S1
                     2/09/83  2/09/83 11:32  3    3        0:05   0:06
29     dd CFM: COST-PERFORMANCE/EMS/2-14/CFM GROUP,BJ,OC/GB4.S1
                     2/14/83  2/15/83 11:20  9    8        0:06   1:13
30     MICROVAX:68,000 LANDSLIDE/EMS/2-14/OLSEN/GB4.S1
                     2/14/83  2/15/83 11:00  6    4        0:05   0:10
31     HISTORY:LEARNING FROM CDC-CRAY/EMS/2-14/PEG,TMC,OC/GB4.S1
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Number	Name	Created	Modified	Size	Version	Last	Total
		2/14/83	2/15/83 10:51	10	8	0:01	0:49
32	MANAGEMENT PROBS 0 & 1/EMS/2-14/PEG,TMC,OC/GB4.S1	2/14/83	2/15/83 10:38	8	4	0:07	0:21
33	TEKNOWLEDGE:TECHNOLOGY BOARD/EMS/2-14/PATEL,ABEL/GB4.S1	2/14/83	2/15/83 13:34	6	3	0:28	0:37
34	STANFORD: PROF. BOB WHITE/2-15/GB4.S1	2/15/83	2/15/83 13:01	2	3	0:01	0:04
35	CDC: LTR TO NEIL LINCOLN/2-15/GB4.S1	2/15/83	2/15/83 16:17	3	4	0:00	0:09
36	MCC SITE: COLOCTION W/HPP CENTER/BOB INMAN/2-15/GB4.S1	2/15/83	2/16/83 11:02	3	2	0:02	0:10
37	COMPRESSION:LABS,INC.OPPORTUNITIES/EMS/CRAWFORD/2-15/GB4.S1	2/15/83	2/16/83 8:49	6	4	0:04	0:19
38	PRINT SERVER: EMS-RON CRISS-REPLY BY GORDON-2/16-GB4.S1	2/16/83	2/18/83 9:35	5	7	0:00	0:07
39	COMPRESSION LABS:LTR TO JOHN TYSON/2-16/GB4.S1	2/16/83	2/16/83 9:47	3	1	0:06	0:06
40	SCHLUMBERGER:EMS-SKIP GARVIN-2/14-GB4.S1	2/17/83	2/17/83 10:48	12	3	0:00	0:00
42	PC MICROVAX: EMS-2-17-OLSEN,SHIELDS,HINDLE-GB4.S1	2/17/83	2/18/83 13:22	6	4	0:00	0:13

Name: GB0004, # of Docs: 72, Blocks left: 116 (of 627)

Number	Name	Created	Modified	Size	Version	Last	Total
1		7/12/79	10/05/79 2:51	9	120	0:02	1:06
2	BEIGE BOOKS--EIS,ENG. SERVICES--EMS/OOD/GB0004	7/12/79	7/24/79 5:10	14	7	0:00	0:00
3	NETWORK AND DDP PROTOCOLS VERIFICATION--EMS/PLOWMAN.../GB0004	7/12/79	7/12/79 14:04	6	2	0:00	0:00
4	LA34+BUILT IN MODEM FIRST IMPRESSION--EMS/WILLIAMS,RC/GB0004	7/12/79	7/12/79 9:06	7	2	0:00	0:00
5	CCA--EMBARASSING TALK WITH MARRILL--EMS/CRAWFORD.../GB0004	7/12/79	7/12/79 14:07	12	4	0:01	0:01
6	INDEX FROM CI/GB0004	7/12/79	10/05/79 2:54	27	10	0:01	0:01
7	TECHNICAL PAPERS PRESENTATION--EMS/CUDMORE.../GB0004	7/12/79	7/12/79 14:16	3	1	0:00	0:00
8	MAGAZINE CANCELLATION FORM LETTER/GB0004						

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                      7/12/79 10/04/79  8:40  2    7        0:00   0:11
 9     MAGAZINE CANCEL--LOCATOR OF USED MACHINERY & EQUIP./GB0004
                      7/12/79  7/12/79 16:34  3    3        0:01   0:07
10     BI + THE MULTIPROCESSORS/STEVE JENKINS.../GB0004
                      7/12/79  7/18/79  8:55  5    3        0:04   0:14
11     MICROPRODUCT DEVELOPMENT STAFF THANK-YOU/WESLEY,ZEH/GB0004
                      7/12/79  7/18/79  4:11  4    2        0:01   0:07
12     ENGINEERING REQUESTS TO MANUFACTURING PAST & FUTURE/OC/GB0004
                      7/16/79  8/03/79 14:12  34   9        0:00   0:42
13     VOTE AND SAGE PROJECTS TOGETHER/KUSIK,FULLER,JOHNSON/GB0004
                      7/18/79  7/18/79  4:59  3    3        0:01   0:04
14     PASCAL -- UC/SD/DELAGI/GB0004
                      7/18/79  7/18/79  4:58  3    2        0:01   0:04
15     OHIO UNIVERSITY--PLEASE CONTACT JIM BELL/ RAJU/GB0004
                      7/19/79  7/25/79  5:17  4    5        0:01   0:13
16     HASBROUCK, REPLY TO /BEVIER HASBROUCK/GB0004
                      7/19/79  9/20/79  7:55  2    2        0:01   0:04
17     MUSEUM LECTURE/BOOK SERIES/GB0004
                      7/23/79  7/23/79  6:41  15   3        0:04   0:08
18     ECC REQUEST FOR COMPUTER ENGINEERING BOOK/HUGO/GB0004
                      7/24/79  8/30/79  0:54  2    3        0:00   0:04
19     PSI THANK YOU/JAESCHKE/GB0004
                      7/24/79  7/26/207  5:48  2    2        0:00   0:05
20     RM80, RA80, RA81, AND UDA/LACROUTE,DEMMER/GB0004
                      7/26/207  7/26/207  6:35  5    3        0:06   0:06
21     UNIVERSTIY OF CAMBRIDGE COMPUTER LABORATORY/WILKES/GB0004
                      7/23/79  7/25/79  5:17  7    6        0:00   0:35
22     CX REVIEW AND DOCK MERGE/SMITH,SHIELDS,KNOWLES/GB0004
                      7/26/207  7/28/79  2:14  14   9        0:04   0:53
23     GOALS FOR OOD FY79/OPERATIONS COMMITTEE/GB0004
                      6/13/78  7/27/79  3:04  7    8        0:01   0:22
24     EBOD PRESENTATION/INTRODUCING SYSTEMBUS 80/GB0004
                      8/02/79  8/02/79 15:03  4    3        0:02   0:02
25     BROWN U INAUGURAL SYMPOSIUM/PETER WEGNER/GB0004
                      7/30/79  7/31/79  0:55  3    4        0:01   0:06
26     ABSTRACT--REJUVINATING EXPERIMENTAL C.S./BROWN U/GB0004
                      7/30/79  7/31/79  0:44  4    5        0:01   0:05
27     GOALS FOR FY79/OPERATIONS COMMITTEE/GB0004
                      7/30/79  7/30/79  2:50  22   8        0:01   0:08
28     GOALS OOD FOR FY80/GB0004
                      8/03/79  8/06/79  0:58  7    3        0:06   0:07
29     TITLES-SOME POSSIBLE TITLES FOR LARRY/OLSEN/GB0004
```

8/06/79 8/06/79 3:38 4 2 0:01 0:01
30 LSI - MORALE AT WX/CUDMORE/CLAYTON..../GB0004
8/06/79 8/08/79 10:02 3 3 0:01 0:03
31 WHIRLWIND - HISTORICAL REPORT YOUR WROTE?/WILDES/GB0004
8/06/79 8/08/79 10:03 4 5 0:01 0:12
32 VIDEO TELECONFERENCING SYSTEM/KOTOK/GB0004
8/06/79 8/10/79 3:28 7 7 0:01 0:15
33 NATL.RES. COUNCIL--MEMBER C.SCIE.&TECH.BRD/GOLDHABER/GB0004
8/07/79 8/07/79 6:59 3 3 0:00 0:10
34 FORWARD FOR KNUTH BOOK/GB0004
8/20/79 8/27/79 6:03 8 5 0:02 0:51
35 TEX--LET'S BUILD PRODUCT AND INTERNAL TYPSETTING/GB0004
8/20/79 8/27/79 5:51 7 4 0:00 0:20
36 BRITISH SCIENCE MUSEUM--GIVE -8/BORROW PARTS?/JANE RAIMES/GB0004
8/20/79 8/21/79 0:00 3 4 0:00 0:06
37 THANK YOU FOR ABACUS/CALCULATOR COMBO/WATANABE/GB0004
8/20/79 8/21/79 0:32 2 2 0:10 0:13
38 TERMINAL SPECIALS (E.G. LA124)/GB0004
8/20/79 8/21/79 0:03 3 2 0:00 0:05
39 PRINTER--CENTRONICS QUIETWRITER/CROUSE ET AL/GB0004
8/21/79 8/21/79 1:13 6 1 0:02 0:02
40 SRC--SCIENCE RESEARCH COUNCIL,RUTHERFORD LAB/HOPGOOD/GB0004
8/23/79 8/24/79 7:26 3 2 0:02 0:30
41 ORG.ANNOUNCEMENT--HOLMAN,SAVIERS,FULLER/ENG.MGRS/GB0004
8/29/79 8/29/79 5:16 7 1 0:01 0:01
42 REQUEST FOR MNEMODEX SYSTEM/GORDON/GB0004
8/30/79 8/30/79 4:48 2 2 0:00 0:01
43 BROWN UNIVERSITY--REJUVENATING COMPUTER SCIENCE/GB0004
9/05/79 9/06/79 2:12 16 10 0:01 0:48
44 RENSSELAER POLYTECHNIC INSTITUTE/FRANKLIN/GB0004
9/10/79 9/10/79 1:25 3 1 0:05 0:05
45 BIRNBAUM (HEAD OF CS RESEARCH, IBM WATSON LABS/OLSEN.../GB0004
9/10/79 9/14/79 4:02 8 5 0:02 0:15
46 NOMINATION FOR SAM--ALLAN T. WATERMAN AWARD/GB0004
9/10/79 9/10/79 1:59 7 2 0:01 0:01
47 WHO HAS CHARTER FOR VAX/VMS ARCHITECTURE/FULLER.../GB0004
9/11/79 9/11/79 8:28 3 3 0:00 0:14
48 PUSHING BASIC+2 (I.E. NEW VAX-11 BASIC) AT DECUS/DALEY.../GB0004
9/13/79 9/14/79 6:30 4 7 0:01 0:39
49 DOING ADVANCED DEVELOPMENT/MARSHALL,PARKE/GB0004
9/13/79 9/14/79 5:33 3 2 0:04 0:09
50 PASCAL STRATEGY/JOHNSON,KEATING,WHITE.../GB0004

9/13/79 9/14/79 6:52 4 4 0:00 0:20
51 INTERFACE TO STANFORD ON THEIR VLSI + TEX WORK/KUSIK,HALIO.../GB0004
9/13/79 9/14/79 5:53 3 2 0:02 0:17
52 BUSINESS & SOCIAL RESEARCH INSTITUTE/VEDIN/GB0004
9/14/79 9/14/79 2:34 3 1 0:08 0:08
53 CORNELL UNVIERSITY--NOMINATION FOR SAM FULLER/BALLANTYNE/GB0004
9/17/79 9/17/79 4:24 3 2 0:00 0:02
54 PURGING/USING OUR CAPITAL EQUIPMENT/JOHNSON,CROWTHER.../GB0004
9/18/79 9/19/79 6:33 3 3 0:03 0:24
55 PERSONNEL--X'S REASONS TO LEAVE DEC/GB0004
9/21/79 9/21/79 6:06 8 4 0:02 0:44
56 EDITORS AND FORMS LANGUAGES/OOD.../GB0004
9/21/79 9/26/79 5:49 8 8 0:01 0:48
57 MANUFACTURING - SPRINGFIELD/TS04/TU77--EMS/SAVIERS.../GB0004
9/21/79 9/21/79 7:01 2 1 0:00 0:00
58 CHICAGO OFFICE VISIT AND THEIR OBSERVATIONS/GB0004
9/25/79 9/26/79 5:04 13 7 0:01 0:26
59 CMU--SPICE UPDATE + MUSEUM ARTIFACTS/WACTLAR/GB0004
9/25/79 9/26/79 6:36 10 7 0:00 0:19
60 CMU EXPENSES FOR 9/19/79/JACKMAN/GB0004
9/25/79 9/26/79 5:57 3 3 0:00 0:17
61 MEETING WITH KEN-CHARTERS,PHILOSOPHY,KEEPING PEOPLE/OLSEN/GB0004
9/26/79 9/27/79 7:12 7 8 0:00 0:20
62 MUSEUM THANKS/WORKERS/GB0004
9/26/79 9/27/79 2:57 4 5 0:00 0:09
63 WILKES THANK YOU LETTER/WILKES/GB0004
9/26/79 9/27/79 5:59 7 10 0:01 0:22
64 TECHNISCHE HOGESCHOOL DELFT/VANDEGOOR/GB0004
9/27/79 9/27/79 6:02 3 2 0:00 0:07
65 HITACHI RESEARCH LAB/HAMEDA/GB0004
10/04/79 10/04/79 16:03 3 3 0:00 0:03
66 MEETING CONFIRMATION--OFFICE SEC OF DEFENSE/FISHER/GB0004
10/04/79 10/05/79 2:15 3 4 0:01 0:06
67 BASIC + 2 ON VAX--EMS/SNYDER/GB0004
10/05/79 10/05/79 2:30 1 1 0:00 0:00
68 LA34--EMS/CLAYTON/GB0004
10/05/79 10/05/79 2:32 3 1 0:00 0:00
70 WILKES OFFER--EMS/JIM BELL/GB0004
10/05/79 10/05/79 2:36 3 1 0:00 0:00
71 BABBAGE, CHARLES INSTITUTE--EMS/OLSEN/GB0004
10/05/79 10/05/79 2:38 3 1 0:00 0:00
72 YALE CONTRIBUTION--EMS/JIM BELL/GB0004

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                          10/05/79 10/05/79  2:40  4    1        0:00   0:00
 73     MAIL PRODUCT LINE--EMS/OLSEN/GB0004
                          10/05/79 10/05/79  2:41  2    1        0:00   0:00


Name: GB4/83, # of Docs: 26, Blocks left: 449 (of 779)
-------------------------------------------------------------------------------
Number  Name                     Created  Modified       Size Version  Last   Total
-------------------------------------------------------------------------------
  1
                           4/28/83  9/12/83  1:48  4    76       0:00   0:26
  2     historical exhibit and paper DONE 5/9/83 Mon 9:10:19
                           5/08/83  5/09/83  7:10  9    3        0:03   0:53
  3     ci clusters DONE 6/6/83
                           5/04/83  6/06/83 11:09  4    3        0:00   0:47
  4     cutler's group  DONE 6/6/83
                           5/04/83  6/06/83 10:48  13   5        0:00   1:57
  5     si valley engineering DONE 6/6/83
                           5/04/83  6/06/83 11:00  20   5        0:11   1:53
  6     supermicro (see the memo for title) DONE 6/6/83
                           5/04/83  6/06/83 11:05  4    3        0:01   0:30
  7     AI, LISP, Visit at Stanford, and us. DONE 6/6/83
                           5/04/83  6/06/83 12:43  27   7        0:00   3:44
  8     A microvax pc clusters group needs to be formed DONE 6/6/83
                           5/04/83  6/18/83  6:27  7    5        0:00   0:43
  9     Why you'd think twice about working in the low end HOLD 6/13
                           6/11/83  6/18/83  0:09  3    5        0:08   0:26
 10     Why we must enter into arrangement w trilogy HOLD 6/13/83
                           6/11/83  6/24/83  0:12  8    9        0:11   1:31
 11     PAPER: DIGITAL ENVIRONMENT FOR COMPUTING, 6/18 /GB4
                          10/20/83 10/20/83 13:49  25   1        0:01   0:01
 12     PAPER: DIGITAL ENVIRONMENT FOR COMPUTING AS OF 10/17/83 /GB4
                          10/20/83 10/20/83 13:52  41   2        0:00   0:03
 13     NOTE TO SAM WIN, JACK RE DEC PRODUCTS... /GB4
                          10/20/83 10/20/83 13:54  9    1        0:01   0:01
 14     LASL letter DONE 6/14/83
                           6/11/83  6/13/83  7:08  3    3        0:00   0:18
 15     Wheel of reincarnation paper HOLD 6/13/83
                           6/11/83  6/13/83  7:11  1    3        0:00   0:09
 16     Print Station: We must redirect it DONE 6/13/83 Mon
                           6/11/83  6/13/83  9:46  20   7        0:00   4:45
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 17     QVSS DONE 6/13/83 Mon
                             6/11/83  6/13/83  7:06  6    2        0:01   0:40
 18     we have to sell pro's and ci clusters DONE 6/13/83 Mon
                             6/11/83  6/13/83  7:00  6    3        0:01   0:31
 19     let's hire david warren DONE 6/13/83 Mon
                             6/12/83  6/13/83  7:07  3    3        0:01   0:15
 20     crisis in engineering training DONE 6/13/83 Mon
                             6/12/83  6/13/83  6:40  6    3        0:06   0:48
 21     why a head count freeze would be good (facilitator/processors versus content folks) HOLD
6/13/83
                             6/12/83  6/13/83  7:11  3    2        0:01   0:18
 22     are we fragmenting ourselves too much HOLD 6/13/83
                             6/12/83  6/13/83  7:10  1    2        0:00   0:10
 23     proposal: I would make BI an industry standard bus
                             6/18/83  6/18/83  4:04  1    1        0:04   0:04
 24     INDEX
                             9/12/83  9/12/83  1:49  10   1        0:00   0:00
 25     the stations DONE
                             6/19/83 10/20/83 13:43  15   2        0:00   2:10
 26     dean's talk DONE 6/21/83
                             6/20/83 10/20/83 13:43  29   4        0:01   2:41


Name: GB0005, # of Docs: 57, Blocks left: 98 (of 627)
-------------------------------------------------------------------------------
Number  Name                     Created  Modified      Size Version  Last   Total
-------------------------------------------------------------------------------
  1
                            10/11/79 11/20/79 10:39  8    104      0:05   1:09
  2     PBS - GB MAIL ANALYSIS/GB0005
                            10/11/79 10/15/79  9:18  66   24       0:03   7:01
  3     BRITISH SCIENCE MUSEUM--SENDING -8/JANE RAIMES/GB0005
                            10/11/79 10/12/79  5:28  3    4        0:00   0:01
  4     ABSTRACT--PROFESSION BASED SYSTEM,CONSIDERATIONS ON THE DESIGN/GB0005
                            10/15/79 10/17/79 17:03  3    10       0:01   0:10
  5     FIELD MATRIX/DAVIS/GB0005
                            10/15/79 10/17/79  8:37  2    6        0:00   0:11
  6     DIGITAL MORALE/OC,OOD/GB0005
                            10/15/79 10/17/79  8:31  3    5        0:01   0:14
  7     MUSEUM COMMITTEE AGENDA/DISTRIBUTION/GB0005
                            10/15/79 10/31/79  4:34  4    4        0:07   0:30
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8	TERMINALS OBSOLETE TO TPL AND RIO/CROWTHER--EMS/GB0005							
		10/15/79	10/23/79	16:30	2	3	0:00	0:00
9	DEC,VISITING(OVERSEAS)OFFICES,PLANTS,ENG./JOHNSON.../GB0005							
		10/15/79	10/17/79	8:45	6	7	0:00	0:26
10	BRAZIL - THANK YOU LETTER/STEINBERG/GB0005							
		10/15/79	11/02/79	5:37	5	4	0:00	0:34
11	PAPER, NATIONAL HIGH TECHNOLOGY, A C. INDUSTRY--OLD (10-15-79)							
		10/15/79	0/00/00	3:28	50	9	0:31	3:52
12	PERSONNEL, RESIGNATION--BRUCE HURWITZ/BJ,LP--EMS/GB0005							
		10/16/79	10/23/79	16:26	2	4	0:00	0:04
13	BRAZIL - THANK YOU LETTER/VISSER/GB0005							
		10/16/79	11/02/79	5:37	5	4	0:00	0:02
14	BRAZIL - UNIVERSITY OF SAO PAULO/MOSCATO/GB0005							
		10/17/79	11/08/79	11:05	5	10	0:01	0:29
15	BRAZIL - UNIVERSITY OF CAMPINAS/MACHADO/GB0005							
		10/17/79	10/17/79	14:23	3	2	0:02	0:05
16	BRAZIL - UNIVERSITY OF RIO/MARINHO/GB0005							
		10/17/79	11/06/79	6:56	4	6	0:00	0:19
17	2080 GOALS--EMS/FAGERQUIST,MCBRIDE.../GB0005							
		10/18/79	10/18/79	16:43	3	6	0:01	0:15
18	EMS (VS WPS) AND OUR FUTURE PRODUCT/OOD.../GB0005							
		10/18/79	10/23/79	16:27	9	15	0:00	0:29
19	PROMOTIONAL LITERATURE RESPONSIBILITY/KENT/GB0005							
		10/22/79	10/22/79	8:28	2	2	0:04	0:04
20	CI-HIGH COST OF THE CI-BUT KEEP GOING/RODGERS,FULLER...--EMS/GB0005							
		10/22/79	10/23/79	16:26	3	6	0:00	0:09
21	NAVAL RESEARCH LABORATORY/SLAGLE/GB0005							
		10/22/79	10/23/79	12:20	3	3	0:01	0:03
22	PAPER, NATIONAL HIGH TECHNOLOGY, A C. INDUSTRY--NEW (10-22-79)							
		10/22/79	10/22/79	15:30	70	1	0:04	0:04
23	BELL LABORATORIES--OLD/MCGILL/GB0005							
		10/22/79	10/22/79	16:19	4	2	0:03	0:03
24	ENG. + MANUFACTURING ORGANIZED TO FACE FUTURE COMPETITORS/GB0005							
		10/22/79	12/04/79	2:55	12	12	0:01	0:59
25	BELL LABORATORIES--NEW/MCGILL/GB0005							
		10/23/79	10/23/79	10:01	10	4	0:05	0:13
26	RANDELL, RE YOUR CONSULTING/RANDELL/GB0005							
		10/23/79	10/23/79	16:08	7	4	0:01	0:04
27	DP BROCHURE AND PRESENTATION TO BOD/DEMMER,PLOWMAN.../GB0005							
		10/23/79	10/23/79	10:26	3	3	0:01	0:06
28	TERMINALS-COLOR AND THEIR USE IN CAD--EMS/GB0005							
		10/23/79	10/23/79	16:25	2	7	0:00	0:11

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29     TEX--CONFIRMING YOUR STRATEGY TEX TYPESET SYS.--EMS/FORD/GB0005
                           10/23/79 10/23/79 14:27  2    4        0:00   0:05
30     JAWS--CONGRATULATIONS AT THIS DECISION POINT--EMS/CLAYTON/GB0005
                           10/24/79 10/25/79 17:05  2    5        0:01   0:04
31     TPS - YOUR TPS PRESENTATION/DALEY--EMS/GB0005
                           10/24/79 10/24/79  7:09  2    6        0:01   0:08
32     NEW 11/44 PROCESSOR--DRAFT/GB0005
                           10/26/79 12/04/79  3:22  22   9        0:01   0:02
33     PERSONNEL, KEEPING VERSUS RECRUITING--EMS/MEYER,DAVIS/GB0005
                           10/26/79 10/26/79 13:28  2    4        0:04   0:09
34     COST TARGETS--EMS/ROSING/GB0005
                           10/26/79 10/26/79 14:55  1    4        0:00   0:02
35     TRAX 1.5--CONGRATULATIONS--EMS/CADY/GB0005
                           10/29/79 10/29/79  5:34  2    4        0:00   0:07
36     L.COST (ICCS)--EMS/VAN ROEKENS.../GB0005
                           10/29/79 10/29/79  5:30  3    4        0:00   0:14
37     ETHERNET,XEROX-DEC ANNOUNCEMENT OF--EMS/CLAYTON,FULLER/GB0005
                           10/29/79 10/29/79  5:03  2    4        0:01   0:08
38     PBS - SLIDES/GB0005
                           10/29/79 10/31/79  6:18  20   10       0:04   0:61
39     PBS - SLIDES PART II/GB0005
                           10/29/79 10/31/79  6:14  18   13       0:04   2:43
40     11/24--EMS/CADY/GB0005
                           10/30/79 10/30/79  1:00  2    1        0:00   0:00
41     1990+ STRATEGY STATEMENT/FINN,CHAMBERLAIN/GB0005
                           10/30/79 11/02/79  0:02  8    9        0:01   0:53
42     VMS-DISTRIBUTING DEVELOPMENT--EMS/JOHNSON,HEFFNER,CARCHIDI/GB0005
                           10/30/79 10/31/79  2:08  3    6        0:00   0:09
43     PL/1--EMS/PORTNER,LYLE,JOHNSON/GB0005
                           10/31/79 10/31/79  2:07  1    5        0:01   0:04
44     PL/1 AT DECUS--EMS/CUTLER/GB0005
                           10/31/79 10/31/79  3:32  2    4        0:00   0:06
45     COMPENSATION--MONOTONICITY OF PAY-A PROBLEM?--EMS/OC,BURNS/GB0005
                           10/31/79 10/31/79  3:35  3    4        0:00   0:13
46     TRAX 1.5 PROPOSED DIRECTION--EMS/JOHNSON,DALY.../GB0005
                           10/31/79 11/01/79 11:47  3    6        0:00   0:15
47     DOD SOFTWARE PROGRAM--EMS/J.BELL/GB0005
                           11/01/79 11/01/79  1:27  2    6        0:01   0:17
48     1990 SPACE STRATEGY & PLAN/1990 COMMITTEE/GB0005
                           11/05/79 11/06/79  9:01  16   6        0:01   0:42
49     NI FOR INTERCONNECTING COMET/MERCURY--EMS/GILBERT,VANROEKENS/GB0005
                           11/05/79 11/06/79  0:58  1    5        0:00   0:02
```

50	VT78 FLOPPY-FAN IN--EMS/CLAYTON,SAVIERS,SMITH/GB0005	10/31/79	10/31/79 9:01	2	5	0:00	0:05
51	EMS DESIGNER/MUMPS PROJ. LEADER--EMS/JOHNSON,CRAWFORD.../GB0005	10/31/79	10/31/79 9:01	2	5	0:00	0:05
52	ETHERNET ADVANCED DEVELOPMENT--EMS/BELL,PORTNER/GB0005	10/31/79	10/31/79 9:01	2	6	0:00	0:06
53	IEEE - NATIONAL ENGINEERING FOUNDATION/WEINSCHEL/GB0005	11/05/79	11/09/79 0:33	16	14	0:03	1:10
54	VMS ON NEBULA--CONGRATULATIONS--EMS/SOFIO.../GB0005	11/07/79	11/07/79 1:05	3	5	0:01	0:14
55	OFFICE DESIGN--OFFICE OF CENTRAL ENGINEERING/GB0005	11/07/79	11/07/79 2:20	11	5	0:02	0:13
56	MUSEUM JOBS--DIGITAL COMPUTER MUSEUM - PHASE TWO/GB0005	11/07/79	11/07/79 2:45	14	5	0:00	0:22
57	SCIENCE MAGAZINE/ABELSON/GB0005	11/07/79	11/08/79 11:35	6	9	0:02	0:18

Name: GB6 , # of Docs: 6, Blocks left: 731 (of 779)

Number	Name	Created	Modified	Size	Version	Last	Total
1		6/21/83	6/21/83 14:50	1	5	0:00	0:00
2	TRAINING: ENGR. SKILLS=PROJECT/EMS/6-13/EMC/GB6	6/21/83	6/21/83 14:55	6	2	0:01	0:01
3	PRO & CI: WE HAVE TO SELL/EMS/6-13/SHIELDS/GB6	6/21/83	6/21/83 14:57	13	2	0:02	0:02
4	QVSS: THANKS FOR GETTING/EMS/6-13/HUETTNER/GB6	6/21/83	6/21/83 14:58	8	2	0:01	0:01
5	COMMUNICATIONS: NEW PRODUCTS/EMS/6-14/HUETTNER/GB6	6/21/83	6/21/83 14:59	4	2	0:01	0:01
6	EMS PRODUCTIVITY:MASSIVE FOR USER/EMS/6-14/CRAWFORD/GB6	6/21/83	6/21/83 15:00	4	2	0:01	0:01

Name: GB9A , # of Docs: 4, Blocks left: 687 (of 779)

Number	Name	Created	Modified	Size	Version	Last	Total

```
  1
                            12/04/84  1/25/85  0:57  1    7        0:00   0:00
  2     NCC STEVE'S VERSION 12/4, GB REWRITE
                            12/04/84  1/25/85  1:12  73   3        0:00   0:01
  3     slides--ECC DUE DILIGENCE MEETING
                             1/25/85  1/25/85  1:32  4    3        0:01   0:45
  4     SLIDE - DUE DILIGENCE MEETING 1/26/85
                             1/25/85  1/25/85  1:31  6    2        0:00   0:13

<n>on embargoing ibm pc's &use micros for super computers SENT VAX <#>9<>
<n>swern expenses letter CORRECTED/SENT VAX <#>8<>
<n>Admiral Inman <#>7<>
<n>MUDGE CONSULTATION LETTER <#>6<>
<n>INDEX <#>5<>
<n>Mrs. Bellisario <#>4<>
<n>gsg letter and bill <#>3<>
<n>GB18 GB Consulting <#>2<>


Name: GB18  , # of Docs: 9, Blocks left: 702 (of 779)
-------------------------------------------------------------------------------
Number  Name                     Created  Modified       Size Version  Last   Total
-------------------------------------------------------------------------------
  1
                             9/09/84 11/30/84  2:06  2    10       0:00   0:00
  2     GB18 GB Consulting
                             9/09/84  0/00/00  2:06  1    2        0:00   0:03
  3     gsg letter and bill
                             9/09/84  9/12/83  7:27  5    4        0:01   1:63
  4     Mrs. Bellisario
                             9/09/84  9/12/83  7:25  5    4        0:02   0:30
  5     INDEX
                             9/12/83  9/12/83  1:08  3    1        0:00   0:00
  6     MUDGE CONSULTATION LETTER
                            10/12/84  0/00/00  1:34  24   8        0:09   3:51
  7     Admiral Inman
                            10/13/84  0/00/00  2:20  6    5        0:15   1:61
  8     swern expenses letter CORRECTED/SENT VAX
                            10/28/84  0/00/00  1:26  4    2        0:03   0:33
  9     on embargoing ibm pc's &use micros for super computers SENT VAX
                            11/29/84  1/25/85  7:33  9    5        0:00   0:51
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Name: GBELL , # of Docs: 6, Blocks left: 526 (of 627)

Number	Name	Created	Modified	Size	Version	Last	Total
1		3/09/77	9/27/83 6:24	1	11	0:00	0:00
2	publication/history index	3/09/77	5/04/77 3:00	30	9	0:00	0:00
3	office file index	3/09/77	3/09/77 10:22	32	2	0:00	0:00
4	bell vita-long	4/29/77	2/05/79 11:07	24	8	0:01	0:04
5	bell vita - 3/4 page	7/22/77	7/22/77 2:25	4	1	0:00	0:00
6	Index from CI/GBELL	3/29/78	3/29/78 2:29	3	1	0:00	0:00

Name: GORDON, # of Docs: 8, Blocks left: 110 (of 627)

Number	Name	Created	Modified	Size	Version	Last	Total
1		5/04/81	2/16/86 0:01	1	84	0:01	0:06
2	EM talk outline	3/20/82	2/16/86 0:01	20	8	0:00	3:19
3	fortune (PROCESSED)	0/00/00	2/16/86 0:02	6	5	0:01	1:38
4	process forum talk	4/11/83	2/16/86 0:03	7	3	0:01	0:43
5	PROCESS REQUIRED TO GENERATE A COMPUTER AS OF 4/9/82	4/09/82	2/16/86 0:03	150	38	0:00	9:29
6	Compcon script	1/28/84	2/04/84 0:03	85	13	0:01	22:45
8	ARCH. & IMPL. WITHOUT BRACKETED AREAS - 4/22/82	4/23/82	4/26/82 13:42	115	12	0:00	5:20
9	sunday backup	4/25/82	4/26/82 13:43	119	4	0:01	0:09

Name: GORDON, # of Docs: 61, Blocks left: 128 (of 627)

Number	Name	Created	Modified	Size	Version	Last	Total
1		4/26/78	3/28/79 2:45	4	64	0:00	0:00
2	running 8's on 11's	4/26/78	4/28/78 10:48	2	2	0:02	0:04
3	high end vax-10s-20s-30s	4/26/78	4/28/78 10:52	4	4	0:01	0:05
4	rockwell/comm study	4/26/78	4/28/78 10:53	3	2	0:01	0:07
5	promo for vax/& ncc	4/26/78	4/28/78 10:59	4	2	0:05	0:12
6	esg marketplace	4/28/78	5/01/78 0:07	14	7	0:01	1:04
7	bus based chips/8086	5/01/78	5/02/78 4:35	14	6	0:01	1:08
8	sales offices impressions	5/01/78	5/12/78 1:55	44	9	0:03	2:23
9	icc bus	5/01/78	5/02/78 3:00	11	5	0:01	0:37
10	mccredie	5/01/78	5/02/78 2:11	6	5	0:02	0:26
11	comm/networks reorganization	5/01/78	5/02/78 4:32	15	6	0:00	0:39
12	traub/newell	5/01/78	5/02/78 11:32	11	6	0:00	0:35
13	phister	5/01/78	5/02/78 2:23	3	4	0:01	0:13
14	RAME goals and constraints	5/01/78	5/02/78 2:59	9	3	0:01	0:37
15	brooks	5/02/78	5/05/78 0:05	9	4	0:05	0:48
16	simulating computers	5/02/78	5/02/78 2:15	13	6	0:00	0:28
17	disk and crt area	5/03/78	7/05/78 11:20	3	3	0:01	0:05
18	next annual report	5/03/78	5/03/78 1:28	4	3	0:01	0:03

19	memory price disparity	5/08/78	5/10/78	10:36	4	4	0:01	0:08
20	terminals/11-based	5/08/78	5/10/78	10:48	12	5	0:04	0:38
21	system revenue 1980's	5/08/78	5/09/78	10:28	11	7	0:01	0:43
22	busses: help!	5/08/78	5/09/78	9:26	7	4	0:01	0:11
23	ood secretaries	5/11/78	6/01/78	9:33	2	3	0:02	0:22
24	technical director	5/12/78	5/16/78	2:31	6	4	0:01	0:29
25	hydra task force	5/12/78	5/12/78	1:32	3	1	0:10	0:10
26	sales support	5/12/78	5/15/78	9:21	4	4	0:02	0:05
27	cornell	5/15/78	5/16/78	2:32	2	2	0:01	0:10
28	slides	5/22/78	5/22/78	9:44	6	11	0:01	0:34
29	vax-11,11's,10's, vs 360/370	5/22/78	5/22/78	12:16	9	5	0:00	0:30
30	chu	5/23/78	5/23/78	10:03	2	1	0:05	0:05
31	portability/warterloo	5/26/78	5/31/78	1:01	10	6	0:09	1:02
32	fougere	5/31/78	6/01/78	9:00	3	2	0:00	0:05
33	pohlman	5/31/78	6/01/78	9:07	4	5	0:07	0:16
34	temp	5/31/78	7/06/78	2:28	2	4	0:00	0:09
35	mit program/demmer	6/19/78	6/19/78	14:04	3	4	0:01	0:05
36	budget cuts/physical changes	6/19/78	6/19/78	9:09	4	1	0:11	0:11
37	ROM/software	6/19/78	6/19/78	13:04	4	4	0:04	0:11
38	NCC attendees and supports	6/19/78	6/26/78	10:18	8	6	0:00	0:32
39	CAD strategy	6/19/78	6/19/78	11:58	4	2	0:02	0:07

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40     8086-PDP-11 comparison
                           6/19/78  6/20/78 11:08  8    10        0:01   0:33
41     fortran
                           6/19/78  6/20/78  9:51  8    3         0:04   0:27
42     VLSI RAD Project
                           6/19/78  6/20/78 10:11  5    2         0:19   0:29
43     cca mail system
                           6/19/78  6/20/78  9:38  9    6         0:06   0:33
44     siewiorek
                           6/19/78  6/19/78 13:11  2    1         0:03   0:03
45     australian grants
                           6/20/78  6/20/78 10:59  2    3         0:00   0:03
46     computer engineering course
                           6/26/78  6/28/78  9:34  4    2         0:05   0:13
47     R80 and RL02
                           6/26/78  6/28/78  9:10  6    6         0:02   0:23
48     BLISS in Colorado
                           6/26/78  6/28/78  9:41  4    2         0:07   0:17
49     travel to colorado/teleconferencing
                           6/26/78  6/28/78  9:28  5    2         0:12   0:16
50     pickett
                           6/29/78  8/25/78  4:36  3    3         0:00   0:08
51     typeset
                           7/05/78  8/24/78  9:03  9    7         0:01   0:21
52     colorado/disk
                           7/05/78  8/24/78  9:02  14   7         0:01   0:28
53     esgwp
                           7/05/78  7/17/78 10:34  19   7         0:00   0:23
54     org.changes
                           7/05/78  7/06/78  1:25  5    5         0:02   0:10
55     arvind
                           7/05/78  7/06/78  2:24  3    4         0:06   0:18
56     hedges
                           7/06/78  7/06/78  3:00  3    5         0:00   0:14
57     wecker
                           7/06/78  7/06/78  3:01  2    2         0:00   0:04
58     engineering managers
                           7/06/78  7/06/78  2:34  21   4         0:01   0:01
59     karlstrom
                           7/06/78  7/06/78  3:00  2    3         0:01   0:07
60     dulchinos
                           7/06/78  7/06/78  2:48  2    1         0:04   0:04
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Number	Name	Created	Modified		Size	Version	Last	Total
61	Index from CI/GORDON	3/28/79	3/28/79	2:46	19	1	0:00	0:00

Name: HEURIS, # of Docs: 10, Blocks left: 438 (of 627)

Number	Name	Created	Modified		Size	Version	Last	Total
1		2/01/82	0/00/00	0:00	1	16	0:00	0:02
2	HEURISTICS UPDATE	2/01/82	0/00/00	0:04	43	32	0:04	5:57
3	short heuristics	2/27/82	2/27/82	18:08	12	6	0:02	0:28
4	slides heuristics	2/27/82	3/15/82	10:41	28	19	0:13	4:51
5	backup heuristics	3/13/82	0/00/00	1:45	44	5	0:50	0:60
6	SLIDES - HEURISTICS - EDITED FOR PROJECTION	3/16/82	3/28/82	0:01	29	3	0:01	0:03
7	test	0/00/00	8/04/82	13:22	1	2	0:00	0:00
8	Japan advantages DUPLICATE OF ABOVE - DONE 5/3/82	5/02/82	5/03/82	13:20	6	6	0:00	2:20
9	japs - DONE 5/3/82	5/02/82	5/03/82	13:20	6	2	0:00	0:04
10	gate array ems done 8/4/82 Wed 13:21	0/00/00	8/04/82	13:18	4	3	0:01	0:20

Name: INDEX , # of Docs: 3, Blocks left: 419 (of 627)

Number	Name	Created	Modified		Size	Version	Last	Total
1		7/25/78	3/29/78	3:00	1	22	0:00	0:00
2	Index from CI/INDEX	3/29/78	3/29/78	3:00	2	1	0:00	0:00
11	index.idx	7/27/78	7/27/78	6:29	202	3	0:54	0:54

Name: LOUISE, # of Docs: 74, Blocks left: 47 (of 627)

Number	Name	Created	Modified	Size	Version	Last	Total
1		7/10/78	5/02/85 0:48	4	106	0:00	0:03
2	commission plan	7/10/78	7/10/78 13:36	7	5	0:00	0:14
3	v11sys	7/10/78	7/10/78 12:50	8	4	0:01	0:10
4	chips	7/10/78	7/11/78 0:51	9	6	0:01	0:22
5	people	7/10/78	7/10/78 12:51	7	5	0:00	0:05
6	nds	7/10/78	7/10/78 12:52	6	4	0:01	0:15
7	info.arch	7/10/78	7/11/78 0:34	2	2	0:02	0:05
8	arpa/vlsi effort	7/10/78	7/11/78 0:31	4	4	0:01	0:09
9	toronto	7/10/78	7/10/78 12:52	2	3	0:00	0:05
10	cohen	7/10/78	7/12/78 14:00	6	5	0:01	0:36
11	8086	7/11/78	7/12/78 12:44	3	2	0:02	0:05
12	franklin	7/11/78	7/12/78 13:55	5	4	0:00	0:26
13	unibus/mini i/o	7/12/78	7/12/78 12:51	4	3	0:03	0:12
14	lindamood	7/13/78	7/13/78 11:45	8	8	0:00	0:32
15	labels form	7/14/78	7/14/78 12:50	1	2	0:01	0:01
16	OOD	7/14/78	10/23/78 5:08	1	6	0:00	0:01
17	mkt	7/14/78	7/14/78 12:10	1	2	0:00	0:00
18	plm	7/14/78	7/14/78 13:44	2	4	0:10	0:10
19	mj						

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                         8/01/78  8/14/78  2:56  11   5        0:01   0:35
20     temp
                         7/18/78  9/29/78  5:00  2    35       0:00   0:23
21     bell diary summer 78-Japan, Australia, Fiji
                         7/20/78  7/28/78 12:50  11   6        0:01   1:06
22     jones
                         7/20/78  7/21/78  3:00  2    2        0:00   0:04
23     flores
                         7/27/78  7/27/78  4:08  2    2        0:00   0:04
24     low power bipolar gate array
                         7/28/78  7/28/78 10:16  4    1        0:18   0:18
25     Fujitsu's M-200
                         7/28/78  1/24/79  3:11  6    5        0:00   0:14
26     commitment to nec
                         7/28/78  7/28/78 11:24  6    3        0:04   0:16
27     Bell Log II
                         7/28/78 10/12/78 11:11  84   21       0:00   6:54
28     smart/jones jobs
                         8/10/78  8/14/78  2:43  2    4        0:00   0:03
29     vms
                         8/14/78  1/24/79  3:10  3    4        0:00   0:08
30     clocks
                         8/14/78  8/15/78 10:00  4    3        0:03   0:19
31     rms
                         8/14/78  1/24/79  3:09  3    3        0:00   0:12
32     applications software
                         8/14/78  1/24/79  3:08  7    3        0:00   0:23
33     bad report
                         8/14/78  8/15/78 10:21  2    3        0:00   0:04
34     sony
                         8/14/78  8/15/78  9:54  6    4        0:08   0:23
35     kiviat graphs
                         8/15/78  8/15/78 12:52  2    1        0:04   0:04
36     nec
                         8/15/78  8/15/78 12:55  3    1        0:03   0:03
37     sight guide
                         8/15/78  8/15/78 12:59  3    1        0:04   0:04
38     cpu/system upgrades
                         8/15/78  8/23/78  0:35  3    2        0:01   0:06
39     rsts upgrade with vax
                         8/15/78  8/23/78  0:40  4    5        0:03   0:08
40     administrative unit
```

8/15/78 8/15/78 13:15 3 1 0:04 0:04
41 instructions
8/16/78 11/15/78 5:11 24 7 0:27 1:32
42 araki
8/17/78 8/17/78 13:00 2 3 0:00 0:07
43 SIGARCH list
8/17/78 8/17/78 10:13 4 1 0:41 0:41
44 first impressions--japan
8/22/78 2/01/79 3:27 67 15 0:00 4:08
45 dot matrix
9/06/78 1/24/79 3:07 3 3 0:00 0:06
46 abstract
9/06/78 9/14/78 12:05 5 9 0:00 0:29
47 corell/congratulations
9/06/78 1/24/79 3:02 6 6 0:01 0:36
48 iwama
9/06/78 9/11/78 9:03 3 5 0:01 0:19
49 far east mfg
9/06/78 9/08/78 10:39 9 7 0:01 0:26
50 jordan/wulf
9/06/78 9/08/78 11:47 5 3 0:00 0:12
51 external mfg go-away
9/06/78 1/24/79 3:05 4 3 0:00 0:26
52 japan trip diary index
9/06/78 10/12/78 11:13 11 9 0:01 0:36
53 COBOL specification
9/06/78 9/08/78 11:15 5 2 0:06 0:12
54 css controller for RL01
9/06/78 9/08/78 9:53 3 5 0:00 0:05
55 interaction with teradyne
9/13/78 9/15/78 11:50 4 4 0:01 0:24
56 goals/oc/new strategy
9/14/78 1/24/79 3:05 3 7 0:02 0:18
57 market domination
9/14/78 2/01/79 3:27 11 8 0:01 0:42
58 hamada
9/14/78 9/19/78 10:08 4 4 0:00 0:12
59 oc strategy presentation
9/15/78 9/17/78 13:36 6 7 0:03 0:26
60 floating point std
9/15/78 9/15/78 11:58 2 2 0:02 0:02
61 HSC50/NDS

```
                              9/15/78  9/17/78 13:32  3    3        0:01   0:09
 62     rms/dcl compatibility
                              9/17/78  9/17/78 13:30  3    1        0:04   0:04
 63     financial review
                              9/19/78  9/19/78 14:04  2    2        0:00   0:02
 64     oc sec
                              9/20/78  9/20/78  8:52  3    2        0:01   0:02
 65     slides dist
                              9/20/78  9/20/78 13:54  2    1        0:02   0:02
 66     lou/mj/ohio
                              9/20/78  9/20/78 14:40  2    2        0:03   0:08
 67     messages--9/21
                              9/21/78  9/21/78 14:39  6    1        0:16   0:16
 68     messages 9/22
                              9/22/78  9/22/78 11:56  4    1        0:14   0:14
 69     product managers memo
                              9/25/78  1/24/79  3:00  4    5        0:00   0:27
 70     telephone 9/25
                              9/25/78  9/25/78  4:45  6    1        0:21   0:21
 71     nsf workshop
                              9/29/78  9/29/78  2:21  6    2        0:22   0:22
 72     melton
                              9/29/78  9/29/78  3:32  2    1        0:06   0:06
 73     code listing
                             10/24/78 10/24/78 14:50  6    1        0:00   0:00
 74     Index from CI/LOUISE
                              3/28/79  3/28/79  2:40  22   1        0:00   0:00


Name: LOUISE, # of Docs: 64, Blocks left: 53 (of 627)
--------------------------------------------------------------------------------
Number  Name                     Created  Modified       Size Version  Last   Total
--------------------------------------------------------------------------------
  1
                             10/06/78  3/28/79  2:25  4    101      0:00   0:01
  2     resale of modems
                             10/06/78  1/24/79  3:20  5    10       0:00   0:25
  3     LDP user's perspective
                             10/06/78 10/10/78  9:23  15   11       0:00   1:13
  4     kruth
                             10/06/78 10/16/78  9:20  2    5        0:00   0:06
```

5	idea on the 2020							
		10/06/78	1/24/79	3:20	5	7	0:00	0:17
6	boyd							
		10/06/78	10/10/78	9:26	2	3	0:00	0:08
7	patterson/NCAR							
		10/06/78	10/10/78	12:00	4	4	0:00	0:23
8	harper							
		10/06/78	10/10/78	10:54	3	3	0:06	0:12
9	vatche							
		10/06/78	10/10/78	9:57	5	5	0:01	0:20
10	low cost alphanumeric terminal							
		10/06/78	1/24/79	3:19	10	7	0:01	0:33
11	publication/comm in Japanese							
		10/06/78	2/01/79	3:21	4	3	0:00	0:08
12	Index from CI/LOUISE							
		3/28/79	3/28/79	2:26	19	1	0:00	0:00
13	richard watson LLL visit							
		10/10/78	10/16/78	9:32	3	2	0:01	0:08
14	cox							
		10/10/78	10/16/78	9:36	2	2	0:00	0:02
15	Baud/9600 is coming in terminals							
		10/10/78	1/24/79	3:17	4	4	0:00	0:07
16	plowman/software report							
		10/10/78	10/10/78	14:24	2	1	0:01	0:01
17	MSR11							
		10/10/78	3/26/80	11:53	2	2	0:00	0:02
18	basic strategy							
		10/16/78	0/00/00	1:15	18	9	0:01	1:02
19	lsivax							
		10/16/78	10/18/78	11:00	11	2	0:05	0:25
20	ocsp's							
		10/16/78	10/18/78	10:54	14	6	0:03	0:20
21	VAX/10/20 comparison							
		10/16/78	10/26/78	0:30	7	8	0:01	0:50
22	how fast can software be built							
		10/16/78	10/26/78	0:32	6	8	0:01	0:32
23	VAX-11							
		10/16/78	10/18/78	10:23	5	2	0:05	0:11
24	pascal/vax							
		10/16/78	10/18/78	11:23	2	2	0:01	0:04
25	arpa net							
		10/19/78	10/19/78	1:34	2	2	0:00	0:05

26	large systems strategy team							
		10/20/78	10/20/78	14:39	13	15	0:02	0:46
27	managers list							
		10/20/78	10/20/78	10:50	21	3	0:02	0:02
28	tape							
		10/20/78	10/23/78	6:06	66	4	0:40	3:11
29	thanks for talk							
		10/23/78	10/24/78	0:38	3	3	0:04	0:11
30	Grosch							
		10/23/78	10/23/78	2:13	13	1	0:01	0:01
31	Bill Johnson list							
		10/23/78	10/24/78	0:31	6	3	0:00	0:00
32	blum							
		10/24/78	11/20/78	11:01	4	7	0:01	0:26
33	ems dist list							
		10/24/78	10/27/78	0:19	4	3	0:00	0:11
34	tedhelp							
		10/25/78	10/30/78	1:14	6	5	0:00	0:41
35	CEcourse							
		10/25/78	10/30/78	1:17	5	5	0:01	0:24
36	cover							
		11/01/78	11/01/78	0:49	2	1	0:02	0:02
37	new cis & cobol on 10							
		10/30/78	10/30/78	6:28	2	2	0:02	0:07
38	rationale -- basic strategy							
		10/30/78	2/05/79	12:04	32	20	0:02	2:53
39	disks							
		10/30/78	10/31/78	1:18	14	3	0:14	0:17
40	ibm							
		10/30/78	10/31/78	0:56	8	4	0:03	0:05
41	lsicrit							
		10/30/78	10/30/78	2:30	12	5	0:17	0:19
42	blues							
		10/30/78	10/31/78	1:40	9	5	0:21	0:29
43	shoebox I,II,III products							
		11/02/78	1/24/79	3:15	2	2	0:00	0:01
44	sangster							
		11/02/78	3/13/79	3:50	2	3	0:00	0:10
45	ts04							
		11/03/78	11/03/78	4:56	5	5	0:01	0:17
46	basic product strategy							
		0/00/00	3/26/80	11:03	38	26	0:05	2:30

47	decus attendance/participation							
		11/06/78	11/10/78	11:10	5	5	0:00	0:07
48	sutherland							
		11/06/78	11/07/78	12:48	2	2	0:02	0:09
49	vax dmt, when?							
		11/07/78	11/07/78	12:03	3	1	0:14	0:14
50	capabilities vs rings							
		11/07/78	11/07/78	12:38	2	1	0:03	0:03
51	not emulating 360/370							
		11/08/78	11/09/78	3:26	5	5	0:00	0:04
55	common bliss							
		11/13/78	11/13/78	3:17	4	3	0:01	0:17
58	oodprob							
		11/15/78	11/16/78	3:10	6	5	0:01	0:05
59	trax							
		11/15/78	11/16/78	3:12	3	4	0:00	0:04
60	unbundle							
		11/15/78	11/16/78	3:13	6	4	0:00	0:04
61	displays							
		11/15/78	11/16/78	3:17	5	3	0:03	0:09
62	budget/redbook							
		11/16/78	11/16/78	6:46	9	1	0:18	0:18
63	vms size/new goal							
		11/17/78	11/20/78	9:39	9	4	0:12	0:40
64	extending vax architecture for cobol							
		11/17/78	11/20/78	9:50	4	2	0:06	0:08
65	lcg funds							
		11/20/78	11/21/78	10:23	5	4	0:01	0:37
66	minnow, no/dolphin 10/20 vax sooner							
		11/20/78	11/21/78	10:27	4	3	0:03	0:16
68	puffer FY80 memo to ood							
		11/22/78	11/22/78	4:40	6	9	0:01	0:30
69	vrablik							
		11/22/78	11/22/78	4:47	5	5	0:00	0:12
70	vt162 and friends							
		11/22/78	11/22/78	4:44	4	2	0:01	0:05

Name: MAIL-3, # of Docs: 16, Blocks left: 177 (of 627)

Number	Name	Created	Modified		Size	Version	Last	Total

1		11/20/79	9/28/81 9:30	2	46	0:00	0:08
2	NOVEMBER '79 MAIL-LOG/GB1.S10	11/20/79	6/16/80 10:28	18	20	0:01	0:40
3	INDEX FROM CI/GB1.S10	11/21/79	12/13/79 10:38	3	4	0:00	0:01
4	DECEMBER '79 MAIL-LOG/GB1.S10	12/03/79	9/10/80 15:51	26	78	0:01	3:62
5	JANUARY '80 MAIL-LOG/GB1.S10	1/03/80	3/21/80 14:57	27	97	0:05	2:49
7	FEBRUARY '80 MAIL-LOG/GB1.S10	2/01/80	3/18/80 10:47	24	76	0:01	2:31
8	MARCH '80 MAIL-LOG/GB1.S10	3/03/80	11/10/80 15:53	34	113	0:01	3:39
9	APRIL '80 MAIL-LOG/GB1.S10	4/02/80	1/22/81 14:13	35	121	0:00	4:26
10	MAY '80 MAIL-LOG/GB1.S10	5/02/80	11/04/80 11:24	38	115	0:03	4:30
11	JUNE '80 MAIL-LOG/GB1.S10	6/02/80	11/04/80 11:21	36	100	0:01	4:59
12	JULY '80 MAIL-LOG/GB1.S10	7/01/80	12/05/80 9:19	38	135	0:02	4:56
13	AUGUST '80 MAIL-LOG/GB1.S10	8/01/80	12/05/80 9:17	25	88	0:00	3:30
14	SEPTEMBER '80 MAIL-LOG/GB1.S10	9/02/80	2/19/81 16:55	37	105	0:01	3:41
15	OCTOBER '80 MAIL-LOG/GB1.S10	9/30/80	12/05/80 13:31	40	95	0:02	4:17
16	NOVEMBER '80 MAIL-LOG/GB1.S10	11/03/80	1/22/81 11:01	27	97	0:01	3:04
17	DECEMBER '80 MAIL-LOG/GB1.S10	12/02/80	1/22/81 11:00	24	83	0:01	2:48

Name: MAILOG, # of Docs: 2, Blocks left: 234 (of 627)

Number	Name	Created	Modified	Size	Version	Last	Total
1		3/15/82	3/15/82 15:36	1	1	0:00	0:00

2	MAIL LOG 1981	3/15/82	4/01/82 14:39	389	3	0:05	0:40

Name: MARIE , # of Docs: 24, Blocks left: 357 (of 627)

Number	Name	Created	Modified	Size	Version	Last	Total
1		12/13/82	2/09/83 13:35	2	40	0:00	0:00
2	DAVID	12/22/82	1/11/83 15:23	24	6	0:29	3:29
3	cover memo	12/13/82	12/13/82 3:47	3	1	0:16	0:16
4	QUESTIONAIRE	12/13/82	2/02/83 13:46	2	5	0:01	1:26
5	REFERENCE MANUAL INFO	12/14/82	2/02/83 12:33	6	7	0:01	2:41
6	MISCELLANEOUS INFO	12/14/82	1/11/83 14:01	9	4	0:01	1:00
7	GREGOR	12/20/82	2/09/83 11:40	8	7	0:00	1:04
8	Meredith	1/05/82	1/05/82 3:25	4	2	0:20	0:21
9	DEBBIE	12/21/82	12/27/82 15:16	4	4	0:02	0:53
10	CHRIS	12/27/82	1/04/83 11:07	8	2	0:57	1:25
11	JAMIE	12/27/82	1/05/83 0:07	7	3	0:07	1:20
12	GERI	1/03/83	1/05/83 0:49	8	3	0:32	1:17
13	CAROLE	1/03/83	2/02/83 10:41	9	10	0:08	2:01
14	ARCHIVIST/REGISTRAR	1/04/83	2/09/83 11:40	10	8	0:01	1:09
15	BILL	1/05/83	1/11/83 15:45	1	2	0:01	0:04
16	DUMMY DOCUMENT	1/12/83	1/12/83 11:04	5	5	0:00	0:16
17	DUMMY2						

		1/12/83	1/12/83 11:07	8	4	0:03	0:21
18	GWEN	0/00/00	0/00/00 0:17	3	1	0:16	0:16
19	FINAL DRAFT	2/01/83	2/09/83 15:12	80	39	0:09	8:35
20	SECRETARU	2/01/83	2/01/83 4:16	6	2	0:03	0:28
21	Part Two Draft	2/02/83	2/09/83 15:31	15	18	0:01	1:16
22	TABLE OF CONTENTS	2/02/83	2/09/83 11:05	5	18	0:12	1:16
23	DOCUMENT LIBRARY	1/21/83	2/02/83 13:47	11	15	0:00	0:19
24	ABBREVIATION FILE	1/21/83	2/02/83 15:18	1	17	0:01	0:10

Name: MCC&AO, # of Docs: 12, Blocks left: 640 (of 779)

Number	Name	Created	Modified	Size	Version	Last	Total
1		3/30/83	6/27/83 13:57	1	14	0:01	0:01
3	SORT SPEC	4/21/83	5/24/83 2:27	1	2	0:01	0:02
4	SORT OUTPUT	4/21/83	5/24/83 3:17	33	15	0:05	0:24
5	FORM DOCUMENT FOR LP	4/21/83	5/24/83 2:32	1	4	0:02	0:22
6	SELECTION SPECIFICATION FOR LP	4/21/83	4/21/83 13:28	1	1	0:01	0:01
7	MCC-TAB form document	5/24/83	5/24/83 3:12	1	3	0:02	0:08
8	SPEC FOR MCC-TAB	5/24/83	6/09/83 9:14	2	5	0:00	0:02
9	mcc-tab output list	5/24/83	5/26/83 8:23	5	13	0:00	0:08
10	AO - HOW ARE YOU DOING/WHY NOT USING LETTER/MJ5	5/31/83	6/22/83 12:16	2	10	0:00	0:47
11	AO ELECTRONIC MAIL LETTER	6/09/83	6/09/83 15:55	32	6	0:01	0:10

12	mcc sort (whole list)						
		6/22/83	6/22/83 11:22	1	1	0:01	0:01
13	output document (MCC whole list)						
		6/22/83	6/27/83 14:00	35	9	0:00	0:43

Document 4 comment:
ÁJ
Document 13 comment:
ÁJ

Name: MESSGB, # of Docs: 3, Blocks left: 529 (of 627)

Number	Name	Created	Modified	Size	Version	Last	Total
1							
		7/17/81	3/09/82 13:08	1	6	0:00	0:01
2	MESSAGES FROM 4/80 TO 12/31/80 MESSGB						
		7/17/81	7/28/81 15:11	42	5	0:01	0:59
3	MESSAGE LOG FROM 10/1/81 THRU 1/31/81/MESSGB						
		3/09/82	3/09/82 13:08	52	2	0:01	0:12

Name: MJF/GB, # of Docs: 12, Blocks left: 459 (of 627)

Number	Name	Created	Modified	Size	Version	Last	Total
0							
		3/25/80	12/07/82 9:41	1	127	0:00	0:00
2							
		0/00/00	7/07/82 8:21	21	17	0:00	4:53
3							
		10/24/82	10/25/82 0:01	6	2	0:01	0:24
4							
		0/00/00	3/31/82 15:50	9	4	0:00	0:40
5							
		0/00/00	4/20/82 12:41	11	6	0:01	1:02

Name: MJF/GB, # of Docs: 12, Blocks left: 459 (of 627)

Number	Name	Created	Modified	Size	Version	Last	Total
0		3/25/80	12/07/82 9:41	1	127	0:00	0:00
2		0/00/00	7/07/82 8:21	21	17	0:00	4:53
3		10/24/82	10/25/82 0:01	6	2	0:01	0:24
4		0/00/00	3/31/82 15:50	9	4	0:00	0:40
5		0/00/00	4/20/82 12:41	11	6	0:01	1:02
6		0/00/00	11/02/82 10:31	14	5	0:04	0:44
7		11/14/82	11/14/82 0:20	4	1	0:20	0:20
8		11/20/81	11/30/81 15:55	22	9	1:53	5:57
9		11/14/82	11/14/82 1:06	6	1	0:16	0:16
13		0/00/00	5/21/82 11:34	49	21	0:33	7:20
14		5/12/82	7/23/82 0:04	4	8	0:01	1:33
17		0/00/00	5/21/82 10:57	4	2	0:00	0:12

Name: PAPER1, # of Docs: 8, Blocks left: 164 (of 627)

Number	Name	Created	Modified	Size	Version	Last	Total
1		5/14/79	11/07/79 6:07	2	15	0:01	0:06
2	JAPAN ESSAY--2ND VERSION--SENT OUT FOR POSSIBLE PUBLICATION/PAPER1	5/14/79	10/19/86 0:29	100	9	0:02	0:31
3	JAPAN ESSAY--(FIRST VERSION) BEFORE 10/19/78 /PAPER1	5/14/79	11/07/79 5:46	115	3	0:00	0:06
4	JAPAN - INNOVATION IN JAPAN--A LESSON FOR US?/DARTMOUTH/PAPER1	6/15/79	6/15/79 2:27	39	16	0:01	1:14
5	INDEX FROM CI/PAPER1						

Number	Name	Created	Modified	Size	Version	Last	Total
		6/28/79	10/29/79 0:34	4	2	0:00	0:00
6	NATIONAL HIGH TECHNOLOGY, A COMPUTER INDUSTRY PAPER--DRAFT 2/PAPER1	10/26/79	10/26/79 10:52	70	1	0:03	0:03
7	NATIONAL HIGH TECHNOLOGY, A COMPUTER INDUSTRY PAPER--DRAFT 1/PAPER1	10/26/79	10/26/79 10:55	50	1	0:02	0:02
8	NATIONAL HIGH TECHNOLOGY, A COMPUTER INDUSTRY PAPER--DRAFT 3/PAPER1	10/26/79	10/26/79 11:48	74	1	0:03	0:03

Name: PAPER2, # of Docs: 5, Blocks left: 444 (of 627)

Number	Name	Created	Modified	Size	Version	Last	Total
1		11/07/79	0/00/00 0:01	1	5	0:01	0:01
2	NATIONAL HIGH TECHNOLOGY, A COMPUTER INDUSTRY PAPER--11/7/79-PAPER2	11/07/79	8/17/81 11:32	78	11	0:00	0:13
3	INDEX FROM CI/PAPER2	11/14/79	0/00/00 0:00	3	2	0:00	0:00
4	PAPER--GENERATING COMPUTER GENERATIONS/PAPER2	10/13/80	10/13/80 10:33	90	11	0:04	0:51
5	index from paper2	0/00/00	0/00/00 0:01	3	1	0:00	0:00

Name: REPORT, # of Docs: 10, Blocks left: 305 (of 627)

Number	Name	Created	Modified	Size	Version	Last	Total
1		0/00/00	0/00/00 0:49	1	31	0:00	0:00
2	cacm operating system sec 4	3/24/77	8/22/77 13:38	61	26	0:00	0:00
4	cmu lecture side 1	2/28/77	3/02/77 2:25	40	7	0:00	0:00
5	cmu lecture side 2	3/01/77	3/03/77 8:45	42	5	0:00	0:00
6	cmu lecture side 3	3/01/77	3/03/77 9:12	23	4	0:00	0:00
7	cacm hardware sec 5						

		3/15/77	8/22/77 13:43	46	19	0:00	0:00
8	cacm introduction sec 1	3/15/77	8/22/77 13:31	29	35	0:00	0:00
9	cacm isp sec 2	3/15/77	8/22/77 13:33	38	34	0:00	0:00
10	cacm pms sec 3	3/15/77	8/22/77 13:36	31	27	0:00	0:00
11	apology to reviewers	3/24/77	3/24/77 10:57	1	2	0:00	0:00

Name: RL1.S4, # of Docs: 44, Blocks left: 97 (of 627)

Number	Name	Created	Modified	Size	Version	Last	Total
1		3/17/81	8/21/81 14:35	6	110	0:01	0:57
2	RANKING OF U.S. & WW SUPPLIERS/GB2.S4	3/17/81	5/12/81 8:55	6	11	0:01	1:07
3	SLIDES -- TRANSITIONS(OC PRESENTATION)/GB2.S4	3/17/81	3/25/81 10:01	19	14	0:00	1:09
4	COMPETITORS--ENG & MFG LIMITS--FUTURES/CLAYTON.../GB2.S4	3/17/81	5/12/81 8:57	12	10	0:02	0:07
5	HEURISTICS FOR BUILDING GREAT PRODUCTS/AOCW BOOK/GB2.S4	3/17/81	3/18/82 16:11	27	9	0:00	0:10
6	CURSORY THOUGHTS ON HIGH END DISKS/ENG STAFF/GB2.S4	3/17/81	3/31/81 12:42	24	15	0:00	0:31
7	ENIAC SLIDES, UNIVERSITY OF MICHIGAN--/BURKS/GB2.S4	3/23/81	4/17/81 14:43	2	5	0:02	0:06
8	AOCW BOOK--CHAPTER 1/GB2.S4	3/18/81	1/04/83 8:29	148	26	0:00	1:15
9	COVER SHEET--ENG. STRATEGY OVERVIEW/GB2.S4	3/18/81	3/31/81 12:49	1	4	0:01	0:03
10	NAUTILUS--MAKE/BUY TALLY SHEET/GB2.S4	3/19/81	3/31/81 12:47	9	9	0:01	0:42
11	CT FY'82 SHORTFALL (FUNDING)/JOHNSON, TED/GB2.S4	3/24/81	3/31/81 12:46	16	9	0:01	0:27
12	NAUTILUS--MAKE OR BUY A GATE ARRAY FROM TI/CUDMORE/GB2.S4	3/25/81	3/31/81 12:44	5	3	0:00	0:01
13	MILL--CLEAN UP CAMPAIGN!/FORBES/GB2.S4	3/25/81	3/31/81 12:44	6	3	0:00	0:00

14	J-11: AT BOARD, BOX AND SYSTEM/LYLE/GB2.S4	3/25/81	3/31/81	12:44	9	3	0:00	0:00
15	DP--THE STERN BOOK: HOLD THE PRESS/KENAH/GB2.S4	3/25/81	3/31/81	12:44	3	3	0:00	0:00
16	FCC--IF DON'T CONFORM, THEN NO ANNOUNCEMENT/BURNETT/GB2.S4	3/25/81	3/31/81	12:44	5	4	0:00	0:01
17	STRATEGY--THOUGHTS ON ENG. BUDGET AND STRATEGY/CORBEN/GB2.S4	3/25/81	3/31/81	12:42	15	3	0:01	0:01
18	WPS--GETTING CHARTERS/ORGANIZED TO SELL PRODUCTS/BROOKS/GB2.S4	3/25/81	3/31/81	12:41	10	3	0:00	0:01
19	TLC--DEMO/AVERY/GB2.S4	3/25/81	3/31/81	12:41	4	3	0:01	0:01
20	CT--AND 16 BIT ARCHITECTURE/CONKLIN/GB2.S4	3/25/81	3/31/81	12:40	8	6	0:00	0:04
21	SUVAX--PETER JANSEN & ECS/KNOWLES/GB2.S4	3/25/81	3/31/81	12:40	5	4	0:00	0:06
22	SUVAX--MISSING THE BOAT WITH SUVAX/KNOWLES/GB2.S4	3/25/81	3/31/81	12:39	3	3	0:00	0:01
23	SUVAX--ANDY'S SUGGESTION ON ALTERNATIVE STRATEGY/DEMMER/GB2.S4	3/25/81	3/31/81	12:38	4	5	0:01	0:02
24	CANADA--YOUR PROJECT/KNOWLES/GB2.S4	3/25/81	4/01/81	8:54	3	4	0:00	0:00
25	GIGI--USING IT TO MAKE BIG/GOOD SMART TERMINALS/KNOWLES/GB2.S4	3/25/81	3/31/81	12:36	5	3	0:00	0:01
26	WPS MARKET--COMMENTS/BROOKS/GB2.S4	3/25/81	3/25/81	15:46	9	2	0:00	0:00
27	SUVAX--WE GOT COMPETITION/DEMMER/GB2.S4	3/25/81	3/25/81	15:49	7	2	0:01	0:01
28	SUVAX AND ARPA/WEISS/GB2.S4	3/25/81	3/31/81	12:36	5	3	0:00	0:00
29	EUROPEAN ENGINEERING--SCOTLAND,FRANCE,GERMANY/DEMMER/GB2.S4	3/25/81	3/31/81	12:36	9	3	0:00	0:01
30	FACILITY--WEST COAST R&D FACILITY/ECKHOUSE/GB2.S4	3/25/81	3/31/81	12:35	5	3	0:00	0:00
31	SUVAX--FINDING MONEY FOR SUVAX/KUSIK/GB2.S4	3/25/81	3/31/81	12:35	4	3	0:00	0:00
32	CONSULTANTS--BOOZ ALLEN, BUYING (AND GIVING)/DELAGI/GB2.S4	3/25/81	3/31/81	12:35	7	3	0:01	0:01
33	DESIGN--MECHANICAL ELEGANCE-A FAST TRACK TO Q&P/ENG STAFF/GB2.S4	3/25/81	3/31/81	12:34	5	3	0:01	0:02
34	TERMINALS--LOW COST SYSTEMS/MKT. COMM./GB2.S4	3/25/81	3/31/81	12:33	7	3	0:00	0:00

Number	Name	Created	Modified	Size	Version	Last	Total
35	COMPUTING & COMMUNICATION SUGGESTIONS/BERTOCCHI/GB2.S4	3/25/81	3/31/81 12:33	7	3	0:01	0:01
36	HARDWARE/TAXONOMY-- FULLER/GB2.S4	3/25/81	9/02/81 15:18	12	6	0:01	0:02
37	CT--DISCLOSING/GVPC/GB2.S4	3/25/81	3/31/81 12:32	2	3	0:00	0:01
38	OKI--STAY MANUFACTURER, NOT DISTRIBUTOR/BROOKS/GB2.S4	3/25/81	3/31/81 12:32	4	3	0:01	0:01
39	COMPUTER--DESK TOP (THE PROFESSIONAL MANAGERS)/JOHNSON,TED/GB2.S4	3/25/81	3/31/81 12:31	7	3	0:00	0:02
40	MUSEUM--LECTURE AT SPITBROOK?/FORRESTER/GB2.S4	3/27/81	3/27/81 8:44	4	2	0:05	0:06
41	INTEL--INTERFACE ETHERNET & BUYING FROM THEM/FEDERMAN/GB2.S4	3/30/81	3/31/81 10:22	15	7	0:00	0:24
42	SIEMENS--RE:VAX YOU PURCHASED/BAUR/GB2.S4	3/30/81	4/26/82 11:37	13	7	0:00	0:33
43	MUSEUM--CONFIRMATION OF LECTURE/BRAINERD/GB2.S4	3/30/81	3/31/81 9:01	6	2	0:03	0:07
44	CT ENGINEERING LOCATION /GB2.S4	4/27/81	4/28/81 14:45	3	7	0:00	0:04

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Number	Name	Created	Modified	Size	Version	Last	Total
1		3/31/81	9/14/81 16:12	9	131	0:00	1:33
2	MUSEUM-SIEMENS LOA OF NEEDLE TELEGRAPH/JESSE/GB2.S5	3/31/81	7/20/81 13:39	5	8	0:00	0:10
3	SIEMENS MUSEUM--THANKS--LOAN OF MATERIALS/GOETZELER/GB2.S5	3/31/81	5/20/81 14:54	8	10	0:00	0:15
4	MEMORY VIEWS OF THE WEEK/SAVIERS/GB2.S5	4/06/81	4/08/81 8:10	2	4	0:00	0:13
5	LAWRENCE LIVERMORE LAB--THANK YOU/MICHAEL/GB2.S5	4/06/81	4/08/81 8:10	2	4	0:00	0:05
6	MCF--MILITARY COMPUTER FAMILY DRAFT STATEMENT/GB2.S5	4/06/81	5/29/81 12:17	4	8	0:00	0:22
7	LLL--HIGH SPEED COMPUTING/ENG STAFF.../GB2.S5	4/06/81	5/20/81 9:32	30	25	0:02	2:50
8	NAE PEER COMMITTEE/IVAN GETTING/GB2.S5						

4/07/81 5/29/81 12:14 4 4 0:03 0:08

9 MILITARY COMPUTER FAMILY--FORM LETTER/GB2.S5

4/08/81 5/15/81 12:34 2 6 0:00 0:03

10 MILITARY COMPUTER FAMILY LIST/GB2.S5

4/10/81 9/14/81 16:13 8 13 0:01 1:09

11 MILITARY COMPUTER FAMILY SPEC/GB2.S5

4/10/81 5/29/81 13:34 1 5 0:00 0:00

12 MILITARY COMPUTER FAMILY RESULTS/GB2.S5

4/10/81 6/02/81 13:48 2 10 0:00 0:03

13 REVIEW DRAFT REPORT--80S TRANSITIONS/ROBINSON/GB2.S5

4/13/81 5/29/81 12:32 2 4 0:01 0:05

14 REVIEW-RISC PAPER, UNIV. OF CALIFORNIA, BERKELEY--PATTERSON/GB2.S5

4/13/81 6/02/81 13:48 3 4 0:00 0:10

15 PRODUCT--RATIO OF DEV. COST/NOR ENG STAFF/GB2.S5

4/13/81 4/15/81 14:43 3 5 0:01 0:15

16 INFOTECH, PERGAMON--U OWE ME MONEY/C. BOON/GB2.S5

4/14/81 5/29/81 12:15 5 4 0:01 0:13

17 OFFICE PRODUCT ANNOUNCEMENT--KEN'S GRAND ONE/OC/GB2.S5

4/15/81 4/15/81 10:23 4 2 0:00 0:00

18 CT100 FUNDING/CAMPBELL/GB2.S5

4/15/81 4/15/81 10:25 4 2 0:01 0:01

19 PRODUCTS--WINNING, GREAT PRODUCTS/ENG STAFF/GB2.S5

4/15/81 12/08/82 10:49 10 5 0:00 0:02

20 PRODUCTS--HEURISTICS FOR GREAT PRODUCTS/OLSEN, KEN/GB2.S5

4/15/81 4/15/81 10:32 24 2 0:02 0:02

21 TERMINALS MARKETING PLANS/LYLE/GB2.S5

4/15/81 5/29/81 12:17 4 3 0:01 0:02

22 GRAPHICS ARCHITECTURE--ALAN KAY VISIT/STRECKER/GB2.S5

4/15/81 4/15/81 10:37 3 2 0:01 0:01

23 PRODUCT PLACQUES AND OC WOODS COMMENTS/CORBEN/GB2.S5

4/15/81 5/29/81 12:27 13 3 0:00 0:01

24 TRAINING--VLSI COURSE ENROLLMENT/CROXON/GB2.S5

4/15/81 4/21/81 8:13 4 3 0:00 0:01

25 ERGONOMETRICS--CONTINUING,DEC COMPUTER 278 TYPE/KO/GB2.S5

4/15/81 4/15/81 10:49 19 2 0:06 0:06

26 WPS 278 FIX MY PROBLEM/FORBES/GB2.S5

4/15/81 8/28/81 10:29 3 4 0:00 0:01

27 STRATEGY--CORPORATE FINANCIAL STRATEGY/BERTOCCHI/GB2.S5

4/15/81 4/28/81 14:55 4 3 0:00 0:00

28 LEADERSHIP 11/73 - LOW COST VAX FUNDING--DEMMER/GB2.S5

4/15/81 5/29/81 12:11 8 3 0:01 0:04

29 NI--MAKING IT WORK/KOTOK/GB2.S5

4/15/81 4/15/81 11:03 8 2 0:01 0:01

30 EUROPEAN ENGINEERING--IN AYR/LACROUTE/GB2.S5

4/15/81 4/15/81 11:04 4 2 0:00 0:00

31 DP--CONGRATULATIONS, GOOD LUCK, AND DUTIES/LACROUTE/GB2.S5

4/15/81 4/15/81 11:07 11 2 0:01 0:01

32 TERMINALS--WINNING COMPUTING TERMINALS/LYLE/GB2.S5

4/15/81 9/02/81 15:16 4 4 0:00 0:02

33 ORGANIZATIONAL--CHANGE-WHAT IT MIGHT LOOK COMMENTS/GVPC/GB2.S5

4/15/81 5/29/81 12:26 12 4 0:01 0:03

34 ENGINEERING/MANUFACTURING SEGMENTATION/GVPC/GB2.S5

4/15/81 9/02/81 15:07 20 4 0:02 0:07

35 MUSEUM AFIPS TAXONOMY (MUSEUM)/SAMMET/GB2.S5

4/21/81 5/19/81 9:00 4 8 0:00 0:09

36 MIT--COMMENTS ON MAURICE WILKES/MOSES/GB2.S5

4/21/81 5/04/81 13:06 3 6 0:00 0:13

37 STANFORD--RE:WILKINSON LECT. ON PILOT ACE TAPED?/FEIGENBAUM/GB2.S5

4/21/81 5/29/81 12:30 2 3 0:01 0:04

38 PERSONNEL REVIEWS FORM - ENG STAFF /GB2.S5

4/21/81 5/29/81 12:09 15 11 0:00 0:38

39 WPS COMMITMENTS (8-BASED)--OUR PERFORMANCE/STEWART/GB2.S5

4/22/81 5/29/81 12:43 3 8 0:06 0:18

40 CUSTOMER COMPLAINT U. OF CALIF., LA--VAX 780/POPEK/GB2.S5

4/22/81 5/29/81 12:36 2 8 0:01 0:11

41 UNIVERSITY OF TEXAS--RE:LIPOVSKI PROMOTION/BROWN/GB2.S5

4/27/81 5/29/81 12:37 5 4 0:01 0:07

42 CMU--RE: HONORARIUM CHECK/HABERMAN/GB2.S5

4/27/81 4/27/81 10:56 2 3 0:00 0:09

43 SUVAX DISPLAY AND ARPA DEMO/MARSHALL/GB2.S5

4/29/81 4/30/81 8:15 2 3 0:00 0:02

44 REFERENCE-STAMBAUGH TEACHING AT BOSTON UNIVERSITY/PADULA/GB2.S5

5/04/81 5/29/81 12:06 2 4 0:02 0:06

45 NORTHEASTERN CSD AND US/MEANY.../GB2.S5

5/04/81 5/04/81 11:45 14 6 0:01 0:09

46 CSS--SURVIVING BUILDING GM'S KLUDGE/BUTLER.../GB2.S5

5/04/81 5/08/81 9:55 3 4 0:00 0:11

47 FCC--BUBBLE INTO OPERATION/OC/GB2.S5

5/04/81 5/08/81 14:19 4 4 0:00 0:13

48 ENG. SECS

7/20/81 7/20/81 13:52 3 3 0:00 0:05

49 NEBULA--HOW GOOD AND TIMELY IS IT?/MARSHALL/GB2.S5

5/08/81 5/13/81 15:39 3 5 0:02 0:14

50 OFFICE OF INTERNAT. PUB. NIKKEI ELEC. TRANS./SHONYO/GB2.S5

		5/11/81	12/30/81	9:10	3	5	0:03	0:16
51		5/11/81	5/29/81	12:04	2	5	0:00	0:10
52	STOCK GRANTS-REVIEW & RATIONALE/ENG STAFF/GB2.S5	5/11/81	5/29/81	12:31	3	3	0:01	0:06
53	SIEMENS AG--PHOTOS/GUMIN/GB2.S5	5/12/81	5/12/81	13:44	2	1	0:06	0:06
54	eng. staff and secs./gb2.s7	7/20/81	7/20/81	11:48	3	1	0:05	0:05
55	NAE--MY FEELINGS ON THE AHCOM/PERKINS/GB2.S5	5/18/81	5/21/81	15:21	13	9	0:00	0:32
56	COMET--UNDERSTANDING TO HELP VENUS & NAUTILUS/DEMMER.../GB2.S5	5/18/81	5/19/81	8:31	3	5	0:01	0:02
57	PERSONNEL REVIEWS DIRECT REPORTS PROPOSAL/OC/GB2.S5	5/18/81	5/29/81	12:08	8	5	0:00	0:05
58	VENUS AND IT'S CONTINGENCIES/DEMMER.../GB2.S5	5/18/81	5/19/81	8:20	8	6	0:01	0:06
59	SIA--BECOMING A MEMBER/CUDMORE/GB2.S5	5/18/81	5/29/81	12:29	2	5	0:01	0:05
61	PERSONNEL--SOME FOLKS WE MIGHT GET TO WORK HERE/KO/GB2.S5	5/21/81	5/29/81	12:26	3	4	0:00	0:02
62	DECSET--A VERY NICE BASE/MITCHELL/GB2.S5	5/21/81	5/21/81	13:41	14	2	0:02	0:02
63	GENERATION--5TH GEN., A TRANSITION/CHRISTY/GB2.S5	5/21/81	5/21/81	13:46	19	2	0:00	0:00
64	WPS278--HAVE TO HAVE ONE WORKING BEFORE WE SHIP/COLE/GB2.S5	5/21/81	7/22/81	15:22	13	3	0:00	0:02
65	FINANCE--ACTUAL PRODUCT DATA VS. BURP PLANS/CLINTON/GB2.S5	5/21/81	5/21/81	13:57	8	2	0:01	0:01
66	MUSEUM--WILKINSON TALKS/EBOD MEMBERS/GB2.S5	5/21/81	5/21/81	13:59	3	2	0:01	0:01
67	WPS278--NOVEMBER 5-YEAR PLAN MEETING/OLSEN/GB2.S5	5/21/81	5/21/81	14:01	8	2	0:01	0:01
68	GIGI--VK100 INCOMPATIBILITIES WITH VMS/JANSEN/GB2.S5	5/21/81	5/21/81	14:04	3	2	0:00	0:00
69	FCC--MORE ON THE 11C03/CREASER/GB2.S5	5/21/81	5/21/81	14:06	3	2	0:01	0:01

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Number	Name	Created	Modified	Size	Version	Last	Total
1		5/21/81	9/28/81 15:10	10	155	0:00	1:57
2	FCC--MINC, 11C03, ETC./BROWN/GB2.S6	5/21/81	6/10/81 11:34	3	4	0:01	0:01
3	WPS 278 AND 11/23--FUTURE PACKAGING/OLSEN, KEN/GB2.S6	5/21/81	9/28/81 9:22	5	10	0:00	0:01
4	CT REVIEW AND APPROVAL/OLSEN, KEN/GB2.S6	5/21/81	6/11/81 9:30	5	3	0:00	0:01
5	WPS 278--NOTE ON CONTROL OF THE 278/STONE/GB2.S6	5/21/81	6/05/81 12:19	3	4	0:00	0:00
6	TRAINING--VLSI COURSES/ENG STAFF/GB2.S6	5/21/81	9/28/81 15:10	2	4	0:00	0:00
7	VT134--BRIAN'S COMMENTS/MILLER/GB2.S6	5/21/81	5/21/81 14:20	7	2	0:02	0:02
8	CT/VT FAMILY--OC REVIEW/BROOKS/GB2.S6	5/21/81	5/21/81 14:22	6	2	0:01	0:01
9	CT--KNOCK OUT AND ORIGINAL GOALS/BROOKS/GB2.S6	5/21/81	5/21/81 14:33	23	2	0:07	0:07
10	SCORPIO--REVIEWS AND METHODOLOGY/TEICHER/GB2.S6	5/21/81	5/21/81 14:35	5	2	0:00	0:00
11	CT--4/28/81 DISCUSSION/OLSEN, KEN/GB2.S6	5/21/81	6/11/81 9:12	4	3	0:00	0:00
12	SCORPIO REVIEW--IT LOOKS VERY GOOD/TEICHER/GB2.S6	5/21/81	5/21/81 14:42	7	3	0:00	0:00
13	QUALITY AND PRODUCTIVITY--WHAT'S THE ANSWER?/HANSON/GB2.S6	5/21/81	7/22/81 15:57	7	3	0:00	0:01
14	VK100--FIX OR VMS (W/O VK100)/CARCHIDI/GB2.S6	5/21/81	5/21/81 14:54	21	2	0:07	0:07
15	IBM/JAPAN--EVANS TALK ON JAPANESE SEMICONDUCTORS/ENG STAFF/GB2.S6	5/21/81	7/08/81 9:19	7	6	0:00	0:00
16	QUALITY PROGRAM/HINDLE/GB2.S6	5/21/81	5/21/81 14:58	3	2	0:01	0:01
17	CT ENGINEERING LOCATION/OPERATIONS COMMITTEE/GB2.S6	5/21/81	5/21/81 14:59	3	2	0:00	0:00
18	UNIVERSITY OF SASKATCHEWAN--PERSONAL UNIX/KAVANAUGH/GB2.S6	5/26/81	9/28/81 9:21	3	5	0:00	0:12
19	JAPAN-REFLECTIONS ON FACTORY MGMT. PAPER/ENG. STAFF/GB2.S6	6/03/81	6/12/81 16:15	19	10	0:02	1:19
20	ENG. PROCESS--QUALITY & PRODUCTIVITY/ENG STAFF/GB2.S6	5/26/81	9/02/81 15:10	10	8	0:00	0:45

21 MOSTEK SELLING TINY CHIPS AS LICENSEE/GB2.S6
6/04/81 6/08/81 8:43 8 3 0:00 0:01

22 KEYBOARD--INTELLIGENT KEYBOARD AS A COMPONENT/MILLER/GB2.S6
5/26/81 5/27/81 13:39 3 6 0:00 0:11

23 CAD--OUR KEY TO SURVIVAL & WHO CAN MANAGE IT?/PEG/GB2.S6
6/08/81 6/09/81 9:46 3 4 0:01 0:05

24 ETHERNET--OUT AND STANDARDIZE IT/LACROUTE/GB2.S6
5/27/81 5/28/81 14:07 3 3 0:00 0:12

25 STANDARDS--WHAT'S OUR POSITION/FULLER,WHITE/GB2.S6
5/27/81 5/27/81 16:26 5 5 0:01 0:21

26 WPS-LOW COST-LA'S & COMPUTING KEYBOARD/STEWART ET AL/GB2.S6
6/08/81 6/09/81 9:08 8 5 0:03 0:10

27 WPS 278 ORG. LOW COST COMPUTING KEYBOARD/GUTMAN/GB2.S6
6/08/81 6/09/81 9:32 3 5 0:01 0:07

28 MOSTEK--THANK YOU FOR OUR VISIT/PROTHRO/GB2.S6
6/08/81 6/08/81 13:07 6 8 0:01 0:23

29 CT BREADBOARD AVAILABILITY FOR PROGRAM DEV./MILLER/GB2.S6
6/08/81 6/09/81 9:41 2 4 0:01 0:03

30 VT125 GRAPHICS PRODUCT VS. CUTTING MFG./PICOTT/GB2.S6
6/08/81 6/09/81 9:24 5 6 0:01 0:08

31 VENUS DOCUMENTS--STATE OF THE DESIGN/GB2.S6
6/08/81 12/03/81 14:21 9 3 0:00 0:06

32 VAX'S--LOW COST/CARCHIDI/GB2.S6
6/09/81 6/09/81 14:16 8 2 0:02 0:02

33 SEMIS--ANDY'S SUGGESTION ABOUT SEMIS - JAPAN/O.C./GB2.S6
6/09/81 6/09/81 14:32 4 2 0:00 0:00

34 WPS 278--WHAT COST, WHAT PAYOFF, WHAT RISK/KNOLL/GB2.S6
6/09/81 6/09/81 14:41 16 2 0:03 0:03

35 FCC BUBBLE-CONGRATULATIONS/KIRK/GB2.S6
6/09/81 6/09/81 14:44 4 2 0:00 0:00

36 CT FOR WPS?--CAN WE GET THE 278 BETTER/MILLER/GB2.S6
6/09/81 6/09/81 14:47 6 2 0:00 0:00

37 WPS 278--KHO'S MAY 4 MEMO (278 PROPOSAL)/JOHNSON, TED/GB2.S6
6/09/81 6/09/81 14:50 5 2 0:00 0:00

38 CT CONNECTORS--USING MOUDLAR JACKS/MILLER/GB2.S6
6/09/81 6/09/81 14:52 4 2 0:00 0:00

39 PDP-11/23--KEN'S COMMERCIAL PACKAGE/SHANZER/GB2.S6
6/09/81 6/09/81 14:55 4 2 0:00 0:00

40 VISICALC--ON VAX FOR INTERNAL THEN EXTERNAL/JOHNSON,BILL/GB2.S6
6/09/81 6/09/81 14:58 4 2 0:01 0:01

41 DP--COMMENTS ON STRATEGY AND MINI SERIES/KENAH/GB2.S6
6/09/81 6/09/81 15:03 12 2 0:01 0:01

42	VENUS: NOW WHAT?/FAGERQUIST/GB2.S6	6/09/81	6/23/81	16:09	6	3	0:00	0:01
43	TECHNICAL LEADERSHIP/WILKES/GB2.S6	6/11/81	6/11/81	14:45	2	5	0:01	0:08
44	LOW END GROUP TEAM PROPOSAL/GB2.S6	6/16/81	11/09/81	12:07	18	11	0:01	0:30
45	APPOLLO/AVERY/GB2.S6	6/11/81	6/11/81	14:24	3	5	0:01	0:24
46	NAUTILUS--THE NEXT STEP/CROXON/GB2.S6	6/11/81	6/11/81	10:34	6	2	0:01	0:01
47	BOARDS--ONE WEEK PROTO BOARDS/HOMAN/GB2.S6	6/11/81	6/11/81	10:39	3	2	0:02	0:02
48	VENUS--ONE WEEK TURNAROUND / EXTRA KL10'S THIS QTR./DEMMER/GB2.S6	6/11/81	6/11/81	10:43	6	2	0:02	0:02
49	FCC--11/C03/SMITH, PETER/GB2.S6	6/11/81	6/11/81	10:45	2	2	0:00	0:00
50	PDP-11/780 USE MCA'S,NEW TTL/FASTLOGIC/DEMMER/GB2.S6	6/11/81	6/11/81	10:48	4	3	0:00	0:01
51	AWARDS--FLEECE OR FAMINE/THOMPSON/GB2.S6	6/11/81	6/11/81	10:50	4	2	0:00	0:00
52	DEC-WEST--PEOPLE FOR/CUTLER/GB2.S6	6/11/81	9/09/81	15:49	3	3	0:00	0:01
53	DISTRIBUTED SYSTEMS--HARDWARE DEVELOPMENT IN NH/DALEY/GB2.S6	6/11/81	6/11/81	15:57	3	3	0:01	0:01
54	P&Q--PROJECT TO DEMO. QUALITY AND PRODUCIBILITY/OLSEN, KEN/GB2.S6	6/11/81	6/11/81	10:58	13	2	0:02	0:02
55	TERMINALS ARCHITECTURE--AND COMPATIBIILTY/CRAWFORD/GB2.S6	6/11/81	6/11/81	11:01	7	2	0:01	0:01
56	REWARD/PENALTY--SYSTEM IN ENGINEERING/MANUFACTURING/CROXON/GB2.S6	6/11/81	6/11/81	11:03	4	2	0:01	0:01
57	SUPPORTING 16-BIT--PRODUCTS AND DOING EXEMP. ENG./OLSEN/GB2.S6	6/11/81	6/11/81	11:05	6	2	0:00	0:00
58	TEST	6/23/81	6/23/81	10:50	5	3	0:06	0:07
59	ZILOG CHIPS TO IMPLEMENT VAX/AK ET AL/GB2.S6	6/24/81	6/24/81	8:33	10	1	0:00	0:00
60	CAD-HIGH PRIORITY-VT125'S FOR CAD & STD CAD WKSTNS/GB2.S6	6/24/81	6/25/81	16:05	3	4	0:02	0:25
61	AT&T PRESENTATION LEVEL PROTOCOL MANUAL	6/25/81	6/29/81	15:50	2	3	0:00	0:07
62	MIT INDUSTRIAL LIAISON BOOK/PROF.DERTOUGOUS/GB2.S6	6/29/81	6/30/81	14:19	2	3	0:03	0:10

63	ORG.DOMAIN/BELL/PORTNER/GB2.S6	6/30/81	9/28/81 9:23	14	9	0:00	0:57
64	ALTERNATIVES FOR TERM. & TERM. BASED COMP. SYSTEM/OLSEN/GB2.S6	7/06/81	6/09/83 7:18	35	6	0:00	0:07
65	CT/OFIS-STEWART'S & MY ISSUES/BJ/GB2.S6	7/06/81	7/07/81 12:36	3	4	0:04	0:16
66	PERSONNEL--16-BIT PROG. OFFICE MGR./ENG. STAFF/GB2.S6	7/08/81	7/08/81 9:41	5	2	0:00	0:00
67	SCORPIO--PLANNIING, ARCHITECTURE, IMPLEMENT/CUTLER/GB2.S6	7/08/81	7/08/81 9:46	4	2	0:00	0:00
68	VENUS AND OTHER VAXES--BUILDING/DEMMER/GB2S.6	7/08/81	7/08/81 9:49	3	2	0:00	0:00
69	SCORPIO--MANAGEMENT/TEICHER/GB2.S6	7/08/81	7/08/81 9:51	5	2	0:00	0:00
70	ORGANIZATION--SOME THOUGHTS ON CONTINUED.../ENG. STAFF/GB2.S6	7/08/81	7/08/81 9:53	5	2	0:01	0:01
71	XEROX--MAY BE A COMPETITOR.../BUZZ BROOKS/GB2.S6	7/08/81	7/08/81 9:56	11	2	0:01	0:01
72	MOSTEK--SELLING TINY CHIPS WITH.../MACKENZIE/GB2.S6	7/08/81	7/08/81 9:59	8	2	0:01	0:01
73	CONTRACT--BELL/PORTNER RESPONSIBILITY/GB2.S6	9/28/81	2/10/82 14:04	6	2	0:00	0:04
74	ORGANIZATIN ALTERNATIVES FOR ENG/OC SLIDES/GB2.S6	9/28/81	9/28/81 9:30	18	2	0:00	0:01

Document 65 comment:
TO: BRUCE STEWART
CC: BJ, AVRAM
FM: GORDON BELL
SUBJ: BRUCE STEWART'S (AND MY) ISSUES

Name: SECT1 , # of Docs: 75, Blocks left: 98 (of 627)

Number	Name	Created	Modified	Size	Version	Last	Total
1		12/28/79	9/27/83 6:19	9	223	0:01	2:19
2	RANDELL BANK TRANSACTION FOR MILLIONAIRE/BANK/GB1.S1	12/31/79	2/25/80 4:37	4	6	0:00	0:26
3	OFFICE OF CENTRAL ENGINEERING (OCE)/DIST/GB1.S1	0/00/00	2/01/80 13:19	13	11	0:00	1:62

4	TERMINALS-ISSUES ON WHERE TERMINALS ARE HEADING/PICOTT/GB1.S1	1/07/80	9/29/80	10:52	19	14	0:01	1:15
5	OCE AGENDA/DIST/GB1.S1	1/07/80	6/16/81	11:46	8	6	0:01	0:12
6	OCE-DESIGN GOALS AND CONSTRAINTS/DIST/GB1.S1	1/07/80	6/16/81	11:47	15	8	0:00	0:12
7	ROADRUNNER/EMS/BUFFET/GB1.S1	1/07/80	2/01/80	11:45	2	5	0:00	0:07
8	MFG/ENG REV. OF FY80 CHARTER/GOALS/OBJECTIVES/THOMPSON/GB1.S1	1/07/80	9/29/80	11:05	2	5	0:00	0:07
9	CAMBRIDGE SCHOOL/YOUNGREN/GB1.S1	1/08/80	1/23/80	9:06	2	4	0:00	0:10
10	DIGITAL STANDARD BUSSES INTERFACES/GB1.S1	1/14/80	1/14/80	14:47	3	1	0:00	0:00
11	INDIVIDUAL DEVELOPMENT PLANNING KICKOFF/OOD/GB1.S1	1/14/80	2/20/80	13:11	6	9	0:00	0:17
12	STORE PRODUCTS DIRECTION, WHY I'M OPPOSED/MOORE,LP,BJ/GB1.S1	1/14/80	2/20/81	16:03	11	16	0:03	0:30
13	INDUSTRIAL DESIGN/SCHNEIDER/GB1.S1	1/15/80	2/29/80	11:30	17	7	0:00	0:51
14	DECUS DATA/HURLEY/GB1.S1	1/15/80	1/15/80	16:00	2	1	0:04	0:04
15	MINC--CONGRATULATIONS ON DROP SHIPPING FR. WF/MCBRIDE/GB1.S1	1/15/80	1/16/80	8:48	2	4	0:01	0:10
16	STORE PRODUCTS DIRECTION...RULER CORRECTION	1/16/80	2/20/81	16:00	12	4	0:06	0:16
17	POPULATION FIGURES -URGENT- FROM AL PYFFER/GB1.S1	1/16/80	3/12/80	13:04	3	3	0:01	0:08
18	PRODUCT HISTORY DATA/GUTMAN,LACROUTE,PEARSON/GB1.S1	1/16/80	9/29/80	11:04	4	7	0:02	0:21
19	BUS SCHEDULE/GB1.S1	1/17/80	9/29/80	10:51	11	11	0:00	0:17
20	STRATEGY ISSUES - SLIDES/32 BIT REVIEW/GB1.S1	1/17/80	7/22/80	9:05	7	9	0:00	0:33
21	I/C EXHIBIT FOR YOUR AWARENESS PROGRAM/CUTLER/GB1.S1	1/17/80	1/31/80	4:36	6	6	0:05	0:45
22	BADGE--GWEN /GB1.S1	1/17/80	2/20/81	16:04	3	5	0:00	0:10
23	BUS SCHEDULE SLIDES FOR HANDOUT/GB1.S1.19	1/17/80	2/20/81	16:06	8	5	0:00	0:05
24	APPLICATIONS-RISK/APPROACHES OF BLDG IN 80'S/STONE/GB1.S1	1/17/80	2/25/80	4:41	5	8	0:00	0:25

25	THREE RIVERS PER Q - A THREAT, TREND?/FAGERQUIST/GB1.S1	1/17/80	1/23/80	13:55	3	8	0:01	0:15
26	STRATEGY ISSUE SLIDES FOR HANDOUTS/GB1.S1.20	1/17/80	2/01/80	15:03	6	4	0:00	0:05
27	WPS ENGINEERING INTO CE ANNOUNCEMENT/STAN OLSEN	1/18/80	2/08/80	11:27	6	17	0:00	0:26
28	MARKETING COMMITTEE ANSWER/WITMORE/GB1.S1	1/18/80	2/25/80	4:37	2	5	0:00	0:07
29	DOCK MERGE/CUSTOMER MERGE/PROGRAM MANAGER/OOD/GB1.S1	1/18/80	2/01/80	13:17	4	8	0:00	0:29
30	CSS RE: CHARTER TO BE HW PRODUCT FOCUSSED/BUTLER/GB1.S1	1/18/80	2/01/80	13:17	3	6	0:00	0:18
31	BOROVOY, ROGER--CLASS OF '56/GB1.S1	1/21/80	9/29/80	10:53	2	3	0:00	0:05
32	DARTMOUTH MEDICAL SCHOOL/STIBITZ/GB1.S1	1/21/80	1/23/80	12:43	4	6	0:00	0:14
33	BABBAGE, CHARLES, INSTITUTE/ARMER/GB1.S1	1/21/80	1/30/80	10:03	5	8	0:00	0:08
34	NATIONAL SCIENCE FOUNDATION/PASTA/GB1.S1	1/21/80	4/25/80	4:13	3	4	0:02	0:06
35	NAE--ABSTRACT OF ENGINEERING EDUCATION/BOLEY/GB1.S1	1/22/80	5/22/80	4:51	1	5	0:00	0:11
36	HARRIS SEMICONDUCTOR GROUP/DOBSON,PENNINGTON/GB1.S1	2/04/80	3/13/80	15:17	12	12	0:01	0:63
37	THANK YOU FOR UNDERWOOD TYPEWRITER/PANNELL/GB1.S1	1/22/80	1/22/80	12:20	3	1	0:04	0:04
38	LOWER COST SYS. ARE LIMITED--DISK ELECTRONICS/CLAYTON/GB1.S1	1/22/80	1/24/80	8:56	3	3	0:01	0:02
39	IEEE - PAPER ON INNOVATION.../WEINSCHEL/GB1.S1	1/23/80	1/25/80	16:21	2	2	0:00	0:06
40	SW ARCHITECTURE - DESIGN OF AN INTERCONNECT/STRECKER/GB1.S1	1/29/80	2/20/81	16:11	5	4	0:01	0:02
41	VT100--WINNING THE VT100 FAMILY/PICOTT,CLAYTON.../GB1.S1	1/30/80	7/02/80	10:11	4	5	0:01	0:17
42	NSF PERMISSION/GB1.S1	1/23/80	2/20/81	16:18	2	3	0:00	0:06
43	VT278 BUSINESS PLAN/COLE/GB1.S1	1/30/80	1/31/80	12:12	2	4	0:01	0:09
44	MEETING OUR COMMITTMENTS/OOD/GB1.S1	1/30/80	9/29/80	11:04	5	13	0:00	0:29
45	COMPTROLLER GENERAL/STAATS/GB1.S1	1/30/80	7/14/81	16:36	21	14	0:00	2:25

46	ANTIQUES-ANOTHER ARITHOMOMETER?/DELEHAR/GB1.S1	1/30/80	3/07/80	12:10	1	4	0:00	0:04
47	PRICE VS. FUNCTUALITY FACTS/CLATYON,CAMPBELL/GB1.S1	2/01/80	2/01/80	9:26	3	6	0:01	0:11
48	DIRECTION-MY UNDERSTANDING OF THE DIRCTION/CLAYTON/GB1.S1	2/01/80	9/29/80	11:06	9	2	0:01	0:01
49	APPROVAL OF PAPERS FOR VARIOUS/JIM BELL/GB1.S1	2/01/80	2/01/80	12:48	5	1	0:00	0:00
50	DP--MORE ON THE DEFINITION OF DP/GB1.S1	2/01/80	2/01/80	12:53	3	1	0:00	0:00
51	INTERFACE CHIP/ZEH/GB1.S1	2/01/80	2/01/80	12:55	3	1	0:00	0:00
52	INVITATION/GILMORE/GB1.S1	2/01/80	2/01/80	12:57	6	1	0:00	0:00
53	PUBLICATION POLICY/JIM BELL/GB1.S1	2/01/80	2/01/80	12:59	6	1	0:00	0:00
54	SOLID WIRE ON PEDESTAL 100'S/BUSIEK/GB1.S1	2/01/80	2/01/80	13:01	5	1	0:00	0:00
55	WS200 VS. WD200/STAN OLSEN,STEWART/GB1.S1	2/11/80	2/11/80	4:47	4	4	0:00	0:01
56	WPS-BRING IN ON AN 11 THAT'S COMPATIBLE WITH 8/WILLIS/GB1.S	2/07/80	2/08/80	11:22	24	7	0:04	0:25
57	METROPOLIS - ENJOYED ANNALS ARTICLE - GB/GB1.S1	2/08/80	2/08/80	12:05	5	1	0:01	0:01
58	UNIVERSITY OF MICHIGAN--PHOTOS REQUEST/GALLER/GB1.S1	2/08/80	3/28/80	9:10	5	2	0:00	0:01
59	KOSKO, DAVE/CARCHIDI/GB1.S1	2/11/80	2/11/80	4:48	3	3	0:00	0:01
60	ROM, A BIG ROM FOR ONE FLOPPY?/COLE/GB1.S1	2/12/80	2/25/80	14:00	3	5	0:01	0:13
61	CABINETS AND RL02'S/LACROUTE,GUTMAN/GB1.S1	2/12/80	2/12/80	15:53	2	6	0:00	0:06
62	VLSI-KEEPING PEOPLE THROUGHOUT SCORPIO/CLAYTON.../GB1.S1	2/11/80	2/11/80	4:47	2	5	0:00	0:01
63	SPACE PLANNING GUIDELINES/HOLMAN/GB1.S1	2/11/80	2/13/80	14:03	12	6	0:01	0:02
64	DIRECTIONS TO TEWKSBURY RE: GRAPHICS/PICOTT/GB1.S1	2/11/80	2/11/80	4:46	3	4	0:00	0:00
65	WANG, AN - NOMINATED FOR NAE/KEN OLSEN/GB1.S1	2/11/80	2/11/80	4:46	2	4	0:00	0:00
66	STRATEGIC SPACE PLANNING INTERACTION MATRIX/OOD/GB1.S1	2/13/80	2/13/80	12:42	9	8	0:00	0:56

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 67     PRODUCTS/INTRO STRATEGY--WRONG IN LE?/MACKEEN/GB1.S1
                             2/11/80  2/11/80  4:46  5    3        0:01   0:02
 68     TECHNICAL REVIEW ARTICLE/ALLEN/GB1.S1
                             2/13/80  2/13/80 14:42  1    3        0:00   0:07
 69     PERSONAL VAX PROJECT--GET IT MOVING QUICKLY/THISSELL/GB1.S1
                             2/11/80  7/02/80 10:10  14   6        0:01   0:03
 70     SOLAR THOUGHT FOR THE DAY/STOCKEBRAND/GB1.S1
                             2/11/80  2/11/80  4:44  3    4        0:00   0:00
 71     DAVIS, SHEL--LETTER TO GWEN/GB1.S1
                             2/15/80  2/20/81 16:20  4    5        0:00   0:13
 72     BUDGET--WHY CE MUST INCREASE FOR FY81/GB1.S1
                             0/00/00 11/10/80 13:48  30   19       0:00   3:25
 73     BAXTER ASSOCIATES, INC./GREATHOUSE/GB1.S1
                             2/15/80  2/15/80 11:21  2    2        0:08   0:08
 74     FINISHING THE 74 PROPERLY/DEMMER/GB1.S1
                             2/11/80  2/15/80 11:28  3    3        0:00   0:00
 75     WPS P/L AND PRODUCT DIRECTION/STEWART.../GB1.S1
                             2/15/80  2/15/80  4:39  4    5        0:01   0:11


Name: SECT2 , # of Docs: 53, Blocks left: 240 (of 627)
-------------------------------------------------------------------------------
Number  Name                    Created  Modified       Size Version  Last   Total
-------------------------------------------------------------------------------
  1
                            12/31/79  9/22/80 11:07  6    145      0:01   1:02
  2     WPS - A SHARED BUYOUT?/STEWART.../GB1.S2
                             2/18/80  2/18/80 11:38  2    2        0:00   0:00
  3     MINUTES, RE: 11/FEB/80 MINUTES/PADERSON/GB1.S2
                             2/18/80  2/20/80 16:45  5    5        0:00   0:21
  4     PRODUCTS--DILEMMA--NEEDING MORE /SAVIERS.../GB1.S2
                             2/18/80  2/27/80  4:09  16   13       0:00   0:63
  5     K.PLI, WHAT'S A K.PLI?/LIGNOS.../GB1.S2
                             2/18/80  2/19/80 15:51  3    8        0:00   0:04
  6     FAT-WHY I WANT TO RESTRUCTURE THE FAT/SMITH/GB1.S2
                             2/18/80  2/20/80 16:04  18   10       0:01   2:06
  7     SYSTEMS TYPES,CATEGORIES OF /SMITH/GB1.S2
                             2/18/80  9/29/80 10:57  7    10       0:00   0:53
  8     BAUD (2400) SEEMS LIKE ENOUGH/CRAWFORD/GB1.S2
                             2/18/80  2/20/80 14:24  4    4        0:02   0:10
  9     LOW END SEMICONDUCTOR MAKE/BUY POLICY/PADERSON/GB1.S2
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2/18/80 3/10/80 3:40 10 13 0:00 0:42

10 MIT/MOSES/GB1.S2

2/18/80 3/18/80 11:03 2 3 0:16 0:23

11 PEYSER (MINNA POST)AND ASSOCIATES/PEYSER/GB1.S2

2/19/80 2/20/80 13:40 2 2 0:01 0:07

12 AAAS NOMINATION FOR FELLOW - GB VITA/GB1.S2

2/20/80 2/20/81 16:27 14 5 0:00 0:04

13 BUDGET - STRATEGY TO RAISE THE CE BUDGET/TOMASIC/GB1.S2

2/20/80 2/21/80 10:08 3 3 0:00 0:12

14 INFOTECH/MULLER/GB1.S2

2/20/80 2/21/80 10:39 1 2 0:00 0:01

15 INTERCONNECT MEETING/GB1.S2

2/22/80 4/04/80 9:20 4 6 0:00 0:05

16 APPLICATIONS, MICROCOMPUTER /ZARRELLA/GB1.S2

2/22/80 2/25/80 11:13 1 3 0:01 0:09

17 SYSTEMS 1970-1990/SMITH/GB1.S2

2/25/80 9/29/80 10:58 9 10 0:00 0:36

18 TERMINALS-SOLID WIRE ON PEDESTAL 100'S/BUSIEK/GB1.S2

2/25/80 7/02/80 10:11 6 7 0:00 0:04

19 TERMINALS PRODUCT DIRECTION/OLSEN, STAN/GB1.S2

2/25/80 9/29/80 10:56 9 4 0:01 0:11

20 WPS ORGANIZATION--LET'S WRAP UP TOMORROW/OLSEN, STAN/GB1.S2

2/25/80 2/25/80 4:25 4 2 0:01 0:01

21 NEBULA-GETTING SERIOUS WITH NEBULA/LACROUTE/GB1.S2

2/25/80 2/25/80 4:50 10 3 0:01 0:05

22 HARRIS/DOBSON, PENNINGTON/GB1.S2

2/25/80 3/05/80 12:06 5 8 0:00 0:10

23 R80 - YOUR NOTE/HINDLE/GB1.S2

2/25/80 2/25/80 4:56 7 2 0:02 0:02

24 BUDGET, FY81, 82, 83 BUDGET/CLAYTON/GB1.S2

2/25/80 2/25/80 4:59 3 3 0:00 0:01

25 MULTITERMINAL SYS. OLEH SPEAK GOOD WORDS/OLSEN, STAN/GB1.S2

2/25/80 2/25/80 5:02 10 2 0:03 0:03

26 VAX-PERSONAL PROJECT/CADY/GB1.S2

2/25/80 4/15/80 13:41 15 3 0:01 0:03

27 NOMENCLATURE PROGRAM/BENNETT/GB1.S2

2/25/80 2/25/80 5:09 11 2 0:02 0:02

28 EUROPEAN ENGINEERING LOCATION IN JAPAN/FROST/GB1.S2

2/25/80 2/25/80 5:10 4 2 0:00 0:00

29 TOUCH TONE--MORE ON THEM/JOHNSON/GB1.S2

2/25/80 2/25/80 5:12 2 2 0:00 0:00

30 BUDGET, PROPOSAL TO RAISE ENG. BUDGET/CLAYTON/GB1.S2

2/25/80 2/25/80 5:15 9   2   0:02   0:02

31 TELECONF. STRATTON V--PERMISSION TO LORRIN/PORTNER/GB1.S2

2/25/80 2/25/80 5:18 5   2   0:02   0:02

32 OCR'S BEING USED W/DEC WS'S,REQUEST INFO RE:/GILMORE/GB1.S2

2/25/80 4/11/80 11:29 2   4   0:00   0:02

33 MAKE BUY SPACE--PLEASE HELP/CROUSE/GB1.S2

2/25/80 3/10/80 3:40 5   3   0:00   0:00

34 TERMINALS & SMALL SYS ENGINEERING--LOCATION/CLAYTON/GB1.S2

2/27/80 9/29/80 10:56 5   5   0:00   0:22

35 HG, OR HGII/VAN ROEKENS,HASSETT/GB1.S2

2/27/80 2/28/80 13:35 2   6   0:00   0:11

36 COMPUTER CONSOLES INC. (CCI)/AFFEL,TAI/GB1.S2

2/27/80 3/03/80 15:44 2   4   0:00   0:11

37 VAX PARTY EXPENSES/GB1.S2

5/15/80 2/23/81 16:24 3   5   0:00   0:12

38 VAX PARTY FORM INVITATION/GB1.S2

3/04/80 2/23/81 16:24 2   20   0:00   0:13

39 VAX PARTY SPEC/GB1.S2

3/04/80 2/23/81 16:25 1   68   0:00   0:17

40 VAX PARTY FORM RSVP TALLY/GB1.S2

3/04/80 2/23/81 16:25 1   29   0:00   0:40

41 VAX PARTY LIST/GB1.S2

3/04/80 2/23/81 16:25 65   22   0:00   0:32

43 ARITHMOMETER PAYMENT, DELEHAR/BANK/GB1.S2

3/07/80 2/23/81 16:26 2   3   0:01   0:10

44 NATIONAL SCIENCE FOUNDATION/RESNIKOFF/GB1.S2

3/10/80 3/10/80 11:17 1   3   0:00   0:06

45 BACKPLANE, MERCURY/VAN ROEKENS.../GB1.S2

3/10/80 3/10/80 12:09 2   4   0:01   0:09

46 DATA FLOW MACHINE OPERATIONAL?/DICKMAN,FULLER/GB1.S2

3/10/80 3/10/80 12:05 2   8   0:00   0:05

47 UMASS--EVALUATION OF PROPOSAL/MORRIS/GB1.S2

3/11/80 5/22/80 4:51 2   3   0:00   0:09

48 TEXAS INSTRUMENTS/CRAGON/GB1.S2

3/10/80 3/10/80 12:01 1   3   0:00   0:02

49 DIBS III & FIXED PARAMETERIZED/ALGORITHMIC APPLIC./GB1.S2

3/11/80 3/11/80 15:27 11   2   0:02   0:02

50 ARITHMOMETER/DELEHAR/GB1.S2

3/12/80 3/12/80 11:23 1   3   0:01   0:03

51 TERMINALS BUSINESS LOCATION/SO,JS,RC/GB1.S2

3/14/80 2/23/81 16:29 6   11   0:00   0:23

52 LAWRENCE LIVERMORE LABORATORY/WOOD--GB/GB1.S2

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                              3/14/80  3/14/80 11:32  3    1        0:02   0:02
 53     RESULT
                              3/20/80  4/04/80 15:24  2    18       0:00   0:04
 54     VAX PARTY PROGRAM FORM/GB1.S2
                              3/26/80  4/04/80  9:10  6    8        0:00   0:05

Document 53 comment:
   mc
2


Name: SECT1 , # of Docs: 35, Blocks left: 97 (of 627)
-------------------------------------------------------------------------------
Number  Name                    Created  Modified       Size Version  Last   Total
-------------------------------------------------------------------------------
  1
                             12/31/80  9/27/83  6:16  5    97       0:01   0:28
  2     ECKERT-MAUCHLY AWARD--CLARK NOMINATION/STONE ET AL/GB2.S1
                             12/31/80 11/16/81 11:35  20   32       0:01   1:40
  3     CT'S,VT'S AND Q-BUS SYSTEMS--WHERE ARE WE GOING?/LYLE/GB2.S1
                              1/05/81  8/31/81 16:26  10   7        0:01   0:36
  5     MUSEUM--SUBMIT PAPER TO ANNALS/ATANASOFF/GB2.S1
                              1/05/81  1/05/81 14:37  9    3        0:00   0:21
  6     ASTC/GRINELL/GB2.S1
                              1/05/81  2/09/81  0:12  7    10       0:01   0:27
  7     PRINTER--SHEET FEED VS. ROLL OR FOLDED FORM/LYLE.../GB2.S1
                              1/05/81  1/07/81  9:38  4    6        0:01   0:06
  8     DIGITAL PRESS--STERN MANUSCRIPT REVIEW/KENAH,DUFFY/GB2.S1
                              1/06/81  2/15/83 11:27  92   11       0:00   0:17
  9     TERMINALS HOME QUIZ/OOD/GB2.S1
                              1/08/81  1/08/81 15:38  4    2        0:05   0:18
 10     SCOTT INSTRUMENTS--VOICE RECOGNITION/NIEDERHOFER/GB2.S1
                              1/09/81  1/26/81 11:34  3    4        0:00   0:06
 11     REFERENCE FOR BILL MILLER/GINZTON/GB2.S1
                              1/13/81  2/03/81 12:51  1    3        0:00   0:03
 12     CONSOLE--IN VENUS & JUPITER/FAGERQUIST/GB2.S1
                              1/12/81  1/12/81 12:09  3    6        0:01   0:05
 13     HARVARD U.--WORKSHOP,COMM. NETWORK MANGE./OETTINGER/GB2.S1
                              1/16/81  4/15/81 11:25  3    5        0:01   0:13
 14     TINY--SELLING, ESPECIALLY WITHIN DEC/LYLE.../GB2.S1
                              1/12/81  1/12/81 12:00  6    5        0:00   0:04
 15     MUSEUM LECTURE/ZUSE, KONRAD/GB2.S1
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		1/16/81	1/20/81	9:53	4	14	0:00	1:01
16	MUSEUM - SIEMENS' ZUSE --EXHIBIT/DATENTECHNIK/GB2.S1							
		1/16/81	2/03/81	12:41	3	7	0:00	0:01
17	MUSEUM LECTURE AND ENIAC MATERIAL /BURKS/GB2.S1							
		1/16/81	2/03/81	12:50	6	9	0:01	0:04
18	DP BOOK--MICROPROC. LSI-11 (BY F. LEE--MIT)/MACKEEN/GB2.S1							
		1/12/81	2/03/81	12:38	5	6	0:00	0:05
19	MUSEUM LECTURE SCHEDULED/EDWARDS/GB2.S1							
		1/16/81	2/03/81	12:47	2	4	0:01	0:01
20	MUSEUM--DO WRITE ARTICLE FOR ASC/GALLER/GB2.S1							
		1/19/81	2/03/81	12:48	4	6	0:01	0:07
21	MUSEUM--GETTING ARTICLE TO GALLER/ATANASOFF/GB2.S1							
		1/19/81	1/20/81	9:38	3	5	0:03	0:06
22	MUSEUM--REPLICA OF SHICKARD MACHINE/TAYLOR/GB2.S1							
		1/19/81	2/02/81	9:16	2	8	0:00	0:08
23	ZEBCO--FISHING REEL/GB2.S1							
		1/20/81	1/22/81	13:48	2	2	0:00	0:02
24	DP - BOOK,"MICROPROCESSORS LSI-11/LEE/GB2.S1							
		1/20/81	1/20/81	11:28	3	2	0:01	0:07
25	MUSEUM--POSSIBLE LECTURE(COLOSSUS)/FLOWERS/GB2.S1							
		1/20/81	1/21/81	12:38	2	5	0:01	0:16
26	GENERATING COMPUTER GENERATIONS TALK AS OF 1/26/81/GB2.S1							
		1/26/81	2/09/81	14:54	124	5	0:02	0:10
27	ORGANIZATION - OOD RESTRUCTURED--1/23/81/GB2.S1							
		1/26/81	9/20/82	14:12	11	4	0:00	0:05
28	HSC-50 BUSINESS PLAN/GUTMAN/GB2.S1							
		2/02/81	2/13/81	13:24	5	3	0:01	0:02
29	MUSEUM--THANK YOU & PAYMENT FOR PASCAL/GUATELLI/GB2.S1							
		1/27/81	2/02/81	2:26	4	4	0:00	0:02
30	ATANASOFF - U. OF WISCONSIN-MADISON-- INFO./THOMPSON/GB2.S1							
		1/27/81	2/15/83	11:29	3	6	0:00	0:03
31	GENERATING COMPUTER GENERATIONS TALK AS OF 1/27/81/GB2.S1							
		1/27/81	2/09/81	14:50	124	6	0:03	0:13
32	SIEMENS--TERMINALS CONTACT/SCHWAB/GB2.S1							
		1/27/81	2/04/81	13:33	1	2	0:00	0:03
33	WPS PRODUCT LIST/OLSEN, KEN/GB2.S1							
		1/27/81	1/30/81	9:26	3	8	0:07	0:13
34	BOARDS RELAYOUT--MFG WILL PAY/OOD/GB2.S1							
		2/02/81	2/02/81	2:26	4	2	0:00	0:00
35	SUVAX: WHAT DO I TELL THIS TROOP/OLSEN, KEN/GB2.S1							
		2/02/81	2/02/81	2:29	6	2	0:01	0:01
36	FCC--I'M GOING AHEAD WITH BOYLSTON/OLSEN, KEN/GB2.S1							

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                             2/02/81  3/12/81 15:48  6    3        0:00   0:01

  6
                             0/00/00 11/02/82 10:31  14   5        0:04   0:44
  7
                            11/14/82 11/14/82  0:20  4    1        0:20   0:20
  8
                            11/20/81 11/30/81 15:55  22   9        1:53   5:57
  9
                            11/14/82 11/14/82  1:06  6    1        0:16   0:16
 13
                             0/00/00  5/21/82 11:34  49   21       0:33   7:20
 14
                             5/12/82  7/23/82  0:04  4    8        0:01   1:33
 17
                             0/00/00  5/21/82 10:57  4    2        0:00   0:12
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Name: SECT1 , # of Docs: 57, Blocks left: 139 (of 627)
-------------------------------------------------------------------------------
Number  Name                    Created  Modified       Size Version  Last   Total
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  1
                            10/05/81  6/07/82 15:19  8    271      0:04   2:49
  2     INDEXXES
                             6/07/82  6/07/82 15:19  21   1        0:00   0:00
  3     CMU JOINT PROP. FOR DEV. OF PERSONAL C./SLIDES/ GB3.S1
                            10/16/81  5/27/82 10:04  5    8        0:01   0:03
  4     COMMUNICATIONS, COMPETITIVE RESP./DEMMER ET AL/GB3.S1
                            10/05/81  5/12/82 11:27  5    4        0:00   0:02
  5     DPD,  HERE IS A FRANK APPRAISAL/ABBOTT/GB3.S1
                            10/05/81  5/12/82 11:54  2    4        0:01   0:03
  6     THANKS: MURRAY, DR. JOHN, TEACHING VLSI/GB3.S1
                            10/19/81  5/12/82 11:52  2    5        0:00   0:16
  7     MUSEUM: REQUEST FOR DEUCE DRUM PROF. MURRAY ALLEN/GB3.S1
                            10/19/81  5/12/82  9:50  3    5        0:00   0:09
  8     PHILIPS, THANKS-HOSP. IN EINDHOVEN/DRS. TEER & BOSMA/GB3.S1
                            10/05/81  4/30/82 12:54  2    13       0:01   0:13
  9     PHILIPS, THANK YOU/MR. HOFF/GB3.S1
                            10/05/81  5/12/82 17:03  3    7        0:01   0:11
 10     ROYALTY PAYMENTS-CARNEGIE MELLON/OBRIEN/GB3.S1
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                    10/05/81  5/12/82 17:09  2    5        0:00   0:00
11    PHILIPS, THANKS-HOSPITALITY IN EINDHOVEN/PENNENBORG/GB3.S1
                    10/06/81  5/12/82 17:02  5    20       0:01   0:51
14    FLOPPY, DISCLOSURE OF ELEC. FLOPPY/SAVIERS ET AL/GB3.S1
                    11/12/81  5/12/82 11:50  2    7        0:02   0:04
15    PRODUCT DIFFERENTIATION FOR STORES-11/23/GUTMAN/GB3.S1
                    10/06/81  1/21/82  9:17  2    4        0:03   0:04
16    VT102 REPLACEMENT PACKAGING/OLSEN/GB3.S1
                    10/07/81 11/22/82  9:28  9    14       0:00   0:54
17    CONTRIBUTION: C. IN SCI&TECH CENTERS-MUSEUM/CONT.CO /GB3.S1
                    11/02/81  5/12/82 11:44  5    7        0:02   0:62
18    IBM COMMITMENT WHAT THEY'RE DOING/WHAT WE SHOULD DO/GB3.S1
                    11/12/81  5/12/82 11:53  6    7        0:01   0:07
19    CMU JOINT PROP. DISC.-DOUG VAN HOUWELLING/FULLER/GB3.S1
                    11/17/81 12/29/81 10:59  7    3        0:00   0:01
20    DAWN, DECISION TO CONTINUE/WILL T./GB3.S1
                    10/08/81  4/30/82 12:36  2    8        0:00   0:04
22    CMU JOINT VENTURE DISC. WITH ALLEN NEWELL/FULLER/GB3.S1
                    11/17/81 12/29/81 10:59  6    3        0:01   0:02
23    CMU PROC. AHEAD-EXPL THE CMU/DEC RES. PROP./FULLER/GB3.S1
                    11/17/81  2/23/82 10:26  3    4        0:00   0:01
24    VENDOR: RIXON INTERFACE W/DEC SENT TO BERNIE/BERNIE/GB3.S1
                    10/10/81  5/12/82 17:09  4    7        0:00   0:08
25    CMU SUPPORTING MARIO'S PROMOTION/HABERMANN/GB3.S1
                    10/10/81  4/30/82 12:24  4    4        0:01   0:01
26    CMU JONT VENTURE INTO TOTAL ENVIRONMENTAL COMPUTING/GB3.S1
                    11/17/81 12/29/81 10:58  5    3        0:00   0:01
27    SERVER, GETTING A PERSONAL COMPUTER/GUTMAN/GB3.S1
                    11/17/81  2/23/82 10:25  5    4        0:03   0:05
28    CMU PROPOSAL--US AND THE NEXT ENG. SITE/FULLER/GB3.S1
                    11/17/81  1/08/82 12:33  4    5        0:00   0:03
29    SUVAX, MEETING ON TERMINALS STATUS/CHAMPINE/GB3.S1
                    11/17/81 12/29/81 10:57  5    3        0:00   0:00
30    MUSEUM: FLOWERS LECTURE-OCT. 15 AT MUSEUM/ENG. USERS/GB3.S1
                    11/17/81 12/29/81 11:30  3    4        0:00   0:00
31    BUSSES, WILL OURS DRIVE US OUT OF BUSINESS/FULLER/GB3.S1
                    11/17/81 11/17/81 15:03  5    2        0:01   0:01
32    PLUTO, GETTING A REAL START ON /LACROUTE/GB3.S1
                    11/17/81 12/29/81 11:28  5    3        0:01   0:02
33    CMU PROPOSAL FOR JOINT DEV. OF PERSONAL COMP./FULLER/GB3.S1
                    11/03/81  5/12/82 12:55  5    5        0:01   0:03
34    MUSEUM: OREGON MUS. OF SCI & TECH TEMPLETON/GB3.S1
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11/03/81 5/12/82 12:58 2 6 0:02 0:13
35 INVITATION NO: CAN'T SUPPT. VAX/780 COMP LAB/PROF PEASE/GB3.S1
11/03/81 4/30/82 12:53 5 4 0:02 0:15
36 SEMICONDUCTOR, YOUR FAULTY PERCEPTION RE SELLING TINY/TJ/GB3.S1
11/17/81 6/01/82 16:35 8 4 0:00 0:01
38 QBUS, USING IT FOR BUILDING COMM SYSTEMS/BUTLER/GB3.S1
11/17/81 12/29/81 11:31 6 4 0:00 0:00
39 TAIWAN, CT05-ENGINEERING/TETSCHNER/GB3.S1
11/17/81 11/17/81 15:13 3 2 0:00 0:00
40 RECOGNITION: TURNER'S ARTICLE ON IBM AWARD/DELAGI/GB3.S1
11/17/81 11/17/81 15:15 3 2 0:01 0:01
41 EQUIPMENT NEEDED FOR GUARANTE/CHARLIE ROSE/GB3.S1
11/18/81 4/30/82 13:28 3 4 0:01 0:07
43 RENTAL CAR FOR HOOPER/GB3.S1
11/20/81 3/04/82 12:39 3 4 0:04 0:16
44 INVITATION NO: BUTLER, COST & PARTNERS CAN'T ATTEND/GB3.S1
11/20/81 5/12/82 11:08 1 4 0:01 0:06
45 HERTZ, FOUNDATION-RE: TOM MCWILLIAMS/TALLEY/GB3.S1
11/23/81 5/12/82 12:25 2 3 0:02 0:07
46 HERTZ, CONGRATULATIONS FOUNDATION/MCWILLIAMS/GB3.S1
11/23/81 5/12/82 12:26 2 2 0:01 0:10
47 HOROWITZ RESPONSE/I FEEL THE SAME WAY/GB3.S1
11/23/81 5/27/82 10:01 1 5 0:00 0:10
48 ORGANIZATIONS, THOUGHTS ON EVOLVING/ENG. STAFF/GB3.S1
1/11/82 1/11/82 15:03 15 6 0:01 0:27
49 EMS RESPONSE TO INTERNAL IMPLEMENTATION/CRAWFORD
1/11/82 1/11/82 16:13 3 3 0:01 0:14
50 ORGANIZATIONS EVOLVING/ENG STAFF/GB3.S1
1/12/82 5/27/82 9:59 15 2 0:01 0:01
53 SEMICONDUCTOR STRATEGY, CAN WE ARRIVE AT?/GB3.S1
1/12/82 1/12/82 10:02 7 1 0:00 0:00
54 CONTRIBUTION: U OF NC FUNDING HELP/CHAMBERLAIN/CAPOWSKI/GB3.S1
11/30/81 5/12/82 11:10 2 4 0:02 0:09
59 STATE OF THE DESIGN-WHAT WE HAVE-WHAT WE WANT/GB3.S1
12/03/81 5/12/82 17:15 9 5 0:01 0:07
61 HEURISTICS FOR BUILDING GREAT PRODUCTS/GB3.S1
1/12/82 2/02/82 10:38 31 15 0:13 3:13
62 REFERENCE: FOR DR. MORRIS' PROMO-YES I AGREE/RIORDON/GB3.S1
12/04/81 5/12/82 17:09 2 5 0:01 0:10
64 INVITATION NO: INMOS ARCHITECUTRE /BARRON /GB3.S1
12/08/81 6/01/82 15:38 3 6 0:01 0:11
65 GEMINI SIMULATION (COMMENTS ON YOUR STATUS RPT)/KUSIK/GB3.S1

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                          1/14/82  1/14/82  9:14  2    1        0:05   0:05
 67     THANKS: BOOK-BIRTHPLACES OF EUROPEAN SCI./HARRY GRAY/GB3.S1
                          8/14/81  5/12/82 12:44  4    9        0:01   0:18
 69     MCF PETITION TO STOP MCF /LOWELL WOOD/GB3.S1
                          1/15/82  5/27/82  9:56  4    5        0:01   0:11
 72     DAVIS, GERALD SUMMARY MEMO TO GBELL RE: DEC MARKETS ETC
                          1/19/82  6/01/82 14:40  15   7        0:00   1:17
 73     DAVIS, GERALD THANK YOU FOR DINNER /GB3.S1
                          1/22/82  6/01/82 14:40  2    5        0:01   0:17
 79     ETHERNET, UNIBUS OF FIFTH GENERATION/GB3.S1
                          1/25/82  6/02/83 11:42  133  23       0:01   3:50


Name: SECT2 , # of Docs: 58, Blocks left: 105 (of 627)
------------------------------------------------------------------------------
Number  Name                    Created  Modified       Size Version  Last   Total
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  1
                          1/29/82  0/00/00  0:01  8    132      0:01   1:62
  2     INDEXXES
                          6/07/82 10/19/82  9:02  22   4        0:00   0:00
  4     CUSTOMER: DUPONT (PENSAK)FOR GOOD RELATIONS-ACT NOW/GB3.S2
                          2/02/82  6/01/82 17:09  7    5        0:00   0:08
  5     HEURISTICS FOR BUILDING GREAT PRODUCTS-PRELIM. DRAFT/GB3.S2
                          2/02/82 11/30/82 11:45  43   16       0:02   0:39
  6     MOTO-OKA THANKS FOR PRES. 5TH GEN. RESEARCH PROG/MOTO OKA/GB3.S2
                          2/02/82  8/10/82  9:41  4    10       0:00   0:03
  7     MOTO-OKA HELP, THANKS/DERTOUZOUS AND PENNFIELD/GB3.S2
                          2/02/82  5/12/82 11:48  3    8        0:01   0:14
  9     ETHERNET SPEECH-PRESS CONFERENCE/GB3.S2
                          2/08/82  6/02/83 11:43  79   11       0:00   1:09
 10     MOCW AGENDA/ENG STAFF/GB3.S2
                          3/11/82  6/01/82 16:54  8    7        0:00   1:43
 11     WPS8-DILEMA OF INTRODUCING 3 P.C.'S/AVERY ET AL/ GB3.S2
                          4/08/82  6/01/82 16:53  7    6        0:00   1:10
 13     AUBURN UNIVERSITY EXEC REPORT OF NO VALUE/PROF LINK/GB3.S2
                          8/11/82  4/30/82 13:05  2    3        0:00   0:05
 14     THANKS: FOR TEACHING COURSE/CARVER MEAD/ GB3.S2
                          2/12/82  5/12/82 11:18  5    7        0:08   0:12
 15     ENGINEERING SPECIFIC ORGANIZATION IDEAS/OC/GB3.S2
                          2/16/82  5/12/82 17:13  5    4        0:01   0:02
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16	ENGINEERING ORGANIZATIONS/GB3.S2	2/16/82	6/01/82	16:56	5	9	0:01	0:07
17	DEC2080 SLIP CAN'T MEAN NI & PLUTO WILL SLIP/GB3.S2	2/16/82	3/01/82	4:03	6	9	0:00	0:07
18	ETHERNET PRESENTATION IN NY - THANK YOU/GB3.S2	2/16/82	2/23/82	10:41	5	8	0:01	0:09
19	BELL: WHAT GORDON LIKES AND DISLIKES/GB3.S2	2/16/82	9/30/82	4:50	7	10	0:01	0:29
20	VENDOR FEEDBACK--COMMENTS ON OUR MKTING FOLKS/ENG.STAFF/GB3.S2	2/16/82	5/12/82	11:27	5	8	0:02	0:07
21	ECKERT MAUCHLEY AWARD GIVEN FOR PATTERSON WRITEUP/GB3.S2	2/16/82	6/01/82	17:07	4	10	0:01	0:17
22	VT278, CONGRATULATIONS/GB3.S2	2/16/82	3/01/82	3:59	2	3	0:00	0:01
23	PERSONNEL: INDIVIDUAL CONTRIBUTOR (LIST OF NAMES)/OC/GB3.S2	2/16/82	8/10/82	15:52	5	8	0:01	0:05
24	PC TIME SHARING CENTRAL/GROUP/PERSONAL DEFINITIONS/GB3.S2	2/16/82	3/01/82	3:58	5	3	0:00	0:02
25	PERSONNEL: BJ, NOMINATION FOR VP/OC/GB3.S2	2/16/82	5/12/82	12:42	9	6	0:01	0:18
29	SUVAX AS COMP.PROD. IN OUR LIFETIMES/11/81/GB3.S2	2/19/82	2/26/82	3:58	5	3	0:00	0:01
30	CAD BUDGET XTRA 600K MULTI YEAR MULTIWIRE SUPPORT/11/5/81/GB3.S2	2/19/82	2/26/82	3:59	3	3	0:01	0:02
31	VAX, PROMOTING FOR PERSONAL COMP. SUPPORT DEV./11/5/81/GB3.S2	2/19/82	2/26/82	3:59	3	4	0:00	0:01
32	LNI REPEATER BY THANKSGIVING/11/6/81/GB3.S2	2/19/82	2/26/82	3:59	2	3	0:00	0:01
33	VENUS, GORDON'S VISIT TO MARLBORO/11/8/81/GB3.S2	2/19/82	2/26/82	4:00	8	4	0:00	0:01
34	SUVAX INTERIM-IN MY LIFETIME-FOR MAY ANNOUNCEMENT/11/81/GB3.S2	2/19/82	2/26/82	4:00	4	4	0:00	0:01
35	GIGI SUPPORT-DON'T DO THIS/AVERY/11/8/81/GB3.S2	2/19/82	5/12/82	12:28	3	4	0:01	0:03
36	MUSEUM: COMPUTER SCIENCE & TECHNOLOGY CENTERS/11/10/81/GB3.S2	2/19/82	5/12/82	12:53	5	4	0:01	0:02
37	SANDIA AND LASL--VAX, LAN, OFFICE & V18X/AVERY ET AL/GB3.S2	2/19/82	5/12/82	17:11	12	4	0:00	0:03
38	CMU JOINT VENTURE PROPOSAL-WOULD LIKE YOUR SUPPORT/11/81/GB3.S2	2/26/82	2/26/82	4:02	5	3	0:00	0:01
39	ETHERNET, ICL PRES WILMOT ON USING ETH./LACROUTE/11/81/GB3.S2	2/26/82	5/12/82	12:39	8	4	0:01	0:02

40	MUSEUM: WES CLARK DESCRIBES LINC @ MUSEUM/11/14/81/GB3.S2.39	2/26/82	2/26/82	4:03	4	3	0:01	0:01
41	TERMINALS THOUGHTS ON FOR DUMB, WPS & TECH. USE/11/81/GB3.S2	2/26/82	2/22/83	13:46	12	4	0:01	0:02
42	VS11, SUDS AVAILABILITY/11/21/81/GB3.S2	2/26/82	2/26/82	4:03	4	3	0:00	0:00
43	SCORPIO, DISCUSSION AT GVPC/11/21/81/GB3.S2	2/26/82	2/26/82	4:04	5	3	0:01	0:02
44	NAUTILUS CONCERNS/11/23/81/BOB STEWART/GB3.S2	2/26/82	5/12/82	12:56	7	4	0:01	0:01
45	MICRO, TASK FORCE ON A COMPETITIVE MICROPROCESSOR/12/81/GB3.S2	2/26/82	2/26/82	4:04	10	3	0:00	0:00
46	SUVAX, STATUS AS OF 3:45 P.M. 12/2/81/GB3.S2	2/26/82	2/26/82	4:05	5	3	0:01	0:01
47	MICROS, RILEY'S COMMENTS ON THE 11, 16- & 32-BIT/12/81/GB3.S2	2/26/82	2/26/82	4:05	17	3	0:00	0:02
48	REVIEW ENGINEERING MARCH. REVIEW THOSE WHO NEED/12/81/GB3.S2	2/26/82	2/26/82	4:05	8	3	0:00	0:00
49	DG, OUR VAX STRATEGY AND THE NEXT DG MACHINES/12/81/GB3.S2	2/26/82	2/26/82	4:06	5	3	0:01	0:02
50	VAX, WHAT WOULD A SIMPLER VAX ACCOMPLISH/12/81/GB3.S2	2/26/82	2/26/82	4:06	8	3	0:00	0:02
51	CHRISTMAS CARD, TYPE CHRISTMAS=MERRY; NEW_YEAR/12/81/GB3.S2	2/26/82	2/26/82	4:08	3	3	0:02	0:03
52	CHIPS, THIS AIN'T GOOD ENOUGH/CUDMORE/12/82/GB3.S2	2/26/82	5/12/82	11:19	5	4	0:01	0:01
53	MASS STORAGE AND BUILDING LOW END PRODUCTS/12/81/GB3.S2	2/26/82	2/26/82	4:09	6	2	0:01	0:01
54	EDUCATION: CS GOING INTO C. ENG ED. BUSINESS/12/81/KO/GB3.S2	2/26/82	5/12/82	11:47	5	5	0:03	0:04
55	ENG. PROJECTS STRUCTURING (DRAFT)/1/11/82/CORBEN/GB3.S2	2/26/82	5/12/82	12:03	6	6	0:00	0:01
56	TOOMBE, DEAN (TI) PHONE CALL OF 1/14/82/1/14/82/GB3.S2	2/26/82	2/26/82	4:13	4	4	0:02	0:02
57	MOTO-OKA PRESENTS 5TH GEN. PROJ./1/82/ENG USERS/GB3.S2	2/26/82	5/12/82	12:52	5	4	0:01	0:02
58	OFFICE APPLICATION--APPROACH TO DOING/1/16/82/GB3.S2	2/26/82	2/26/82	4:14	4	3	0:00	0:00
59	REVIEW ENGINEERING NON-PRODUCT GROUPS 1/82/ENG STAFF/GB3.S2	2/26/82	5/12/82	12:03	8	4	0:02	0:04
60	NETWORK SERV BUS--USING ENG AS A PROTOTYPICAL/GB3.S2 1/26/82	2/26/82	12/08/82	13:26	3	5	0:00	0:00

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 61     JAPAN, DOMINATE COMP BY 1990 IF 5G EFF SUCCEEDS/ENG STAFF/GB3.S2
                             2/26/82  5/12/82 12:41  6    4        0:00   0:02
 62     CONTRIBUTION: PLS FUND HAROLD COHEN / COMMITTEE/ 1/30/82/GB3.S2
                             2/26/82  2/26/82  4:16  8    3        0:00   0:01
 63     TERMINALS, GETTING ARCH. SPECIFIED /AVERY ETAL/1/30/82/GB3.S2
                             2/26/82  2/22/83 13:47  4    6        0:01   0:02
 64     COMMITTEE: COMP. FOR SCI. ADV COMM FRIEDLAND&FIEGENBAUM/GB3.S2
                             3/01/81  5/12/82 11:35  7    4        0:08   0:11
```

Document 4 comment:
   Dupont (Pensak) Messages to us
champine, demmer, bill long tech johnson, win hindle, ko,
gonzales, mcinnis, fuller, payne, fagerquist,
Document 20 comment:
   subject: comments on our marketing foks by a vendor, how us?
To: eng staff
cc: operations committee, bob lane, berube
Document 24 comment:
   Subject: PC, timesharing, central/group/personal definitions
to: oc, peg, rose ann, avram, berube, lane, clayton, folsom,
leroyd, loveland, art campbell, joel schwartz, gonzales

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Name: SECT4 , # of Docs: 37, Blocks left: 77 (of 627)
-------------------------------------------------------------------------------
Number  Name                    Created  Modified       Size Version  Last   Total
-------------------------------------------------------------------------------
  1
                             4/21/82  6/07/82 16:43  5    107      0:00   1:11
  2     CMU RE YOUR PROPOSAL ON ? /JORDAN,GRANGER/GB3.S4
                             4/26/82  6/22/82 11:38  3    13       0:02   0:26
  3     BOOK: SOFTWARE ENGINEERING, WANT TO WRITE?/ANKLAN/GB3.S4
                             5/04/82  5/05/82 14:41  6    8        0:01   0:08
  4     MUSEUM: SYMBOL, NEW HOME FOR /PROF. STEWART,IOWA STATE/GB3.S4
                             5/04/82  8/10/82  9:42  3    7        0:01   0:17
  5     SIEMENS, NICE TO MEET YOU HERE/GRASSMAN/GB3.S4
                             4/26/82  4/30/82 10:51  3    3        0:06   0:14
  6     ORGANIZATION CHART (ENGINEERING) SHOWING NEW EMC/GB3.S4
                             5/21/82 10/13/82 14:22  8    16       0:00   0:31
  7     INDEXXES
                             6/07/82  6/07/82 15:22  14   1        0:00   0:00
  8     VT200, WHY ISN'T OPAL THE VT200?/CHAMPINE/GB3.S4
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		5/03/82	5/18/82	14:15	4	7	0:00	0:22
9	U OF TEXAS-MAKING SCHOOL OF ENG PROF'NL/WOODSON,GLOYNA/GB3.S4	5/03/82	5/19/82	12:37	3	6	0:01	0:17
10	ECKERT-MAUCHLY AWARD, THANKS FOR INTRO /PATTERSON /GB3.S4	5/03/82	5/04/82	12:09	5	9	0:01	0:27
11	LISP AND AI MARKET-HIGH PERFORMANCE AI/GB3.S4	5/03/82	5/04/82	11:10	3	2	0:02	0:15
12	BELL: REPLACEMENT COST FOR RADIO/GB3.S4	5/03/82	5/14/82	16:55	2	6	0:01	0:18
15	TALK: PROCESS REQUIRED TO GENERATE A COMPUTER/SPEECH/GB3.S4	5/04/82	9/20/82	13:49	148	3	0:00	0:05
16	TALK/BOOK: ARCH. & IMPL. WITHOUT BRACKETED AREAS/GB3.S4	5/04/82	6/01/82	10:24	115	2	0:01	0:05
17	JAPANESE ADVANTAGE: IS IT REAL?/BOD,OC/GB3.S4	5/05/82	6/07/82	16:43	7	7	0:00	0:02
20	MCE ALPHA OMEGA DRAFT TO DELAGI/GB3.S4	5/10/82	5/24/82	9:32	37	4	0:10	0:14
21	FIFTH GEN. PROG. INTEREST LETTER TO YAMAMOTO/GB3.S4	5/11/82	6/10/82	12:03	3	7	0:00	0:10
23	LATTICE LOGIC--USING CMOS GATE ARRAY DES SYS/LIPPERT/GB3.S4	5/13/82	5/18/82	16:35	7	3	0:00	0:01
24	ECKERT-MAUCHLY AWARD, THANKS TO JACK LIPOVSKI/GB3.S4	5/12/82	5/12/82	14:32	2	2	0:00	0:00
26	OFIS AND CT/WPS SOFTWARE/AVERY/GB3.S4	5/13/82	5/13/82	11:30	10	2	0:01	0:01
27	WORLD COMPUTER CENTER--RECOMMENDATION OF EQUIPMENT/OC/GB3.S4	5/17/82	9/24/82	13:16	23	3	0:00	0:02
28	COMET MCA/DEMMER/GB3/S4	5/17/82	5/19/82	12:17	6	3	0:00	0:00
29	NBS MAIL--STANDARD/OC/GB3S.4	5/17/82	5/19/82	12:30	5	3	0:00	0:01
30	MANUFACTURING MKT--WILL IT BE NEXT MKT WE COVET/CADY/GB3.S4	5/17/82	5/19/82	12:30	7	4	0:00	0:04
31	PERSONNEL: HIRING WITHIN/WITHOUT, OUT-PLACE/BORNSTEIN/GB3.S4	5/17/82	8/26/82	11:51	5	6	0:00	0:00
32	MCE (MICROELECTRONIC C. ENTERPRISE) TF MTG/CHENAIL/GB3.S4	5/17/82	5/18/82	11:55	6	4	0:00	0:01
33	CRAY GROUP WHO WANTS TO BUILD A VAX/DEMMER/GB3.S4	5/17/82	8/13/82	14:32	12	4	0:02	0:04
34	KEYBOARD DAISY CAD AND OUR KEYBOARD/AVRAM/GB3.S4	5/17/82	5/18/82	16:33	5	5	0:00	0:01
35	INVESTMENT & COMPLEXITY FOR GUIDING ENG/DEMMER/GB3.S4							

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                             5/17/82  6/03/82 15:46  11   5        0:01   0:02
 36     BUDGETS AND (EMC) ENG. MGMT COMMITTEE /FULLER/GB3.S4
                             5/17/82  6/03/82 15:45  5    4        0:00   0:01
 37     PRODUCT LINE MANAGERS--DATA ON REASON FOR/HINDLE/GB3.S4
                             5/17/82  5/18/82 16:32  5    4        0:00   0:06
 38     ETHERNETS STARS FOR ENG & TYPESETTING REV/ENG STAFF/GB3.S4
                             5/17/82  5/18/82 16:32  7    3        0:00   0:01
 39     PLUTO GREAT.SELL WIDELY AS COMM C./JOHN ADAMS/GB3.S4
                             5/17/82  5/19/82  8:47  5    4        0:00   0:00
 40     ETHERNET--KEN'S PRES:HELP AND COMMENTS/JOHN ADAMS/GB3.S4
                             5/17/82  5/18/82 16:31  11   3        0:00   0:01
 41     ORGANIZATION--ENG. CHANGES/ENG STAFF/GB3.S4
                             5/17/82 10/13/82 13:34  6    5        0:00   0:00
 42     TMS/AVRAM/GB3.S4
                             5/17/82  5/19/82 12:06  4    4        0:01   0:03
 44     ABSTRACT: ETHERNET AND THE FIFTH GENERATION/GB3.S4
                             5/18/82  6/25/82 10:55  2    3        0:05   0:12

Document 3 comment:
   Patti Anklan, Orphan::Anklan
cc demmer, bill johnson, bill heffner, cutler
Subject:  VAX/VMS Release 1 Book


Name: SECT5 , # of Docs: 70, Blocks left: 66 (of 627)
-------------------------------------------------------------------------------
Number  Name                    Created  Modified       Size Version  Last   Total
-------------------------------------------------------------------------------
  1
                             6/20/80 11/04/80 15:39  9    178      0:02   1:28
  2     MFG./ENG. WOODS/SMITH/GB1.S5
                             6/20/80  6/20/80 13:05  5    1        0:00   0:00
  3     SUVAX FOR UNIVERSITIES/ROSING/GB1.S5
                             6/20/80  7/11/80  1:12  2    3        0:00   0:00
  4     VAX MEMORY--BUYING ADD ON/ECKHOUSE/GB1.S5
                             6/20/80  6/20/80 13:07  5    1        0:00   0:00
  5     WPS STRATEGY, ESPECIALLY THE 200/BROOKS/GB1.S5
                             6/20/80  6/20/80 13:07  8    1        0:00   0:00
  6     TERMINALS--WE NEED LOTS OF ARCHITECTURE/PICOTT/GB1.S5
                             6/20/80  6/14/83  0:29  5    2        0:01   0:01
  7     PRODUCT STRATEGY VS. BUSINESS AS USUAL/O/C/GB1.S5
                             6/20/80  7/21/80 14:29  10   2        0:00   0:05
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8	STIBITZ--LIST OF CIRCUIT DRAWINGS/GB1.S5	6/25/80	6/25/80	9:25	1	2	0:01	0:04
9	ENGINEERING ORGANIZATION/PORTNER/GB1.S5	6/26/80	6/27/80	15:02	5	7	0:00	0:25
10	VAX--SINGLE USER, WE NEED IT/KNOWLES.../GB1.S5	6/26/80	7/23/80	13:49	6	8	0:00	0:24
11	STANFORD UNIVERSITY--THANK YOU--LECTURE/FEIGENBAUM/GB1.S5	6/26/80	9/22/80	11:06	4	8	0:00	0:20
12	DATAQUEST RESEARCH NEWSLETTER--REQUEST/RILEY/GB1.S5	6/30/80	7/09/80	16:49	3	5	0:02	0:07
13	STANFORD VLSI PROGRAM/CUDMORE,CLAYTON/GB1.S5	6/30/80	7/09/80	16:49	8	8	0:00	0:17
14	UNIVERSITY OF CAMBRIDGE--YOUR ARRIVAL/WILKES/GB1.S5	6/30/80	7/09/80	16:50	6	5	0:01	0:08
15	FAIRCHILD CAMERA CORP.--REQUEST:PLS. SEND BOOK/HOGAN/GB1.S5	6/30/80	11/04/80	11:24	2	7	0:00	0:07
16	STATE UNIVERSITY OF NEW YORK AT ALBANY/ROBINSON/GB1.S5	6/30/80	11/04/80	11:24	2	6	0:00	0:09
17	WPS TREE/GILMORE.../GB1.S5	6/30/80	6/30/80	4:13	4	3	0:01	0:37
18	RUTHERFORD AND APPLETON LABORATORIES/HOPGOOD/GB1.S5	6/30/80	7/22/80	12:54	3	5	0:00	0:00
19	HUDSON LOBBY DISPLAY/COURTRIGHT/GB1.S5	7/01/80	7/01/80	10:29	5	5	0:02	0:17
21	HISTORICAL TECHNOLOGY ORDER/MOSKOWITZ/GB1.S5	7/09/80	8/18/80	11:27	4	5	0:01	1:02
22	SPECIALIZED BOOK SERVICE INC./SCHEER/GB1.S5	7/14/80	7/14/80	9:37	3	1	0:13	0:13
23	BRIEUX COLLECTION--MALASSIS CHAUVIN COLLECTION/GB1.S5	7/15/80	8/18/80	15:36	12	5	0:00	0:08
24	ATANASOFF, JOHN--PIONEER LECTURE/GB1.S5	7/15/80	2/09/81	12:58	5	5	0:00	0:01
25	ZUSE, KONRAD--THANKS FOR YOUR LETTER/GB1.S5	7/18/80	7/21/80	12:10	3	3	0:00	0:15
26	MUSEUM--WILKINSON INVITATION TO LECTURE/WILKINSON/GB1.S5	7/21/80	9/16/80	16:44	5	10	0:00	0:18
27	ESG'S PERSONAL WORKSTATION/HURLEY ET AL/GB1.S5	7/21/80	6/14/83	0:27	5	8	0:00	0:12
28	AZTEC EMS/ROSING/GB1.S5	7/21/80	8/05/80	9:48	3	6	0:00	0:11
29	VENUS/780 ARRAY PROCESSOR & KAHAN AS CONSULTANT/DEMMER/GB1.S5	7/23/80	7/23/80	16:57	5	2	0:00	0:00

30 INTEL--IMPRESSIONS ON VISITING/CLAYTON/GB1.S5
7/23/80 9/11/80 10:48 26 3 0:00 0:01
31 NEW YORK UNIVERSITY MEDICAL CENTER/EISENBUD/GB1.S5
7/22/80 7/22/80 14:02 2 3 0:01 0:06
32 NAE PEER COMMITTEE MEMBERS/GB1.S5
7/22/80 9/18/80 15:21 2 6 0:00 0:11
33 INTEL--A PATH TO FAST,CHEAP & GOOD NI,WHY NOT?/CLAYTON/GB1.S5
7/23/80 7/23/80 16:54 8 3 0:01 0:01
34 WEST COAST TRIP--CONCERNS/VIEWING MAYNARD FROM AFAR/OOD/GB1.S5
7/23/80 7/23/80 16:51 9 2 0:01 0:01
35 NI ON MERCURY VS.CI LONG INTERIM VS.SHORT RANGE/CARCHIDI/GB1.S5
7/23/80 7/23/80 16:50 6 2 0:01 0:01
36 WILKES, MAURICE--GETTING MOVE ARRANGED/BELL, J./GB1.S5
7/23/80 4/14/81 9:44 6 3 0:01 0:02
37 WPS--SLAVED TUBES ON WPS FOR FORGRD BACKGROUND/BROOKS/GB1.S5
7/23/80 7/23/80 16:48 6 2 0:01 0:01
38 SUVAXES--WHO ARE WE GOING TO WORK WITH/GLORIOSO,PEEBLES/GB1.S5
7/23/80 7/23/80 16:46 5 2 0:01 0:01
39 VENUS--CONGRATULATIONS ON THE PROGRESS/REPORT/FAGERQUIST/GB1.S5
7/23/80 7/23/80 16:45 3 2 0:01 0:01
40 CONGRATULATIONS JIM MILTON/WHAT'S THE CHARTER?/FITZGERALD/GB1.S5
7/23/80 8/05/80 9:49 4 3 0:00 0:01
41 TELECONFERENCING--I DOUBT DECISION WILL BE MADE/KOTOK/GB1.S5
7/23/80 7/23/80 16:42 28 2 0:02 0:02
42 DECISON MAKING TO ALAN--PLEASE HELP ME EXPLAIN/BERTOCCHI/GB1.S5
7/23/80 7/23/80 16:39 32 2 0:04 0:04
43 TELECONFERENCING DECISION--HIGH PRICED/KOTOK/GB1.S5
7/23/80 7/23/80 16:34 12 2 0:01 0:01
44 TELECONFERENCING--ALAN, YOU AND ??/BERTOCCHI/GB1.S5
7/23/80 7/23/80 16:33 6 2 0:01 0:01
45 TELECONFERENCING DECISIONS(OR LACK THEREOF)/BERTOCCHI/GB1.S5
7/23/80 7/23/80 16:32 15 2 0:03 0:03
46 TELECONFERENCING RESOLVE THIS CONFLICT/OLSEN, KEN/GB1.S5
7/23/80 7/23/80 16:27 5 2 0:02 0:02
47 MSD DIRECTIONS/DEMMER/GB1.S5
7/23/80 7/23/80 16:25 7 2 0:07 0:07
48 MERCURY ON NI/MCNAMARA/GB1.S5
7/23/80 7/23/80 16:18 5 2 0:01 0:01
49 DP QUALITY ACQUISITION--SOME QUICK (AND OTHERS)/KENAH/GB1.S5
7/23/80 7/23/80 16:16 6 2 0:01 0:01
50 SOFTWARE BLUEPRINT--BITTING OFF LESS/KENAH/GB1.S5
7/23/80 7/23/80 16:15 7 2 0:03 0:03

51	MINUTES--CONFIDENTIAL(7/10/80) MEETING,LP,JM,GB/PORTNER/GB1.S5							
		7/23/80	9/18/80	15:20	12	4	0:00	0:04
52	SEGMENTATION DIMENSIONS OF OUR PRODUCTS & WORK/(4)/OOD/GB1.S5							
		7/23/80	2/09/81	12:48	8	5	0:01	0:03
53	MFG/ENG/MKT SEGMENTATION--A BETTER ONE?/SMITH, JACK/GB1.S5							
		7/23/80	3/30/81	8:56	19	7	0:00	0:06
54	TIME ANALYSIS THESE DAYS/GB/GB1.S5							
		7/23/80	7/23/80	16:04	5	2	0:02	0:02
55	TIME ANALYSIS OF MY OWN NON-DISCRETIONARY TIME/OOD/GB1.S5							
		7/23/80	9/11/80	11:17	9	6	0:01	0:03
56	COMPETITIVE COMPARISON-DEC & WANG WPS BY B. ROSE/BROOKS/GB1.S5							
		7/23/80	7/23/80	15:58	5	2	0:01	0:01
57	MT. FUJI SNOW JOB TO FORD BOARD/OLSEN, KEN/GB1.S5							
		7/23/80	9/11/80	10:50	6	4	0:00	0:02
58	INTEL--GROVE MEETINGS/GETTING A POLICY/CLAYTON/GB1.S5							
		7/23/80	9/11/80	11:04	10	3	0:02	0:03
59	EMS PRODUCTS PLAN (7/18/80) BY PASLASKI/DALEY/GB1.S5							
		7/23/80	7/23/80	15:53	6	2	0:01	0:01
60	FAIRCHILD CAMERA CORP.--THANK YOU FOR THE BOOK/HOGAN/GB1.S5							
		7/24/80	9/18/80	15:18	5	9	0:00	0:21
61	INTEL--THANKS FOR THE VISIT/GROVE/GB1.S5							
		7/24/80	9/11/80	10:48	6	6	0:00	0:37
62	VMS DEMO--INFORMATIVE,IMPRESSIVE,MORE SOURCE/HAMILTON/GB1.S5							
		7/24/80	7/25/80	12:35	3	6	0:01	0:07
63	SUVAX NOMENCLATURE AND TARGET SCHEDULES/DEMMER/GB1.S5							
		7/25/80	7/28/80	9:59	5	6	0:01	0:25
64	BRIGHAM YOUNG UNIVERSITY--RE:STRETCH/GARDNER/GB1.S5							
		7/28/80	7/29/80	11:00	6	6	0:01	0:23
65	LONG RANGE PLAN--MUSEUM/GB1.S5							
		7/28/80	11/04/80	11:15	8	12	0:00	0:60
66	PINON AND R81 COMPATIBILITY/LIGNOS/GB1.S5							
		8/13/80	11/04/80	11:15	1	2	0:01	0:03
67	TU58 INVENTORIES:CAN WE REMOVE IT FROM MARKET?/SAVIERS../GB1.S5							
		8/13/80	11/04/80	11:14	2	3	0:00	0:06
68	WILKES HELP-WITH-VISA LETTER TO US EMBASSY,ENG./PELTIER/GB1.S5							
		8/15/80	4/14/81	9:44	10	7	0:00	0:16
69	PELTIER(RE:WILKES VISA/AM. EMBASSY, ENGLAND)TWX SENT 8/15/GB1.S9							
		8/15/80	11/04/80	11:14	10	6	0:00	0:08
70	MUSEUM RE ENIAC LECTURE/ECKERT/GB1.S5							
		8/15/80	9/17/80	14:49	6	5	0:00	0:07
71	MUSEUM PLAN FOR FY81--GKB & GB							
		8/21/80	9/04/80	16:54	9	7	0:00	0:58

Document 67 comment:
To: Gutman, Saviers, Bauer
cc: Stan Olsen, Jack MacKeen, John Alexanderson, oc
SUBJ: TU58 INVENTORIES: CAN WE REMOVE IT FROM THE MARKET?

Name: SECT5 , # of Docs: 16, Blocks left: 95 (of 627)

Number	Name	Created	Modified	Size	Version	Last	Total
1		12/20/79	11/26/80 14:22	2	97	0:01	0:12
2	CALENDAR - GORDON	9/30/80	12/29/80 14:34	57	902	0:01	57:05
3	MESSAGE LIST - GORDON - FROM 10/17 TO PRESENT/RL0.S5	10/17/80	12/29/80 16:37	44	150	0:29	5:45
4	PROBLEM TALK SCHEDULE FORM/RL0.S5	12/20/79	9/30/80 15:09	1	6	0:00	0:00
5	PROBLEM/TALK/VISIT SPEC/RL0.S5	12/20/79	3/17/80 9:36	1	7	0:01	0:02
6	RESULT FILE/RL0.S5	12/20/79	1/03/80 9:32	15	8	0:18	0:22
7	PROBLEM/TALK/VISIT LIST/RL0.S5	9/30/80	9/30/80 15:06	14	2	0:01	0:02
8	PROBLEM FORM/RL0.S5	10/17/80	10/17/80 13:26	3	1	0:01	0:01
9	CALENDAR ARCHIVE - GORDON - FROM 9/29/80 TO ?/RL0.S5	10/17/80	12/29/80 14:35	43	23	0:01	0:47
10	MESSAGE LIST ARCHIVE - GORDON - FROM 4/80 TO 10/16/80 /RL0.S5	10/17/80	5/28/81 10:34	233	18	0:07	1:00
11	TELEPHONE BOOK - LIST - GB PERSONAL /RL0.S5	11/05/80	12/29/80 8:54	47	20	0:06	0:61
12	TALK SCHEDULE - GORDON /RL0.S5	11/05/80	12/08/80 11:40	7	5	0:00	0:07
13	MEMO HEADER	2/25/80	2/25/80 12:54	2	4	0:00	0:01
14	slides	11/20/80	11/20/80 8:40	3	2	0:04	0:17
15	BOOKSHELF - REFERENCE MATERIAL, GB OFFICE /RL0.S5	11/26/80	11/26/80 14:22	10	1	0:01	0:01

Number	Name	Created	Modified		Size	Version	Last	Total
16	BOOKSHELF - ORIGINALS, GB OFFICE /RL0.S5	11/26/80	11/26/80	14:23	33	1	0:01	0:01

Name: SECT6 , # of Docs: 63, Blocks left: 133 (of 627)

Number	Name	Created	Modified		Size	Version	Last	Total
1		8/25/80	10/02/81	3:43	8	173	0:01	1:12
2	MUSUEM LECTURE SERIES/KILBURN/ARE YOU INTERESTED?/GB1.S6	8/25/80	8/26/80	15:00	3	3	0:01	0:06
3	MUSEUM--INFO (NEWSLETTER/BROCHURE)/HUSKEY/GB1.S6	8/25/80	9/19/80	15:17	4	7	0:00	0:08
4	ZUSE, KONRAD--THANK YOU/GB1.S6	8/25/80	8/26/80	10:56	3	4	0:01	0:13
5	BELL--MY ROLE, SIX MOST IMPORTANT ITEMS/OLSEN/GB1.S6	8/26/80	11/04/80	11:10	7	5	0:00	0:06
6	GOALS (AND OBJECTIVES) FY80 FOR OOD/OLSEN/GB1.S6	8/26/80	11/04/80	11:10	14	10	0:00	0:29
7	GLOSSARY OF OOD/GB1.S6	8/26/80	11/04/80	11:10	14	10	0:00	0:28
8	MFG. ENG. SEGMENTATION PITCH TO YOUR STAFF/SMITH/GB1.S6	8/27/80	2/09/81	12:33	3	11	0:00	0:05
9	VT278 SLIP/A NUDGE/OPPORTUNITY TO MOVE TO 11/DALEY/GB1.S6	8/27/80	8/27/80	14:09	3	2	0:02	0:02
10	MFG. ENG. SEGMENTATION/WHAT NEXT?/COLEMAN/GB1.S6	8/27/80	2/09/81	12:38	18	11	0:05	0:07
11	JAPANESE DISCUSSION AND WHAT TO BUILD/COLEMAN/GB1.S6	8/27/80	9/08/80	11:21	7	3	0:00	0:03
12	LA200/VT200 SPECS + SCHEDULE/WILLIAMS/GB1.S6	8/27/80	8/27/80	14:02	7	2	0:01	0:01
13	EMS PRODUCT PLAN/CHISHOLM/GB1.S6	8/27/80	9/25/80	16:36	10	3	0:00	0:02
14	SOFTWARE BEIGE BOOK/CHRISTY/GB1.S6	8/27/80	8/27/80	13:58	4	2	0:01	0:01
15	SYSTEMS + CCEG ENGINEERING CHARTERS/FITZGERALD/GB1.S6	8/27/80	8/27/80	13:57	12	2	0:02	0:02
16	SUVAX PROGRAM MANAGER ROLE/DEMMER/GB1.S6	8/27/80	8/27/80	13:55	4	2	0:01	0:01
17	TERMINALS/WE NEED CAPITAL,INTERNAL EQUIPMENT/PORTNER/GB1.S6							

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                       8/27/80  8/27/80 13:54  3    2        0:02   0:02
18     PUBLISH--TINY PERMISSION TO PUBLISH/CLAYTON,TITELBAUM/GB1.S6
                       8/27/80  8/27/80 13:52  2    2        0:01   0:01
19     PERSONNEL:SR CONSULTING ENG.PROMOTION(MUDGE)/TEICHER/GB1.S6
                       8/27/80  8/27/80 13:51  5    2        0:02   0:02
20     DIGITAL PRESS/COMPUTER ENGINEERING ROYALTIES/TECIHER/GB1.S6
                       8/27/80  8/27/80 13:48  3    2        0:02   0:02
21     SEMIS STRATEGY/TEICHER/GB1.S6
                       8/27/80  9/22/80 17:01  8    6        0:00   0:03
22     CORPORATE REPORT CARD/OLSEN, K./GB1.S6
                       8/27/80  9/08/80 11:07  25   6        0:01   0:07
23     KO--KNOCK OUT:AN APPLIC. TER/SM.SYS./OOD.../GB1.S6
                       8/28/80  5/03/82  8:57  21   7        0:01   0:03
24     UNITED STATES CONGRESS/PAYER,ALIC/GB1.S6
                       8/29/80  9/29/80 12:47  1    2        0:00   0:04
25     UNIVERSITY OF CALIF.--THANK YOU/LUEHRMANN/GB1.S6
                       8/29/80  9/29/80 12:54  3    3        0:00   0:11
26     UNIVERSITY OF CALIF.,SAN DIEGO--THANK YOU/REYNOLDS/GB1.S6
                       8/29/80  9/03/80  9:04  4    3        0:01   0:12
27     INTEL/THANK YOU/CARSTEN/GB1.S6
                       9/02/80  9/03/80  8:40  2    3        0:01   0:02
28     DIGITAL--READING, ENGLAND/RE:PDP-8/BUXTON/GB1.S6
                       9/02/80  9/02/80 16:29  3    7        0:00   0:06
29     AMERICAN EMBASSY--IMMIGRANT VISA'S/PELTIER/GB1.S6
                       9/02/80  9/02/80 16:27  4    3        0:00   0:11
30     ACM--SAN FRANCISCO TALK/THANK YOU FOR INVITATION/HUANG/GB1.S6
                       9/02/80 10/31/80 12:26  2    3        0:01   0:03
31     BEIGE BOOK-WHETTED APPETITE/OOD/GB1.S6
                       9/02/80  9/02/80 16:47  4    6        0:00   0:03
32     SEMIS--DRAFT OF BUYING STD. SEMIS/MOFFA/GB1.S6
                       9/02/80  9/08/80 11:14  8    5        0:03   0:04
33     OFIS ARCH. DRAFT FOR KO,WPS,EMS/DALEY,GILMORE.../GB1.S6
                       9/02/80 10/06/80 11:42  39   5        0:00   0:04
34     ENGINEERING/GB'S ANNUAL REVIEW--COVER SHEET/OC,BOD/GB1.S6
                       9/03/80  9/04/80 16:48  3    7        0:00   0:13
35     GOALS (AND OBJECTIVES) FY81 FOR OOD/OLSEN, KEN/GB1.S6
                       9/03/80 11/04/80 11:08  7    5        0:00   0:26
36     NAE ELECTION COMMITTEE/LIEBOWITZ/GB1.S6
                       9/08/80  9/11/80  8:36  21   7        0:00   1:35
37     NAE MEMBERS AND WHERE FOUND/GB1.S6
                       9/08/80 11/04/80 11:08  7    5        0:01   0:03
38     U. OF NEWCASTLE--WE ARE COMING TO VISIT/RANDELL/GB1.S6
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                      9/15/80 10/02/80 13:50  3    6        0:00   0:03
39     KO FIRST MEETING 8/27/80/OLSEN, KEN/GB1.S6
                      9/16/80  5/03/82  8:56  3    4        0:00   0:01
40     COMMUNICATIONS--EXECUTING THE COMM.,NETWORKS/DEMMER.../GB1.S6
                      9/29/80  9/29/80 10:08  7    7        0:01   0:06
41     COMPETITION--SMALLTALK/XEROX BEING A SUBJECT/SAMBERG/GB1.S6
                      9/16/80  9/16/80 15:11  3    7        0:01   0:03
42     EMS ON VMS--BASING THE MAIL SYSTEM/TRAVIS/GB1.S6
                      9/16/80  9/16/80 15:10  8    8        0:00   0:02
43     ROI ISSUE/LYLE/GB1.S6
                      9/16/80  9/16/80 14:31  10   3        0:00   0:01
44     OFIS--TARGET ARCHITECTURE AND PRODUCTIVITY/DALEY/GB1.S6
                      9/16/80  9/16/80 14:30  4    4        0:00   0:01
45     BEIGE BOOK REVIEW/THOMPSON/GB1.6
                      9/18/80  9/18/80 11:41  3    5        0:00   0:07
46     SEMIS RE:CPU STRATEGY/DECISION METHODS/TEICHER/GB1.S6
                      9/16/80  9/16/80 14:30  5    4        0:01   0:02
47     DECMAIL SCHEDULE SANITY CHECK--EMS/WPS PROGRAMS/DALEY/GB1.S6
                      9/16/80  9/16/80 14:27  8    3        0:03   0:04
48     CMU--GB PERSONAL BOOKS/SIEWIOREK/GB1.S6
                      9/22/80  9/22/80 16:23  2    3        0:00   0:07
49     LOW END HELP/CLAYTON/GB1.S6
                      9/16/80  9/16/80 14:24  5    3        0:00   0:00
50     DP REVIEWS--INTRODUCTION TO OFFICE AUTOMATION/KENAH/GB1.S6
                      9/16/80  9/16/80 14:24  10   3        0:01   0:02
51     KO COMPUTER/OLSEN/GB1.S6
                      9/16/80  5/03/82  8:55  6    4        0:01   0:01
52     KO EDITOR IDEAS/TRAVIS/GB1.S6
                      9/16/80  5/03/82  8:55  2    4        0:00   0:01
53     STRATEGY--PLS CONSIDER VAX (NEBULA)/DEMMER/GB1.S6
                      9/16/80  9/16/80 14:23  5    4        0:01   0:01
54     VMS--SECURITY DEMO AND NEXT VERSIONS OF VMS/CARCHIDI/GB1.S6
                      9/16/80  9/16/80 14:22  5    4        0:00   0:01
55     SIEMENS--MUNICH INVITATION/BAUR/GB1.S6
                      9/16/80  9/16/80 14:21  3    3        0:00   0:00
56     KO--WED. MORNING MEETING(9/10/80)/CLAYTON/GB1.S6
                      9/16/80  5/03/82  8:58  5    6        0:00   0:02
57     ABSTRACT--GENERATING COMPUTER GENERATIONS/GB1.S6
                      9/24/80 10/07/81 13:44  2    7        0:03   0:12
58     INTERCONNECT PROGRAM REVIEW ATTENDANCE/FULLER/GB1.S6
                      9/25/80 11/04/80 11:05  4    3        0:00   0:01
59     PDP-11 PROGRAM ENVIRONMENT ON VMS/DALEY,STEWART.../GB1.S6
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		9/29/80	9/29/80 10:20	8	6	0:01	0:10
60	KO BUS--THOUGHTS ON KO BUS/ADDITIONS QBUS/MILLER,GAUBATZ/GB1.S6	9/30/80	5/03/82 8:53	14	8	0:01	0:04
61	SLIDE--CRAYL,AMDAHLV6, TT9900/GB1.S6	9/30/80	10/31/80 16:39	3	4	0:00	0:10
63	KO/VT200 ORG.--LET'S GET IT WRITTEN DOWN/CLAYTON/GB1.S6	10/01/80	5/03/82 8:58	3	5	0:00	0:02
64	NAE RANKING FOR 18TH ELECTION/PEER GROUP/GB1.S6	10/02/80	10/31/80 16:38	4	7	0:00	0:26

Name: SECT6 , # of Docs: 45, Blocks left: 169 (of 627)

Number	Name	Created	Modified	Size	Version	Last	Total
1		6/07/82	1/07/83 10:46	6	121	0:00	0:22
2	JAPAN THANK YOU 6 LETTERS 7/82 TRIP/GB3.S6	7/14/82	1/11/83 11:55	26	25	0:01	0:31
3	JAPAN THANK YOU 12 LETTERS 7/82 TRIP/GB3.S6	7/14/82	8/02/82 16:31	47	22	0:00	0:56
4	JAPAN CHART COMPANY/PRODUCT COMPETITIVE MATRIX/GB3.S6	7/14/82	11/24/82 11:12	33	22	0:00	0:55
6	CHALLENGES FOR IN THE NEXT 0 TO 5 YEARS /GB3.S6	7/19/82	10/05/82 16:53	18	6	0:00	0:03
7	REFERENCE: RAJ REDDY /GB3.S6	7/19/82	7/21/82 15:45	3	2	0:00	0:00
8	JAPAN COMPANY/PRODUCT COMPETITIVE MATRIX MEMO/GB3.S6	7/19/82	8/24/82 13:47	3	9	0:01	0:13
9	JAPAN: CHINA COMPANY THANK YOU /GB3.S6	7/20/82	7/20/82 14:07	8	3	0:03	0:11
10	JAPAN: WATANABE THANKS/GB3.S6	7/20/82	7/21/82 9:15	4	4	0:00	0:08
11	JAPAN: MORIZONA THANK YOU/GB3.S6	7/20/82	8/17/82 8:39	2	7	0:00	0:04
12	JAPAN: SONY THANK YOU /GB3.S6	7/20/82	9/09/82 10:42	5	15	0:01	0:09
13	JAPAN: NTT WE'D LIKE TO BE A SUPPLIER /GB3.S6	7/20/82	7/20/82 14:27	3	3	0:06	0:09
14	JAPAN: FUJITSU & MITI THANK YOU /GB3.S6	7/20/82	8/02/82 16:30	3	8	0:01	0:12

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15     JAPAN: U OF TOKYO/DR. GOTO /GB3.S6
                         7/20/82  9/07/82 14:56  4    8        0:00   0:05
16     JAPAN: FUCHI THANKS /GB3.S6
                         7/20/82  1/11/83 11:58  4    9        0:01   0:06
17     JAPAN: MITSUI THANKS/GB3.S6
                         7/20/82  7/21/82  9:17  4    6        0:00   0:04
18     ITINERARY SAN FRANCISCO, MCC MEETING, 7/25 &26/GB3.S6
                         7/20/82  7/30/82  8:51  2    9        0:00   0:36
19     TAIWAN: THANKS 5 LETTERS 7/82 TRIP/GB3.S6
                         7/20/82  8/02/82 16:31  27   9        0:00   0:28
21     JAPAN IMPRESSIONS / OC + PEG /GB3.S6
                         7/20/82 10/05/82 16:54  12   15       0:01   0:42
22     JAPAN: ENGINEERING IN--LET'S MOVE/GB3.S6
                         7/21/82 10/05/82 16:57  27   6        0:02   0:49
23     JAPAN: NOTES ON VARIOUS COMPANIES/RESEARCH ORGS/PEG:/GB3.S6
                         7/21/82 11/15/82 18:02  10   13       0:00   0:47
24     KEYBOARD, CAN WE BUY THE BROTHER? /AVERY/GB3.S6
                         7/26/82  7/26/82 13:32  7    1        0:00   0:00
25     PROJECTS: WHICH TO DO, READING OF MCNAMARA /GB3.S6
                         7/26/82  7/26/82 14:38  8    1        0:00   0:00
27     PROLOG TODAY! / ECKHOUSE /GB3.S6
                         7/26/82  7/26/82 14:49  2    1        0:00   0:00
28     MARKETING: ISSUES ABOUT DOING THE BASICS/ KC /GB3.S6
                         7/26/82  7/26/82 14:54  9    1        0:00   0:00
29     LATTICE LOGIC, WORKING WITH /BHALERAO /GB3.S6
                         7/26/82  7/26/82 15:01  6    1        0:00   0:00
30     MARKETING: LET'S DEFINE BY REVIEWING AND BY EXAMPLE /KO/GB3.S6
                         7/26/82  7/26/82 15:06  6    1        0:00   0:00
31     PRODUCTIVITY VIA FEWER BUT HIGHER QUALITY MESSAGES/BERUBE/GB3.S6
                         7/26/82  7/26/82 15:11  7    1        0:00   0:00
32     GATE ARRAYS, CMOS: WHO,HOW AND NEED TO VLSI?/BASKETT/GB3.S6
                         7/26/82  8/06/82 14:33  7    2        0:00   0:00
33     MCC: MORE ON MCE PRESENTATION BY CDC /EMC:/GB3.S6
                         7/26/82  7/26/82 15:19  6    1        0:00   0:00
34     MARKETING: PROPOSED ADS FOR COMMERCIAL USERS/BERUBE/GB3.S6
                         7/26/82  9/22/82  8:59  15   2        0:01   0:01
35     DESIGNING: TRAINING FOR NAUTILUS DOING REAL DESIGNS/CROXON/GB3.S6
                         7/26/82  7/26/82 15:44  6    1        0:00   0:00
36     CM'S AS PERFORMANCE ALTERNATIVE TO BIG MACHINES/FULLER/GB3.S6
                         7/26/82  7/26/82 16:02  7    1        0:00   0:00
37     MARKETING: COMMERCIAL/KO/GB3.S6
                         7/26/82  7/26/82 16:08  8    1        0:00   0:00
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38 UNIX STANDARDS, BRITISH POLICY /CARCHIDI /GB3.S6
7/26/82 7/26/82 16:12 5 1 0:00 0:00
39 VAX: COMPETITIVENESS NOW AND IN FUTURE, HIGH PERF/KC /GB3.S6
7/28/82 8/19/82 11:26 14 12 0:00 0:05
40 ITINERARY: PARIS/LONDON, 8/24/82 THRU 9/9 /GB3.S6
7/28/82 8/27/82 16:58 9 27 0:00 2:17
41 ITINERARY: CALIFORNIA 8/8/82 TO 8/11 WITH KALB/GB3.S6
7/28/82 8/10/82 13:22 2 7 0:01 0:20
42 DARTMOUTH - THANKS FOR THE COURSE/RICHMOND/GB3.S6
7/28/82 7/28/82 13:17 6 6 0:05 0:10
46 NYIT - THANKS FOR COMING/SHURE/GB3.S6
8/02/82 8/11/82 14:43 3 4 0:05 0:11
47 MCC: MCC REQUEST FOR SUPPORT FROM DEC / OC /GB3.S6
8/02/82 9/24/82 11:25 7 18 0:01 0:17
48 MCC: ALPHA OMEGA SUPPORT MEMO/PEG ET AL/GB3.S6
8/02/82 9/24/82 11:27 5 17 0:01 0:22
49 MCC: MOTIVATION FOR ALPHA OMEGA/GB3.S6
8/02/82 11/16/82 10:37 7 7 0:00 0:06
52 JAPAN: FUJITSU, CONFIDENTIAL INFO/YASAFUKU/GB3.S6
8/02/82 9/14/82 16:09 3 6 0:00 0:10
60 MUSEUM: BUILDING/HOME COMMITTEE/BLOCH,/GB3.S6
8/10/82 8/16/82 16:13 7 12 0:00 0:50

Document 3 comment:
multi
2
Document 4 comment:
WHITE OUT LAST COLUMN OF PRINT OFF BEFORE GIVING OUT
Document 40 comment:
<date>8/10/82 Tue 14:45
<club>PAT
<message>PLEASE CALL THE UNIVERSITY ARMS IN CAMBRIDGE ENGLAND. THE
NUMB

~~Name: SECT7 , # of Docs: 57~~, Blocks left: 102 (of 627)

Number	Name	Created	Modified	Size	Version	Last	Total
1		10/06/80	12/01/80 14:18	7	144	0:00	0:50
2	OFIS ARCHITECTURE COUPLING/PEEBLES/GB1.S7						

10/06/80 10/06/80 13:13 9 3 0:00 0:01
3 VT200--SMALL SYSTEMS/OLSEN,KEN/GB1.S7
10/06/80 10/23/80 13:02 4 4 0:00 0:01
4 ORGANIZATION--AN EXPERIMENT TO REDUCE HASSLE/CUTLER/GB1.S
10/06/80 10/06/80 13:13 24 3 0:01 0:03
5 GRAPHICS--ARCHITECTURE & PRODUCTS FOR KO & SUVAX/PICOTT/GB1.S7
10/06/80 10/06/80 13:11 8 6 0:00 0:02
6 BUDGET--PARAMETERIZED SOFTWARE/MARCUS/GB1.S7
10/06/80 10/06/80 13:10 19 7 0:00 0:04
7 WPS/EMS/KO DIRECTION AND STATUS/BROOKS/GB1.S7
10/06/80 10/06/80 13:10 21 3 0:01 0:06
8 KO BUS--DEFINING THE II VIS A VIS Q&Q DERIVATES/GEAGHAN/GB1.S7
10/06/80 10/06/80 13:08 7 5 0:01 0:01
9 KO PACKAGE--GOALS/THOUGHTS--MODULE MODULARITY/CLAYTON/GB1.S7
10/06/80 10/06/80 13:06 12 3 0:01 0:02
10 KO--DISPLAY INDEPENDENCE/STRAUSS/GB1.S7
10/06/80 10/06/80 13:04 3 3 0:00 0:00
11 BUS--10/20/ENGINEERING POSITION/HINDLE/GB1.S7
10/06/80 10/06/80 13:03 6 3 0:00 0:01
12 KO BUS--MACHINE, QNI/UNI/LNI/NI/ROSING/GB1.S7
10/06/80 10/29/80 15:15 4 4 0:00 0:02
13 KO BUS--VIS A VIS MULTIBUS/MILLER/GB1.S7
10/06/80 10/10/80 10:46 3 4 0:00 0:02
14 OFIS/KO--OVERSPENDING/RELAX A LITTLE/FREEDMAN/GB1.S7
10/06/80 10/29/80 15:16 5 4 0:00 0:00
15 JAPAN--NOTE DEVELOPMENT BY MITSUBISHI/OOD/GB1.S7
10/06/80 10/06/80 13:00 4 3 0:00 0:01
16 OFIS--VLACH PRODUCT STRATEGY UPDATE--9/8/80/DALEY/GB1.S7
10/06/80 10/06/80 12:59 5 3 0:00 0:00
17 ORGANIZATION--ENGINEERING THOUGHTS/OOD/GB1.S7
10/06/80 10/06/80 12:59 8 3 0:01 0:02
18 TELECONFERENCING/SAIA/GB1.S7
10/06/80 10/29/80 15:14 4 4 0:00 0:01
19 EMS/VMS (LDP'S) VS. DECMAIL/MILESKI/GB1.S7
10/06/80 10/06/80 12:57 16 5 0:01 0:03
20 SUVAX/SMITH, PETER/GB1.S7
10/06/80 10/31/80 12:42 6 4 0:00 0:00
21 MIT--ABYSMAL INTERFACE/ECKHOUSE/GB1.S7
10/06/80 12/04/80 16:36 5 5 0:00 0:01
22 EMS/VMS STEALTH MIRAGE FEASIBILITY APPROACH/DALEY/GB1.S7
10/06/80 10/29/80 15:33 12 7 0:00 0:02
23 VAX-11, PDP-11 ENVIRONMENT--ANOTHER LOW END TOOL/HEFFNER/GB1.S7

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                        10/31/80 10/31/80 10:02  6    4        0:00   0:10
24     DECMAIL--GOALS,CONSTRAINTS,PLAN/STEWART/GB1.S7
                        10/06/80 10/31/80 16:34  4    4        0:00   0:01
25     TELEPHONE--AT&T SERVICE/FORBES/GB1.S7
                        10/06/80 10/31/80 16:34  9    5        0:00   0:01
26     JAPAN--FS STUDY--GET OTHERS TO HELP TOO/SENIOR/GB1.S7
                        10/31/80 10/31/80 10:01  17   3        0:00   0:01
27     IBM--RE:GUATELLI DOING WORK FOR MUSEUM/HADDAD/GB1.S7
                        10/09/80  1/08/81 14:56  3    10       0:01   0:10
28     IBM--RE:GUATELLI DOING WORK FOR MUSEUM/SULLIVAN/GB1.S7
                        10/09/80  1/08/81 14:54  3    9        0:01   0:10
29     IBM--RE:GUATELLI DOING WORK FOR MUSEUM/BRANSCOMB/GB1.S7
                        10/09/80  1/08/81 14:55  5    10       0:01   0:24
30     SIRIUS--INRIA MACHINES/POUZIN/GB1.S7
                        10/10/80 10/13/80 13:11  2    2        0:01   0:06
31     TALK--GEORGE BALL - 10/13/80/GB1.S7
                        10/13/80 10/31/80 16:33  15   13       0:00   0:59
32     UNIVERSITY OF MANCHESTER--LECTURE,DR. EDWARDS/KILBURN/GB1.S7
                        10/13/80 10/13/80  0:29  2    2        0:00   0:01
33     NATIONAL RESEARCH COUNCIL--DRAFT REPORT/GOODWIN/GB1.S7
                        10/13/80 10/13/80  0:55  3    4        0:01   0:05
34     ROSING--WHY HE WENT TO APPLE/OC/GB1.S7
                        10/14/80 10/14/80 17:04  12   5        0:01   0:11
35     ORGANIZATION GOALS AND CONSTRAINTS/GB1.S7
                        10/14/80 10/29/80 15:52  10   4        0:01   0:13
36     ATANASOFF DISPLAY AGREEMENT & VISIT ARRANGEMENTS/GB1.S7
                        10/21/80 10/24/80 16:43  7    6        0:00   0:13
37     SOFTWARE ORGANIZATION ISSUES/OOD/GB1.S7
                        10/21/80 10/21/80 11:30  4    5        0:01   0:18
38     REFERENCE FOR DAVID ROBINSON UNIVERSITY OF DELAWARE/WARTER/GB1.S7
                        10/27/80 10/27/80 13:26  2    4        0:00   0:10
39     REFERENCE FOR DAVID PATTERSON CALIF.,BERKELEY/SEQUIN/GB1.S7
                        10/27/80  1/10/83 11:54  3    4        0:01   0:15
40     NAE PANEL TALK--ACADEME,INDUSTRY,& GOVERNMENT/GB1.S7
                        10/27/80 10/31/80 16:30  15   4        0:01   0:54
41     CMU--THANKS TO BILL KEATING ET AL/FULLER/GB1.S7
                        10/31/80 10/31/80 10:01  17   3        0:00   0:01
42     EMS/VMS--MAKING AVAILABLE VS. WAITING FOR DECMAIL/REYER/GB1.S7
                        10/29/80 10/29/80 16:21  5    3        0:01   0:02
43     OFIS--JULIUS' COMMENTS ON THE OFIS PROG./DALEY/GB1.S7
                        10/29/80 10/29/80 16:21  7    3        0:00   0:01
44     TU58/SAVIERS/GB1.S7
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Number	Name	Created	Modified	Size	Version	Last	Total
		10/29/80	10/29/80 16:20	2	3	0:00	0:01
45	CMU--PLEASE HELP BILL WULF/FULLER/GB1.S7	10/29/80	10/29/80 16:20	30	3	0:00	0:01
46	OA:GIVE UP/ACT TOGETHER/BROOKS/GB1.S7	10/29/80	10/29/80 16:34	15	7	0:01	0:07
47	CHARTER DUTIES/STOCKEBRAND/GB1.S7	10/29/80	10/29/80 16:19	4	3	0:00	0:00
48	KO & LANGUAGES/SNYDER/GB1.S7	10/29/80	10/29/80 16:19	4	3	0:01	0:02
49	MERCURY/CARCHIDI/GB1.S7	10/29/80	10/31/80 12:41	5	5	0:00	0:01
50	NI--KEN'S MEMO, GOOD POINTS/MILLER/GB1.S7	10/31/80	10/31/80 10:00	3	3	0:00	0:01
51	NEBULA, SUVAX, APPLE/KNOWLES/GB1.S7	10/31/80	10/31/80 10:00	4	3	0:00	0:01
52	NEBULA--YOUR EMS/LACROUTE/GB1.S7	10/31/80	10/31/80 9:59	5	4	0:00	0:01
53	NI-BASED COMM--LET'S GO DIRECTLY/ADAMS/GB1.S7	10/31/80	10/31/80 9:59	10	3	0:01	0:02
54	SCORPIO--ENOUGH TO COMPETE WITH NEW 32-BIT MICROS?/CLAYTON/GB1.S7	10/31/80	10/31/80 9:58	6	3	0:01	0:01
55	KO AND LACK OF PROGRESS AGAIN GOALS/CLAYTON/GB1.S7	10/31/80	10/31/80 9:57	25	3	0:00	0:02
56	VT200--YOU ARE GOING TO FAIL,TOGETHER A CHANCE/CLAYTON/GB1.S7	10/31/80	10/31/80 9:56	5	3	0:01	0:01
57	GROUP (11)--GETTING TO A SINGLE 11 SYSTEMS GROUP/CLAYTON/GB1.S7	10/31/80	10/31/80 9:54	7	3	0:00	0:00

Name: SECT7 , # of Docs: 54, Blocks left: 57 (of 627)

Number	Name	Created	Modified	Size	Version	Last	Total
1		8/11/82	11/24/82 11:17	8	116	0:00	0:12
2	ITINERARY: MCC MEETING DENVER, 8/19/82 /GB3.S7	8/11/82	9/28/82 13:08	4	14	0:00	0:62
3	MCC: ALPHA OMEGA PROPOSAL/GB3.S7	8/12/82	10/04/82 9:47	145	35	0:00	8:42
4	MCC: ALPHA OMEGA PROPOSAL TRANSMITTAL LETTER /AO COMMITTEE/GB3.S7	8/16/82	11/23/82 8:33	4	30	0:01	0:23

5	ECOLE POLYTECHNIQUE: RESPONSE TO JEAN-DANIEL NICOUD/GB3.S7	8/17/82	9/01/82	10:33	2	5	0:00	0:24
6	EMS REG. ISI ENVIRONMENT	8/16/82	9/24/82	11:54	4	6	0:00	0:24
7	JUPITER PRIORITIES/HJERPPE/GB3.S7	8/19/82	8/19/82	11:00	5	1	0:00	0:00
8	JAPAN: CONTINUING TO BUILD JAPANESE PROFILES/KOBAYASHI/GB3.S7	8/19/82	8/19/82	11:07	4	1	0:00	0:00
9	JAPAN: MISC. MSGS. FROM JAPAN & ENG/KOBAYASHI/GB3.S7	8/19/82	8/19/82	11:10	11	1	0:00	0:00
10	STRATEGY: SOME CHALLENGES IN THE NEXT 0-5 YEARS/OLSEN/GB3.S7	8/19/82	5/12/83	9:11	18	3	0:00	0:00
11	TERMINAL: WHY WE MUST BUILD GREAT PORTABLE/AVERY/GB3.S7	8/19/82	2/22/83	13:59	19	2	0:02	0:02
12	PRINTER: FINDING $'S TO BREADBRD LQP/SHEET FEED/AVERY/GB3.S7	8/19/82	8/30/82	14:07	3	3	0:00	0:00
13	VT192: PUTTING THE MODEM OPTION BACK IN/AVERY/GB3.S7	8/19/82	8/19/82	11:21	4	1	0:00	0:00
14	VT192: FINALIZING SPEC BEFORE WE SLIP SCHED./AVERY/GB3.S7	8/19/82	9/14/82	16:09	6	4	0:00	0:01
15	SUMNEY/TECH. POS. OF US COMP. SEMICOMP. CO./GB3.S7	8/23/82	9/28/82	11:56	3	4	0:00	0:14
16	TOM FORTUNE,FRESNO CA;TO KO REG CITIZEN & GOV'T COMM/GB3.S7	8/23/82	8/24/82	14:40	2	4	0:00	0:08
17	ABSTRACT: LOCAL AREA NETS, DISTR.PROCESSING & 5TH GEN/GB3.S7	8/24/82	9/07/82	9:17	2	7	0:00	0:08
18	WCC:THANK YOU: JJ SERVENT-SCHEINER & N NEGROPONTE/GB3.S7	9/10/82	9/22/82	9:24	5	12	0:03	0:40
19	U OF CAMBRIDGE THANK YOU/DR. HOPPER & HERBERT/GB3.S7	9/10/82	9/13/82	12:06	5	4	0:01	0:22
20	VT:OVERFUNDING-HUETTNER/AVERY/SMITH GB3.S7	9/10/82	10/06/82	13:05	4	7	0:01	0:19
21	LA100:WHAT'S THE STORY?-SMITH/AVERY/RING GB3.S7	9/10/82	9/13/82	14:47	1	5	0:01	0:06
22	APPLICATIONS PRODUCTS: DOING THEM RIGHT-OC, PEG... GB3.S7	9/10/82	10/06/82	12:57	17	11	0:01	1:31
23	WCC:WORLD COMPUTER CENTER AND WPS-SOURNAC GB3.S	9/10/82	11/16/82	14:31	7	9	0:00	0:39
24	FOUR WHEELS:OF REINCARNATION--PEG, RAD, TMC,... GB3.S7	9/10/82	8/16/82	9:25	28	15	0:01	2:20
25	OPPENHEIMER:EXCERPT FROM AN OPPEN. PROSPECTUS/OC, PEG... GB3.S7	9/13/82	9/13/82	15:45	3	3	0:00	0:10

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27     CLARK:RECOMMENDATION LETTER\MACARTHUR FOUNDATION GB3.S7
                           9/13/82  9/13/82 13:40  5    6        0:01   0:15
28     CRAPPY PRODUCTS:THE SIDE EFFECTS OF SLIPS AND VOIDS/OC + GB3.S7
                           9/13/82 10/13/82 12:17  10   5        0:01   0:10
29     ALPHA-OMEGA:ALPHA-OMEGA AND CFM/HUSTVEDT,LIPCON,POE,MACK GB3.S7
                           9/13/82  9/17/82 13:10  2    3        0:01   0:09
30     LETTER:PER BRINCH-HANSEN  GB3.S7
                           9/15/82 11/22/82 11:08  2    4        0:01   0:06
32     MCC TRANSMITTAL LETTER, $4K FOR INCORPORATION/GB3.S7
                           9/17/82 11/22/82 12:19  2    5        0:03   0:09
33     ITINERARY: AUSTRALIA 12/12/82 THRU 1/1/83/GB3.S7
                           9/18/81 12/10/82 11:38  4    13       0:14   2:48
34     ITINERARY - LASL, 10/5 & 6/1982, AO/GB3.S7
                           9/18/81 10/01/82  9:27  3    6        0:01   0:13
40     ALPHA OMEGA AGENDA, 10/5&6, LOS ALAMOS/GB3.S7
                           9/23/82  9/23/82  0:03  9    6        0:01   0:12
41     AI SOFTWARE IDEA FOR ADVERTISING
                           9/24/82  9/27/82  8:31  3    2        0:01   0:13
43     CFM: CYLES FOR THE MASSES, EMS 8/22/82 /CHRISTY ET AL/GB3.S7
                           9/27/82  9/27/82 16:59  18   1        0:00   0:00
44     VAX EXTENDED, DUCHAMP'S VECTOR INSTRUC. EMS 8/21/FULLER/GB3.S7
                           9/27/82  9/27/82 17:02  5    1        0:00   0:00
45     WPS-CT300 PHASE 0 OF POINT PRODUCT, EMS 8/21/DOCKSER ET AL/GB3.S7
                           9/27/82  9/27/82 17:04  5    1        0:00   0:00
46     COMPUTERS FOR MANUFACTURING, EMS 8/21/82 /CADY /GB3.S7
                           9/27/82  9/27/82 17:06  6    1        0:00   0:00
47     ISI, ENVIRONMENT (TALK W BALZER) EMS 8/18/ CHAMPINE ET AL/GB3.S7
                           9/27/82  9/27/82 17:09  5    1        0:00   0:00
48     MULTICOMPUTERS, CONSTRUCTING EXPERIMENT,EMS 8/16/FULLER/GB3.S7
                           9/27/82  9/27/82 17:12  4    1        0:00   0:00
49     CFM PRODUCTS AND A/D TO GET MORE, EMS 8/14,CHRISTY ET AL/GB3.S7
                           9/27/82  9/27/82 17:14  8    1        0:00   0:00
50     ICL COLLABORATION TO ESTABLISH MAIL STD,EMS 8/14/LACROUTE/GB3.S7
                           9/27/82  9/27/82 17:16  4    1        0:00   0:00
51     WORKSATIONS ON A WINNING TRACK, EMS 8/14/SMITH/GB3.S7
                           9/27/82  9/27/82 17:17  4    1        0:00   0:00
52     ALPHA OMEGA...SEMINAR TO PRESENT/GET IDEAS,EMS 8/12/FULLER+/GB3.S7
                           9/27/82  9/27/82 17:20  5    1        0:00   0:00
53     GATE ARRAYS, BETTER PRODUCTS THROUGH,EMS 8/9,FOLSOM+/GB3.S7
                           9/27/82  9/27/82 17:24  25   1        0:00   0:00
54     VT192 - SCHEDULE, EMS 8/9 /AVERY+/GB3.S7
                           9/27/82  9/27/82 17:26  7    1        0:00   0:00
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55	BUS, GETTING A WINNING STRATEGY, EMS 8/7, DEMMER+/GB3.S7							
		9/27/82	9/27/82 17:28	10	1		0:00	0:00
56	VS100 AND PERSONLA NEBULA, EMS 8/7, CHAMPINE+/GB3.S7							
		9/27/82	9/27/82 17:33	8	1		0:00	0:00
57	MARKETING ADS CONTENT, EMS 8/4, HINDLE+/GB3.S7							
		9/27/82	9/27/82 17:36	12	1		0:00	0:00
58	MARKETING OUR OFFICE PRODUCTS, EMS 8/4, SPENCER+/GB3.S7							
		9/27/82	9/27/82 17:38	19	1		0:00	0:00
59	ALPHA OMEGA...DRAFT FOR COMMENTS, EMS 8/4, DELAGI+/GB3.S7							
		9/27/82	9/27/82 17:39	4	1		0:00	0:00
60	BUDGET PROBLEM, DEALING WITH, EMS 8/2, EMC:/GB3.S7							
		9/27/82	9/27/82 17:43	5	1		0:00	0:00
61	VS200, GET COLOR QUICK,EMS 8/2,BUTLER+/GB3.S7							
		9/27/82	9/27/82 17:44	3	1		0:00	0:00
62	OA,RE-CENTRALIZED ORDER PROCESSING, EMS 8/1,BJORK/GB3.S7							
		9/27/82	9/27/82 17:45	5	1		0:00	0:00

Document 3 comment:
   page 20-deliverables table requires 14 pitch
Document 4 comment:
   list:GB3.S14.11
spec: .12
form: .13   FORM LETTER:GB3.S7.4
Document 6 comment:
   subject: isi, environment (talk with bob balzer)
to: sam fuller, dieter huttenberger, bill strecker, del
thorndike, george champine, bill johnson, dick hustvedt, rose ann
giordano
Document 21 comment:
   SUBJECT: LA100:WHAT'S THE STORY?
TO: JACK SMITH, BILL AVERY, JOHN RING
GB3.S7.21
Document 25 comment:
   TO: OC, PEG, GEORGE CHAMBERLAIN, CLAYTON
SUBJECT: EXCERPT FROM AN OPPENHEIMER PROSPECTUS
GB3.S7.25
Document 29 comment:
   TO: HUSTVEDT, LIPCON, POE, MACKENZIE
CC: DAY, TOM GAMNON, HEFFNER, CARCHIDI
SUBJECT: ALPHA-OMEGA AND CFM (CYCLES FOR THE MASSES)

Name: SECT8 , # of Docs: 44, Blocks left: 343 (of 627)

Number	Name	Created	Modified		Size	Version	Last	Total
1		9/02/81	10/02/81	10:19	5	102	0:07	0:16
2	TEST	9/02/81	9/22/81	10:23	1	3	0:00	0:12
3	THANK YOU FOR LETTER/STANISLOW BUDKOWSKI/GB2.S8	9/10/81	9/24/81	15:57	2	6	0:00	0:28
4	DECWORD ANNOUNCEMENT/GB2.S8	9/11/81	9/11/81	15:26	2	1	0:04	0:04
5	SLIDES--CT,VAX,278, FOR BOD MEETING/9/14/81/GB2.S8	9/14/81	9/14/81	8:49	9	1	0:00	0:00
6	EMS--RX50B, TEAC/RX50 AND ENGINEERING IN JAPAN/LYLE/GB2.S8	9/14/81	9/16/81	14:08	4	9	0:01	0:19
7	RUSS DOURNE	9/22/81	9/24/81	10:44	1	3	0:01	0:02
8	WHAT I LEARNED ABOUT DP FROM JAMES MARTIN/OLSEN/GB2.S8	9/22/81	3/23/82	9:05	3	4	0:00	0:12
9	EMS--CAN GEORGE CHAMPINE BE ON OSS?/LIGNOS/GB2.S8	9/21/81	9/24/81	10:44	2	3	0:00	0:07
10	EMS--ROBOTS	9/21/81	9/21/81	8:25	7	8	0:00	0:08
11	EMS--WOODS	9/21/81	9/21/81	8:25	7	7	0:00	0:05
12	EMS--GUTMAN	9/21/81	9/21/81	8:26	4	6	0:01	0:04
13	FORTUNE	9/21/81	9/21/81	8:19	6	2	0:00	0:00
14	HEURISTICS FOR BUILDING GRAT PRODUCTS/GB2.S8	9/21/81	3/23/82	9:05	26	3	0:00	0:01
15	WORLTON LECTURES/JACK WORLTON/GB2.S8	9/24/81	9/24/81	14:19	1	2	0:00	0:03
16	JAMES MARTIN SEMINAR/MARTIN/GB2.S8	9/24/81	9/24/81	15:04	2	2	0:01	0:04
17	PROFESSOR MURRAY/GB2.S8	9/25/81	10/05/81	13:25	3	3	0:01	0:12
18	INDEX	10/02/81	10/02/81	10:01	13	1	0:00	0:00
19	INDEXES	10/02/81	10/02/81	10:01	2	1	0:00	0:00

20	GB2.S10 INDEX	10/02/81	10/02/81	10:02	2	1	0:00	0:00
21	LOW END--OC WOOD DISCUSSION AND ACTION ITEMS/PEG/GB2.S8	10/01/81	10/01/81	8:41	8	2	0:00	0:00
22	ROBOTICS--COMPUTER SCIENCE BOARD REVIEW OF../CADY/GB2.S8	10/01/81	10/01/81	8:45	8	2	0:01	0:01
23	LOW END--AN AGGRESSIVE VT AND SET OF LOW.../AVERY/GB2.S8	10/01/81	11/09/81	11:58	7	3	0:01	0:01
24	XEROX--THE 820, A LOW COST ETHERNET.../AVERY/GB2.S8	10/01/81	10/01/81	8:49	5	2	0:00	0:00
25	SEMICONDUCTORS--PESENTATION OF.../CUDMORE/GB2.S8	10/01/81	10/01/81	8:58	11	2	0:01	0:01
26	TERMINALS--GETTING VT'S,LA'S,ROBIN AND CT OU..AVERY/GB2.S8	10/01/81	10/01/81	9:01	10	2	0:01	0:01
27	ROBIN--3 WEEK CAT SCHEDULE IS GR.../FOLSOM/GB2.S8	10/01/81	10/01/81	9:03	4	2	0:01	0:01
28	ROBIN--3 WEEK CAT SCHEUDLE IS GREAT, BUT.../FOLSOM/GB2.S8	10/01/81	10/01/81	9:04	4	2	0:00	0:00
29	LOW END---INTELLIGENT AND COMPUTER TERMINAL../AVERY/GB2.S8	10/01/81	10/01/81	9:08	15	2	0:02	0:02
30	PACKAGE--KEN'S ALTERNATIVE MONITOR FOR THE.../AVERY/GB2.S8	10/01/81	10/01/81	9:20	7	2	0:00	0:00
31	JAPAN--VERTICALLY INTEGRATED SEMIS/ENG.STAFF/GB2.S8	10/01/81	10/01/81	9:22	7	2	0:00	0:00
32	PLAN--HOW CAN WE GET A REALISTIC GEMINI/DEMMER/GB2.S8	10/01/81	10/01/81	9:25	11	2	0:01	0:01
33	VT134--BILL, THESE FOLKS WORK FOR YOU/AVERY/GB2.S8	10/01/81	10/01/81	9:27	3	2	0:01	0:01
34	PAPER--ISSCC- J-11/COURTRIGHT/GB2.S8	10/01/81	10/01/81	10:01	3	2	0:00	0:00
35	VT200--KEN'S SUGGESTIONS ABOUT/AVERY/G2.S8	10/01/81	10/01/81	10:03	3	2	0:01	0:01
36	NEBULA--A $3B PRODUCT THAT HAS TO.../DEMMER/GB2.S8	10/01/81	10/01/81	10:04	5	2	0:00	0:00
37	GB2.S11 INDEX	10/02/81	10/02/81	10:02	6	1	0:00	0:00
38	GB2.S12 INDEX	10/02/81	10/02/81	10:03	6	1	0:00	0:00
39	GB2.S13 INDEX	10/02/81	10/02/81	10:03	2	1	0:00	0:00
40	GB2.S15 INDEX	10/02/81	10/02/81	10:05	4	1	0:00	0:00

41	GB2.S14 INDEX	10/02/81	10/02/81 10:05	3	1	0:00	0:00
42	GB2.S9 INDEX	10/02/81	10/02/81 10:18	2	1	0:00	0:00
43	RL1.S10 INDEX	10/02/81	10/02/81 10:19	2	1	0:00	0:00
44	RL1.S13 INDEX	10/02/81	11/09/81 12:01	2	4	0:00	0:01

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Number	Name	Created	Modified	Size	Version	Last	Total
1		10/04/82	11/30/82 13:09	8	171	0:00	0:28
2	TSONGAS LETTER RE MIT MEETING/GB3.S8	10/04/82	10/18/82 9:07	8	13	0:01	0:13
3	ARPA - /LETTER TO DR. LEVINTHAL ET AL VIA ARPANET	10/04/82	11/05/82 13:37	5	13	0:00	0:17
4	TECKNOLWEDGE BOD, NOTES RE FEIGENBAUM/GB3.S8	10/04/82	11/18/82 16:28	4	4	0:01	0:02
5	LASL THANKS FOR HOSPITALITY/EWALD,BUZBEE/GB3.S8	10/11/82	10/11/82 13:10	3	4	0:00	0:01
8	VAX PERFORMANCE, EFFORT TO IMPROVE/EMS:DEMMER ETAL/GB3.S8	10/13/82	10/25/82 8:59	7	2	0:00	0:00
9	AO DISCUSSION WITH FERNBACH&FEIGENBAUM/EMS:FULLER/GB3.S8	10/13/82	4/06/83 16:20	6	2	0:00	0:00
10	VENUS REVIEW CONGRATS...SINCE 5/81/EMS:GLORIOSO+/GB3.S8	10/13/82	10/13/82 11:56	5	1	0:00	0:00
11	A1 DEMO THANKS--BE #1 IN OFFICE SALES/EMS:WYMAN+/GB3.S8	10/13/82	10/13/82 12:04	6	1	0:00	0:00
12	OFIS DISCUSSION WITH DAVIES NOT GOOD/EMS:DOCKSER/GB3.S8	10/13/82	10/13/82 12:12	12	1	0:00	0:00
13	NYIT, MORE COLLABORATION + A PRO/EMS:BENIGNI,AK/GB3.S8	10/13/82	11/08/82 14:05	7	3	0:00	0:00
14	KO:SOCIAL ECOLOGY RESEARCH /THORSHEIM&ROBERTS/ GB3.S8.14	10/14/82	10/14/82 14:24	3	5	0:00	0:14
15	KO:IPA-PAPER-IMPROVE R & D PRODUCTION/SZAKANGI/GB3.S8.15	10/14/82	10/25/82 15:16	2	7	0:10	0:18
16	ORG CHART--ENGINEERING/GB3.S8.16						

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                        10/14/82 12/01/82  9:29  10   16       0:03   0:54
17     ANTIQUE PAYMENT, PLANIMETER/M.KENNEDY/GB3.S8
                        10/15/82 11/30/82 13:30  2    6        0:00   0:12
18     MUSEUM: DONATE LAND AS ENDOWMENT/MATHEWS/GB3.S8
                        10/18/82 10/19/82  8:46  11   14       0:01   0:30
19     MUSEUM: CANADIAN AN/FSQ7 FIELD TRIP REPORT/GB3.S8
                        10/18/82  4/06/83 16:23  35   6        0:02   0:05
20     LETTER TO DR. ARNOLD WEBER--CONGRATULATIONS GB3.S8.20
                        10/18/82 11/22/82  8:34  2    4        0:00   0:05
21     ITINERARY: MINN/SF/10/27/82--ALPHA OMEGA,TECKNOWLEDGE/GB3.S8
                        10/22/82 10/25/82  4:59  4    7        0:00   0:22
24     TRAINING:ENGINEERING OBSOLESENCE/REYNOLDS/GB3.58
                        10/25/82 10/27/82 10:12  10   11       0:00   0:26
25     Training: Eng. Obsolescence Transmittal Memo/GB3.S8
                        10/26/82 10/26/82  8:22  3    3        0:00   0:06
27     Training:  Over 40 Engineers (GB3.S8)
                        10/26/82 10/26/82 12:06  6    5        0:00   0:08
31     VAX11 USER'S GUIDE: LTR DENNIS GELLER,BABSON/11-2/GB3.S8
                        11/01/82 11/23/82 13:00  2    3        0:02   0:07
32     INTERRUPTS: LTR HARVEY CRAGON/11-2/GB3.S8
                        11/01/82 11/23/82 12:58  5    4        0:01   0:04
35     TEKNOWLEDGE BOD:/LTR ED FEIGENBAUM/11-2/GB3.S8
                        11/02/82 11/23/82 12:12  3    5        0:01   0:15
36     ITINERARY: 11/7 THRU 11/13, SF&OREGON/GB3.S8
                        11/05/82  1/25/83 12:43  5    9        0:00   0:38
37     PRODUCTS: COMPETITIVE/MEMO/11-8/OC,EMC,PEG/GB3.S8
                        11/08/82 11/23/82 12:10  16   6        0:01   0:21
38     ITINERARY: ALPHA OMEGA, MINN. 11/21-23/GB3.S8
                        11/18/82 11/19/82 14:44  2    8        0:00   0:08
40     AI & Expert Sys:LISP,PRODUCTS,NEEDS &MKTG./WEISS ET AL/GB3.S8
                        11/15/82 11/30/82 11:54  18   4        0:01   0:02
43     SRI, Alpha Omega + Join Museum?/Miller/GB3.S8
                        11/15/82 11/15/82 11:19  4    3        0:01   0:01
44     LLL-Multiprocessor Work/Michaels/GB3.S8
                        11/15/82 11/15/82 11:48  4    5        0:01   0:09
45     FPS - thanks + OA Ideas/Turner/GB3.S8
                        11/15/82 11/15/82 12:04  5    9        0:01   0:17
46     LLL-thanks & Good Luck on IIA/Wood M.Williams/GB3.S8
                        11/15/82 11/24/82 12:18  5    5        0:00   0:15
47     FPs-Join Museum?/Winningstad/GB3.S8
                        11/15/82 11/15/82 12:11  3    1        0:02   0:02
48     Japan-More Thoughts/Aguero/GB3.S8
```

		11/15/82	11/30/82	11:56	14	9	0:01	0:26
49	VAX,Implementation when hardwired & Microprogrammed/EMC/GB3.S8	11/15/82	12/06/82	16:35	31	8	0:01	0:31
50	LBL/Speaker/Consultant/GB3.S8	11/15/82	11/16/82	11:42	5	4	0:03	0:14
51	STANDARDS/SEMIS & SYSTEMS DESIGN/PRAKASH BHALERAO,GB3.S8	11/15/82	11/15/82	13:40	3	2	0:00	0:11
52	DEC 10/20 BUSINESS/KNOWLES/GB3.S8	11/15/82	11/15/82	14:03	16	3	0:03	0:04
53	VENUS: NEED, LLL MULTIPROCESSORS/EMS/11-16/DEMMER ET AL/GB3.S8	11/15/82	11/23/82	11:33	12	6	0:02	0:55
54	WRL:CHARTER/EMS/11-16/FULLER,BASKETT/GB3.S8	11/15/82	11/23/82	11:25	7	8	0:03	0:25
57	EDUCATION: MIT lifetime program,EMS-10/4/EMC/GB3.S8	11/18/82	11/22/82	12:14	7	3	0:01	0:02
58	SPEECH: KEN'S DATA FOR KO/EMS-10/3/A.CRAWFORD/GB3.S8	11/18/82	11/18/82	11:55	10	2	0:01	0:01
60	YALE: CS DEPT. VISIT/EMS/11-16/MARCUS,FULLER/GB3.S8	11/15/82	11/23/82	11:22	10	11	0:01	0:37
61	SHARED:LPC(F&J VERSIONS) VS PC'S/EMS-10/9/M.GUTMAN/GB3.S8	11/18/82	11/18/82	11:53	7	3	0:00	0:01
62	SHARED:11'S, SOME SPT FOR LOW END/EMS-10/10/GUTMAN,MARCUS/GB3.S8	11/18/82	11/18/82	11:49	5	3	0:00	0:01
63	VAX ARCHITECTURE:EXTENDING-NAME/EMS-10/10/D.BHANDARKAR/GB3.S8	11/18/82	11/18/82	11:48	7	2	0:01	0:01
64	VAX:VIA MICROPROGRAMMING/EMS-10/10/D.BHANDARKAR/GB3.S8	11/18/82	11/18/82	11:47	5	2	0:01	0:01
65	MIT:NEC IN NE,POOR RELATIONSHIP/EMS-10/11/KEILLOR/GB3.S8	11/18/82	11/18/82	11:46	6	4	0:00	0:04
66	IBM'S:AGGRESSIVE BEHAV.W/UNIV. & RSCH/EMS-10/11/OC,BUTLER/GB3.S8	11/18/82	11/18/82	11:41	6	3	0:01	0:02
67	ANNOUNCEMENT: RECOMMEND ARCH/EMS-10/11/U.FAGERQUIST/GB3.S8	11/18/82	11/18/82	11:08	10	2	0:01	0:01
68	TECH COMP CENTER:BENCHMARK & EXPERIMENT/EMS-10/13/GANNON/GB3.S8	11/18/82	11/18/82	11:07	7	2	0:01	0:01
69	Q VS BI REPORT:THANKS/EMS-10/16/DEMMER,JESSEL,STRECKER/GB3.S8	11/18/82	11/18/82	11:06	5	2	0:01	0:01
70	CMU LOSS:WHY SIGNIFICANT & NEXT STEP/EMS-10/18/AVERY,OC/GB3.S8	11/18/82	11/18/82	11:05	9	3	0:00	0:01
71	VAX CENTER: ZK FOR PARALLEL.&EXT./EMS-10/19/CARCHIDI/GB3.S8	11/18/82	11/18/82	11:04	4	3	0:00	0:00
72	MIT:MTG. TO PROPOSE A PC PLAN/EMS-10/20/SAM,WIN,BJ/GB3.S8							

Number	Name	Created	Modified	Size	Version	Last	Total
		11/18/82	11/18/82 11:04	3	3	0:01	0:02
73	AI:MKT. & PRODUCTS-LET'S GO AFTER/EMS-10/12/ABEL,FULLER/GB3.S8	11/18/82	11/18/82 11:03	6	5	0:00	0:03
74	VAX ARCHITECTURAL: EXTEN.&REDUCTIONS/EMS-10/24,DILEEP/GB3.S8	11/18/82	11/18/82 10:27	17	3	0:01	0:02
75	TAIWAN: VERSUS AUTOMATION FOR COST/EMS-10/24/KO,J.SMITH/GB3.S8	11/18/82	11/18/82 10:28	6	3	0:00	0:01
76	VAX & PRIORITIES:PRODUCTS CHARTS & REORG/EMS-10/26/BJ/GB3.S8	11/18/82	11/18/82 10:23	5	2	0:02	0:02

Name: SECT13, # of Docs: 15, Blocks left: 88 (of 627)

Number	Name	Created	Modified	Size	Version	Last	Total
1		12/30/80	11/23/82 15:05	2	36	0:00	0:08
2	FILE INDEX - DEC GENERAL FILEs/GB3.S14.9	11/22/82	12/10/82 14:05	6	9	0:01	0:12
3	MAIL TICKLER FORM FOR TRACKING LIST/GB2.S13	6/11/81	11/01/82 8:52	1	5	0:00	0:02
4	FILE INDEX - GB PERSONAL/GB3.S9	11/22/82	11/23/82 16:36	11	8	0:00	0:11
5	FILE INDEX - ALPHA EXTERNAL FILES/RLO.S9	11/23/82	12/10/82 14:32	8	7	0:01	0:09
6	MAY TO DATE/MASTER '81 MAIL-LOG + TICKLER LIST/GB2.S13	5/04/81	12/10/82 15:53	468	2016	0:02	31:28
7	MAIL TICKLER FORM/GB2.S13	5/29/81	11/01/82 8:54	1	20	0:00	0:18
8	MAIL TICKLER SPEC /GB2.S13	5/29/81	11/23/82 11:07	1	41	0:00	0:19
9	MAIL TICKLER LIST/GB2.S13	6/11/81	11/01/82 8:51	1	16	0:00	0:06
10	MAIL TICKLER RESULT/RL1:SECT13	6/10/81	9/01/81 11:02	2	46	0:01	0:26
11	DK FOR MAIL TICKLER/GB1.S13	6/11/81	6/11/81 9:54	2	3	0:01	0:08
12	MAIL SUMMARY SPEC	3/04/82	7/14/82 11:26	1	11	0:00	0:04
13	MAIL SUMMARY FORM (DAILY)	3/04/82	3/04/82 15:52	2	8	0:00	0:52

```
 14     LOAN OUT LOG
                            6/18/82 11/05/82  8:52  2    29       0:01   0:31
 15     FILE INDEX - TECHNICAL
                           11/23/82 12/10/82 13:59  14   4        0:10   0:52

Document 14 comment:
   <item>
<to>
<ext>
<date out>
<approx ret date>
<>



Name: SECT14, # of Docs: 7, Blocks left: 572 (of 627)
-------------------------------------------------------------------------------
Number  Name                    Created  Modified       Size Version  Last   Total
-------------------------------------------------------------------------------
  1
                            1/28/81 10/02/81 10:04  1    11       0:01   0:01
  2     LIST TO BE SORTED/GB2.S14
                            1/28/81  6/23/81 16:09  20   12       0:00   0:22
  3     SPEC FOR SORT
                            1/28/81  1/28/81 17:48  2    72       0:00   0:04
  4     FORM FOR SORT
                            1/28/81  9/28/81  9:10  1    5        0:00   0:00
  5
                            1/28/81  1/28/81 17:48  20   21       0:02   0:03
  6
                            1/28/81  1/28/81 17:49  1    1        0:00   0:00
  7     GB2.S14 INDEX
                           10/02/81 10/02/81 10:04  3    1        0:00   0:00


Name: SECT14, # of Docs: 15, Blocks left: 522 (of 627)
-------------------------------------------------------------------------------
Number  Name                    Created  Modified       Size Version  Last   Total
-------------------------------------------------------------------------------
  1
                            6/17/82  9/27/83  6:21  2    26       0:01   0:03
```

Number	Name	Created	Modified	Size	Version	Last	Total
2	CITIBANK LITERATURE/GB3.S14	6/17/82	7/23/82 8:28	1	3	0:15	0:20
3	LASL TRANSMITTAL LETTER OF JAPAN PAPER/BUZBEE/GB3.S14	6/18/82	7/23/82 8:11	1	3	0:00	0:02
4	MIT ALUMNI NOMINATION--NO /PICARDI/GB3.S14	7/23/82	7/23/82 8:12	2	1	0:00	0:00
5	SRC-REPLACE GB WITH KALB/SUMNEY/GB3.S14	7/23/82	7/23/82 12:23	3	2	0:01	0:11
6	NYIT-- JOHN COLOMBO REG. TRANSPORTATION/NYIT LECTURE/GB3.S14	7/27/82	7/27/82 10:19	3	4	0:01	0:09
7	DELAHAR ANTIQUES - CHECK PLUS PICKUP INFO/GB3.S14	8/10/82	8/10/82 9:44	3	3	0:21	0:23
8	LIST OF NAMES FOR 25TH ANNIVERSARY POSTERS/GB3.S14	8/11/82	8/23/82 3:45	8	7	0:02	0:06
9	DEC-GENERAL FILES GB3.S14	8/11/82	8/11/82 15:42	15	2	0:01	0:02
10	MCC: ALPHA OMEGA DISTRIBUTION LIST/GB3.S14	8/13/82	8/16/82 10:02	18	11	0:02	0:47
11	MCC: ALPHA OMEGA LIST - SORTED/GB3.S14	8/16/82	1/11/83 12:18	19	23	0:01	0:28
12	MCC: ALPHA OMEGA SPEC/GB3.S14	8/16/82	8/18/82 13:45	1	7	0:00	0:02
13	MCC: ALPHA OMEGA FORM/GB3.S14	8/16/82	8/16/82 13:36	1	3	0:03	0:04
14	MICROFILM OF GB PAPERS/GB3.S14	8/24/82	8/24/82 8:43	6	1	7:45	7:45
15	INDEX GB3S14	8/31/82	8/31/82 10:26	6	2	0:01	0:01

Document 10 comment:
ÁJ
Document 11 comment:
ÁJ

Name: SKT,$#, # of Docs: 6, Blocks left: 219 (of 627)

Number	Name	Created	Modified	Size	Version	Last	Total
1		0/00/00	3/29/78 2:36	1	33	0:00	0:00
2	Essay 1						

Number	Name	Created	Modified		Size	Version	Last	Total
		0/00/00	1/13/78	8:50	140	58	0:00	0:00
3	List of Figures	10/29/76	5/12/77	12:55	3	4	0:00	0:00
4	The Marketplace	5/12/77	1/23/78	12:41	214	6	0:00	0:00
5	Essay 3	8/10/77	11/22/77	13:43	40	4	0:00	0:00
6	Index from CI/SKT,$#	3/29/78	3/29/78	2:36	3	1	0:00	0:00

Name: SLIDES, # of Docs: 59, Blocks left: 284 (of 627)

Number	Name	Created	Modified		Size	Version	Last	Total
1		9/12/78	11/08/79	10:13	6	70	0:04	0:06
2	problem/eng.spending	9/12/78	9/12/78	15:43	3	2	0:00	0:00
3	market/product goals	9/12/78	7/08/80	11:23	3	2	0:00	0:01
4	premises/considerations	9/12/78	9/12/78	14:43	3	2	0:03	0:03
5	message 10/20	9/12/78	9/12/78	14:48	4	4	0:04	0:05
6	eight	9/12/78	9/12/78	14:58	2	3	0:01	0:05
7	micros-11	9/12/78	9/12/78	14:57	3	1	0:07	0:07
8	vax-11	9/12/78	9/12/78	0:30	2	4	0:00	0:02
9	unibus 11	9/12/78	9/12/78	0:31	3	4	0:01	0:08
10	viewgraph list	9/13/78	7/08/80	11:24	7	15	0:01	0:50
11	basic cpu/slide 1	9/13/78	9/15/78	9:28	7	5	0:01	0:22
12	basic software	9/13/78	9/13/78	9:32	5	1	0:11	0:11
13	storage	9/13/78	9/13/78	9:39	3	1	0:07	0:07

14 "gets" and cancel
9/13/78 9/14/78 12:35 6 4 0:01 0:20
15 slides--product strategy (81-82)
10/12/78 11/13/78 1:07 12 13 0:00 0:41
16 strategy to oc 12/11
12/09/78 12/18/78 0:04 10 5 0:00 0:27
17 HARDWARE/SOFTWARE SALES BY ARCH
12/09/78 12/09/78 1:09 10 6 0:01 0:27
18 hrdwr/sftwr sales by layer
12/09/78 12/09/78 3:32 10 4 0:00 0:18
19 software sales
12/09/78 12/09/78 1:30 10 2 0:18 0:19
20 memory sales
12/09/78 12/09/78 1:44 10 2 0:13 0:13
21 terminal sales
12/09/78 12/09/78 3:44 10 5 0:00 0:15
22 DEV INVESTMENT BY ARCHITECTURE
12/09/78 7/08/80 11:22 10 4 0:01 0:22
23 DEVELOPMENT INVESTMENT BY LAYER
12/09/78 7/08/80 11:22 12 5 0:00 0:23
24 development investment by architecture
12/09/78 12/09/78 3:37 10 2 0:01 0:17
25 strategy similar to ibm/1964-360
12/11/78 12/11/78 9:25 4 3 0:02 0:19
26 PRODUCT STRAGETY
12/11/78 7/08/80 11:21 6 9 0:00 0:25
27 (HOW) WIN AGAINST IBM
12/11/78 12/11/78 9:29 4 2 0:04 0:11
28 SOME STANDARDS QUESTIONS/SLIDES
2/07/79 2/13/79 12:11 2 7 0:03 0:12
29 INDUSTRIES INVOLVED IN (INCREASED) INFORMATION PROCESSING/SLIDES
2/07/79 2/07/79 12:01 2 3 0:00 0:07
30 LIMITS TO MICROSTRUCTURES/SLIDES
2/07/79 2/13/79 12:08 2 2 0:01 0:04
31 APPLICATIONS PROGRAMS POSSIBILITIES/SLIDES
2/07/79 2/07/79 12:06 4 2 0:00 0:18
32 DISCIPLINE AND ENVIRONMENT DEPENDENT/SLIDES
2/07/79 2/07/79 11:25 3 1 0:06 0:06
33 COMPUTERS ONLY THEME SUPPLEMENT (AND SUPPLANT)/SLIDES
2/07/79 2/13/79 12:06 2 6 0:01 0:13
34 Q1-Q5/SLIDES
2/07/79 2/07/79 17:12 4 5 0:00 0:15

35	COMMERCIAL PRODUCT PHILOSOPHY/MARCUS-CADY/SLIDES	2/08/79	2/08/79	13:35	2	2	0:01	0:06
36	COMMERCIAL PRODUCT PHILOSOPHY-B/MARCUS-CADY/SLIDES	2/08/79	2/08/79	13:31	2	4	0:00	0:04
37	COMMERCIAL PRODUCT PHILOSOPHY-C/MARCUS-CADY/SLIDES	2/08/79	2/08/79	13:40	4	3	0:01	0:06
38	COST* FOR VARIOUS MAIL SYSTEMS/SLIDES	2/13/79	2/13/79	12:22	2	3	0:01	0:08
39	PAPER COSTS (LAST 10 YEARS)/SLIDES	2/13/79	2/13/79	12:44	2	3	0:00	0:03
40	COMMUNICATIONS COSTS/SLIDES	2/13/79	2/13/79	12:37	3	3	0:00	0:07
41	BPO'S VIEWDATA/SLIDES	2/20/79	2/20/79	6:02	1	2	0:01	0:06
42	TECHNOLOGY PROGRESS/SLIDES	2/20/79	2/21/79	1:06	3	2	0:03	0:09
43	AT&T'S ADVANCED COMMUNICATIONS SERVICE (ACS)/SLIDES	2/20/79	2/20/79	6:26	2	1	0:03	0:03
44	FORMS OF PARALLELISM/SLIDES	2/20/79	2/21/79	1:02	1	2	0:07	0:10
45	SINGLE SITE PARALLELISM/SLIDES	2/20/79	2/21/79	0:53	3	2	0:02	0:06
46	WHY MULTIPROCESSORS HAVEN'T EMERGED YET/SLIDES	2/20/79	2/21/79	0:46	2	2	0:02	0:06
47	GROSCH'S LAW COULD HOLD/SLIDES	2/20/79	2/21/79	0:43	3	5	0:00	0:30
48	COSTS TO USE A COMPUTER/SLIDES	2/20/79	2/21/79	1:11	4	3	0:04	0:11
49	BASIC MODEL (1973) BIST/DIE/SLIDES	2/20/79	2/21/79	1:12	4	3	0:01	0:12
50	MANY WAYS TO DO INFORMATION STORAGE AND PROCESSING/SLIDES	2/20/79	2/21/79	1:13	2	2	0:00	0:02
51	THREE MULTIPROCESSOR COMPUTERS STRUCTURES/SLIDES	2/20/79	4/22/80	11:33	2	8	0:00	0:07
52	WHY COMPUTERS EVOLVE RAPIDLY/SLIDES	3/01/79	4/22/80	11:34	2	3	0:00	0:08
53	BASIC INTERCOMMUNICATION (UNIBUS)/SLIDES	3/01/79	4/22/80	11:34	5	3	0:00	0:15
54	Index from CI/SLIDES	4/04/79	11/14/79	8:58	20	5	0:00	0:00
55	VAX/VMS COMPUTING ENVIRONMENT FOR 80'S/90'S/36-BIT STMNT/OC/SLIDES	4/11/79	4/17/79	0:40	2	10	0:01	0:11

56	JAPAN TALK/DARTMOUTH/SLIDES	4/13/79	4/13/79 14:21	9	10	0:00	1:60
57	DISTRIBUTED CROSSING SLIDE/SLIDES	10/17/79	4/22/80 11:34	2	5	0:00	0:23
58	DP TALK SLIDES/SLIDES	10/23/79	4/22/80 11:33	3	2	0:00	0:00
59	DISTRIBUTED PROCESSING TALK SLIDES/SLIDES	11/08/79	4/22/80 11:32	5	7	0:00	0:08

Name: SOCIAL, # of Docs: 9, Blocks left: 584 (of 627)

Number	Name	Created	Modified	Size	Version	Last	Total
1		10/25/78	4/17/79 6:13	1	9	0:02	0:02
2	entertainment list	10/25/78	12/05/78 0:57	20	7	0:01	0:32
3	spec entertainment	10/25/78	10/26/78 2:05	1	4	0:02	0:03
4	entertainment form/all functions	10/25/78	10/26/78 0:11	1	2	0:00	0:00
5	entertainment form names only	10/25/78	10/25/78 8:32	1	1	0:00	0:00
6	entertainment form--who's coming	10/26/78	10/26/78 2:13	1	5	0:01	0:05
7	results	10/26/78	10/26/78 2:10	3	8	0:03	0:05
8	restaurant guide	11/28/78	11/28/78 16:54	2	1	0:05	0:05
9	INDEX FROM CI/SOCIAL	4/17/79	5/16/79 2:28	4	2	0:00	0:00

Name: TALKS , # of Docs: 13, Blocks left: 566 (of 627)

Number	Name	Created	Modified	Size	Version	Last	Total
1		9/14/78	2/20/80 16:25	2	27	0:01	0:12

2	ABSTRACT LIST /TALKS ,	9/14/78	1/30/79 16:41	6	21	0:00	1:46
3	VITA - 1 PAGE, UPDATED 2/22/79 /TALKS ,	2/22/79	3/23/79 0:44	4	2	0:01	0:12
4	ABSTRACT--JAPANESE DISTRIBUTORS/CONCERN FOR COMPUTERS (LONG)/TALKS ,	9/14/78	2/22/79 0:13	5	6	0:00	0:01
5	ABSTRACT LIST FORM /TALKS ,	9/14/78	4/25/80 2:15	1	5	0:00	0:05
6	ABSTRACT LIST SPEC /TALKS ,	9/14/78	9/14/78 12:11	1	1	0:00	0:00
7	RESULT /TALKS ,	9/14/78	9/14/78 16:03	6	9	0:00	0:01
8	ABSTRACT--PDP-11 FAMILY & VAX 11/780 /TALKS ,	9/14/78	3/24/80 8:23	3	2	0:02	0:02
9	TALK LIST (WITH NOTES ONLY) /TALKS ,	9/14/78	1/22/79 15:08	5	8	0:01	1:30
10	ABSTRACT--MINICOMPUTER ARCHITECTURE /TALKS ,	9/14/78	1/19/79 1:50	3	2	0:01	0:01
11	ABSTRACT--DISTRIBUTED PROCESSING/LIMITS TO ITS GROWTH /TALKS ,	1/19/79	4/25/80 2:03	4	7	0:00	0:07
12	ABSTRACT--JAPAN HAS TURNED US INTO DISTRIBUTORSHIP(SHORT)/TALKS ,	2/01/79	2/22/79 0:13	2	7	0:00	0:22
13	Index from CI/TALKS	4/17/79	5/16/79 2:35	6	2	0:00	0:00

Name: TEMP , # of Docs: 20, Blocks left: 394 (of 779)

Number	Name	Created	Modified	Size	Version	Last	Total
1		9/14/83	1/06/85 0:00	2	39	0:00	0:04
2	parallelism MASTER TRANSFERRED TO GB7 11/9/83	11/08/83	11/09/83 8:31	46	9	0:01	12:54
3	bob rau startup DONE 11/14/83 Mon	11/13/83	11/14/83 10:19	4	4	0:00	0:15
4	ARPA MESSAGES AS OF 10/25/83	10/25/83	11/07/83 0:37	164	4	0:32	0:35
5	to do 14 nov	11/14/83	4/01/84 0:49	4	10	0:01	1:41
6	Bill Grinker letter--DONE SENT FROM VAX						

```
                              1/05/84  1/06/83  2:21  5    2        0:00   0:27
  7     C/P taxonomy--FOR SLIDES-DONE
                              1/07/84  9/09/84  0:02  13   12       0:01   4:37
  8     levels of parallel computing--SLIDES-DONE
                              1/07/84  1/09/83  2:41  7    11       0:01   2:40
  9     arvind letter of recommendation EDITED/SENT FROM VAX 2/15/84
                              2/14/84  2/15/84  2:28  5    4        0:07   3:19
 10     Thoughts on why Slumberger should buy ecc
                              2/25/84  5/14/84  1:51  10   4        0:01   1:46
 11     strecker ieee recommendation DONE
                              3/15/84  3/21/84  1:03  18   10       0:02   4:24
 12     Poduska IEEE Fellow recomendation DONE
                              4/08/84  0/00/00  6:10  14   7        0:02   3:03
 13     cragon letter of rec SENT 5/14/84
                              5/13/84  5/14/84  1:49  4    4        0:00   1:37
 14     taxonomy figure for micros paper
                              6/02/84  6/03/84  8:38  11   6        0:01   3:19
 15     ralston recomendation letter for nae DONE 6/13/84
                              6/12/84  6/13/84  1:20  2    2        0:00   0:17
 16     wulf nae recommendation DONE
                              6/28/84  0/00/00  4:32  5    3        0:01   0:34
 17     darpa people proposal
                             10/16/84  0/00/00  0:16  16   4        0:11   3:08
 18     Museum walkabout
                             11/27/84 11/27/84  1:14  4    2        0:13   0:13
 19     letter to Fortune editor re Multi picture/article
                             11/27/84 12/18/84  0:58  3    2        0:01   0:19
 20     comments on CM* book
                              1/06/85  1/07/85  0:21  5    4        0:01   0:27

Document 3 comment:
   Subject: Bob Rau (408-356-4435) Supercomputer company
to: pg


Name: TRANSP, # of Docs: 12, Blocks left: 480 (of 779)
-------------------------------------------------------------------------------
Number  Name                  Created  Modified       Size Version  Last   Total
-------------------------------------------------------------------------------
  1
                             11/30/83 10/04/84  7:29  2    26       0:01   0:04
  2     schanin memo/ DONE 12/19/83 Mon
```

		12/18/83	12/19/83	0:42	7	3	0:00	0:29
3	DARPA/SIEWIOREK/bell proposal SENT 3/10/84 (+ON VAX)							
		3/07/84	3/24/84	0:25	55	14	0:08	11:20
4								
		6/30/84	6/30/84	0:14	2	1	0:07	0:07
5	MORBY, TA ASSOCIATES letter to Ms. VC SENT FROM VAX							
		6/09/84	6/11/84	2:51	12	13	0:10	3:43
6	critique of NRC Supercomputer Report							
		8/18/84	9/22/84	3:16	62	16	0:02	12:09
7	PFIAD recommendations on vlsi, effective sc use, vhsic, poor efforts							
		9/22/84	9/28/84	7:33	30	11	0:01	9:10
8	DARPA proposal claims (has to be 1 page)							
		9/27/84	9/30/84	0:35	7	15	0:02	3:20
9	Technical Volume							
		9/27/84	10/05/84	0:54	85	29	0:00	34:52
10	Taxonomy section of the technical volume							
		9/27/84	9/27/84	18:26	2	2	0:01	0:36
11	Outine for Executive Summary and Technical Volumes							
		9/30/84	10/01/84	0:43	6	5	0:01	1:09
12	index							
		10/04/84	10/04/84	7:29	5	1	0:00	0:00

(HOW) CAN WE WIN AGAINST IBM?

SITUATION

THEY HAVE SEVERAL INCOMPATIBLE FAMILIES SEGMENTED (SOMEWHAT) AT DIFFERENT CUSTOMERS:

- **360/370 WITH 3 DIFFERENT OPERATING SYSTEMS (MANY LANGUAGES)**
- **SYSTEM 34 IN TRANSITION TO NEW SYSTEM 38 (RPG II, III)**
- **A "MINI" IN SERIES 1 WITH SEVERAL OPERATING SYSTEMS (PL1, COBOL, FORTRAN, MACHINE)**
- **8100 FOR DISTRIBUTED PROCESSING (COBOL, FORTRAN, MACHINE)**
- **5100 FOR PERSONAL COMPUTING (APL, BASIC)**
- **SYSTEM 6 FOR WORD PROCESSING**

. ? FOR HOME/PERSONAL COMPUTING (?)

. ? FOR PROGRAMMABLE INTELLIGENT TERMINAL (SERIES 1)

FOCUS

0. A HOMOGENEOUS, DISTRIBUTED COMPUTING ENVIRONMENT

1. GOING TO A SINGLE, COMPATIBLE VAX AND 11 RANGE WHICH COVERS

THEM IN BASIC CAPABILITY. KEEP LOWER ENTRY PRICES SO THAT

BUYING DECISIONS ARE KEPT AT WORKER LEVEL. (THE 38 DOES HAVE

GREATER CAPABILITY)

2. DECNET AND HIGHER SPEED (BETTER) COMMUNICATIONS

3. TARGETING CONFIGURATIONS SO AS TO APPLY OUR NOW PRODUCTS

(E.G., TRAX, VMS) VERSUS THEIR FUTURES (8100 AND 38)

4. TARGETING

EMS 8-MAR-79 11:11:09 430 1

To: Jan Lounsbury, Ulf Fagerquist, Bill McBride
CC: Len Halio, Bill Demmer, Larry Portner, Bernie Lacroute
From: Gordon Bell
Date: THU 8-MAR-79 11:11:09 EDT

Subject: SOME ITEMS I WANT TO INTERJECT IN YOUR STAFF FOR DECISION

LOUNSBURY = JOHN LENG

There are two items that I hope will enter into the deliberations on the 10/20:

1. I really don't think we are getting out of the >$250K range by having a Venus at that price. The HYDRA structure will be used here to build as large a system as you want to sell. I would argue that this may be an inherently better way to do processing NOW because it will allow the user to partition work into say 2 or 3 machines, each of which will be tuned to a particular function: batch, timesharing with predominantly editing, Commercial with predominately Data Bases, etc. The goal will be to have each of the systems have access to a particular system that is theirs... but is inherently sharable. I think this will clobber the approach we have used in the past where, like IBM, we build a hugh system that has to be partitioned and tuned for all the functions of batch, interactive, real time, and transaction processing. The monitor and the system grow without bounds in terms of complexity.

2. This HYDRA structure is the key to getting our current customer base over to VAX from 10/20's. By getting them over, I don't mean migration where programs are moved on a standard basis and a user wheels out the 10/20.
Instead, the porgrams would stay in place and new ones would

mainly be done on
VAX and the production progreams with the greatestt time consumption would be
"gradually moved over" as the load on the 10/20 demands. I wrote a number of
"sample customer letters" to show how I think this would be accomplished.

There is another issue that I would like to urge you to raise to the top of
the stack: Getting Graphics Now! I want to get Si to reconsider
compatibility, and I would like to get LDP to take part of the graphics work
to implemnt . Here, we'd do the overall planningand architecture...various
groups would do different implementations. /

Command:

GB0002/62

| d | i | g | i | t | a | l | **i n t e r o f f i c e m e m o r a n d u m**

Subject: **The 11/23, 11/24, BI=UNIBUS-'90**

To: Dick Clayton, ML12-2/E71
Bill Demmer, TW/D19

Date: 5/13/79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

CC: EBOD
Roger Cady, MK1-2/E25
Bruce Delagi, MR2-1/M64
Bernie Lacroute, TW/A08
Ward MacKenzie, PK3-1/A60
Bill McBride, MR2-3/E70
Stan Pearson, ML12-2/E71
Larry Portner, ML12-3/A62
Jack Shields, PK3-2/A58
Jack Smith, ML1-4/A54

Mike Tomasic, ML12-2/E71

Can I please implore you to move along the lines suggested in my memo of 5/6/79 such that we capitalize on the 11/23 (with CIS), yet build toward a better long term solution. A copy of pages 2 and 3 are attached. We have some time because our products are strong and we have to go in the right direction because:

.the cost of 23 versus 24 systems really favors the 23.

.on large systems where the 24 might be warranted due to the UNIBUS options, for UNIBUS investment based users (the Technical OEMs), a 23 with an adapter will be as cost effective as the 24 when the address space is the limit.

.the competition is strong in the form of Intel and we need a bus that will compete with them.

.none of the busses--UNIBUS or the Qbus, Qbus to 128K, and especially the PAX'd Qbus are strong enough to get us into the mid 80's, let alone the '90s.

.continued investment by us or our customers will only detract from the right solution.

.we don't have the chips to ship anyway in the 24 systems.

.by the time we are building these large, 24 based systems, the 44 can be used at negligible penalty.

Let's use this opportunity to start limiting the overlap in products and the introduction of more, marginal ones.

GB:swh
Attachment

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Roger Cady	MK1-2/E25	Dick Clayton	ML12-2/E71
Bruce Delagi	MR2-1/M64	Bill Demmer	TW/D19
Andy Knowles	ML10-2/A52	Bernie Lacroute	TW/A08
John Leng	MR1-1/A65	Ward MacKenzie	PK3-1/A60
Julius Marcus	MK1-2/C37	Bill McBride	MR2-3/E70
Stan Pearson	ML12-2/E71	Larry Portner	ML12-3/A62
Jack Shields	PK3-2/A58	Jack Smith	ML1-4/A54
Mike Tomasic	ML12-2/E71		

FROM: GORDON BELL DATE: SUN 14 OCT 1979 7:55 PM EST
DEPT: OOD
EXT: 223-2236
TO: ROGER CADY

SUBJECT: RE: 11/24

In general, I'm with you. I think what will ultimately happen is doing 24 with cis and pax for the systems groups and doing pax on the 23 either now or when we have to. My druthers is to make one the systems machine and one the components machine...not having both be

systems
machines. I walked through the analysis of alternatives with Bernie and
Stan and they were supposed to use this methodology in terms of costs,
market requirements and availability to get us to a rational position
quickly. Apparently this isn't happening fast enough. The numbers
should point out the right direction.

Command >

EMS 12-FEB-79
20:48:40 400 1
To: Bernie Lacroute, Mike Powell, Brian Croxon, Dave Rodgers, Bill Demmer
CC: Mary Jane Forbes, Ed Fauvre, OOD
From: Gordon Bell
Date: MON 12-FEB-79 20:48:40 EDT
Subject: Stopping the 11/74 and moving ahead with 11/70 multiprocessor
----
Today the Operations Committee voted to support the Commercial Product Line,
Product Management, Service and Manufacturing recommendations to stop the
11/74. The 11/70 multiprocessor will proceed ahead as planned.

I am sorry that we did not decide earlier because it would have meant that we
could have worked on products which would have gone to market. However,
given that we are not marketing the 74, there is a significant increase in
emphasis on marketing the 11/780 and I believe that this effort will have
higher payoff.

I want to thank all of you who have been involved in the

engineering of the
74 and ask that you hang in there over these next few weeks while we
structure the new engineering projects which are in a general direction of
more VAX and better network support. Although it is unclear as to the
specific project, we require significant work in the interconnection and
front ending of computers, mass storage , and in both low and high end VAX
systems including a VLSI VAX. Again, I am sorry about the decision, I think
it is basically right and that we should proceed to develop significant new
hardware.

Command:

STAFF ITEM - DECIDE ON JUNGLE AGENDA

Digital **Interoffice Memo**

Subject: **1977 Jungle Meetings**

To: OOD
76

Forbes

Ext.: 2237

Date: 5 NOV

From: MJ

Dept: OOD
Loc.: ML12-1

SUBJECT/TO BE

ACCOMPLISHED

February 3 and 4 - Puerto Rico	
March 31/April 4 - Local	
June 21 to 24 - Go west (4 days) Denver/Phoenix/Albuquerque	
August 25 and 26 - Local	

October 20 and 21 - Edgartown (on the Cape)

MJ:ljp

Suggestions
Multi-level structure for OOD.
Goals - 1978, 80,?

EMS 7-JUN-79
10:21:41 510 1
To: Larry Portner, Paul Bauer, Bob Puffer
From: Gordon Bell
Date: THU 7-JUN-79 10:21:41 EDT
Subject: 1990 Core Group Space Task Force

I'm on the 1990 Core Group Space Task Force. Paul should attend, as our representative on this one when Bob gets off. Also it is essential that we attend the one chaired by Smith on Manufacturing location and the one chaired by Stan, John and Julius on P/L location. Is this happening? (Please don't let DCG move from MR just as we get into Hudson.

Command:

```
+---------------------------+                              GB0005/48
|   |   |   |   |   |   |   |
| d | i | g | i | t | a | l |   i n t e r o f f i c e   m e m o r a n d u m
|   |   |   |   |   |   |   |
+---------------------------+
```

Subject: **1990's Space Strategy and Plan: Let's Write it Down!**

To: 1990's Committee

CC: Ken Olsen, ML10-2/A50
George Chamberlain, MS/B80
OOD

Date: 11/5/79 Mon
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

BACKGROUND AND MOTIVATION

After the last OC, it became clear that we need a better way to work on space. Having reviewed the file on our 1990 strategy, I think I see the problem... namely, it isn't written down in any coherent way, and merely consists of some implicit notions that we are going to have centers spring up in different places depending on needs, deals, etc. Also it barely covers 1983! We argue violently about particular sites, buildings, etc. in a completely unstructured fashion, because there is <u>not</u> agreement on the conceptual framework or strategy. Also, it is inherently difficult because we aren't really sure what the organization will look like in 1990.

We can always change it, but first: WRITE IT DOWN!

<u>AN OUTLINE FOR THE STRATEGY AND PLAN</u>

0. Organizational design assumptions (if they appear to be important)

1. Location of population assumptions as they relate to travel, energy, cost of living and labour. Especially necessary for manufacturing part

2. Needs vs time (The emphasis will be on writing and validating a model for all the groups and company as a whole)

3. Our goals and constraints in regard to:
   - .Site types (their names, site types and sizes)
   - .Site tennants (policies as to who cohabits)
   - .Building standards

4. Plans for alternative ways to satisfy the needs versus time

5. An index of definitions

<u>CHARACTERIZING THE GOALS AND CONSTRAINTS</u>

We must decide on these in order to stop the hassle on individual plans. Here, a constraint is something that we intend to never violate, for example, no buildings greater than 600 Ksf, or start a new cluster outside of Mass, NH. Equally important are targets or goals which we expect to attain, these include statements like minimize future growth in Mass. by no new sites beyond x, y, ... z (actually list them to avoid ambiguity). In order to fully understand this, let me urge you to look at the document I used to control the design of VAX; the summary with my comments is attached.

Although I don't know what they are, I would like to get the Space group to pull these together and I would review them for consistency and applicability before the 1990 group goes over them. Let me suggest the following:

<u>Constraints</u>
All campuses (clusters) should be at least two functions and preferrably more.

Market oriented Product Lines should co-exist with their own market specific engineering, sales support, and service support.

Hardware and Software Engineering, Service Support, Market Support should cohabit for base products.

No single office buildings greater than 600 Ksf should be built.

Sales and Service (Hardware and Software) cohabit at every level and site.

All sites which are DEC built are selected on basis for at least a factor of 2 growth, and preferrably a factor of 4. Here, I assume a 12% growth in group size will handle a capacity growth of 26%. Note 12% doubles every 6 years. If we start a site at say 2/3 capacity and grow it a factor of 3 in size (or 4.5 in population) would give about 14 years of growth on a site!

<u>Goals</u>
Mfg and Eng should cohabit for process intensive designs.
Examples:

- .LSI chip design (eg. Comet chips, Fonz)
- .print part of technology
- .tape and disks
- .tape and disk heads and media

Integrate high volume and FAT plants such that the tradeoff between standard and special product is possible and measureable.

Move to more clusters (giving more freedom of functional choice).

Move to clustering of implicit divisions when all possible.

<u>CHARACTERIZING THE SITES AND TENNANTS</u>

It is important to separately characterize the types of spaces (sites) and the tennants (occupants). Let me propose these site names, by size:

1. Clusters (campuses) 1-3 Msf
2. Satellites (buildings or sites that operate to another satellite or cluster) 100-500 Ksf
3. Field sites ? Ksf

The tennant typings are:

1. Heterosite with multiple functions
2. Heterosite operating implicitly or explicitly as a division
3. Homogesite holds a single function
4. Homogesite of Manufacturing and Engineering for process intensive products
5. Homogesite for Sales and Service

<u>SPECIFIC PLANS</u>, HOW THEY MIGHT GROW AND HOW THEY RELATE TO GOALS

Location Host/Tennants size
(now) (max)

[Msf]

[Msf]

HETEROSITE CAMPUSES
Maynard HQ (OOP, OOD, OOM, Sales, F/A), Misc. P/L 1.8 1.8
Merrimac Comml and Computer Product P/L .6 1.8
Marlboro Tech P/L, LSGE, Term and micro P/L .7 (1.3)
72.0
Andover SVC and Mfg. (violates sales/svc coupling goal) ? 1.8

HOMOGESITE CAMPUSES (Violates Constraint for a Campus)
Salem FAT (violates volume/FAT coupling goal) .6 1.2
Phoenix Terminals volume (violates Mfg./ Eng. coupl. goal) ? ?

HETEROSITE SATELLITE
Hudson Mfg. / Eng of Semis .3 .6?
Colorado Mfg. / Eng. of disks .3 1.3?

HOMOGESITE SATELLITES
Twksbry Hardware Base/FS support (violates HW/SW couple)
.2 .2?
Spitbrk Base SW (needs SWS and HW coupling) .2 .6?
Acton Mfg. engineering
Westboro Mfg. engineering satelite to Acton

Nortboro Warehouse
Westfld   Mfg.
Westmntr Mfg FAT (violates volume/FAT coupling goal)

FIELD HETEROSITES
Acton   GIA   .07 (.1)
.3

GB:swh
Attachment

GB0005/41

| d | i | g | i | t | a | l | **i n t e r o f f i c e   m e m o r a n d u m**

Subject: **Getting At a Rationale Way to Address Space**

To: George Chamberlain, MS/B80
Shel Davis, PK3-1/C21
Ed Finn, MS/B87
Ken Olsen, ML10-2/A50
Ed Schwartz, MS/F17
1990 Committee

Date: 10/31/79 Wed
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

After the latest OC, I was moved to try to think of space/location differently. We need some clearer policy statements and a better model for space. Space has been a problem because of the time varying (implicit and explicit) constraints that come up, e.g.:

1. No buildings over X sq. ft.
2. No more space in Massachusetts.
3. All people in a central site.

Proposal I:

We (1990's) should meet and decide on what are constraints (e.g. no buildings >600K sq. ft; start a new site outside of

Mass., N.H.) and what are goals (e.g. minimize the expansion in Mass.). Let's settle for now (although we can charge) just how large we want buildings and clusters. Al, could you get us a list of constraints and goals to start with?

Proposal II:

We should seperately characterize a space plan in terms of various sized sites and occupants. Thus, let me propose names/sizes for sites of:

1. Clusters (Campi) 1-3 M sq. ft.
2. Satellites 100K - 500K sq. ft.
3. Satellites of satellites?
4. Field Offices ?

Occupied by:

1. Heterosite (multiple functions)
2. Heterosite operating implicitly or explicitly as a division
3. Homogesite (single function)
4. Manufacturing/Engineering
5. Homogesite Sales and Service (SVS, SWS, Sales)

Thus we get

Heterosites

MY: OOP, MKT. Support, Finance HQ., MFG HQ, Eng. HQ, Sales HQ, P/L?
[ML, PK, PMR; no expansion]
MR: LSG Eng., Tech P/L, DCG, Terminals, (>1M sq. ft.)
MK: Commercial P/L; Comp. P/L; Commercial Eng.
(.6 Msq.ft. -> 1.8 Msq.ft.)
Hudson:(division?) Semi MFG/Eng/DCG? (500 sq.ft. -> ?

Msq.ft.)

Homogesite Satellites (SVC, Eng, GIA, etc.)

Andover Service (with MFG.)
Eng. (Spitbrook, Tewksbury)
GIA (Acton)
MFG. Eng. (Acton, WX)

Homogesite Clusters?

MFG/Eng Satellites
CX, Phoenix

Field Satellites (Sales + SVC)
MFG Satellites
Salem, WF, WM, etc.

Satellite of satellites
HK (to Phoenix) ?

Proposal III:

Let's re-look at low level intra-building standards and intra cluster windows, office sizes, etc. as they effect feeling.

GB:swh

FROM: GORDON BELL DATE: THU 18 OCT 1979
4:44 PM EST
DEPT: OOD
EXT: 223-2236
TO: LARRY PORTNER
ULF FAGERQUIST
PER HJERPPE
ANDY KNOWLES
SI LYLE
BILL MCBRIDE @MR16

SUBJECT: 2080 GOALS

GB0005/17/EMS

Let's make sure we're altogether on these before EBOD. I expect the priorities to be: reliability (and/or cost of ownership), time to market, performance/cost, enhanceability (mid-life-kickerable), performance, and manufacturing cost.

These all assume a constant development budget. Any increase in performance should not affect ttm or coo. However, any ideas for mid-life-kickers on performance could profitably affect ttm a minimum (say 1 month) because it would extend the product life. In other words, let's have performance at the original goal and get us the implicit increased reliability and decrease ttm!

GB:swh

+---------------+ ID#0168

! d i g i t a l ! i n t e r o f f i c e m e m o r a n d u m

+---------------+

Subject: **Should We Use 8086 or Z8000?**

To: Dick Clayton, Bill Demmer, Ulf Fagerquist

Date: 12 JULY 78
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

follow up 7/26/78

As a backup in the VAX, 11, and 10 areas where we need performance to support future intelligent peripherals (Comm, A/D/A, Disk) I believe we have to examine the feasibility (competitiveness) of using either the 8086 or Z8000 (? availability) for these fixed programs. We were considering Fonz, but it's availability is getting questionable.

These programs should be written in higher level languages (e.g., PL/M)!

GB:ljp

+---------------+
! d i g i t a l !   i n t e r o f f i c e   m e m o r a n d u m
+---------------+

Subject: **8086 -- PDP-11 Comparison Report**

To: Dick Clayton, Sam Fuller
Date: 20 JUNE 78
From: Gordon Bell
CC: OOD, Fernando Colon Osorio, Bill Keating, Andy Knowles, Jack MacKeen, Roy Moffa, Rich Olsen, Mike Riggle, Gil Steil, Mike Titelbaum, Dave Velten
Dept: OOD
Loc.: ML12-1 Ext.: 2236

follow up 7/5/78

The Small Systems Report on this subject is the first insight I've seen on this subject despite the many pages written. (The many other memos on this subject only prompted me to think maybe we should have a policy of getting every boss to co-sign each time a report is issued.) The authors are to be commended for content and clarity.

The only two pages I would like are options cost (the chip counts are fine) and comparison of various sized systems made this way (both with/without the associated peripherals). I.e., where does this fit in Tomasic's product space for the low-end?

My conclusions based on the report are:

1. The F chip set looks quite competitive...we've got to hurry up, get it in the products and push the hell out of it. We may need the WCS in order to stay out of Intel's way (i.e., segment)

ourselves. The CIS + 22-bits is probably mandatory too (although the systems costs may mean we don't worry until the 65 Kbit chip is in production).

2. Both T and F are needed in order to get us internally totally to 11's (versus 8085 for logic replacement) and for cheaper systems.

3. There will be pressure to bring in the 8086 both for cost and performance reasons for things like disk controllers and KMC11 replacements -- we must resist! There has to be an <u>immediate</u> architectural planning effort to get our plan. Fernando Colon Osorio has pretty much defined the bounds of the problem. I'm encouraged the Fonz will be able to handle these jobs...and must.

4. The language problem still bothers me (see memo), nor do we have a development system!

After we get the above prices, which size the problem (opportunities/exposure) could we get an architecture plan quick to really use Fonz and industry standard peripherals effectively?

GB:ljp

Attachment

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

	Jim Bell	ML3-2/E41	Dick Clayton	ML12-2/E71
	Jim Cudmore	ML1-5/E30	Bill Demmer	TW/D19
	Ulf Fagerquist	MR1-2/E78	John Kevill	ML1-3/E58
	John Meyer	ML12-1/A11	Larry Portner	ML12-3/A62
	Bob Puffer	ML12-2/E38		
Fernando Colon Osorio		ML3-3/E54	Sam Fuller	TW/A08
	Bill Keating	ML12-3/A62	Andy Knowles	MR2-2/A52
	Jack MacKeen	MR2-2/M65	Roy Moffa	MR2-1/M64
	Rich Olsen	ML1-2/E65	Mike Riggle	ML4-1/B32
	Gil Steil	ML5-5/E76	Mike Titelbaum	ML1-2/E65
	Dave Velten	ML5-5/E76		

To; bj, jim cudmore cc: jack smith, sam fuller, bill strecker, mahendra patel, Dick Hustvedt

BACKGROUND

Bill and Mahendra got our terminology turned somewhat, but we still aren't organized right to get the various products.

We aren't moving rapidly or with enough focus to get a MicroVAX PC Cluster, a single system formed from a collection of single user and single function servers to provide what is fundamentally a shared, system. They're tied together using a LAN cable, and might be called a LAN-based cluster.

The CI Clusters are great as one can see in Colorado. These are really the aggregation of several, shared system to form a single system where many more users can operate together in a shared file system, using a set of computers. These might be called Close Are Net (CAN) Clusters.

LANs on Ethernet are creeping into existence as we have hopes someday to have our own, Ethernet controller for VAX. However, systems built this way are still networks of independent systems with more formal, hierarchical protocols. They're an evolution on our Wide Are Nets.

Seaboard/Seahorse is an excellent base for building specialized function clusters, providing network-wide construction, debugging, loading, etc. Clearly OEMs will use it this way for real time. This should be used for specialized servers for the MICROVAX PC CLUSTERS: file/database (being done in CX), communications (gateway to Ethernet Network of VAXen), printing (if we ever get a printer and a group to write the software). This is really a SEAcluster.

MICROVAX PC CLUSTERS is what we need. Finally it looks like we're going to get a CRT controller for Seahorse, and VC100's being defined as the first, bounded version of the MicroVAX PC. Dick Hustvedt's doing the SDA graphics architecture implementation. We still need:
0. The Person Server- Hardware's not committed yet, Dick software
1. Someone to take overall responsibility for the Cluster
2. File/DB Server- Rubinson
3. Communication Server to Ethernet- ?
4. Print Server- ? (We still don't have a Printer interface spec'd.

In doing it this way, there's a major question as to how and when we build a standalone MicroVAX PC, as the Cluster is predicated on being diskless. (These work just fine at Stanford using SUN Workstations and 750's for file servers!)

I'd like to get together and find out who's doing what, since it's beginning to look like we have the right components coming. For starters, I'd like to see someone take the responsiblity for the whole cluster and be given as many resources as possible to get the product done. This could get us a quality product most rapidly! (I have less faith that we should do it again like PRO.)

Can you folks set up a meeting to start this discussion? (or state that it's all decided?)

00 CORE DECGRAM ACCEPTED S 004812 O 703 23-SEP-82 20:04:59

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* d i g i t a l *
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TO: see "TO" DISTRIBUTION DATE: THU 23 SEP 1982 7:35 PM EDT

FROM: GORDON BELL
cc: see "CC" DISTRIBUTION
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5176493601

SUBJECT: THANKS FOR ALL-IN-ONE DEMO. LET'S BE #1 IN THE OFFICE BY SALES

I thoroughly enjoyed the demo and interaction on All-In-One, and
anxiously await to use it on our own VAX. It's an impressive set of tools for the office and the basis for others to build additional tools that work together in a system.

It is most urgent to get books out on it of the form:
1. A user's manual that has the whole thing including DECmail for the heavy duty office environment for professional and secretary.
2. A tutorial on office automation where we feature it as being "this is what office automation is".
I hope that we might be able to help with the writing somehow.

It should be noted that you folks have created a second generation office automation system. Because you adhere to the principles of VAX/VMS regarding providing an extendable fully compatible environment, versus just having a set of independent tools, you have the second generation.

WE SHOULD ALL NOTE THAT A SECOND GENERATION SYSTEM IS PROBABLY NOT BUILDABLE ON ANY OF THE EARLIER SYSTEMS (eg. 370, Prime, HP)
... or for that matter, RSTS, RSX and Tops due to the difficulty of addressing and lack of common data dictionaries, etc. From my perspective, this is one of the few applications I've seen that begins to utilize VAX the way it is supposed to be.

My only concern now is getting it marketed. This is a great product to go cream the System 38, Wang and other parts of IBM with and to become number one. We must get market share while it is possible and the other folks get their products.

As Pogo said: "We've met the enemy and he is us".

"TO" DISTRIBUTION:

JOHN M CHURIN @CHNC	ART LARAMEE	SKIP WALTER
BOB WYMAN		

"CC" DISTRIBUTION:

HENRY ANCONA	DON BUSIEK	BOB DOCKSER
WIN HINDLE	BILL JOHNSON	JULIUS MARCUS
KEN OLSEN	JACK SHIELDS	JACK SMITH

WPS USERS - Leave HP mode and type <CR>

VITA

Chester Gordon BELL 492-34-5875
Page Farm Road
Lincoln, Mass. 01773

Born: Kirksville, Missouri 19 August 1934

S.B. (Electrical Engineering) (1956) Massachusetts Institute of Technology,
S.M. (1957)

Vice President, Engineering: Digital Equipment Corporation (1972-present)

Associate Professor of Electrical Engineering and Computer Science (1966-1969);
Professor of Electrical Engineering and Computer Science (1970-present).

ENGINEERING: Aircraft Gas Turbine Testing Laboratory, General Electric Corporation, Cincinnati, Ohio (1954); American Electric Power, Ohio Power Company, Canton, Ohio (1955); Heavy Military Electronics Division, General Electric Corporation, Syracuse, New York (1956); New York City Development Headquarters, American Electric Power, New York, New York (1956); Speech Communications Laboratory, M.I.T. Division of Sponsored Research, Massachusetts Institute of Technology, Cambridge, Massachusetts (January-August 1959); Research Engineer, Electronic Systems Laboratory, Massachusetts Institute of Technology, Cambridge, Massachusetts (1959-1960); Manager in Charge of Computer Design, Digital Equipment Corporation, Maynard, Massachusetts (1960-1966).

CONSULTING: Digital Equipment Corporation, Maynard, Massachusetts; United States Steel Corporation, Pittsburgh, Pennsylvania; Computer Corporation of America, Cambridge, Massachusetts; Applied Dynamics, Ann Arbor, Michigan; RIDC Industrial Development Fund, Pittsburgh, Pennsylvania.

GOVERNMENT COMMITTEES: Member, National Academy of Sciences and Engineers COSINE Committees: COSINE Task Force on Machine Organization (July 1968); COSINE Task Force on the Computer Engineering Curriculum within Electrical Engineering (August 1969); COSINE Task Force on Minicomputers (November 1971). Also the National Science Foundation, Office of Computing Activities and COSERS--Computer Science and Engineering Research Study; served on the Council for International Exchange of Scholars and currently a member of the National Research Council's Computer Science and Technology Board.

PROFESSIONAL SOCIETIES: American Association for the Advancement of Science; American Men of Science; Association for Computing Machinery; Eta Kappa Nu; Fellow, Institute of Electrical and Electronics Engineers, and National Academy of Engineering.

PATENTS: Multistable Circuit, #3,275,848, 9/27/66, C. G. Bell (PDP-4,5); Digital Computing System, #3,376,554, 4/2/68, C. G. Bell, A. Kotok (PDP-6); Apparatus for Performing Character Operations, #3,401,375, 9/10/68, C. G. Bell, A. Kotok (PDP-6); Multiple Configuration Data Processing System, #141,282, 5/7/71, filed but not issued. C. G. Bell, John Eggert, Robert VanNaarden, Peter Williams (PDP-16); Homogeneous Memory for Digital Computer Systems, #188084, C. G. Bell, not assigned, filed 10/12/71 (for all machines); Branching Circuit for Microprogram Controlled Central Processor Unit, C. G. Bell, John E. Buzynski, Charles H. Kaman, James F. O'Loughlin, #3,900,835, 8/19/75.

COMPUTERS: PDP-4 (predecessor of PDP-7, -9, and -15) architecture, logical design and implementation; PDP-5 (predecessor of PDP-8 series) architecture; PDP-6 (predecessor of DEC System 10) computer and operating system, architecture, logical design, and implementation; TSS/8 (timesharing system based on PDP-8 codesign; PDP-11 consultant on structure and architecture; PDP-16 (Register Transfer Modules - RTM); C.mmp - a multi-mini-processor computer (Wulf and Bell, 1972), member - design group.

AWARDS: IEEE McDowell, Mellon Institute, Fellow of IEEE, NAE

BOOKS: Bell, Newell, COMPUTER STRUCTURES: READINGS AND EXAMPLES, McGraw-Hill, 1971; Bell, Grason, Newell, DESIGNING COMPUTERS AND DIGITAL SYSTEMS USING PDP-16 REGISTER TRANSFER MODULES, Digital Press, Sept. 1972
Bell, C. G., J. Bell, "Minicomputer Software", Proceedings of the IFIP Conference on Software for Minicomputers, Co-editors, North-Holland Publishing Company, 1976; Bell, C. G., C. Mudge, J. MacNamara, "Computer Engineering", Digital Press 1978.

PUBLICATIONS:

Bell, C., H. Fujisaki, J. M. Heinz, K. N. Stevens and A. S. House, "Reduction of Speech Spectra by Analysis-by-Synthesis Techniques," The Journal of the Acoustical Society of America 33 (12), 1725-1736 (1961).

Van de Goor, A., Don Witcraft and C. G. Bell, "Design and Behavior of TSS/8, APDP-8 Based Time-Sharing System," IEEE Computer Group Conference, June 1969, published in IEEE Transactions on Computers C-18, No. 11 (November 1969).

Bell, C. G., R. Cady, H. McFarland, B. Delagi, J. O'Laughlin, R. Noonan and W. Wulf, "A New Architecture for Mini-Computers -- The DEC PDP-11," Spring Joint Computer Conference, 657-675 (1970).

Bell, C. G., J. Eggert, J. Grason and P. Williams, "The Description and Use of Register Transfer Modules (RTMs)," IEEE Transactions on Computers (May 1972).

Wulf, W. A., and C. G. Bell, "C.mmp--A Multi-mini-processor", Fall Joint Computer Conferencee, 1972.

Bell, C. G., R. C. Chen, S. H. Fuller, J. Grason, S. Rege, and D.

P. Siewiorek, "The Architecture and Applications of Computer Modules: A Set of Components for Digital Systems Design, COMPCON, Feb. 1973.

Updated: 2/13/80
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STANDARDS: THE BASIS OF THIS GENERATION

Gordon Bell
Chief Technical Officer
Encore Computer Corporation

This generation is based on a compleley product fragmented industry that is stratified by levels of integration. Entrepreneurial energy is a major driving force. Short product gestation times and the rapid evolution require

formal and de facto standards. What are the goals (product targets) and constraints (the standards)? What are the roles of the various organizations at the various levels of integration?
September 2, 1980

Ian Huang
Association for Computing Machinery
1133 Pusateri Way
San Jose, CA 95121

Dear Ian Huang:

Thank you for the invitation to speak to the ACM San Francisco Peninsula Chapter. Right now I don't have firm plans to visit the Bay area in the next few months. When I do, and if we can get our schedules together, I'll let you know within the six weeks time period.

Again, thanks and I hope I can speak there some time.

Sincerely yours,

Gordon Bell
Vice President, Engineering
Professor, Computer Science and
Electrical Engineering
Carnegie-Mellon University, on leave

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i n t e r o f f i c e   m e m o r a n d u m

Subject: **ACS/AT&T**

To: John Jones, SJ

CC: Roger Cady, MK1-2/E25
George Plowman, ML5-5/E97

Date: 15 FEB 79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

In response to your February 6 RCS message, OK. I'll send thoughts to you. I think ACS is unlikely to make it. The Telephone Company hasn't done anything right yet here. IBM'll get their first with 8100's. Let's build a compatible version for organizations who (e.g., DEC) want it, but can't get their operations committee to supply.

I still support licensing AT&T to build 11's and VAX's. It's the only way to counteract IBM.

GB:ljp

GB0001/18

Attachment

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Subject: **Administrative Unit**

To: Ted Johnson

Date: 78 AUG

15

From: Gordon

Bell

Dept: OOD

Loc.: ML12-1

Ext.: 2236

follow up

8/29/78

Don't you think it's time to establish an <u>administrative</u> <u>unit</u> that worries about processes, efficiency, communications, etc. These poor sales managers are dying of trivia. Every unit (e.g., Australia) does its own programming. There are no standards of office efficiency. The secretaries in Australia are bored and generally incompetent, etc. Please assume this is being said nicely. I mean you no harm. How about giving this part to Jack Shields?

GB:ljp

October 15, 1984

Admiral Bobby Inman
Microelectronics Computer Corporation
9430 Research Boulevard
Echelon I
Suite 200
Austin, Texas 78759

Dear Admiral Inman:

I've been following the DARPA sponsored MOSIS effort at ISI with great fascination over the last four years. Last year they:

- processed over 1200 LSI and VLSI designs
- from 50 institutions
- using 10 foundries and 4 mask shops
- in 3 - 4 micron, NMOS, CMOS and CMOS-SOS technologies with

scalable 1-3 micron, double metal coming on line (4 foundries at 1 micron)
. at a prototype cost of about $3K per design, for rapid turn-around
. with a Printed Circuit Board service coming on line.

The effort is more than a brokering service for low cost, fast turn-around, chips. It has been the institution and infrastructure to establish much needed standards and intermediate checking to make VLSIzation happen (see my paper on the real Fifth Generation). In fact, the interface is so clean that several companies are using it between their designers and foundry. It is the key to a competitive semiconductor industry (since foundries can be compared), and organizations can get their (hopefully creative) designs into silicon rapidly. Until the Japanese adopt it, we have a real edge! Even so, we'll drive them crazy with so many ideas embodied in silicon.

I believe MCC could be the catalyst to help take MOSIS public beyond their current community. MOSIS is already significant and will ultimately be the coupling between designs and factories. Now, MCC could lead, make adoption go faster and provide what is likely to be its greatest benefit to member companies. I was proposing a significant standards activity to work through MCC for this coupling, but MOSIS is much better because it's arbitrated by a computer.

I hope you'll take a look at this great work. It is the first work that I've seen to build a competitive U. S. manufacturing machine.

Sincerely,

Gordon Bell
Chief Technical Officer

Enclosure
CC: Dr. Robert S. Cooper, DARPA
Dr. Robert Kahn, DARPA
Robert Price, CDC

Keith Uncapher, ISI
00 CORE DECGRAM ACCEPTED S 000401 O 115 06-JUN-82
20:34:15

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* d i g i t a l *
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TO: see "TO" DISTRIBUTION DATE: SUN 6 JUN 1982
8:05 PM EDT
FROM: GORDON BELL
cc: OPERATIONS COMMITTEE: DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: A PROPOSED SET OF ADS FOR COMMERCIAL USERS

I've been concerned about how we might push VAX in this market, especially now that we have a 730. It really bothers me that we may miss a once in a lifetime shot to establish VAX in the office as a distributed processor before IBM gets the 38 or the low cost 370 there.

I'd like to see us run a set of ads, like the VAX ASK ANY USER
ads that when completed, forms a complete picture of our offerings.

The basic theme is: VAX OFFICE WORKER, the only computing system for the 80's because of 13, irrefutable benefits. There would be a few ads that would posit the 13 benefits and argue that they are the right ones and that we have them.

The introductory ads would be followed by 13, detailed ads that would tie together through some theme such as a testimonial, or a tutorial, or a detailed story about the 13. The purpose would be to inform and educate in a particular way.
Although I'd like to orient them to be very technical, they probably should be readable and understandable by corporate management types who aren't experts.

If we do this right, we could get an image of someone who's underplayed their hand, but is just very solid, impenetrable and patient in willing to put the products solely in user terms.

Whether it's 13 or not isn't clear, but some possiblities: best integration of office via wps/data processing/transaction processing; incredible range of compatiblity for different form starting from DM or CT and going through VAX clusters; interconnectability; applications; data management; ease of putting applications up; applications languages to get work done; interconnectability of programs to build on all work; connection with the other, more technical parts of the org who have VAXs; detailed wps; detailed tp; detailed dp; distributed dm; compatble with office environement (look at the small 730 which has 4 file cabinets worth of information in only a 1 cabinet space; flexible interconnect with LANs; ease of purchase via our many channels; customer installability (note IBM PC doesn't have this); cost/performance; etc. (These are off the top of the head, so we'd better think it out.)

"TO" DISTRIBUTION:

DICK BERUBE	ROGER CADY	RICK CORBEN
BILL DEMMER	BOB DOCKSER	BILL JOHNSON
R.L. LANE	JULIUS MARCUS	JOHN O'KEEFE

WPS USERS - Leave HP mode and type <CR>

July 14, 1982

Bernard A. Galler
University of Michigan
Computing Center
1075 Beal Avenue
Ann Arbor, MI 48109

Dear Bernie:

Thanks for the letter about a special issue on the PDP-8 and LINC. Although much more can be written, a lot is given in Computer Engineering, a copy of which is enclosed. This represents a product view of Digital and I'm trying to get a software version of the book.

I've sent a copy of your letter to Dick Clayton, who did the transfer of LINC to DEC, and to Wes Clark, the designer of LINC. Wes gave an excellent Museum talk on LINC from a user perspective and this could be an article. Ed DeCastro was the Project Engineer for new PDP-5 and PDP-8 and it would be good to get his story. As President of DG, I doubt if he has time to write an article, but might give a talk at the Computer Museum sometime.

I'll also circulate your "call for a paper" Digital to potential writers.

Sincerely yours,

Gordon Bell
Vice President, Engineering
Keeper, Digital Computer Museum

GB:pef

GB:3.S5.76

Enclosure - Computer Engineering

CC:
Wes Clark
Dick Clayton
Computer Museum
Ed DeCastro
12/ 5 / 1984 Michael Harrison
Walter tried, but the CBI priority was higher. The Board is what matters, the Exec Committee is less important. It's easy to get 25K and we should come to the 3/8-9 meeting. Must come with a presentation (eg. slides) but it is critical to get the board members at TCM soon. Mike said he would come. They were trying to cut budgets. Politics are that CBI has 4 members on the AFIPS board. We are viewed as a potential regional museum, not an international museum.

SCHLUMBERGER VISIT

Wednesday, 18 April

I. Encore Computer Corporation (Wellesley Hills)

Overview - Ken Fisher

The Encore Computing Environment - Gordon Bell / Julius Marcus

Industry trends and motivation for the companies and products

The companies, products and managing the interfaces

Parallelism as the basis for Encore Products

II. Resolution Terminals and Workstations Company

Products and Markets Charle' Rupp (Pres) and Ike Nassi (Exec)

Lunch (at Encore)

III. HYDRA Computer Company (Natick)

Hardware System - Dave Schanin (Pres, and Hydra Architect)

Software System - Steve Chapin (VP Software)

Market and Competition - Rich Billig (VP Marketing)

Dinner (at Weston Country Club)

Thursday, April 19 (Pittsburgh)

IV. Carnegie-Mellon University -Ivor Durham and Drew Wilson

CMU Multiprocessors, Spice Environment, Other computing

H. T. Kung - Systolic Array Processors

Lunch (at Ultra)

V. Ultra Computing Laboratory

Ultra Performance and Ultra Reliable Processing - Dan Siewiorek

large, applied multiprocessors - Drew Wilson

The Software System - Ivor Durham

| | | | | | | | |
+---------------------------+

Subject: **Aggressive 11/74mP PM and Support**

To: Bill Demmer, TW/D19
Bernie Lacroute, TW/A08

CC: Roger Cady, MK1-2/E25
Julius Marcus, MK1-2/C37
Larry Portner, ML12-3/A62

Date: 26 JAN 79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

follow up 2/7/79

Roger's concerned that we aren't pushing the 11/74mP because Mike Powell isn't interested in it.

Tandem is and will be continuing to erode our base and the 74mP is the only product to get at this market.

Is there an alternative PM who believes in and could push this aggressively?

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I n t e r o f f i c e M e m o

TO: see "TO" DISTRIBUTION DATE: SUN 14 NOV 1982
3:29

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION DEPT: ENG STAFF

EXT: 223-2236

LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5181784461

SUBJECT: AI & EXPERT SYSTEMS: LISP, PRODUCTS, NEEDS & MARKETING

BACKGROUND AND OPPORTUNITY

From recent trips to various customer and university sites, I'm really quite excited about this burgeoning, new field. It feels to me somewhat like it must have felt when Univac installed a computer in the census department and at an insurance company! This is a radical change in computing and we must get prepared to supply systems. It will be far more revolutionary and important than personal computers in both use and impact.

Currently Xerox is the leader with Symbolics second and people wondering if we who were number one so long and who really provided the basis for the development of the field are going to sleep through the whole revolution. Right now they see IBM, HP, Appollo, the new Apple all using 68,000's as possibilities.

This is the most exciting area I've seen because it's going to be the basis for truly great innovative future products. We have an enormous opportunity. Let's not wait till the market is all formed. Let's pioneer the market and make it!

ORGANIZATION AND AI SEMINAR, WHAT ABOUT MARKETING?
Am delighted to see that we are beginning to get our act together
for base systems and applications. The 2 day seminar on the state of the art should give us all a better understanding.

We should market packages like Dendral, Molgen, Mycin, Macsyma,
Vaxima, etc. together with base products like Lisp, Ops, Prolog
on the 10/20 and VAX.

From the seminar we could focus the marketing too, to market the
existing products and get ready for new ones on VAX. The 10/20
group markets products effectively, but who'll market VAX?

OPINIONS ABOUT LISP

John McCarthy is back working on it. He believes the Common LISP effort is going to succeed and be worthwhile. He is looking at Prolog because he believes that these ideas are powerful and should be incoroporated into LISP. He also states that they need hardware support. The current Xerox and Symbolics machines are fun to use. He'd like to see less proliferation.

Ed Feigenbaum sees no way out of the 3 LISPs: InterLISP is currently it, with more support coming from Symbolics; CommonLISP should be the MACLisp follow on, and Portable Standard LISP is in use and will probably be the one that gets used on all the PC's.
This will make LISP much more available.

GETTING LISP ON VAX

I think we're doing everything possible to do this. It's vital!
Technknowledge is acquiring a Workstation for LISP that they can build on and sell, thus we ought to go all out to get their order in order to understand what it is that's needed to compete in this market. We must get this, enhance it through microcode extensions and then set about to radically cost reduce it to be not more than 20K.

CONTRACTING WITH THE GOVERNMENT TO GET STANDARD PRODUCTS

Although there's a wide range of applications in use, they tend to be all built to be used by their designers and/or experts.
Many of the systems though currently specific could be

generic.
The government agencies would like to take this work, much of which was supported by ARPA and make it into products. I think
we could get contracts to take the work and do it. I see this to
be like applications, but we can get paid to do it. The work should be done in the Palo Alto area where the experts exist and
that consultants can be found. The group could live in the lovely Mountain View facility! Harvey, Dennis, Don what you say?

PRODUCTS WE NEED INTERNALLY TODAY AND CAN SELL

A number of the products, particularly Expert Systems will be developed by a team of Experts. For example, PROSPECTOR was developed by a dozen geologists. It tells where to dig for a given mineral, and has been quite successful. Because of the
sociological aspects of the various expert systems, they are often used by other experts to gain leverage. Therefore, one market is simply going to be the proprietary package which is part of a consulting group. For example, it would probably be
pretty trivial to replace the Boston Consulting Group with such a
program. Some really critical products/applications follow.

I. ARTIFICIAL PEOPLE (AT TERMINALS) to manage the trivial interaction with various simple and complex systems is becoming clear to me as the highest priority, highest payoff program we could write. It would be written in OPS and run on everything from PC's to VAX's. The program simply logs into various systems and does the work, most of which is trivial, that a normal user would do sitting at a terminal... perhaps the strongest reason why all terminals should really be computers!

The simplest use would be login, followed by picking up and sending mail. I have accounts on 3 systems and the mail and login are different on everyone of them. The real saving is the time. All I want to say is get the mail, and send mail that's described in a list of files! The program would call up the systems in the middle of the night or whenever to do the work.

II. LLL has a knowledge based system like this that was built to run on the 11/23 systems they use as personal computers. Jerry Owens, Computer Department, Nuclear Systems Software could give us a description of it. They use it to run their large programs and to maintain a user's file systems. They also use this system to make a common interface to the myriad of systems that an individual might have to interface to. PC would use this.

III. EXPERT CAD OPERATOR- is a program that our designers of VENUS could use today. Doing a CAD run, given that some base design data has changed involves running scores of programs across a number of machines all correctly. It is more complex than simply a command language because the human user gets all the work going in parallel, and is able to cope with unforseen situations. In this case, we would get much more work out of our systems because they could be used round the clock. It would free people too.

IV. CONFIGURATION MANAGEMENT AND DESIGN- is a generic program that would be based on our programs XCON and XSEL. Virtually every industry has companies that have to deal with the assembly of large collections of pieces that form a single system. The pieces have a myriad of rules about how they can be combined and how much it costs to put them together. We've pioneered this work. Now let's get the payoff!

V. MACHINE RE-DESIGNER/RE-REALIZERS- is a program like that for VLSI scaling, takes a design in one technology, and then redesigns a given system into another technology. Rather than taking the general problem, I would like to start immediatedly in exploring the set of rules that would take a given network, say VENUS or NAUTILUS, and which will totally prepare or do the work involved in laying out the design in a new technology (MCA II's, higher density boards). Here, the user could give it lots of guidance, and as a minimum the system would prepare all the input for the new gate arrays and new boards. The payoff is >$200M! Yet, it looks doable, based on what I see in research.

APPLICATIONS ACTION

Dennis could you get some folks together to see how we could attack some of these problems. The EXPERT CAD OPERATOR needs to be put in service today and could speed up the VENUS design.

We should also get together with a technology team (Bob Glorioso, J Zeh and Alan Kotok) to see how we could carry on a feasibility study for the RE-REALIZATION/REDESIGN of VENUS.

"TO" DISTRIBUTION:

NORMA ABEL	DON BUSIEK	ROSE ANN GIORDANO
ARNOLD KRAFT	DENNIS O'CONNOR	MAHENDRA PATEL
HARVEY WEISS		

"CC" DISTRIBUTION:

AL CRAWFORD	BILL DEMMER	SAM FULLER
BOB GLORIOSO	WIN HINDLE	BILL JOHNSON
ANDY KNOWLES	KEN OLSEN	LARRY PORTNER
JACK SHIELDS	JACK SMITH	BILL STRECKER

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From the seminar we could focus the marketing too, to market the existing products and get ready for new ones on VAX. The 10/20 group markets products effectively, but who'll market VAX?

OPINIONS ABOUT LISP
John McCarthy is back working on it. He believes the Common LISP effort is going to succeed and be worthwhile. He is looking at Prolog because he believes that these ideas are powerful and should be incoroporated into LISP. He also states that they need hardware support. The current Xerox and Symbolics machines are fun to use. He'd like to see less proliferation.

Ed Feigenbaum sees no way out of the 3 LISPs: InterLISP is currently it, with more support coming from Symbolics; CommonLISP should be the MACLisp follow on, and Portable Standard LISP is in use and will probably be the one that gets used on all the PC's. This will make LISP much more available.

GETTING LISP ON VAX

I think we're doing everything possible to do this. It's vital! Technknowledge is acquiring a Workstation for LISP that they can build on and sell, thus we ought to go all out to get their order in order to understand what it is that's needed to compete in this market. We must get this, enhance it through microcode extensions and then set about to radically cost reduce it to be not more than 20K.

CONTRACTING WITH THE GOVERNMENT TO GET STANDARD PRODUCTS
Although there's a wide range of applications in use, they tend to be all built to be used by their designers and/or experts. Many of the systems though currently specific could be generic. The government agencies would like to take this work, much of which was supported by ARPA and make it into products. I think we could get contracts to take the work and do it. I see this to be like applications, but we can get paid to do it. The work should be done in the Palo Alto area where the experts exist and that consultants can be found. The group could live in the lovely Mountain View facility! Harvey, Dennis, Don what you say?

PRODUCTS WE NEED INTERNALLY TODAY AND CAN SELL
A number of the products, particularly Expert Systems will be developed by a team of Experts. For example, PROSPECTOR was developed by a dozen geologists. It tells where to dig for a given mineral, and has been quite successful. Because of the sociological aspects of the various expert systems, they are often used by other experts to gain leverage. Therefore, one market is simply going to be the proprietary package which is part of a consulting group. For example, it would probably be pretty trivial to replace the Boston Consulting Group with such a program. Some really critical products/applications follow.

I. ARTIFICIAL PEOPLE (AT TERMINALS) to manage the trivial interaction with various simple and complex systems is becoming clear to me as the highest priority, highest payoff program we could write. It would be written in OPS and run on everything from PC's to VAX's. The program simply logs into various systems and does the work, most of which is trivial, that a normal user would do sitting at a terminal... perhaps the strongest reason why all terminals should really be computers!

The simplest use would be login, followed by picking up and sending mail. I have accounts on 3 systems and the mail and login are different on everyone of them. The real saving is the time. All I want to say is get the mail, and send mail that's described in a list of files! The program would call up the systems in the middle of the night or whenever to do the work.

II. LLL has a knowledge based system like this that was built to run on the 11/23 systems they use as personal computers. Jerry Owens, Computer Department, Nuclear Systems Software could give us a description of it. They use it to run their large programs and to maintain a user's file systems. They also use this system to make a common interface to the myriad of systems that an individual might have to interface to. PC would use this.

III. EXPERT CAD OPERATOR- is a program that our designers of VENUS could use today. Doing a CAD run, given that some base design data has changed involves running scores of programs across a number of machines all correctly. It is more complex than simply a command language because the human user gets all the work going in parallel, and is able to cope with unforseen situations. In this case, we would get much more work out of our systems because they could be used round the clock. It would free people too.

IV. CONFIGURATION MANAGEMENT AND DESIGN- is a generic program that would be based on our programs XCON and XSEL. Virtually every industry has companies that have to deal with the assembly of large collections of pieces that form a single system. The pieces have a myriad of rules about how they can be combined and how much it costs to put them together. We've pioneered this work. Now let's get the payoff!

V. MACHINE RE-DESIGNER/RE-REALIZERS- is a program like that for VLSI scaling, takes a design in one technology, and then redesigns a given system into another technology. Rather than taking the general problem, I would like to start immediatedly in exploring the set of rules that would take a given network, say VENUS or NAUTILUS, and which will totally prepare or do the work involved in laying out the design in a new technology (MCA II's, higher density boards). Here, the user could give it lots of guidance, and as a minimum the system would prepare all the input for the new gate arrays and new boards. The payoff is >$200M! Yet, it looks doable, based on what I see in research.

APPLICATIONS ACTION
Dennis could you get some folks together to see how we could attack some of these problems. The EXPERT CAD OPERATOR needs to be put in service today and could speed up the VENUS design.

We should also get together with a technology team (Bob Glorioso, Joe Zeh and Alan Kotok) to see how we could carry on a feasibility study for the RE-REALIZATION/REDESIGN of VENUS.

GB3.S8.40
We could advertise what we have on each system now.

The DECSYSTEM 20 would be featured since all the AI software was born there...since we designed PDP-6 to run LISP well. The 20 has LISP and Prolog, plus there are lots of applications like MACSYMA that run in production mode. Here, the 20 group could go all out to get the software in a sellable (promotable) form!

VAX
We should also push VAX in this market because a 730 can allow one to start day AI at $60K. Here, we have LISP, PROlOG AND OPS5 -- which we wrote for our own applications programs. In addition, there are applications programs like MACSYMA.

Selling AI Applications as a Business
I think we could probably sell a class of applications that are like the XCON, XSEL--that is, a program which worries about how a collection of parts (based on price, extra pieces, restrictions) are put together to become a whole. This is typical of configuring: cars, tractors, pre-fab

buildings, etc. that come from a factory.

Bottom Line
We need a product marketing person to pull these parts together across the company. This is an ideal problem for one of our marketing persons. Can we have one to go after this?
To; PATEL, ABLE, DELAGI, DENNIS O'CONNNOR CC: RAD, PSC, baskett, ed kramer, gannon

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(3MB)	114	
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TO: See "TO" Distribution

cc: See "CC" Distribution
Admin.

DATE: 7 June 1983
FROM: Gordon Bell
DEPT: Engineering

EXT: 223-2236
MS: MLO12-1/A51
EMS @ CORE

SUBJECT: AI -- Activity Update Near & Far

GB5.58

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NORMA ABEL	DENNIS O'CONNOR
BRUCE DELAGI	MAHENDRA PATEL

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TOM GANNON	RAD:
ED KRAMER	

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* d i g i t a l *
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TO: see "TO" DISTRIBUTION   DATE: SAT 23 OCT 1982
12:27 PM EDT
FROM: GORDON BELL
cc: OPERATIONS COMMITTEE: DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5179242435

SUBJECT: AI MARKET AND PRODUCTS: LET'S GO AFTER THEM

Balzer, ISI (see also Dan Lynch) gave me the following:

KL	1		
780	.5 FranzLISP		
780	.3		ISI LISP on a database prob.
750	.9 x 780		
Dolphin	.2-.4		
Dorado	5-6 x Dolphin	180K	
LM2	.5		
3600	4 x LM2 projected	75K	

A COMPETITIVE LISP AND THE KEY APPLICATIONS GROUP
LISP has to have a focus within engineering as a base product in order to get a quality product out of the ones we're looking at. Also, we've got to have a way to get the applications, such as Macsyma to run on it. Symbolics has the license from MIT, but I can't find anyone getting applications. What about 10/20?

IMPROVING PERFORMANCE ON VAX
I'm delighted that we're having the LISP conference here on the 5th to co-ordinate getting a decent LISP and trying to standardize on say, Common LISP. I hope this takes place after many years.

Norma and Michael agreed to gather the various VAX LISPs and describe their internal structures so that the conference will be more meaningful. They also agreed to produce a proposal for a good structure for representing LISP programs so that we "speak LISP" at the meeting. This includes a proposal for enhancements to the VAX architecture so that VAX will execute LISP competitively!!!!! This will also be the basis of executing Prolog competitely too. I would like support from the VAX architecture group in this work. I'm personally sorry to have spent so much time on putting Cobol into VAX, and totally ignoring the AI languages.

The Corporate Long Range Plan last week uncovered this need, too!

"TO" DISTRIBUTION:

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BILL DEMMER	SAM FULLER	ROSE ANN GIORDANO
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ARNOLD KRAFT	BILL LONG	MAHENDRA PATEL
POE AND JESSEL	PETER SMITH	BILL STRECKER

GB3.S8.73
June 18, 1984

Mr. Alan Shughart
Seagate Technology
360 El Pueblo Road
Scotts Valley, CA 95066

Dear Al:

I'm writing to get your support for The Computer Museum.

A first rate team is designing the exhibits, including Dr. Oliver Strimpel, curator of the Science Museum in London and Dr. Paul Ceruzzi, a young history of computing scholar. In addition to the exhibits with historical artifacts, two major interactive galleries are being built for PC's and on the computer and the image. We predict attendance of over 200,000. This world-class, international Museum should be a major attraction and asset for the computing community.

The enclosed brochure describes the Capital Campaign. I would like your financial support in this crucial phase of the project which culminates in the opening, November 12:

1. Seagate's Foundership at $2500. The money, or letter or call of intent must be in by July 1 when the founding period terminates. Or, a "core" membership in the Capital Campaign at the 4K, 8K, ... level.
2. Your own "core" support.

Perhaps most important to me as the Museum's unoffical curator, I would like your artifacts, especially at the opening of the PC gallery. The floppy and wini were major contributions to computing and to the PC, and I don't believe people appreciate or understand the importance. You clearly pioneered the standard component notion that made the PC generation possible.

Finally, I recall your speech to DEC's engineering community at Stratton Mountain Vermont when you were starting on the wini. At that time, I changed the direction of the DEC PC's to use your product, and regret the execution of the DEC PC's were so poor and untimely. Now, I would like to give a major talk at the Museum when it's open.

I'll call you next week to discuss these details.

Sincerely,

Gordon Bell

Enclosure

Mr. Alan Shughart
Seagate Technology
360 El Pueblo Road
Scotts Valley, CA 95066

408-438-6650
December 8, 1978

Dr. Vernon R. Alden
37 Warren Street
Brookline, MA 02146

Dear Vernon:

The enclosed is the result of my recent trip to Japan. I'd like to get your reaction to it. Although it's long, I'm trying to be relevant.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:ljp

Enclosure

December 8, 1978

General Georges F. Doriot
12 Lime Street
Boston, MA 02108

Dear General Doriot:

Ken thought you might be interested in reading my essay on Japan.

Please excuse me for writing so much, but there are lots of issues and I tried to make it readable. Let me know if its too biassed as I'm just an engineer.

I know your busy so I won't mind if you don't get to it.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:ljp

Enclosure

ID#382

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Subject: **Japan Essay**

To: Don Frost, TK
Carl Janzen, AK
Ted Johnson, PK3-2/A55
Ron Smart, AK

Date: 8 DEC 78
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

I'm intending to publish this outside and need your help.

Please note any passages (other than the paper) that would cause DEC-Japan an embarrassment or sales problem.

Please mark any/all inaccuracies (in fact and/or opinion).

Thanks.

GB:ljp

Enclosure
25 November 1984

Dr. Alexander Schure
Chancellor
New York Institute of Technology
Old Westbury, New York, 11568

Dear Dr. Schure:

The Museum finally opened on November 12.

The physical realization has turned out to be much more exciting than any plan could have communicated. The staff made a very large "stretch" to open a range of galleries. The reviews have been positive and it is easy to spend a half day in productive learning. Knowledgeable teenagers are spending their days at the Museum. The most flattering comment to date has been that it is the first American technology museum to be at European standards. Dr. Oliver Strimpel, who did the Museum's Image Gallery has just become the Associative Director and Curator. Oliver was formerly the Curator of the Mathematics Section of The Science Museum, London. The long collecting period and five year breadboard at Digital really paid off in collecting artifacts, building exhibits, doing lectures (ranging from Amdahl to Zuse) and gaining widescale support from computer people and companies.

I want to see this phase aimed at:

- putting a formal educational program in place,
- continued collecting of artifacts (whether letters, films, manuals or machines) in order to record the significant, information processing events, and
- getting broad public support from computer-knowledgeable people who want to learn more about the past and future history of computing.

The Image Gallery has turned out to be a major work and attraction. I would like to urge you to come and give a Pioneer Lecture on Computer Graphics at NYIT. We have a February to May lecture series.

Since the Museum is quite unlike the plan you saw, I hope you can visit the Museum with me on your next trip to Boston and see the transformation. The perspective you now have would also be beneficial. If you have time, I hope you could join Gwen and I for a meal.

Sincerely,

Gordon Bell

June 18, 1984

Mr. Allan Wallach
Vice President, Marketing
Massachusetts Computer Corporation
543 Great Road
Littleton, MA 01460

Dear Allan:

It was great to see you at the Museum last month. I am delighted at your enthusiastic support to help it get going. The irony of the Museum is that, with the exception of Digital, it has it's greatest support from small companies. I believe this has a parallel as to why innovation also comes from small companies. My simple explanations are: decisions are easy to make and the people have imagination, understanding and vision that seem to be totally lacking or mired in the bureaucracy in large corporations.

Gwen enjoyed the interaction with Lorrin and someone else that sounded very much like Jack Burness. They are going to do some very nice demos and interactive exhibits for the image gallery. The exhibit should be great, and I hope we can also show the complete line: Linc, 12, Minc and your machine.

I enclose The Computer Museum brochure on the Capital Campaign and I hope Masscomp can also support us at one of the "Core" levels of 4K, 8K... because we also need cash for the November 12 opening. This will also enable the company to use the various facilities including the library, artifacts and have functions in the Museum.

Right now, the founding period of the Museum is just closing, and I hope you'll become a founder. On this one, the money is needed by June 24.

Sincerely,

Gordon Bell

Enclosure

Digital **Interoffice Memo**

Subject: **Allegheny Airlines was Late Again; Was I Just Unlucky?**

To: Jean Haynes Date: 25 OCT 76
From: Gordon Bell
CC: Allegheny Airlines, Customer Service Representative Dept: OOD
Loc.: ML12-1
Ext.: 2236

Could you please send the CAB or Airline performance data on the difference between actual and scheduled arrival times? I'd like to know averages, standard deviation, and hopefully the shape of the distribution; also, I'll circulate these internally so that others can fly the airlines that are lucky enough to be on time.

It feels like nearly every time I've been on an Allegheny flight, it was late. Specifically, the last two Allegheny flights were afternoon flights, and the hour difference meant an extra 30 minutes in my car or 1 hour in the airport waiting to leave, since they were 3:30 p.m. arrivals.

Allegheny also has problems waiting in the airport because there are not good areas to work in (like TWA), and I'm only able to work at 50% efficiency. (I wouldn't spend the extra money to join anyway if there was such a lounge).

For now, please assume that I've been unlucky in getting on Allegheny flights, and that Allegheny is basically unlucky with schedules.

GB:ljp

GB0003/67

| d | i | g | i | t | a | l | **i n t e r o f f i c e m e m o r a n d u m**

Subject: **Your memo on Engineering Allocation**

To: Ken Olsen

CC: Andy Knowles
Larry Portner
Bill Thompson

Date: 7/6/79 Fri
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

You have the basically right idea that there is a miss-allocation of engineering funds and we will attend to it. For your information, I think we do a reasonable job of the make-buy issue you pointed out in '74. We need a proposal on how to do a better job of product pricing such that the low volume, flaky products get weeded out. Since Central Engineering isn't designing them, I suggest the process (or new algorithm) should be extended to <u>all</u> products!

We, Central Engineering, have only enough resources to do only the basic high volume products. I don't believe we're ever seduced by a single PL or person - unlike the closeted situation in PL Engineering. Virtually everything we do has sufficient demand to justify it. In looking at the last 4Q sales that represents about 1.4 billion in sales and 72% of the revenue, <u>none</u> of these products would be affected by your thesis.

I believe a more fruitful area is how are the engineering projects decided on in the Product Lines and why there is no review, I see:

1. a plethora of low volume, high support software...that may be needed to get incremental sales;

2. a bunch of products that are in principle high volume ideas, but are poorly engineered, such that there is no way to get volume or cost,... but most usually are assured to be poor quality and get your customer hate letters;

3. poor product ideas that are in response to a single customer that could only be done in a product line because it is the one, special case to get the sale;

4. product line specific things that only the manager wants

5.replicated in all areas because they have the revenue stream for hobbies with no plan or review. For example, the Electronic Mail Systems include: CIS (for our own use); Andy's experiment that is outside any review; LDP for their use; and Jack Gilmore because he wants to claim all territory associated with test creation, retrieval or transmission. The irony of this is that we will end up having to make a product and to create the necessary standards. Futhermore we have <u>no</u> access to these funds.

Note, unlike Central Engineering, what we do has to get orders (from our customer P/L's) so that we can add up the costs (including manuals, etc. the ones you mention) so we can price it.

Could we get a list of the PL specific terminals for example, and compare them with the plans in terms of predicted cost, reliability, sales, support, etc. Also compare them to all Central Engineering terminals! I too am concerned about low volume products because we have a need for the high volume ones and their options (eg. modems).

GB:swh
Attachments - 2

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Ken Olsen ML10-2/A50

Andy Knowles ML10-2/A52 Larry Portner ML12-1/T32

Bill Thompson MS/C12

TO: Alpha Omega Attendees September 24, 1982
FROM: Gordon Bell, Digital Equipment Corporation

SUBJ: Alpha Omega Meeting at Los Alamos
October 5 and 6, 1982

This is the tentative agenda. We plan to discuss the contents of Alpha Omega--less time on facilities and more time on content.

Date: 16 Sep 1982 09:48:46-PDT
From: lanl-a!blb@LBL-UNIX
To: lbl-unix!gordon bell
Subject: 10/5-6 AO mtg tentative agenda

Tentative schedule for 10/5-6 A/O mtg at Los Alamos:

Tues 10/5

8:45 pickup at airport
9:00 all visitors badged
9:15 introductions and review of schedule
9:30 How A/O experimental equipment might be integrated into the
Los Alamos network and made accessible nationwide
Concept of distributed processors & access to net resources(Ewald)

"clothing" (software) for the AFP(Douglass)
System configuration for Pups(Moore/Trujillo)
Access from external nets(Sparks)

11:00 Tour the Los Alamos Computing facility and Pups---Ewald

12:00 Lunch at cafeteria

1:00 Review of Los Alamos A/O rationale and goals(Buzbee)
Discussion of A/O project goals(All)

3:00 Discussion of Los Alamos R&D that might be coupled to A/O
- Parallel processing
  - algorithm development(White)
  - experiments(Hayes)
  - languages(Fasel)
- Human-machine interface
  - AI + audio I/O(Papcun)
  - Tools for building expert systems(Douglass)
  - workstations as frontends(Brice or Clifford)
  - distributed graphics(Hamlin)
  - CAD/CAM(McCormick)

7:00 Down in the valley (for dinner)

Weds
8:15 Develop tentative task lists per attached outline or modification
thereof
10:15 Develop tentative schedules for tasklists
11:30 Lunch at cafeteria
1:00 Depart from airport

The following outline is proposed as a framework (strawman) for the discussion
on 8:15 Weds. It is incomplete, e.g. VLSIzation,... So will appreciate
suggestions for additions.

<u>Outline of plan/sched for A/O</u>
Environment

Program Office
Sites

Selection

preparation

occupancy

Communications

plan

install

operation

Experimental equip

select

acquire

network integration

operation

enhance software

Cognitive Assist Functions (5th generation applications--
audio I/O,
expert systems, image analysis, information
processing, etc)
select application targets
analyze performance requirements of applications
acquire/develop software
experiments
spec new equip
iterate

High Performance Computing Systems
General purpose systems with intermediate
parallelism

select generic applications
seek algorithms and architectures that match

experiments

specify implications for software

iterate

Systems with massive parallelism

select special applications

select generic general applications

seek algorithms, architectures, and languages that match

iterate

GB3.S7.40

00 CORE DECGRAM ACCEPTED S 005092 O 429 04-AUG-82 16:44:19

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION DATE: WED 4 AUG 1982

3:58 PM EDT

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5171520001

SUBJECT: ALPHA OMEGA...POST VN COMPUTING: PERSONS & COMMENTS?

Bruce Delagi and I led a group from CDC, Univac, and Harris to define
a research program on parallel computing for use across a large array
of problems including AI. This is a program which we believe must be
executed in order to do the basic work necessary to produce machines
to compete with those produced by the Fifth Generation Computer Program.

CALL FOR COMMENTS ON THE DRAFT PROPOSAL

Please call or EMS me for a copy of the research proposal. Bruce is
going to give a seminar at Hudson on it and we'd like to get your
comments on how the proposal can be improved either by narrowing or
widening the scope.

CALL FOR PEOPLE WHO WOULD LIKE TO WORK ON THE PROJECT

Now, we would like to carry the proposal into the next phase by having
the group who are going to carry out the work write the detailed
research proposal/plan.

If you would like to work on this, please let me know now.

Individuals are needed.

We are looking for someone to head the program. Any candidates?
(Please forward mesage as appropriate).

"TO" DISTRIBUTION:

BRUCE DELAGI	ARNOLD KRAFT	PEG:
RAD:	BARRY RUBINSON	TMC:

WPS USERS - Leave HP mode and type <CR>

Confidential, Please Read and Return Or Destroy

ALTERNATIVES FOR TERMINALS AND TERMINAL BASED COMPUTING SYSTEM ENGINEERING (AND A PROPOSAL)

(G Bell, Independence Day, 1981)

BACKGROUND

There are various reporting structure alternatives for the printing, video and computing terminals engineering organization. These groups, along with 16-bit systems, reported to Si as a former engineering manager. A recommendation for a structure is given, together with the rationale and alternatives.

In late April, Si and I proposed to the Operations Committeee that these areas be part of BOTH engineering and The Computer Products Group in a dual reporting fashion. Therefore, all the alternatives connect to Bell/Portner in some fashion.

RECOMMENDATION

Mike Gutman is now in charge of conventional, multi-user 16-bit systems.

Obtain a replacement for Si as a Product Engineering Group (PEG) manager for terminals and computers built into terminals. Have that manager organize the work for maximum product autonomy, while building on common components and architecture.

This structure permits a team formed with Si to focus on the marketing, manufacturing and engineering aspects of products.

SUMMARY

The following sections describe the recommendation:

- Si's Old Job AS Engineering Manager
- The Proposed Organization (Product Group Level View)
- Win's Four Organizational Alternatives
- Proposed Organization (Detailed)

Rationale Based On Many Organizational Design Criteria

Why Not One Of The Other Proposed Alternative Organizations?

SI's OLD JOB

Si...

16-bit Qbus hardware

Also, VT278 hardware for WPS and Retail Products

16-bit Unibus hardware subcontract to Tewksbury

VT/LA and Terminal based hardware components (monitors/kbd)

Computing Terminals (CT), both hardware/software

Technical Director and A/D coupling

Mike Gutman now has the responsiblity for our conventional, multi-user, 16-bit systems based on the Qbus and Unibus. Both the Micros and Semiconductor groups supply chips and boards for these products too. Bill Johnson subcontracts the software and Grant supplies mass storage.

The following engineering (outside this area) is also associated with terminals and table-based, personal computing systems:

CT software

Disks, subcontracted and independently funded

WPS 278 software

VT278 software for Retail Products Group

Terminals engineering who are building 2 Computing Terminals

Modems for terminals

Special semiconductors and PDP-11 microprocessors

THE PROPOSED ENGINEERING ORGANIZATION (PRODUCT GROUP LEVEL VIEW)

Bell/Portner

(Product Engineering Group, PEG)

32-bit systems

Large computer systems

[Terminals and table-based (personal) computing system]
16-bit systems (part of Si's old job)
Networks, communications and distributed systems
Software
Mass storage
Semiconductors
Power, Packaging, Physical Interconnect

Technical Director (Standards, architecture, R&D)

(Engineering Administration Staff)
Administration
Finance
Personnel
Technical Operations
Strategic Planning
Corp. Product Management
Quality and Operations Analysis

Recording Secretary

The product area, [Terminals and Computing Terminals] is the group and work being examined as to how it can be best organized.
Engineering Staff total is 20 persons... and has become basically ineffective as a team or problem solving group.

PEG has the product responsibility and is beginning to function as a team, although it runs the risk of becoming too large at its current level of 2 + 9. The members and the team are good.

WIN'S FOUR ORGANIZATIONAL ALTERNATIVES
Win suggests the following alternatives:

1. B/P manage the details of how to get Si competitive products

B/P
- 8 Current Product groups
- CT
- VT
- LA
- Technical Director
- 7 Current staff groups

2. Keep all computers together and all terminals together

B/P
- 7 Current Product Groups
- 16-bit
  - CT
- VT
- LA
- Technical Director
- 7 Current staff groups

3. Combine CT and VT in one group and LA in another group

B/P
- 8 Current Product Groups
- CT/VT Products
- LA
- Technical Director
- 7 Current staff groups

4a. One form of the Proposed Organization

B/P
- 8 Current Product Groups
- Terminals and Terminal Based Systems
  - CT
  - VT/LA
- Technical Director
- 7 Current staff groups

There are several other alternatives based on having all the engineering associated with the products that Si's group will be marketing together. I like the following one, for many reasons.

PROPOSED ORGANIZATION (DETAILED)

4b. Maximum autonomy for the various products
B/P

8 Current Product Groups
Terminals and Terminal Based Computing Systems
- CT
- VT
- LA
- VT278 (including hardware and ALL software)
- Common components (keyboards, modems, CRT's)
- Strong, Common Advanced Development and Architecture

Technical Director
7 Current staff groups

There are several variants on this, including putting all the components under one person and all the products under another. I'd like to hire the engineering manager and have him organize the product area to get the best performance for these criteria:

RATIONALE BASED ON MANY ORGANIZATIONAL DESIGN CRITERIA
The reasons alternative 4b feels right:

Bell/Portner and Other Product Engineering Self-Preservation
There are a large number of Product Engineering Groups. For the first time in several months, it looks like we have a management structure and set of managers that really work. Based on recent experience with Bernie, having an effective manager can turn around a group in a week, converting a set of warring peers into a team. Even though there are a very large number of technical issues of concern, I have confidence in the current PEG members. Having someone take over Si's job should provide the added quality we need in engineering management.

Many Engineering Areas Need Our Attention
Taking on the work that Si did is going to significantly delay our work on quality, productivity and engineering training. Also, it saps us of any spare, problem solving capability.

Technical Issues In Terminals and CT's Are Open
A strong manager will create a strong team and we really need a strong team to compete in this area. We must have at least one more strong, technical manager in order to both survive and win. Aggressiveness, new products, control of architecture and interfaces with other engineering groups are of concern. Although Avram (an entrepeneural leader) and Bill (a very good manager) are both highly qualified, the product space is very large, dynamic and most competitive. We need help here!

Protection From Me (and Passers By)
Currently the projects have little protection, or any overall management structure to say no to off the wall suggestions. All the projects in this area appear to be "flat out" trying to do work. Requests put the projects in a state of pandemonium, requiring preparation time for presentations and not work.

Strong, Autonomous Product Focus
It provides us with a very clear product by product focus, while letting us get any economy from the many common components and technology.

Separation of Terminals and Computing Terminals
If there is a transition away from dumb terminals to computing terminals, we can take advantage of it. However, both groups are retained allowing common architecture and technology.

Strong and Clean Coupling With Si's Team
Basically, the main products that Si is selling are in one group: VT, LA, CT and WPS's. This will give us the best coupling with the market for direction, while at the same time let us also drive and be decoupled technologically.

Strong and Clean Coupling With Manufacturing
VT's, LA's and CT's are manufactured within Esten's plants at Westfield, Phoenix and Albuquerque. This is all these plants build. Floppies are made at Springfield and various components are made in the far east.

Very Good Coupling For Shared Technology and Work
These products all share a lot in common, and hence within the group there could be a very strong function that we must have at critical mass. The common technology across all parts:

modems
power and packaging, including noise and radiation control
keyboards
monitors (although the LA's don't need them, VT/CT do)
use of roms for more intelligent terminals
common modules for terminals and computing terminals

including: comm., rom, some video, printers, mass store

architecture of communications to operate on non-DEC systems
architecture for use on DEC systems (badly missing now),
especially VT and VT (graphics)
human factors for much of the design, including editing
imaging based on dot matrices for fonts and graphics
common approach of servicing and customer installation
use and programming of standard VLSI

Printers have unique problems of printing, paper handling and possibly printer-only editing, if we build them.

Computing Terminals require mass storage and programming. Hence, there is the need for software both within and outside DEC.

Provides A Strong Technology Focus For All These Areas
We are late in the video area with respect to both lower cost terminals or for high resolution, one page displays. The later exist or are needed soon on WP Systems.

Minimal Amount of Interaction With Other Parts of Engineering
A single group can manage the interaction with other parts of engineering. This means all engineering will be more effective. Note, that when two groups providing the same function approach a third group about an interface, there is an inherent arbitration function (actually a fourth group) needed. Hopefully there are only these interactions:

- Common terminal architecture interface with software
- Mass storage (CT and VT)
- Semiconductors (all, and all have unique VLSI too)
- Ofis software (for both CT and VT)
- Other operating system software for CT

The Revenues In These Market Directed Products Are Similar to other product groups. Both the terminal and computing terminal revenue streams (in $B) are less than the other areas.

FY	VT	LA	CT/278	16-b	32-bit
81	.16	.16	.05	1	0.6
82	.2	.2	.06?	1.1	1.0
83	.22	.27	.13	1.2	1.5
84	.29	.3	.4	1.3	2.0

The Proposal Is Similar To Other Parts Of Engineering
While not a reason per se to reject other alternatives, I would like someone else to manage the people who manage projects. Note,

B/P(level 2)
- Mass storage (level 3)
  - CX (Level 4)
    - Big Drive Projects (level 5)
    - Controllers (level 5)
      - Specific controller project (level 6)
- ...
- Large Computers
  - Venus Program
  - 36-bit
    - Jupiter
- ...
- Terminals and Terminal Based Computing Systems

(Personals)

- CT family of products
    - CT Product Management
    - CT Hardware manager
    - CT Software
    - CT product assurance
- VT products
    - VT project
- LA family
    - LA200, etc.
- Components
    - Keyboards, monitors, etc.
- Single VT278 mogul
    - Product manager
    - Software, including WPS, RPG, etc.
    - Hardware

... etc.

Prior to Si's leaving, we seemed to be getting improved focus on products. This has to continue, but we need help to do it.

Having The 278 In The Group Is Desireable, Though Not Necessary
We still need better focus and drive around the 278, especially the WPS software. The three parts can remain separate: hardware, software (and Product Management) and WPS software. Mike Gutman should also focus full-time on PDP-11 Products!

WHY NOT ONE OF THE OTHER PROPOSED ALTERNATIVE ORGANIZATIONS?

Alternative 1
Alt. 1 adds two more direct reports, plus requires Bell-Portner to see that the various charters are established among the groups as to the plethora of components and architectures. It would require the establishment of a functional equivalent to that of the proposed organization. This function would could be in one of the three groups, and while it might be clean, we would often end up as arbiter. I don't know how to handle the advanced development and architecture that is getting us into the current trouble.

Alternative 2
Alt. 2 has nearly all the problems of 1, except that there might be something gained by having the two types of computing systems together. It could supress the focus on CT and thereby limit building the personal system. Historically, we have not been able to focus our management attention in such a way to build a personal system because the pressures are to perpetuate time shared systems. Probably the worst problem is that it puts in jeopardy the conventional 16-bit business which we must have. Mike Gutman has to focus here!

Alternative 3
While alt. 3 allows video technology to be shared across VT's and CT's, we run the risk of doing a poor job in both areas by having resources go to either area. It has problems similar to alt. 1 in that someone has to take on many common functions. Alt. 3 may be better than 1 because it groups our lagging video together.

Alternative 4a
This alternative would certainly be acceptable and let us focus on both terminals and computing terminals. Similarly, there could be a strong advanced development and architecture function which we need for all terminals. Computing terminals have unique and intense problems which are going to consume Avram for the next 3 years! It is just about as good as 4b.

GB2.S6.64

September 2, 1980

Mr. Alec Peltier
Chief of Immigrant Visas
Operations Branch
American Embassy
London

ENGLAND

Dear Mr. Peltier,

On behalf of Digital Equipment Corporation, I would like to thank you for approving the recent visa for Dr. Maurice Wilkes who has now been able to join us here. Since I have known Dr. Wilkes for such a long time, it is also a great personal pleasure to be able to work with him here.

It is truly significant for us and computing here in the U.S. to have Dr. Wilkes. Wilkes has been active in computing for over three decades, making some of the great innovations. He is a Fellow of the Royal Society, a Fellow of the Institute of Electrical and Electronics Engineers, a Fellow of the British Computer Society, of which he was the first President, and a foreign associate of the U.S. National Academy of Engineering. He received the Turing Award and the Harry Goode Memorial Award, two of the highest honors in american computing. He has received honorary Doctorates from five universities in three countries, together with other honors from around the world, including recently being named as a foreign associate of the U.S. Academy of Sciences. In summary, he is a distinguished scientist and engineer of world reputation, possessing unique background and qualifications not available elsewhere.

Thank you again.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:swh
GB1.S6.29

CC: Ambassador Kingman Brewster
Richard Goldstein

REVIEW

Moreau, Rene, The Computer Comes of Age. Cambridge, MA M.I.T. Press, 1984, 227 pp* *.

The troubles begin in the Series Foreword where the editors state "Rene Moreau has given us a technical history that centers on problems and their solutions, stage by stage, from the beginnings of this subject until the year 1963, when the IBM Series 360 computers introduced a new age in the history of technology". The 360 was introduced in April 1964. The 360, a tremendous engineering achievement, used discrete transistor circuits packaged on ceramic substrates. The Integrated Circuit, an earlier invention, is probably the basis of the new age more than any other technology. The editors introduce two types of problems: factual inaccuracies compounded by fallacious and biased assumptions. The bottom line suggests a recall of the book and if you have the time, read on for the reasoning.

The author's first sentence in the preface is ambiguous (which Mark I) and inflammatory:

> "It is not uncommon to read that the first computer was the Mark I, or the Harvard-IBM machine, or perhaps ENIAC; it is seldom stated that the IBM Selective Sequence-Controlled Electronic Calculator (SSEC) alone can claim this distinction."

The **first** computer is something that should be left to historians to sort out in several hundred years. As a student of computer structures, it's hard to see the resemblance between SSEC (especially the one depicted by Moreau) and the modern computer described in the EDVAC report or the Manchester Mark I that Kilburn ran his first program on in June 1948.

The fetish about firsts in computing is a recurring theme that concerns me. Moreau carries firsts to the extreme. Dates have lots of errors and ambiguities, regardless of their source. Even primary contributors often quote dates when something worked in the lab or when a computer was shipped to a site, was commissioned and may have required another year of assembly and testing. Even though a computer ran a program at 10,000 instructions per second for 15 minutes, it may have been one year before it ran 10,000 instructions for 6 hours. For a commercial computer, a better test is probably the delivery of the second (or the tenth) one. I am content to let the first commercial computer title be somewhere among these machines:

- Ferranti's Mark I, identical to Manchester's Mark I, and Lavington states: "The first Ferranti Mark I was installed at Manchester University in February 1951, thereby becoming the world's first commercially available computer to be delivered".[1]
- Lyon's LEO, derived from EDSAC, ran a simple test programme for Princess Elizabeth in February 1951 according to Lavington and was running reliably by January 1952. A party to celebrate the completion of LEO I was held in December 1953.[2]

. Nancy Stern, based on interviews, states Eckert-Mauchly Computer Corporation BINAC was formally accepted by Northrup on August 22, 1949.[3] Goldstine states the BINAC was operational in August 1950. BINAC was subsequently shipped to Northrup where it underwent a series of trials.[4]

. Goldstine states UNIVAC was operational in March 1951.[5] By 1955 15 had been installed. Moreau (correctly) states it was the world's first business computer, a distinction that's now pretty much disappeared.

. Goldstine states the ERA 1101 was delivered in December 1950 to Georgia Tech. It's successors included the 1103 and 1103A.

On the first page of the introduction, Moreau argues that by late 1963, computer science had come of age. The term "computer science" was probably first argued by Newell, Perlis and Simon in a letter to Science in July 1967.

Overall, the book presents a parochial, Franco-IBM view of some early computing developments. Useful graphs are included on cost and performance of various IBM machines and technology versus time. Also, the book has a number of references to the early French literature that may be of use. For example, while clearly dealing with the period prior to 1963, the author lapses into:

> "Lady Lovelace was probably the world's first woman programmer and it is for this reason that in 1979 her name was given to a programming language, ADA, developed in France ..."(p. 17)

There is a constant stream of errors and omissions anywhere you look, for example:

Page 20. Most authorities use 1887 the year of the patent for the date of the Felt Comptometer (not 1885). And Burrough's patent was 1888, not 1886, although The Science Museum catalog notes that he was working on a machine as early as 1880.

Page 61. Engineering Research Associates, ERA (not

Electronics)

Page 91. The first paragraph is full of misinformation. It is probably very dangerous to call the SEAC the first computer to use transistors. While it may have used a few transistors in later modifications, it had no effect (that has been traced, to my knowledge) on the full-scale use of transistors in computers. Were the transistors in the SEAC added later? What were they used for? Like the "first" computer, or the "first" commercial computer, there were probably several "first" transistor machines. Let me add:

- Bell Lab's Leprachaun, 1956,
- Lincoln Lab's TX-0 (project start in 1955 and operational in 1956) to test the Philco SBT100 surface barrier transistor and a large, 64Kword memory for SAGE

. Cray's first machine at Univac that he designed for the Navy which was operational in 1957
. Siemens' 2002 and the transistorized machine (Mailufterl) built by Zemanek

The Philco story is not told well: What is the project start and what is the delivery date of the TRANSAC S-1000? The Philco 2000-210 (predecessor of the 212) and delivered in 1958 is omitted.

The statement about CDC discounting and delivering product in 1958 is unbelievable. In 1957, when both CDC and DEC were incorporated, it became clear that transistors were the next technology for computers and then the question was designing, tooling, and getting to the market with a product. What company was first by a month or so, doesn't really matter after the innovative work had been completed at Bell Labs, MIT's Lincoln Laboratory, etc.. The CDC 1604 was not available until late 1959 or early 1960, not 1958 as Moreau claims.

pp 92-102 is poorly organized for what should just be a description and commentary on three interesting machines. The omission of Atlas, which I regard as one of the few great computers, in this category is bad taste. The CDC 6600, introduced in 1964, was equally as important as Atlas and I think more important than the other three. I would hardly put the Gamma 60 in the same class as Stretch in terms of either power or influence. It was an interesting machine, but virtually unknown to everyone from engineers to historians. In writing Computer Structures, I looked at it carefully and could find no real influence on any successors. It was poorly described, hence mysterious and interesting, but naive.

pp 104-106. This page about DEC has about 15 errors. This is embarrassing since the source is given as The Computer Museum, but the Museum can find no correspondence. Usually The Museum refers authors to the book, Computer Engineering, A DEC View of Hardware Systems Design that I, Craig Mudge and John McNamara wrote in August 1978.

Digital was incorporated in 1957, not 1962 (this mistake does not even fit with his data on the following page.) PDP stands for Programmed Data Processor, not Programmed Digital Processor. The names of the machines are usually hyphenated (eg. PDP-1). I was the project engineer of the PDP-4, not, Gordon Hall. The memory capacity, computing speed and instruction format of the PDP-4 were not the same as the PDP-1 (if I could rewrite history, they should have been closer). 45 PDP-4's were built, not 65. Ken Olsen's name is spelled with an e. His brother is Stanley, not Sam. Harlan Anderson was a co-worker at Lincoln Laboratory. (There is no d in Harlan.) John McCarthy did not design the PDP-1. The first one was sold to Bolt, Beranek & Newman Inc.(not company), not built for them. John was consulting for BBN at the time, and developed his ideas for time sharing from working on the PDP-1 (another story.) One of the first papers on time sharing lists McCarthy, Boileu, Fredlein and Licklider. (It was Boilen and Fredkin, not Boileu and Fredlein or Fredkine.) The credit of the "ingenious" high speed channel was gratifying, but the author should have pointed out that this is an early, maybe the "first," of what is now called the Direct Memory Access (DMA) used in virtually all computers.

Page 106. Title The CAB 500. (Dates of project start, first delivery and machine details are missing, but the glimpse I have is a 32-bit, 16K drum machine.)

> "These [relatively cheap machines at the bottom of the manufacturer's lines such as the 1620, 1401, and PDP-1] were the minicomputers, so named to contrast them with the top-of-the-line machines."

The word, minicomputer, was coined and used in the late sixties to denote a new industry building minimal, high performance machines, using the new TTL logic. Minis were often used as components to other systems, and were NOT bottom of the line to large machines in the same company. The whole issue of upward compatibility is quite different. Ralston's Encyclopedia has several pages defining the characteristics of minicomputers and this is totally a misuse of the word. The IBM 1620 and 1401, along with earlier drum machines such as the G-15 and LGP-30, while small do not fit any definition of a minicomputer.

In the conclusions, another, contradictory claim and a clear omission:

> "the CAB 500 and IBM 1620 ... were the forerunners of today's **personal computers**".

I consider the LINC, demonstrated March 27, 1962 to be the first personal computer. It had a keyboard, scope, personal filing system with 256Kbytes, used interactively allowing a person to create, edit, compile and run programs without any off line operations. It also had a variety of analog input/outputs. It was (trans)portable, operated without air conditioning and was usually owned and used by a single individual (mostly life science researchers). About 50 were produced, but including it's successors the LINC-8 and PDP-

12, over 1,000 were built. The machines sold for about $45,000 (the price of today's workstations).

Page 108.

> "in the CAB 500 the microprograms were held on the drum along with the other programs, ... this microprogrammable machine as early as 1960 was one more proof that there was then in France an industry that, if not ahead of the Americans, at least was not significantly behind. Unfortunately, although CAB 500 had some success and about 50 were made, it disappeared with the demise of SEA."

The author fails to point out a few critical lessons of history that I can only conjecture, based on his sketchy presentation of the machine:

1. The use of techniques, such as microprogramming, depend on relative cost, size and performance of logic and memory for control. I can't understand why anyone would use microprograms that would have to be stored on a drum. This is a sure recipe for making a slow machine run very slowly. Designs (especially great ones) are measured both by the ideas omitted and included.
2. As one who has designed several computers, including the peripherals and I/O system for the PDP-1, I resent having the PDP-1 or the 1401 in the same sentence as the CAB 500, given my knowledge, based on the author's poor description of the machine. I believe an interpreter for the PDP-1 could execute CAB 500 programs faster than a real CAB 500.
3. By 1960, all machines used core memories for speed, not drums. Like other machines, CAB 500 may have been innovative, but performed very poorly. Since I don't know the cost, it is hard to understand a measure of cost-performance and hence, relative goodness. CAB 500 was obsolete before it was introduced.

Outside of the errors, a basic problem of the book that makes it questionable for any historical work is summed up on page 166:

> "PAF vanished with the CAB 500, but it had a famous descendant, BASIC, produced in 1965. Even if the authors of this language did not know of PAF, BASIC had the majority of its features."

The facts here might be correct, the interpretation I give is: "let's rewrite history as it might have been" is inexcusable, especially by a scientist. This sort of statement is likely to be rewritten by future, careless authors as: "PAF was the forerunner to BASIC", when they need a sprinkling of history in their first chapters.

BASIC had characteristics that were taken from a variety of languages, including Algol, Fortran and JOSS -- people were working on the same problems at the time. But Kemeny, Kurtz and the others at Dartmouth designed and made BASIC work. If they had taken the whole language of PAF without reference, then the story is different. The section on PAF as a descendent of Fortran does grate on the reader, in light of the lack of data. Sammet (Programming Languages) and Wexelblat (History of Programming Languages) don't mention PAF. I conclude, PAF and the CAB 500 already have their proper place in history and the world doesn't need to know anymore about them. If they were significant and overlooked then the Annals is the proper place to include and argue them.

All of this may be excused, providing grist for nitpickers, of which I am NOT one, to correct; but the conclusion is so offensive that it moved me to write what otherwise would have been a sad, but invisible review:

> "It is no exaggeration to say that there has been no fundamental development in computer science since 1963." (p. 196)

Without time sharing, microprocessors, packet-switching, artificial intelligence, 6600-style I/O computers, distributed computer systems, LANs, many algorithms, various higher level and non-procedural languages, graphical and other modern man-machine interfaces (including speech) -- all developed after 1963 -- computing would be pretty dull. And I look forward to even more fundamental developments in the future emanating from the current research and development by governments, universities, and companies.

A recall is in order. Quality Control taught us the cost of correcting errors downstream is orders of magnitude greater than their initial elimination. The book is filled with defective and missing parts and harmful to our health. It could be the cause of generations of errors, since it inaugurates a new history series and is not just another view about the evolution of the computer.

Gordon Bell, Chief Technical Officer
Encore Computer Corporation
Wellesley Hills, MA GB13.21

[1] Lavington, p.40
[2] Lavington, pp 68-73
[3] Stern, pp 13-14
[4] Goldstine, p.246
[5] Goldstine, p.246

Bibliography

1.
Goldstine, Herman, 1972, "The Computer: From Pascal to von Neumann," Princeton Press.

2.
Lavington, Simon, 1980, "Early British Computer," Digital Press

3.
Ralston, Anthony and E. D. Reilly, Jr., (Editors) 1983, "Encyclopedia of Computer Science and Engineering," van Nostran Reinhold Company.

4.
Stern, Nancy, "The BINAC: A Case Study in the History of Technology," Annals of the History of Computing 1(1), 9-20 July 1979.

00 CORE DECGRAM ACCEPTED S 004690 O 568 11-OCT-82 20:02:24

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION

DATE: MON 11 OCT 1982 3:54 PM EDT

cc: see "CC" DISTRIBUTION

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5178324701

SUBJECT: RECOMMENDED ARCHITECTURE ANNOUNCEMENT

My concurrence is on the basis of whether or not we

understand
AND can demo the product.

I believe we should be able to. IF SO, let's go ahead. It's up to Ulf and Pete though.

"TO" DISTRIBUTION:

ULF FAGERQUIST PETER HURLEY BILL MCBRIDE

"CC" DISTRIBUTION:

PAUL FERESTEN ROSE ANN GIORDANO BERNIE LACROUTE
IRA MACHEFSKY

ATTACHED: MEMO;84

****
* d i g i t a l *
****

TO: GORDON BELL
PM EDT

cc: IRA MACHEFSKY

DATE: THU 7 OCT 1982 3:47

FROM: PAUL FERESTEN
DEPT: LCG MKTG
EXT: 231-4371
LOC/MAIL STOP: MR2-2/8D2

MESSAGE ID: 5177920185

SUBJECT: RECOMMENDED ARCHITECTURE ANNONCEMENT

Gordon,

Although it is not appropriate to announce JUPITER until sufficient performance data is available, we did receive PPC approval to announce CI20/HSC50 support for the KL10. We understand that you also recommended implementation and announcement of the KL10 ETHERNET adapter and PLUTO support. We feel that this announcement at DECUS would put us in an excellent position with our customers in spite of the absense of a JUPITER announcement.

The attached memo is the form in which we would like to make this announcement. There has been some debate regarding whether or not the CI/NI interconnect and its component pieces and protocols constitute an architecture. We would like to announce it as such. We feel that such an announcement requires your support for approval.

If you concur, Please advise and we will proceed.

Regards, Paul

****
* d i g i t a l *
****

TO: PAUL FERESTEN
3:32 PM EDT

DATE: THU 7 OCT 1982

FROM: IRA MACHEFSKY
DEPT: LCG MARKETING
EXT: 231-6863
LOC/MAIL STOP: MR2-2/C2

MESSAGE ID: 5177938222

SUBJECT: DIGITAL SYSTEM INTERCONNECT ARCHITECTURE

The Digital System Interconnect Architecture

The Digital System Interconnect Architecture (DSIA) is the
integration of various new Corporate components, protocols, and
architectures into a unified whole. It is the plan along whose lines
we will be introducing major new products through the '80s. The Digital
System Interconnect Architecture, as an architecture of
architectures, is actually a Meta-architecture.

The Digital System Interconnect Architecture consists of Servers,
buses to connect the servers, and protocols for server communication across
the busses. The servers are of three kinds: 1) Mass storage servers,
of which the HSC-50 is the first of a family; 2) Communications
Servers and 3) Compute Servers. The CI and Ethernet are the two busses
that connect the Servers. The CI connects mass storage and

compute servers
for high speed interprocessor communication and clustering capabilities.
The Ethernet connects compute servers and communication servers to allow
the creation of Local Area Networks.

The new Digital Storage Architecture is an outgrowth of the CI
capabilities while the Digital Network Architecture is being enhanced
to take advantage of the new capabilities provided by Ethernet
Loacl Area Networks.

The KL10 is the first Compute Server to implement the full
Digital System Interconnect Architecture. In the future there
will be new 36 and 32 bit compute servers integrated into
the Digital System Interconnect Architecture.

7-OCT-82 21:37:10 S 03219 MLCG
MLCG MESSAGE ID: 5177938239

GB3.S8.67
November 30, 1982

Dr. Margaret W. Kennedy
7 North Lyons Avenue
Menands, New York 12204

Dear Dr. Kennedy:

Enclosed is a $175 check in payment for the People's typewriter sent to Gordon Bell.

Sincerely,

Mary Jane Forbes
Secretary to Gordon Bell

Enclosure

GB3.S8.17

October 15, 1982

Dr. Margaret W. Kennedy
7 North Lyons Avenue
Menands, New York 12204

Dear Dr. Kennedy:

Enclosed is a $75 check in payment for the stainless steel planimeter you recently sent to Gordon Bell. It arrived in good condition.

Sincerely,

Mary Jane Forbes
Secretary to Gordon Bell

Enclosure

GB3.S8.17
January 30, 1980

Peter Delehar
146 Portobello Road
London W11
ENGLAND

Dear Mr. Delehar:

Thank you for your help in supplying the Arithmometer. Brian Randell is very pleased.

Could you please look for another one for me in the same condition?

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:swh
GB1.S1.46
June 9, 1983

<g> <fn> <ln>
<co>
<add>
<csz>

Dear <g> <ln>:

How goes the MCC-ALPHA OMEGA electronic mail experiment?

In the event an electronic mail system is installed under the aegis of Admiral Inman's office, it would be helpful to get your feedback on the current experiment to make a future MCC electronic mail system an even better tool.

Because activity has not been high, I'd appreciate your comments on the following:

Main reason for not accessing my account is:

To make electronic mail a more useful tool, I would suggest:

Sincerely,

Mary Jane Forbes
Secretary to Gordon Bell

MJ5.27

00 CORE DECGRAM ACCEPTED S 000006 O 1 28-SEP-82 0:32:16

****
* d i g i t a l *
****

TO: SAM FULLER   DATE: MON 27 SEP 1982
10:45 PM EDT
    TOM GANNON   FROM: GORDON BELL
    BILL STRECKER   DEPT: ENG STAFF
                                                      EXT: 223-2236
                                                      LOC/MAIL STOP: ML12-
1/A51

                                                      MESSAGE ID:
5176900677

SUBJECT: A/O DISCUSSION WITH FERNBACH AND FEIGENBAUM

They were positive on the approach. Ed warned that if you start a program as a series of projects, you risk ever building
a large institute. I believe we can always enlarge something after it is going. In this way, we can start the program without getting the top person... and in fact can use this to lure them. No matter what, we also need a super project person
to run the LASL show. We can recruit them now within LASL, CDC, Univac, etc.

This is a program that builds off the contractor strengths and
also lets us go to other places for projects... say 6 in all.

LASL is strong in:
Supercomputers and parallelism for scientific processing... in
  fact has that charter to measure and understand all machines
large databases

graphics and image generation. This should be the basis for doing the compression work and chips.

Also, large networks and facilities.

They have less expertise in AI, VLSI design, human interfaces.

The goal would be to use AFP to explore a large, gp database and one that could encode and store images. The operation would be focused at the hardware/systems level.

STANFORD or SRI would be Prolog or AI Machines

We would still need an overall architecture effort to tie the components together, but that gets into the product issues that might be contentious in the companies.

For now, we'd run with BOD, and I'd be chairman until we get a program head for the whole thing.

Sid was happy with this. Didn't get to talk with CDC folks yet.
Will do this tomorrow.

June 9, 1983

Dr. Donald L. Boyd
Honeywell Inc.
Corporate Technology Center
10701 Lyndale Avenue South
Bloomington, MN 55420

Dear Dr. Boyd:

How goes the MCC-ALPHA OMEGA electronic mail experiment?

In the event an electronic mail system is installed under the aegis of Admiral Inman's office, it would be helpful to get your feedback on the current experiment to make a future MCC electronic mail system an even better tool.

Because activity has not been high, I'd appreciate your comments on the following:

Main reason for not accessing my account is:

To make electronic mail a more useful tool, I would suggest:

Sincerely,

Mary Jane Forbes
Secretary to Gordon Bell

MJ5.27

June 9, 1983

Mr. Leon O. Bonrud
Manager, Technical Planning
Control Data Corporation
Box 1249
Minneapolis, MN 55440

Dear Mr. Bonrud:

How goes the MCC-ALPHA OMEGA electronic mail experiment?

In the event an electronic mail system is installed under the aegis of Admiral Inman's office, it would be helpful to get your feedback on the current experiment to make a future MCC electronic mail system an even better tool.

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Sincerely,

Mary Jane Forbes
Secretary to Gordon Bell

MJ5.27

June 9, 1983

Mr. Roy Kuntz
Dir. Software Engineering
  Languages & Policies
NCR Corporation
1700 South Patterson Boulevard
Dayton, OH 45479

Dear Mr. Kuntz:

How goes the MCC-ALPHA OMEGA electronic mail experiment?

In the event an electronic mail system is installed under the aegis of Admiral Inman's office, it would be helpful to get your feedback on the current experiment to make a future MCC electronic mail system an even better tool.

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Sincerely,

Mary Jane Forbes
Secretary to Gordon Bell

MJ5.27

June 9, 1983

Admiral Bob R. Inman
P. O. Box 11050
Arlington, VA 22210

Dear Admiral Inman:

How goes the MCC-ALPHA OMEGA electronic mail experiment?

In the event an electronic mail system is installed under the aegis of Admiral Inman's office, it would be helpful to get your feedback on the current experiment to make a future MCC electronic mail system an even better tool.

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To make electronic mail a more useful tool, I would suggest:

Sincerely,

Mary Jane Forbes
Secretary to Gordon Bell

MJ5.27

June 9, 1983

Mr. Gordon Bell
Digital Equipment Corporation
146 Main St.
Maynard, MA 01754

Dear Mr. Bell:

How goes the MCC-ALPHA OMEGA electronic mail experiment?

In the event an electronic mail system is installed under the aegis of Admiral Inman's office, it would be helpful to get your feedback on the current experiment to make a future MCC electronic mail system an even better tool.

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Sincerely,

Mary Jane Forbes

Secretary to Gordon Bell

MJ5.27

June 9, 1983

Mr. Sam Fuller
Digital Equipment Corporation
77 Reed Road
Hudson, MA 01749

Dear Sam:

How goes the MCC-ALPHA OMEGA electronic mail experiment?

In the event an electronic mail system is installed under the aegis of Admiral Inman's office, it would be helpful to get your feedback on the current experiment to make a future MCC electronic mail system an even better tool.

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Sincerely,

Mary Jane Forbes

Secretary to Gordon Bell

MJ5.27

June 9, 1983

Mr. Tom Gannon
Digital Equipment Corporation
200 Forest Street
Marlboro, MA 01752

Dear Tom:

How goes the MCC-ALPHA OMEGA electronic mail experiment?

In the event an electronic mail system is installed under the aegis of Admiral Inman's office, it would be helpful to get your feedback on the current experiment to make a future MCC electronic mail system an even better tool.

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Sincerely,

Mary Jane Forbes

Secretary to Gordon Bell

MJ5.27

June 9, 1983

Dr. Gerald Dineen
Honeywell
P.O. Box 524
Minneapolis, MN 55440

Dear Dr. Dineen:

How goes the MCC-ALPHA OMEGA electronic mail experiment?

In the event an electronic mail system is installed under the aegis of Admiral Inman's office, it would be helpful to get your feedback on the current experiment to make a future MCC electronic mail system an even better tool.

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To make electronic mail a more useful tool, I would suggest:

Sincerely,

Mary Jane Forbes

Secretary to Gordon Bell

MJ5.27

June 9, 1983

Mr. Thomas Rykken
Honeywell
P.O. 524, MS MN12-226N
Minneapolis, MN 55440

Dear Mr. Rykken:

How goes the MCC-ALPHA OMEGA electronic mail experiment?

In the event an electronic mail system is installed under the aegis of Admiral Inman's office, it would be helpful to get your feedback on the current experiment to make a future MCC electronic mail system an even better tool.

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Main reason for not accessing my account is:

To make electronic mail a more useful tool, I would suggest:

Sincerely,

Mary Jane Forbes

Secretary to Gordon Bell

MJ5.27

June 9, 1983

Mr. Marvin Beriss
National Cash Register
1440 So. Patterson Blvd.
Dayton, Ohio 55479

Dear Mr. Beriss:

How goes the MCC-ALPHA OMEGA electronic mail experiment?

In the event an electronic mail system is installed under the aegis of Admiral Inman's office, it would be helpful to get your feedback on the current experiment to make a future MCC electronic mail system an even better tool.

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Sincerely,

Mary Jane Forbes

Secretary to Gordon Bell

MJ5.27

June 9, 1983

Mr. Harut Barsamian
Sperry Univac
16842 von Carman Dr., P.O. C19504
Irving, CA 92713

Dear Mr. Barsamian:

How goes the MCC-ALPHA OMEGA electronic mail experiment?

In the event an electronic mail system is installed under the aegis of Admiral Inman's office, it would be helpful to get your feedback on the current experiment to make a future MCC electronic mail system an even better tool.

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Sincerely,

Mary Jane Forbes

Secretary to Gordon Bell

MJ5.27

June 9, 1983

Dr. Neville Black
Sperry Univac
P.O. Box 500, MS A2-200
Blue Bell, PA 19424

Dear Dr. Black:

How goes the MCC-ALPHA OMEGA electronic mail experiment?

In the event an electronic mail system is installed under the aegis of Admiral Inman's office, it would be helpful to get your feedback on the current experiment to make a future MCC electronic mail system an even better tool.

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To make electronic mail a more useful tool, I would suggest:

Sincerely,

Mary Jane Forbes

Secretary to Gordon Bell

MJ5.27

June 9, 1983

Mr. Larry Walker
Sperry Univac
2276 Highcrest Rd., MS 4702
St. Paul, MN 55113

Dear Mr. Walker:

How goes the MCC-ALPHA OMEGA electronic mail experiment?

In the event an electronic mail system is installed under the aegis of Admiral Inman's office, it would be helpful to get your feedback on the current experiment to make a future MCC electronic mail system an even better tool.

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To make electronic mail a more useful tool, I would suggest:

Sincerely,

Mary Jane Forbes

Secretary to Gordon Bell

MJ5.27

June 9, 1983

Mr. Walter Frederickson
Harris Corp.
Harris Corp. HQ
Melbourne, FL 392919

Dear Mr. Frederickson:

How goes the MCC-ALPHA OMEGA electronic mail experiment?

In the event an electronic mail system is installed under the aegis of Admiral Inman's office, it would be helpful to get your feedback on the current experiment to make a future MCC electronic mail system an even better tool.

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To make electronic mail a more useful tool, I would suggest:

Sincerely,

Mary Jane Forbes

Secretary to Gordon Bell

MJ5.27

June 9, 1983

Mr. Roger Wagner
Control Data Corp.
MEV 03P, 511 Eleven Ave. So.
Minneapolis, MN 55415

Dear Mr. Wagner:

How goes the MCC-ALPHA OMEGA electronic mail experiment?

In the event an electronic mail system is installed under the aegis of Admiral Inman's office, it would be helpful to get your feedback on the current experiment to make a future MCC electronic mail system an even better tool.

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Main reason for not accessing my account is:

To make electronic mail a more useful tool, I would suggest:

Sincerely,

Mary Jane Forbes

Secretary to Gordon Bell

MJ5.27

June 9, 1983

Mr. Ed Krall
NCR, MS WHQ-5
1400 So. Patterson Blvd.
Dayton, Ohio 45479

Dear Mr. Krall:

How goes the MCC-ALPHA OMEGA electronic mail experiment?

In the event an electronic mail system is installed under the aegis of Admiral Inman's office, it would be helpful to get your feedback on the current experiment to make a future MCC electronic mail system an even better tool.

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To make electronic mail a more useful tool, I would suggest:

Sincerely,

Mary Jane Forbes

Secretary to Gordon Bell

MJ5.27

June 9, 1983

Mr. John Payne
National Semiconductor Corp., MS D3686
2900 Semiconductor Dr.
Santa Clara, CA 95051

Dear Mr. Payne:

How goes the MCC-ALPHA OMEGA electronic mail experiment?

In the event an electronic mail system is installed under the aegis of Admiral Inman's office, it would be helpful to get your feedback on the current experiment to make a future MCC electronic mail system an even better tool.

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To make electronic mail a more useful tool, I would suggest:

Sincerely,

Mary Jane Forbes

Secretary to Gordon Bell

MJ5.27

June 9, 1983

Mr. Bill Howard
Motorola Inc. C304
P. O. Box 2953
Phoenix, Ariz. 85062

Dear Mr. Howard:

How goes the MCC-ALPHA OMEGA electronic mail experiment?

In the event an electronic mail system is installed under the aegis of Admiral Inman's office, it would be helpful to get your feedback on the current experiment to make a future MCC electronic mail system an even better tool.

Because activity has not been high, I'd appreciate your comments on the following:

Main reason for not accessing my account is:

To make electronic mail a more useful tool, I would suggest:

Sincerely,

Mary Jane Forbes

Secretary to Gordon Bell

MJ5.27

June 9, 1983

Mr. Harold Muller
Motorola Inc.
2200 West Broadway
Messa, Arizona 58202

Dear Mr. Muller:

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PRELIMINARY ENGINEER STRATEGY OVERVIEW

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CHAPTER I

THE PRODUCT STRATEGY
AND TRANSITIONING TO THE FIFTH GENERATION

THE PRODUCT STRATEGY OVERVIEW

THE FIFTH GENERATION

The transition to The Fifth Computer Generation is happening. All generations changes are painful and this one could be harmful unless we recognize and ease the transition. The Fifth Generation is based on: significant 16-bit microprocessors with large memory addressing; small, low cost, 5-10 megabyte mass storage; and communication using Ethernet-type interconnection. It is marked by Personal Computers that will evolve rapidly into Personal Computer Clusters. Clusters can be used as an alternative to our departmental timeshared minicomputers, just as the mini provided an alternative to the central mainframe.

Technology continues to provide 20% per year decline in the price of computing, permitting a wide range of computing styles from a $500 "PDP-11's in a book" to "Cray 1 power" VAXs for $250,000 in 1990. Competition will be fierce as 360/370's become available at minicomputer prices and the semicomputer companies sell what was formerly mainframe power processors for zero cost and start a new industry. Digital's Product Strategy with its homogeneous architecture is aimed at being a major force in this generation.

THE PRODUCT STRATEGY

The product strategy of a homogeneous architecture is simply:

- adopting a single VAX-11/VMS architecture;
- implementing a wide price range of products covering the computing styles of **Personal (Individual) Computing, Timeshared Departmental Computing**, and **Central Computing**;
- interconnecting these in a homogeneous network, including the formation of Personal Computer Clusters; and

. building critical and unique applications.

RATIONALE FOR THE STRATEGY

The basis for a winning strategy is:

.ability to build a homogeneous, network architecture which will greatly benefit the customers, by:

. providing a wide range of price and styles for our varied customers, preserving their data, programming and training investments; and
.allowing a user to compute, dynamically, anywhere across the compatible range without conversions;

.fewer systems to support across Digital, while covering a very wide price range, as processor cost becomes a smaller part of the total system cost;
.fewer systems also imply lower costs with higher quality and greater reliability by moving further down learning curves;
.a clear internal and external mission which both aids productivity and quality;
.product uniqueness and superiority against the emerging commodity-produced mainframes in our minicomputer price band and the semicomputer company "mainframes" fueling the emerging fifth generation computer system building boom; and
. support of our customer base and transition to this new computing style.

IMPLEMENTING THE STRATEGY

Implementation includes continuing to deliver significant 8- and 10/20-based products and building the necessary coexistence hardware and software to make the transition to VAX-11/VMS. The 11, using RSX-11/M will be the basis of Personal Computing until VAX-11/VMS is implementable as a low cost Personal Computer, PC, and Personal Computer Cluster, PCC. Homogeneity must be maintained via files, language, and interconnection standards enabling customers to preserve their data and program investment. RSX-11/M aids this transition because VAX-11/VMS provides a compatible environment. Immediately we must develop unique applications on VAX-11/VMS that cannot be built on competitive 360/370's and semicomputers.

This evolutionary strategy, as ratified two years ago, is the result of the 1975 decision to build VAX-11 together with the technology push and market pull to further distribute processing via Personal Computers and our own Local Area Network.

In the last two years since its inception, the strategy has proven increasingly attractive because no competition appears to have the same focussed vision, capacity and capability.

THE TRANSITIONS

TECHNOLOGY TRANSITION

Transition based on technology evolution is continuing at 20% cost decline per year as shown in the following figure, permitting an incredibly wide range of useful computing devices to be built. The generation period of seven years and the seven generations, 55 year period from 1945 to 2000, is described in the appendix on the fifth and sixth computer technology generations. Economy of scale, also known as Grosch's law, does not hold today for any system or component except very large disks. However, there is diseconomy of scale for large systems primary memory.

From the generations graph, we can observe the following:

- .there is a wider range of useful systems, and these will be appealing to our customers, us and others; For example, in 1985 we could be selling $1,000 computing terminals with the power of the original LINC, and $600K 10/20's.
- . the wide range of useful systems will force all suppliers to be more competitive and selective as new suppliers enter on a point product basis and as the 370 becomes a commodity;
- .IBM, Fujitsu, and others are likely to offer a 4341-2 class machine in our $40,000 to $100,000 minicomputer heartland;
- .competitors, could be targetting the following (for 1985):
  - .Cray 1 power, $625K (or in 1990 for $250K);
  - . x3+ Comet power for $100K;
  - . 780 power for $40K;
  - .a sharable VAX (or big micro) in $6.25K to $16K range;
  - .a personal VAX (or big micro) for under $6.25K;
  - .a computing terminal with VT100 capability, and power of Apple II, or original LINC, for $1,000;
  - . computers in $400 to $1,000 range;
- .we have not provided aggressive enough products,

because:
. the Q and U bus form factors have constrained system cost and size;
. the 19" rack and stack, palletable form factor together with poorly packaged components, has been retained; Packaging in other, lower cost form factors enabling cardboard box shipment and customer merge is essential.
. the terminal has not been used as a package; and
. point products have been insufficiently high quality, software supported, or cost-effective. Even $200 calculators are modular with mass storage, printer, modem and display options.

TRANSITION TO DISTRIBUTED COMPUTING BASED ON NI

The Network Interconnect, NI, based on Ethernet is the Local Area Network intercommunication medium for connecting all the computers within a building or set of buildings at a single location. Because it operates at 10 Mhz., it should have a long product life and be useful for interconnecting:

.departmental and central computers to each other;
.   Personal Computers to form clusters;
.   several thousand voice channels at 2 Khz;
.   several hundred picture channels at 50 Khz;
.computer components together to form a computer; and
.functional server components in a distributed processing system. For DEC, we need to reduce the number of network possibilites that are a product of:

.   hardware systems;
.the 12 operating systems we support; and
.the desirable protocols including X.25, IBM, DECnet and other vendors.

By using the server concept on a network wide, rather than a cluster basis, each system can be connected to NI, and then build specialized servers for the network nodes. We must build the following network-wide specialized servers:

.concentrators for interconnecting dumb terminals and personal computers to all nodes of the network. This permits both concentration and switching to all nodes.

.gateways to systems using other protocols; This would be done once and not in each system requiring communication with a particular system using a particular protocol.

.repeaters and interfaces allowing various networks to communicate with one another;

.central functional servers for the network, including printing;

.real time front ends for interfacing real time control computers to the network.

TRANSITION TO PERSONAL COMPUTERS FROM MINIS AND MAINFRAMES

Personal computers are already beginning to affect the use of departmental level minicomputers and central mainframe timeshared computers in several ways:

. direct, stand alone use;

.more terminal load can be put on a given computer when personal computers are attached to it using terminal emulation, thus lessening the need for more shared computing; (The leading edge university market shows this trend.)

.interconnected clusters of personal computers are a direct alternative and provide nearly all the advantages of timeshared computers.

The concept of Personal Computers interconnected via a Local Area Network Link, like NI, forming Personal Computer Clusters and using functional servers to handle communications, files, printing and interface to people is described in a following section. The Personal Computer has enormous market appeal because it:

.potentially covers the widest range of use on a cost per terminal basis, beginning with one user;

.is personal, non-sharable, and purchasable by an individual;

.has the best response time for what we think of as trivial computation tasks such as word processing; These

highly interactive tasks require much computation and direct access to the screen for data manipulation.
.offers every capability that a dumb terminal has, including installability, yet is only slightly more expensive;
.can carry out many of the tasks that timesharing systems do; and
.can operate within a cluster to have virtually all the important attributes of a large, timeshared system.

We must get the necessary architecture for the clustered systems. Many systems have been built using this distributed server structure. Experimental systems are being planned or built by the Office Group, Laboratory Data Products, Small Systems, VMS, Research, the Computing Terminal base system and DECnet/ Distributed Systems. These systems have to have a standard interface for this level of communication so they can communicate with one another.

TRANSITION FROM CONVENTIONAL RACK AND STACK 16-BIT COMPUTERS
The transition from our current 16-bit rack and stack and Q and Unibus systems business must be made. They are not declining in price according to the technology and are being rendered uncompetitive. Also, every application involving a signficant amount of programming must evolve from the limits of the 16-bit address. The threats:

.16-bit microprocessor cards and systems which have 22-bit memory address space and supplied by both semicomputer companies and their OEMS who are building competitive systems; UNIX and other approaches to building transportable systems are aimed at establishing hardware to be a commodity.
.board and box level systems that are oriented to modern special chip i/o as supplied by the semicomputer suppliers;
.Personal Computer and Clusters, as described above;
.32-bit architectures, including the VAX architecture;
.better box-level form factors not possible with 19", FAT produced, Q- and Unibus systems; Systems must be shipped in cardboard boxes, integrated by the customer, and when broken, self-diagnosing with customer

replaceability.

TRANSITION FROM TERMINALS TO COMPUTING TERMINALS

The major transition for terminals is semantic. That is, just what is a terminal? It is clear that there will be no dumb or fixed function terminals by 1985. Every future terminal we introduce must be a computing terminal. Terminals must change in the following ways:

.larger Personal Computers are an alternative to our conventional, dumb terminals;
.all terminals introduced beginning in FY83 must be customer programmable with at least firmware ROMs and RAM buffers;
.the interconnection, whether it be U. S. or European Modem, NI, or IBM emulator, must be built into the terminal;
.decreasing memory cost will offer fully programmable screens, which in turn will automatically provide graphics; and
.higher resolution, full-page and color displays.

TRANSITION TO SOFTWARE FOR END USE VERSUS PROGRAMMER TOOLS

Although we will continue to supply software for the systems and applications programmers, we are beginning to supply tools for generic applications such as word processing. Using a computer in the office is contrary to our successful past, where we could use ourselves as the model user. Fortunately, we have offices within DEC, and must use them as a laboratory for building effective products. Specifically, we can identify these needs:

.direct use in the office, including providing the ability for OEMs, office managers, organization, and the individuals to tailor their systems;
. better human engineering at the screen and in documentation; Documents and help should be built-in.
.all products must be modifiable for use with any natural language; We sell products in all countries, and these products must operate in the mother tongue.
.applications building tools that professionals who

understand various businesses can use to write applications programs for particular professional and commercial environments.

TRANSITION IN HARDWARE DESIGN SKILLS

The transition in the way we design systems is quite radical, especially as we move into the sixth generation where our current mid range systems are placed on a single chip. At this time, we would expect constant cost mid range systems to be able to store and process voice and images and to be able to communicate with everyone at their own level. The immediate transitions for system designers includes:

.standardization and use of general purpose controllers and processors for conventional controllers; We are not using enough standard VLSI! This also implies that virtually all options are programmed in ROM (firmware), with programs that are fundamentally real time operating system applications. We are failing to recognize and manage this transition at this time.

.use of gate arrays and other LSI to lower cost of all jelly bean and non-processor logic; This requires a significant investment in CAD and designer training. Although this design approach will be used throughout the next generation, it is interim until VLSI design is understood.

.VLSI design, where processors and controllers are placed on a single chip; Currently this is so expensive, that we are not developing chips or design skills outside the Semiconductor Engineering Group to any extent. We need tools so that a basic design can be done in the same time as a PC Board layout; furthermore the PC Board layout and acquisition time must be reduced to one week. We must engage in more VLSI design as a means of cost reduction in some of our high cost peripherals (eg. the electronics constitute 1/2 the cost of the R80!).

.identification of either general purpose or special purpose computers based on VLSI for building the non-processor portion of systems to drastically reduce system cost. Processor design has been the past focus, and now we must optimize the total system cost, including maintenance (life cycle cost) and use.

PERSONAL COMPUTER CLUSTERS, PCC, ARE AN ALTERNATIVE TO TIMESHARED COMPUTERS WITH DUMB TERMINALS

We must establish the 11 as the Personal Computer standard, and build Personal Computer Clusters and Networks compatible with VAX files, and languages. We must introduce a VAX Personal Computer by 1985.

The opening statement of the August 1979 CMU Research Proposal for Personal Computers was "Timesharing is dead, to be replaced by networks of Personal Computers in the 80's". Research groups have built and are building Personal Computer Networks (PCNs) using PCs costing $20K-50K and interconnected by high speed links like the Ethernet. Xerox Research PARC, the developer of the "distributed server" architecture, is the archetype of this environment with several hundred Alto personal computers and service facilities (e.g. File Servers, Printer Servers, Network Server for interconnection to outside computers, and a Tenex Computation and File Server) interconnected over 3 Ethernet segments of several kilometers. Apollo has just introduced a PCN, based on a ring structure and using the M68000, aimed at the technical professional. Three Rivers are delivering PERQs to the CS community and Convergent Technology has announced a clustered, professional workstation. The Datapoint computer system is built using the "distributed server" structure. Apple is likely to introduce Apple-net in 1981 to interconnect their PC's, forming Personal Computer Networks (PCN's). Wang and other WPSs are organized around a co-axial ring, using file and printer servers, and distributing the processing in the terminal computer, forming a limited, single cluster (PCC). Semiconductor companies have again lowered the barrier for entry into the lower part of the computer market.

The PC has evolved from a tiny computer with a serial link to a dumb terminal (glass teletype). New PC's must have the ability to save and restore a complete screen, as the screen is mapped into the processor's primary memory, and to be able to use a screen to help the user more, in a similar fashion to the TV games. This very high speed communication will dictate a whole different Operating System philosophy for screen management. Equally important is "distributing" the operating system to clusters of PC's using the emerging high speed links such as Ethernet.

COMPUTERS ARE A NEW COMPUTER GENERATION

Personal Computers, Personal Computer Clusters, and Personal Computer Networks all form alternatives to our small, medium and large timesharing systems (TSS's) for various reasons and, therefore, we have no choice of ignoring them! The figure shows a guess at how the computing style (batch, shared, RJE, personal, PCC, PCN) has evolved and will evolve from 1950-1990.

Given that a terminal has video, keyboard, power supply, control logic in the form of a microprocessor, a package constrained by the video and keyboard, it is only slightly more expensive to increment the primary memory and add a secondary memory to get a complete computer capable of standing alone and acting as a terminal emulator.

As an example of a terminal evolving into a PC, GIGI has a ROM which gives it Microsoft BASIC capability. Although we provide no secondary memory for programs, our customers probably will. Therefore, the forces to make every terminal evolve into a personal computer are:

- constant overhead of the terminal;
- high cost of people sitting at the terminals (e.g. $20K-150K/year) relative to the terminal;
- lower primary memory cost;
- need for much more processing at the terminal and high bandwidth between the terminal and computer to get more productivity from expensive people;
- the introduction of the small floppy and now
- the small Winchester that can be packaged in the terminal.

Given that we sell a lot of dumb terminals, it is important for us to evolve them this way.

Tasks like editing require a great amount of computing power and very fast interrupt response time. It should also be noted that this kind of response is virtually impossible to deliver in very large, shared systems and gets even worse in very large computers. The issue is really latency versus throughput. There is some evidence to show that the cache miss rate goes up as the square of the processor speed. Also, the access time of large disks is not improving as rapidly as processing speed.

Just as there have been forces to establish the PC as an alternative to the dumb terminal using a terminal emulator program, the forces will continue to replace all the functions that the timeshared system provides by clustering the PC's and by having shared facilities using Ethernet. As we simply cluster the PCs, communication and file access among the machines is provided as long as all the computers are ALL turned on. This requirement leads back to asking for some shared facilities in addition to the communications link. Sharing occurs for two reasons: it is drastically cheaper or that it is necessary for communications. High performance or high quality printers, communications facilities, and large filing systems are examples of economic sharing; a filing system and communications link are examples of communications sharing. With sharing, there's also the need for privacy and higher overall reliability for shared parts.

EVOLUTION FROM TSS TO PC CLUSTERS AND NETWORKS

DEC developed Timesharing Systems (TSSs) so that everyone could "apparently" have their own computer which could be operated in an interactive, not batch fashion. We also built single user minis so everyone could have their own computer (e.g., LINC) as the first truly interactive, personal computers ... and then we put timesharing on the larger minis (e.g. TSS8, evolving to RSTS) to get the cost per terminal down. This era covers 1965 to 1980. 1980 to 1990 is likely to be a transition from the shared system to powerful PC's!

In 1977, with good microprocessors, low cost RAM, and small floppies, the Personal Computer (PC) entered the scene as an alternative to some TSS. By simply adding a terminal emulation program, a PC could operate as a dumb terminal (with some nice file access capability like the old Teletype ASR 33) and still be connected to a TSS. YET THE COST IS NOT MUCH MORE THAN A DUMB TERMINAL. WPS78 is a good example of a PC doing word processing (WP) and behaving as a terminal emulator. PC's that only stand alone and use terminal emulators will be a short lived phenomenon, covering only 1975 to 1985, because there is pressure to have PC Networks in order to minimize and localize shared facilities. This is analogous to the growth limits that departmental minis have placed on central mainframes. However, it is possible that PC's with terminal emulators could strengthen central mainframe computing and decrease departmental minis. PC's with terminal emulation and access to central systems will have wide scale home use!

PC Networks will form from economic pressure and sharing needs. Local area networks like Ethernet permit their formation. Thus, by proper design it appears that one can cover a much wider dynamic product range using this approach as compared to our TSS approach. Figure Evolve shows the evolution from Timesharing Systems to Personal Computers with dumb terminal emulation programs to PC Clusters and finally to networks of clusters PC Networks.

A TSS is composed of components that in principle can be broken apart and assigned to individual computers when forming a distributed PC cluster. A cluster is organized around the "distributed server" concept, where one or more computers reside on distinct processors and communicate with one another using a message passing mechanism via the fast, serial local area network link. The components include: the local area network link, the basic "person server", file service, print service (print queue), communications and network service. The scheduling and accounting programs, and of course, the jobs that exist for each person are distributed on the "person server" machines (i.e. the PCs ... which indeed must be capable of operating standalone!).

Each of the system structures provide alternative capabilities as shown in the following table.

TABLE: WHAT TSS, PC'S AND PC CLUSTERS OR NETWORKS PROVIDE

What	Timeshared System	Personal Computer	PC Cluster/ Net
processing	highest peak	lo-med, guaranteed	
programs size	very high peak	small to medium	= PC
filing	large	small, guaranteed (+ off line)	= PC and TSS
communication	network	term. emulation	= PC and TSS
CRT	slow response "glass Teletype"	fast response, screen oriented	= PC = PC
cost	fixed, can go to lowest$/terminal	lowest entry	f(no. of PCs)
secure	shared, public access	totally private	contained/TSS
pros	explicit costs shared programs big jobs	low entry cost "owned" by indiv. security SW publishing = low cost	ability to expand shared facilities better match to org. structure
cons facilities	shared poor response for terminals higher entry security	limited capability,	limited proc but increasing

THE PRODUCT STRATEGY

Provide a set of homogeneous distributed computing system products so a user can interface, store information and compute, without re-programming or extra work from the following computer system sizes and styles:

.as a single user, personal (micro) computer (PC) within a terminal, and evolving to PC Clusters and PC Networks;
.at a small, local shared, departmental (mini) computer system, and
. via a cluster of large central computer(s);
. with interfacing to other systems for real time processing; and
. all interconnected via NI.

VAX/VMS AND NETWORK BASE ENVIRONMENT
Achieve a single VAX-11/VMS, distributed computing architecture by 1985 (as measured by revenue) through:

.homogeneous distributed computing with varying computing styles including high availability and measured ease (economy) of use;
.building new 11 hardware to fill the product space below VAX; i.e. building a significant PC on the 11 with VAX-compatible files and languages so that user software investment is preserved when the ultimate transition from the 11 to VAX occurs;
.having a clear physical bus structure evolution and transition plan;
.and developing VAX, Personal 11, RSTS, M and M+ software for 11-VAX migration and 11 base protection.

Provide 10/20 systems that will co-exist with VAX/VMS through:

.building hardware that runs current 10 and 20 software;
. building VMS co-existence aids and using common components; and
. making market support and DEC-standard language enhancements.

Build and support the PDP-8 for WPS and small business applications until we get PC-11. Invest in application software that will be compatible with the strategy.

Ethernet (NI), which we call DECnet IV, is the backbone of our distributed processing. Aggressively breadboard; then develop it for gateways and concentrators. This forms the basis for the "server" model of computing for the network.

Provide essential IBM network interfaces and help set International standards. These include: Open-systems Interface, and page standards for text and mail.

APPLICATIONS

Provide general applications-level products that run on VMS and if possible layered on RSTS, M, 10 and 20, as a base for direct use, OEM and user programming including (in order):

.word processing, electronic mail, user typesetting and profession-based CRT-oriented calculators for the office and for professions;
.transaction processing, forms management, and data base query;
.management tools for various sized businesses; and
.general libraries, such as PERT, simulation, etc. aimed at many professions that cross many institutions (industry, government, education, home).

Provide specific profession (e.g., electronic engineering, actuarial statistician), industry (e.g., drug distributor, heavy manufacturer) and commercial products as needed by the Product Lines. Select from the wide range of possible languages a small subset for our own applications programming.

USER LEVEL COMPATIBILITY

Define, and make clear statements internally and to our users about programming for DEC distributed computing environment compatibility. Tighten DEC user interface standards for editors, forms management, application terminals, files and data bases, command languages, language dialects (e.g., BASIC), and applications languages.

DEC standards must be industry standards to get the software industry's maximum support.

HARDWARE COMPONENTS

Interconnection

Interconnection hierarchy with software compatibility:

. 0.3-19.2 Khz point to point communication line compatible for direct, dumb terminal;
.10Mhz NI for interconnection at a site and the backbone of the distributed processing structure;
.80 Mhz CI for interconnecting Hydra and 10/20/VAX Clusters (in a room).

Computer Systems

Thin out our basic computers by 11 to VAX transition and by positioning CPU and Mass Storage systems (including PC's) to be a separated at least a factor of 2.5 apart in the price bands. A low cost, high performance processor either alone or in a multiprocessor configuration should cover a system range of up to 3 bands when combined with the appropriate mass storage configurations.

Memories

Cover the wide range of needs:

. solid state modules for low end software in terminals and PC;
. range of components for Personal Computers;
.removeable and low cost disk (Aztec, small Winchesters) for entry-level shared system;
.hi-volume, mid- and hi-end disks in (R80/R81) with (backup);
. high performance controllers;
and HSC-50 controller for Hydra (evolving to file and data base service).

Computing Terminals

Terminals for everyone (in priority):

- .office environment for quality printing, electronic mail, evolving ASAP for needs (and uniqueness); and
- .professional using graphics (and/or color) evolving to handle images with target application software,
- .low cost (dumb) but with ROM programmability for special use

NI and NI-Servers for Both Shared and PC Clusters

The NI and Personal Computers permit the evolution of two kinds of structures: Distributed Processing with functional servers for our central and departmental TSS's; and the basis of PC clusters (in order):

- .intercommunication among all personal and shared systems;
- .real time service for process and experimental equipment i/o;
- . communications concentrators for dumb terminal interconnection to predominantly central sites;
- .communications gateways to IBM, X25, and non-DEC NI nodes, all levels;
- .file service at central and departmental sites for all levels, but predominantly PC's; and
- .printer service at central and departmental sites for all levels, including PC's.

Specific Personal Computer Products

- .aggressively build PC-11 for three environments:
  - .support our past, conventional O/S's on the PC-11 hardware;
  - .as part of the DEC architecture which starts standalone and evolves to a cluster; this system is compatible with a VAX subset for files and programs and implies a different, lower level interface to be successful. THE Terminal interface must evolve beyond our "glass teletype" to include multiple, concurrent windows and processes.

.establish a VAX environment for PC's (including servers) to envelope the PC-11, PC-VAX (i.e., SUVAX) and PC-VAX (Scorpio)

.build, ship, and test a SUVAX to establish PC-VAX and PCC-VAX and to begin to acquire the applications that only VAX can support; and

.aggressively schedule PC-VAX with a 2.5K - 6.25K cost (system with high resolution scope and mass storage) by 1985

Timeline of Critical Technologies

The figure on the next page describes the availability of technology and various systems versus time.

THE FIFTH AND SIXTH COMPUTER TECHNOLOGY GENERATIONS

A computer generation is identified by four concurrent factors:

.the technology on which the machine (hardware and software) is based;
. the emergence of the machine itself;
. the intended need; and
.the actual use (market)...which may turn out to be a new machine (software) defined by users

The Table of Computing Generations lists various landmarks for these factors in both the future and past generations including the three pre-computing generations. Technology generations are now roughly seven years. These generations are driven mainly by semiconductors which evolve exponentially at yearly density factors of 1.6 - 2.0 and are used for processors and primary memory. Secondary memory in the form of magnetic disks evolve nearly as rapidly with factor changes of 1.4 per year. The seventh generation is fuzzy, so for our purposes, we can look at the next two generations 1980-87 and 1987- 1995.

The seven year period between generations will continue on into the future, based primarily on technology, and machines because:

1. Historically benchmark machines and/or computing styles have emerged each seven or eight years.

The personal computer has emerged in the late fourth generation. With local area network communication, clusters and networks of PCs with specialized function servers (e.g. files, computation, communications) will create a drastically new, alternative distributed computer structure forming the fifth generation.

2. Seven years is roughly the time to get a factor of 100 in semiconductor memory density using Moore's law. (Semiconductor memories double in size every year; the number of bits/die = $2^{(t-1962)}$ for experimental circuits. Add 3 years for the circuit in production.) A more conservative model by Faggin has memory density growing at 1.6/year, thus a factor of 100 would take 10 years. The continued increase in density (at least at 1.6x) looks assured.

3. Seven years is roughly two product design and use generations for small systems. For higher cost machines (minis...super), the product periodicity is roughly seven years.

4. Every ten years drastically new use (and then product) segments occur, having at least a factor of ten lower cost. We assume the real cost reductions will continue at this 20%/year, independent of system size. (Faggin's projection is a factor of 10 cost reduction in 8 years or 25%/year. My 1975 model projected from 1972 used 21% and is given in the following table below, even though it might be appropriate to use a more rapidly decreasing rate (e.g., 25%).

TABLE OF COMPUTING GENERATIONS, WITH NEED, USE AND STRUCTURES

GENERATION	HIGH LEVEL NEED	SPECIFIC USE	COMPUTER STRUCTURE
Electro- mechanical 2 p.c. 1890	Mass production & census	accounting	Census & modernComptomet Electric calculator, Hollerith & account- ing machines
Electronic (thermonic) 1 p.c. 1930	Power, highway & communication grids	Engineering calculations & cryptography	Network analyzer, Mark I, Bell Labs calculators, ENIAC, Collosus.
Electronic (magnetic) 1 c. 1945	Defense	War-machine control via tables & real time	EDVAC, EDSAC, IAS, Whirlwind, LGP30, IBM 650, 701, 709, UNIVAC.
Transistors 2 c. 1958	Space & science	Air defense & traffic control; Engineering & science education	TX-0, IBM 7090 Atlas, Stre
Integrated Circuits 3 c. 1966	Transport flow control & welfare	Process control & social accounting, minis	PDP-8, B50 PDP-6, IBM 360, CDC 6600
LSI 4 c. 1972	Economic models & r.t. control	Interactive computing, computers for logic	Intel 4004, 8008, PDP-11 (RSTS), Cray 1
VLSI 5 c. 1980	Productivity	Office (& home) personal computing	Personal Computer Clusters; VAX Homogenets; general purpose robots
ULSI 6 c. communications ~1987	Information & program overload, energy	Knowledge-based processing	Integration into systems and video stand
Electro-	Arts, leisure,	Travel substitute	Global communicat

optical 7 c. ~1995	food & energy crisis.	& environmental management.	of vi

G Bell System Price Model (3/75)

System price ($) per byte of main memory

$= 3 \times 5 \times 8 \times .005 \times .79^{t-1972} \times$ no. of bytes

$= .6 \times .79^{t-1972} \times$ no. of bytes

<u>where</u>

3 is markup (roughly)
5 is fact that about 1/5 of system is primary

memory
8 is 8 bits/byte
.005 is cost of a bit in 1972
.79 is 21% price decline per year for memory
1972 is base year

Some system prices at various time using the GB 3/75 model:

Bytes	Use	1978	1980	1982	Example
1		.146	.091	.057	
8K	Dedicated fixed	1.2K	745	467	TRS
65K (Qbus limit)	1 user interactive	9.6K	5.9K	3.7K	A II/III
256K (Ubus limit)	n user, 1 applic.	28.3K	23.9K	14.9K	11/23
1M	Small, gp. t/s	153K	95.4K	59.8K	Comet
2M (11/70 bus limit)	Mid, gp. t/s	306K	190.8K	119.5K	VAX 780
8M	Large, gp. t/s	1,225K	763K	478K	

5\. Breadboard structures have emerged in the early part of this fifth generation that can be mass produced to fuel the sixth generation. My guess is that this will take on the form of significantly better I/O, storage, and processing of both voice and 2-d images.

6. There is implicit faith that there's an infinite market. This is clearly substantiated using the five year market data projections. A paper, "Limits of Distributed Processing" describes our computing structure environment together with the factors that may limit computing. None of the following factors look insurmountable for continued exponential change.

- technology
- VLSI design and new ideas for designs
- too many standards, especially in communications/networks
- algorithms
- ability to define and supply useful systems
- lack of applications programs (programmers)...perhaps the most serious
- ability for users to get work from systems

DISTRIBUTED PROCESSING AND LIMITS TO ITS GROWTH

A fifth generation computer, can be fabricated on a very large scale integrated circuit (VLSI). Lower cost and increased use disperses computers in a manner analogous to the ubiquitous fractional horsepower motor. Distributed processing to interconnect dispersed computers is essential in order to avoid overloading people with information transmission and translation tasks.

The factors that affect and limit distributed processing are: physical technology and design complexity, ideas for new computer structures, basic tools to build applications, networking and other standards, useful applications, algorithms, and the human interface to the end user. A hierarchical, interconnecting model for distributing processing is based on established central and group level mini-computers, and evolving, personal computers.

DISTRIBUTED PROCESSING

Distributed processing matches computer systems to information processing needs (i.e. processing, memory, switching, transmission and transduction needs) on a geographical or organizational basis, and interconnects individual computers to form a single, integrated network so that related programs can share and transmit data among the computer nodes. The objectives are:

.to allow either local autonomy or central control of the various distributed parts;
.to provide an evolving open-ended system so that the development and installation of the parts can proceed in a quasi-independent fashion;
.to allow purchase and installation of hardware, taking advantage of timely, reduced hardware cost; and
.to build on and communicate with central systems, fully dispersed group-level mini-computer systems, and emerging personal computers.

Distributed processing is inherently hierarchical based on the principles that govern human organizational structures.

In an organization, computers supplement their human, information processing counter-parts. As computers become better matched to people and organizations, and as people and organizations become more familiar with computers, an individual can interact directly with at least one computer and indirectly with group-level computers serving various functions of the organizational hierarchy. The opportunity of more egalitarian access to data provided by distributed processing may led to a change of the large organization from hierarchical to wider, functional matrix structures.

Large organizations need to interconnect the hierarchy of computers for:

.communication among computer with dumb and intelligent terminals using large, central computers;
.organization of central, group and individual sites;
a functional activity such as word processing or order processing; and
.a specialized computer-based function such as archiving, typesetting, message switching, and electronic mail.

FORCES CREATING DISTRIBUTED PROCESSING

Rapid evolution of semiconductor and magnetic recording technologies have forced computers improvements along paths of:

1. constant cost, with increased performance and productivity for evolutionary use;
2. reduced cost, with constant performance permitting new uses commensurate with the lower cost; and
3. higher cost and performance structures permitting radically new applications.

Costs for nearly all other forms of information processing are because they are labor intensive. Traditional storage, processing, and transmission in libraries and postal systems are increasingly soaring. Simple word processing computers that replace typewriters save the time-consuming process of correcting errors. When groups associated with information processing start using computers a positive feedback, learning curve effect begins further increasing computer markets and uses, and lowering costs.

The industry groups supplying these products and services include:

- .computers - mainframe, minicomputers, personal computers and computer services;
- .semiconductors - nearly all LSI components are either memory or a computer processor;
- .communications - conventional voice and data, new packet networks and associated services;
- .television and cable TV - stand-alone use with TV sets (e.g. games, home computers) and as an alternative to conventional communication;
- .office equipment - typewriters, copiers, and mechanical office equipment are increasingly electronic; and
- .control - gears, cams and levers, and mechanisms for control will become electronic, limited only by transducers and sensors.

LIMITS AND PROBLEM AREAS OF DISTRIBUTED PROCESSING

Ultimately all information processing will be computer based. Presently the speed of the evolution is limited by two factors: technical solutions to distributed processing problems and user assimilation.

Physical Technology

Semiconductors and magnetic recording technology provide the basis for cost and performance improvements. Although, extrapolations too far into the future are generally dangerous, the following technological rates of change, based on the past ten years, will continue for at least five years:

TECHNOLOGY (PERFORMANCE)	YEARLY-RATE OF CHANGE FACTOR
semiconductor memory density	2.0

semiconductors, random logic	1.4-1.6
core memory density improvement	1.3
magnetic disk recording density	1.3-1.4
magnetic tape data-rate	1.25
magnetic tape density	1.2

TECHNOLOGY (COST)	YEARLY-RATE OF CHANGE FACTOR
memory price reduction	0.7
computer system cost reduction	0.8
crt terminal cost reduction	0.85
communication cost/bit transmitted reduction	0.9
packaging (cost/vol.) and power (cost/watt)	1.0
communication line cost <u>increase</u>	1.12
paper cost <u>increase</u>	1.12

Semiconductor technology, shared among several buyers groups, eg. consumer, communications, computers, has a faster rate of improvement than other technologies. Slower evolution has occurred in magnetic recording density because there is only one user, the computer industry. Widely used, well developed technologies, such as CRT's, previously improved for the mass television market are scarcely affected by their increasing use in computers. Costs of paper and communication lines increase with inflation.

Physical transducers that sense temperature, pressure and control power flow are slow to evolve, limiting computer use in automotive applications. Even the most widely used computer equipment, such as keyboards, printing devices and communications devices, evolve slowly by comparison with semiconductors.

Complexity of Semiconductor Design

Gordon Moore of Intel, observed that the effort required to design semiconductors has doubled each 2-2/3 years since 1962, when a circuit only took 3 man months. 1979 circuits required 21 man years and 1982 circuits will take about 45 man years. While it is easy to conceive of organizing a team of 7 to complete a design in 3 years, the same time task by 15 people is difficult to imagine. Better management and design partitioning is required in order to avoid a drastic loss of productivity and quality that would increase the design effort even more. With one million circuits on a chip by 1982, new methodologies will be required to fully utilize VLSI's potential.

Because of the concern and numerous approaches being pursued, I am confident that it will only take another two semiconductor generations (six years) to solve the VLSI design complexity problem. Although we do not have a good measure of circuit complexity, a given circuit description is far less complex than the largest programs (e.g. a million bit, or 128 Kbyte program is not especially large).

Ideas About What to Build

New directions in computer structures are difficult to predict by simply looking at conventional machines. Current limiting factors point to needed innovations. Applications involving two dimensional signal processing for pictures appear to require a different processor design, and speech signal analysis requires vector processing. A general purpose processor could emerge from these alternatives for one-and two-dimensional arrays:

- arrays of conventional microprocessors;
- application specific, functional processors;
- bit array processors to operate directly on the array data structures, including arrays, or associative processing;
- processing associated with memory; and
- data flow architectures.

Basic Tools to Build Applications

Coupling knowledgeable user needs to machine development produces more capable, yet harder to understand systems: a paradox in the attempt to build highly capable and easy to use systems. The popularity of the Bell Labs UNIX System is a testimony to a single, consistent, easy to use language, that is described in a small manual. The popularity of APL and BASIC systems can be similarly explained. Although one would expect that additional capabilities (memory) would make the user interface simpler, few good examples are known. The time to build a given application using the multitude of systems/databases/languages is highly variable, indicating a continued lack of understanding of the design process.

Network and Other Standards

Because standards are evolving, the current situation of distributed processing among countries and vendor systems is a disaster. International protocol standards provided by manufacturers (Internets) and by various common carriers for Packetnets which are called by the same name, are fundamentally different and incompatible. Many standards mean no standards.

We must get beyond the simple standards required for Packetnets and Internets to define protocols for passing high level messages, such as electronic mail, among computers. Office based applications, centered around text processing, electronic mail, user typesetting, office processing, and electronic filing, all require significant user level standards. Using only lower level communications protocol standards will cause a combinational explosion of high level protocol changing gateways. This leads to added overhead, extra development, delay, incompatibility, and often, misinterpretation of messages.

In the low priority area of intra-computer architecture, the U. S. Government has standardized on the existing defacto standard, the IBM Channel, as the means of interconnecting mass storage to computers. Unfortunately this act of standardization will limit change into newer systems architectures.

Useful Applications and Distributing Them

Decisions to use the major applications centered around office automation are very complex. Justifying an application generally requires an understanding of both computer systems (beyond that provided by manufacturers) and the organizational structure of individuals and group users. Although electronic mail seems right, measurements of increased productivity, decreased paper flow, better decision-making, efficiency of communication, and the creation of excess communication are hard to make. To my knowledge, they don't exist.

Given that few measures exist to rationalize, simple stand-alone applications, justifying a distributed network becomes a work of art. Tools have only recently become available for a system manager or developer to distribute the database, processing, and intercommunications over several systems. In the specific case of distributed processing for electronic mail, the results are encouraging but a general solution has not yet emerged.

An underlying difficulty of building applications beyond the generic office automation described above exists because problems are solved by patch-work. Usually programmers with computer science (computer engineering) training and a representative of a particular discipline (eg. accounting, mechanical engineering) put a solution together to get something started. This results in sub-optimal designs. In order to use the computer as a component of systems they design, rather than as a simple tool for problem solving, computer science must take on a pure role, like physics, and each of the disciplines take the responsibility for training people and engineering the systems within its own discipline.

Algorithms

There are many cases of the adage: "It is better to work smarter rather than work harder". If always exponentially improving, technology will eventually permit solving a particular problem in a reasonable time, e.g. a 24 hour advanced weather forecast must be solved in less than 24 hours or an exponentially increasing machine population will be required. However, at a given time, algorithms limit when a problem can be solved and whether it is economically feasible.

Human Interface
The interface between the system and the final user is a barrier in the same way that a root system for building applications programs is a barrier to building applications. Adding more functions so that an application will perform better is generally accompanied by increased complexity requiring more documentation and training. The lack of standards at the user interface will limit getting the payoff inherent in a given system or set of systems, and may cause adverse user reaction. For example, word processing, electronic mail and user typesetting systems are all likely to have different syntax, semantics, manuals, training and procedures for dealing with the same text.

A DISTRIBUTED PROCESSING ENVIRONMENT
Proliferation of dispersed computing forces interconnection, hence distributed processing, so that human users don't have to become information carriers and translators between the different systems they use. Communication within and between organizations with common carrier networks is provided via an interconnected hierarchy.

Interconnecting the Components
The three types of computers in a given organization will be connected via high bandwidth links in what may appear to be a hierarchical structure. In addition, clusters may be connected on a fixed basis. The alternative interconnect possibilities are:

.ethernets or rings to interconnect all terminals and computers with specialized terminal concentrators;
.evolution of phone circuit switches using digital techniques for both voice and data;
. packetnet switching; and
.direct interconnection among the computers with routing through each computer.

Central Computers
The top most computers of the hierarchy will evolve from the current, highly central computation facilities. These

machines store most of the data and do most of the computing in today's organizations. Given the difficulty of migrating files and work from these machines, the emphasis within the centers will be interconnection among the machines within each center, creating in the short run, even larger data bases. The tight interconnection among the central computers will also permit trade-offs among cost, reliability, performance, and evolving performance, for a given application or set of applications. In order to get the economy of scale required to support the large human organizations that attend central computers, their functions will have to be specialized (e.g. front ends for handling many communications lines, and back ending for databases and archiving).

Central computing facilities will continue to be operated by large staffs whose emphasis is on knowledge of the operating systems and getting work done using highly specialized facilities such as CODASYL Databases. The casual user will be dependent on the central systems through the applications. Cost will be high for everything except the storage of very large files, where hardware provides an economy of scale. Programming costs at the center have to be the highest, because the facilities are general purpose and applications are most remote from the ultimate user. The role of central facility will be to provide:

.communications among all the other computers within the organization including gateways between various computer and telecommunications vendors;
.   archival file storage;
.unique, sharable facilities such as very high speed computers and printing devices;
.computational functions for the entire organization e.g. electronic mail;
.operation of historical programs and data bases; and
.relatively high cost computing by having to provide generality and service for the worst case.

Group Level Computers

Group level computers are based on the evolution of timeshared and real time minicomputers and cost roughly that of an additional person. Typically these machines support the single function of the group, (eg. order processing, engineering design and data base, laboratory data gathering and analysis, group word processing, single process control) running a single unattended program. Group level computers provide:

- .relatively cost effective storage of the group data base;
- .unique program(s) aligned with function of the group;
- . relatively high performance processing; and
- .cost-effective computing through sharing of a common function and specialization of work.

Personal Level Computers

Personal computers are emerging rapidly, and many believe that they will become the dominant form of computing. Since the only hardware technology for which economy of scale holds is mass storage, and given that all terminals already have embedded computers for control, it is easy to envision adding more primary memory and doing all the computation at the terminal instead of having computation done in any shared facility. A recent, Carnegie-Mellon University personal computer research proposal states:

> "The era of time-sharing is ending. Time-sharing evolved as a way to provide users with the power of a large interactive computer system at a time when such systems were too expensive to dedicate to a single individual...Recent advances in hardware open up new possibilities...high resolution color graphics, 1 mip, 16 Kword, 1 Mbyte primary memory, 100 Mbyte secondary memory, special transducers,...We would expect that by the mid-1980's such systems could be priced around $10,000."

Personal computers provide:

- . personal data bases and security;
- .more, average computing power, with better response time than shared systems;

.needed processing for the computationally intensive tasks like editing, and speech i/o;

. a program creation environment; and

.relatively higher costs than group level computing, unless the task is very specific and well-matched to the system.

Although both the novice and experienced user relish the independence that the personal computer provides, communications and support by the other levels is equally necessary. Given that we are substantially far from such distributed systems, there are surely additional problems, limits, and opportunities that are yet to be forecast.

GB2.S4.8
To: ? From: Gordon Bell

Apology to Reviewers

We're submitting this paper even though it needs another editing pass!

Tenses: past for divisions
past for computers

monitors **dead** if not running

Given: All **past**.

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M e m o
!___!___!___!___!___!___!___!
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TO: see "TO" DISTRIBUTION   DATE: MON 6 JUN 1983
3:39 PM DST

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

cc: DAVE CUTLER
DICK HUSTVEDT
BERNIE LACROUTE

MESSAGE ID: 5202115163

SUBJECT: APPLE VISIT (AND WHY THEY'RE WINNING)

GB5.49

Wayne Rosing gave me a tour, and I had a nice visit with Steve Jobs.
Wayne left in the summer of 80 and Ken Okin joined him in Sept. 81 to
head the hardware. Wayne is taking over as head of the LISA division.
The whole project is roughly the age of the PRO.

LISA

Would be very proud of it (and happily trade several of our PC's,
their parents and offsprings for it). It is clearly a new generation
based on Xerox PARC's Alto and the STAR (and their designers); and
should achieve the $1B sales they project. All of the first 30 sites
who have the 300 machines have ordered more and one site has ordered

1000!

(We must do at least as well with the VAX PC's in terms of function
and performance; i.e. we simply cannot blow it again -- that is if we
can ever get a project going. We have to be good. It has to be a PC
cluster and it has to network transparently to shared VAXen.)

This version is 80 watts with Apple floppies, backplane with some
components, 3 boards (5Mhz 68,000 Processor plus bitmap video (NO
HARDWARE ASSIST) and 3 ports, 2 memory for 1Mbyte boards). There are
3 option slots (in a different place for customer access) using ZIF
connectors. An encryption chip can be plugged in. The keyboard is
simple and doesn't require an executive size desk (for the executives
who can't type or use computers anyway).

A separate box holds the 5 Mbyte Wini. Several printers are offered
-- all are capable of printing what the computer generates -- unlike
our terminals and PC's (Wayne may have learned what not to do). He's
proud of their low cost to produce Mouse that he insists trying to
make here.

We might expect an integrated version with no extra wini box and a
large file server to emerge. The current Mbyte system has lots of
ways to evolve: color, flush the disk and use a central file server,
use larger rams and bound it, use say 256 Kbytes and paging with the

68020, etc. all of which make it more competitive.

SOFTWARE

The software performance is fine, but they're shooting for x3 speed-up. They simply do not do things (eg. bottom line editing) that will cause a product to look or "feel" bad. The functions (i.e. generic applications) they provide are the key ones. They have a PERT because they built it a year ago to run the project.

The system was written in an extended Pascal except for some low level bit map operations. They have a very nice interface for 3rd party and OEM applications writers.

The mouse operates very smoothly for editing and other functions, although the keyboard can be alternatively used. (A track ball might be even better to avoid needing more desk surface.)

They apparently have a very good algorithm to scale various fonts stored in a canonical size. Work like this has been going on at Xerox. This is non-trivial and represents a real edge.

The project ran a total of 4 years under high pressure, but really

didn't get going until Wayne came on board. The engineering supposedly cost $50M, a bargain (about what we spend on DECmate, and
close to what we spend each year on PRO or on Office).

LISA Division

John Couch hired Wayne who's now going to head the division. John's
going on a brief educational leave to return to run the software business (division?). The wholly self-contained division, complete
with its own bank account, has about 300 -- with 130 engineers (note
hardware and software are together), 100+ in manufacturing start-up
and the rest in marketing. They can make about 50/day in the current
quarters, but are transferring the manufacturing to Dallas -- where
they'll be going to 150/day. Wayne believes the self-contained division enabled them to move rapidly and efficiently. Wayne's taking
all the engineers to Hawaii for a week (at a $250K cost). (DECwest
feels even more autonomous -- and competent!)

The divisional structure does the obvious: dedication to a product
and market; conflict with their sister division and incompatibility
among Apple II, III, LISA and (hopefully) MacIntosh. It's unclear
what Steve Jobs' priorities are: MacIntosh (and his technical ego)
versus Apple (and other products). For our sake hopefully Jobs wins.

They have central sales, and a central manufacturing organization is
evolving. Ken Okin is now concerned that it takes a year to get

something into "volume" production -- not unlike DEC.

Apple-Net

Wayne says it's the "thinking man's Ethernet". 128 taps operates up to 2000', over Twinex at 1Mbit using CSMA/CD. A machine can be up to 100' from the tap. The taps are completely balanced, passive and transformer coupled ala the phone system. This gives them the ultimate in ease of installation and UL.

They have single and quad taps, this makes the simple net very low

cost. The price of a machine port should be $400. They'll license Applenet. They're working on servers. They're providing Ethernet connections via 3COM. They're postured to adapt to the IBM LAN and are "buying out" the SNA interface.

JOBS (and Apple)

Steve Jobs is a young (28) impressive, aggressive, knowledgeable, charming, non-humble engineer who acknowledges few, if any mistakes. Am sure glad we have no one like him. (Ken Okin said he'd even trade me for him.) I met him at a conference on Japanese competition on the weekend.

Steve opened with a question -- "didn't I believe it was too late to
enter the PC market, given that our first three computers were so
dull?" Unphased, I said I didn't think we had an option of not being
good -- whatever that takes, and no matter how long it takes. (Now
what do we do?

The discussion ranged from "post-LISA" to why it was difficult to
engineer their own floppy (i.e. there are no motor engineers; and the
many Japanese companies have many competitive floppy projects before
choosing).

He's most proud of getting to $1B with only 4Kp, and wants to get to
$10K with only 10Kp! He thinks this will require them having 6 very
good products. (Note we have about 5 very good products/systems that
deliver perhaps 80% of the revenue. These carry average and mediocre
components and 500 poor ones.) He espouses building only the best
products and hiring only the best people and having them work in small
teams. He wants nothing to be average, and the way to do this is to
keep things small and manage by results, not large groups and
bureaucracies. This is why they're eliminating the Apple III.

They're building the "world's most automated factory," and he's
shooting for an inventory turn of 16-20 -- enough to beat the Japanese
(at 12), and to better their 7:1.

Bottom Line

LISA looks like about the first PC I really want because it offers capabilities I haven't had in circa 1965 timesharing and their RT/CPM derivatives. Yes, it makes any slides in mixed fonts and graphics at any scale. It's clear we do not have a project aimed at getting such a PC -- nor if we had such a project, it would take at least 2 years to get comparable software. The good news for us is that the 3rd party software world's working on those pieces -- to target LISA, for the 8086 and 68,000. If we move rapidly, can buy and integrate them. (Barry, your job is clear...buy and get us this capability.) It's clear to me the battle's over in the 16-bit space with the 8086 winning it since we never entered it with our protected, vanity PDP-11.

If I had to bet on VAX and MicroVAX in the 32-bit PC space against the 68000 (and its extensions for demand paging to give VAX capability) and the fact that everyone will be building applications for it, I'd want incredible odds because I don't think we even understand there is

a race, where it is or how to enter it.

Today, we're clearly irrelevant to personal computing, except to our existing customers -- where we have 100% market share of a flat and inevitably vanishing market.

"TO" DISTRIBUTION:

MKTG/SLS STRAT COM: PRODUCT STRAT COMM: JACK SHIELDS

- 4 -

WPS USERS - Leave HP mode and type <CR>

July 9, 1979

Donald C. Knapp, Publisher
Appliance Manufacturer
270 St. Paul Street
Denver, Colorado 80206

Dear Mr. Knapp:

Would you please remove my name from your distribution list. I no longer wish to receive this magazine. Thank you.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:swh
GB0003/71

00 CORE DECGRAM ACCEPTED S 002003 O 184 14-SEP-82 6:14:16

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION

DATE: MON 13 SEP 1982 4:35 PM EDT

FROM: GORDON BELL
DEPT: ENG STAFF

EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

MESSAGE ID:
5175576610

SUBJECT: APPLICATIONS PRODUCTS:HOW CAN WE DO THEM?

SITUATION

We're being forced out of the basic systems business by several
factors, including the low business entry cost brought about by
assembling: Winis, monitors, micros, CP/M or UNIX, and published
software. One course is to go into applications...again!

HISTORY (Industry and at DEC-disasters)

With each new generation (1966-1972 all the minicomputer companies
formed because the barrier of requiring circuit design was lifted:
ASI, Beckman, Computer Automation, Data General, (Datacraft, Data
Machines Inc.), ESI, Foxboro, General Automation, HP, Interdata,
Jacquard Systems..., SEL, Standard Computer Corporation, etc. Not
many "made it" and outside of the 11's, no eal standards formed. I
can say that NONE of these contributed to computing, computer
engineering, or very much to its users except heartburn.

Digital's reaction in the late 60's, prior to getting the 11, was to
"go into Applications", with:

Typeset-8 (Henry Burkhardt)
CLINILAB-8

Pulse Height Analyzer (OK, but limited)
Lab-8
Industrial-8
PDP-14 (Alan Ricketts)
Dibol (for building business applications)

More recently, we added:

Word Processing (Dan Bricklin) and Office Automation
Medical
Engineering (Electrical CAD, Structural CAD, Manufacturing (Floor Control)

With the exception of Engineering Application which we bought out, these have ALL been below average.

WHY AND CAN WE LEARN?

Market Pull and the Pseudo Entrepreneur:

Unfortunately, business schools have given what might have been some bright engineers, and others the verbal, and a few analytic skills to "sound-like" entrepreneurs and "business" folks--we often also call this marketing. An instant business is simply based on buying a 1"-2" market survey report, indicating that there may be X who'll pay Y for

Z. Fixed and variable costs are assigned, a given 20% PBT is used and a 2-3 years to get the whole operation started is assumed. A good computer program could write all our business plans--because all it has to do is to appeal to our opportunistic greed.

Unfortunately:

0. Succeeding in applications requires expertise. We have only expertise in building computers!

1. The product is totally absent from the plan.

2. The market/product is inherently the most risky because it's based on having the most market surveys written about it. Possibly it's the largest of various alternatives. Most likely, in a high technology business the real market is just forming somewhere else!

3. Alternatively, it is in an area that's growing rapidly by newly formed company(s) and competent competitors with real expertise.

4. Only pseudo entreprenuers do it: the real entrepreneur wants real risk, real payoff and a real bank(er). None, are present at DEC, except relatively high personal risk. In return here's lots of money to play with.

The Application-ie. the Product and the Engineer:

The engineer is really the key to business (failure) and with the pseudo entrepreneur forms the deadly duo.

Mainstream engineering is demanding, yet paradoxically the most attractive place to be, the project is a fishbowl, peers are tough, and the expectation is perfection. Applications within DEC are non-mainstream, and hence likely to be: invisible outside the particular product/market domain; and because the peers are likely to be few and weak; and totally trusting to their market counterparts because they have little or no understanding of the product domain.
Unfortunately, there's a deadly embrace of what are likely to be two trusting, non-trustworthy souls.

CAN WE DO APPLICATIONS WITH TWO STRIKES AND A WEAK TEAM?

Probably not, based on history and on averages! The original typesetting and WPS were good and state-of-the art because of Henry Burkhart and Dan Bricklin designed and built them.

Since we're determined to keep trying, and in some sense need to

succeed, maybe there are some heuristics:

0. Adhere to "Heuristics on Building Great Products"--as written!
Our opportunistic approach is a clear loss.

1. Ignore all plans for markets that are not based on products - i.e. exactly what a product is, how it'll be used. This automatically throws out the two latest "dreams" for large markets--i.e. the PDP-1400 (the giant, vanishing Industrial Control Market...because U.S. Industry is vanishing and because modern machines are integrated with computers.) and the enormous small-business computer or small business computer market.

2. Buy it! Don't make it from scratch! In DEC's case we have a wonderfully wide spectrum of users. Somewhere, one of our computers is doing a very similar job. This is the secret of the Engineering group's success. No one else has copied their formula!

3. If it must be designed from scratch, get the best engineer who's done it before and "trust" him to lead a small team to do it. "Trust" is earned and clearly demonstrated by lucid specs and a willingness to proceed through clear milestones in an OPEN, inspected fashion. "Trust me and don't bother me (non-inspection)" are the best single indicators of an

incompetent and that project is doomed. Clearly staff the project with real engineers. I'd probably go to the SW Services organization to look for such a person and/or a product.

4. In a new area, design it carefully with some real way to test it. For example, our EMS was tested first on 10's in the ARPA net, migrated to CCA's Comet, and was next implemented on MUMPS in LDP, then applied by DIS. It's been enhanced in the field. DIBS was a similar case.

5. Find some method of using field prototype or example as a means to really define or refine a product. Ideally, use DEC as the guinea pig customer--whether it be a WPS, Mail, voice mail, typesetting, manufacturing system, business system, etc. HP calls this concept "satisfying the needs of the engineer at the next bench". They've also been successful at automating their manufacturing plants and their selling the solution--we do neither! It's very likely that in the 60K people we employee, several need and can test the system.

6. Once there's a product, find someone to help market it! This is not the chicken and egg problem. We covet many markets with no products for them. Rarely do we have great product

that go unmarketed.

BOTTOM LINE

Applications don't appear to be optional for our future products.
Unfortunately, we have no unfair advantage...in fact, everything
including our history indicates high risk.

I don't see how to win.

Any ideas?

Can we discuss at a relevant WOODS?

GB3.S7.22

"TO" DISTRIBUTION:

DON BUSIEK JOHN O'KEEFE OPERATIONS COMMITTEE:
PEG: PL MANAGERS: LARRY PORTNER
OLLIE STONE

APPLICATIONS PROGRAMS POSSIBILITIES

KEY TO USE?

WILL PROGRAMS BE STANDARDIZED, TAILORED, SELF-INSTALLING AND

ENVIRONMENT ADAPTING?		
	non-procedural	. NATURAL LANGUAGE . PROGRAMMING BY EXAMPLE . DATABASE AND QUERY . INDUSTRY APPLICATIONS (knowledgeable installers)
HIGHER LEVEL "programming or learning"	procedural layered languages	. HIGH LEVEL PROGRAM LIBRARY (e.g., payroll) . PROGRAM GENERATOR FOR . SUBROUTINE LIBRARY . LOW LEVEL (e.g., cobol)
fixed programs ADAPTS with PUBLICATION AND high volume use		. KNOWS GENERALLY, THEN . THIRD PARTY --> MASS SELECTION OF PROGRAMS
TO ADAPT		. GENERAL PACKAGES WITH Q/A

. FIXED, SIMPLE GENERIC TASKS

(e.g., word processing)

HOLD

ID#0186

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+---------------------------+
|   |   |   |   |   |   |   |
| d | i | g | i | t | a | l |
|   |   |   |   |   |   |   |
+---------------------------+
```

i n t e r o f f i c e   m e m o r a n d u m

Subject: **Doing Applications Software in the Field (Australia)**

To: Max Burnet, John Holman, John Jones, John Leng, Si Lyle, Julius Marcus, Larry Portner, Peter Watt, Jerry Witmore	Date: 78 AUG 14 From: Gordon Bell Dept: OOD Loc.: ML12-1 Ext.: 2236

With tight funding in Australia, the VAX at the price is an ideal machine size. There are many qualified programs and programmers here and it would be nice to take advantage of the talent somehow.

John Jones has stated that we are going to be in a bind regarding offset (i.e., where we must spend a certain amount within Australia). I believe software development is a good place as there are talented ESG, EPG and LDP programmers. There are also commercial people. Since the pressure will come through GIS, maybe it all has to be done there. I strongly advocate applications programs versus compilers for our basic languages. Problem oriented languages would be the approach I'd see to spend money wisely.

John may make a proposal, as we still have time before getting the maximum pressure.

If we got such a scheme going, it would solve the problem of discounts. Universities would rather have R and D contracts than discounts, even if they amount to the same thing. They can usually finagle internally to get the contract money back to themselves in the form of cash.

There's a nice portable system called DAEMON for running FORTRAN, BASIC, or COBOL on an 11/04 on a cart at Monash University. It has card reader plus mark sense cards and gives very low cost for student jobs and for RJE to large systems. About 80 have been sold in Australia and surely at least the same number could be sold in Europe. We need a mechanism (here CSS) to get things like this marketed.

In talking with Peter Gray, N.S.W. SWS, he suggests that 6-9 mos. program commitments can be made easily. This could be a buffer in their pre-sales/warranty/PL90 resources allocation.

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST: Max Burnet SN John Holman PK3-
1/P84
John Jones SN John Leng MR1-
1/A65
Si Lyle MR1-1/M42 Julius Marcus MK1-
2/C37
Larry Portner ML12-3/A62 Peter Watt SN
Jerry Witmore PK3-1/M40

February 22, 1980

John Zarrella
Microcomputer Applications
P.O. Box E
Suisun City, CA 94585

Dear Mr. Zarrella:

Enclosed is a copy of Computer Engineering: A DEC View of Hardware Systems Design. It contains much of what we know and what we believe we have contributed to computer design.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:swh
GB1.S2.16

Enclosure

FROM: GORDON BELL DATE: THU 17 JAN 1980
4:59 PM EST
DEPT: OOD
EXT: 223-2236
TO: JIM BELL
OLLIE STONE
DICK STRAUSS
CAROL BAILEY
cc: STAN OLSEN
GERALD T MOORE
LARRY PORTNER
BILL JOHNSON
BILL TURNER
BILL KEATING
SAM FULLER

SUBJECT: RISKS/APPROACHES FOR APPLICATIONS IN 80'S

The Operations Committee has asked me to comment on the above. Currently we seem to be studying, developing, or marketing applications using the following:

1. General purpose, fixed function (e.g. WPS which we fully developed).

2. Generic Business as in DIBS, where the user specifies a few parameters (sold in the store). DIBS was purchased from an OEM, then tested and documented.

3. Vertical Business Applications (e.g. Distribution Control) using parameters to set the particular type and size of the business. Study place under Bill Turner.

4. Vertical fixed function, by developing an application in conjunction with a user, Dentist and Contractor packages under Store's Management.

5. Buying successful vertical packages as we did in the case of DIBS, then testing, documenting, and building training programs around them. Not beign done that I can feel.

There are also the possibilities of:

1. Low cost, mass produced highly specialized small packages developed for high volume hardware by us or a user community.

2. Very high level languages, e.g. MPG to aid productivity so as to make any of the above easier and more feasible.

Ollie, would you convene this group to assess the applicability, component costs (for definition, design, programming, documenting, testing, redesign, courseware, etc.), and risks of the above (and any other) approaches for various types of programs that we are planning to offer?

Please get the group together and then meet with me to scope the work. (Jim may want someone else to attend for him.)

GB:swh
GB1.S1.24

```
*****************
* d i g i t a l *
*****************
```

TO: BILL AVERY   DATE: THU 11 JUN 1981
14:19 EST

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION

DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: APPOLLO

MIT has two Appollo's I was surprised at their large size. They had
an 8" Wini (30 Mbytes) plus either five or seven super hex sized PCB's
with one spare PCB, using 16K rams, and giving 1/4 Mbytes, A1 Vezza at
Multics can demo it.

Is Nebula that far off at:

Processor and memory	3	
Ethernet	2	(then 1)
Display	4	(or 2)
Disk	1	
	10	(7)

Also, it's now.

GB.MAL
GB2.S6.45

"CC" DISTRIBUTION:

GUS ASHTON
BILL DEMMER
ANDY KNOWLES
PETER SMITH

Command >

FROM: GORDON BELL DATE: SUN 16 DEC 1979 4:58 PM EST
DEPT: OOD
EXT: 223-2236
TO: JIM BELL
PHIL TAYS
GEORGE HOFF
KENT
OOD:
cc: DICK BEST
ALAN KOTOK

SUBJECT: APPROVAL OF PAPERS FOR VARIOUS PROCEEDINGS

I am to approve two papers for submission to conferences: Ivan Dobes' on CAD associated with MCA (although there is no mention of anything associated with mca); and Bob Hannemnann's on thermal design of the package around mca.

Frankly fellows I'm really pissed because I believe this is not a good idea to publish these papers at this time. Specifically I thought we all decided after the last flap on Comet that we would not publish anything about any of our product related work
until the work came out in a product. Bob's work is especially not publishable by another criteria: the program is not working yet that does the design. Therefore, let me ask that the papers be withdrawn.

Assuming these are good papers that will benefit people who are working with gate arrays (ie our competitiors) and in the design of systems built from ceramic substrates (ie our competitors)
then let me ask some other body who is a little less irrationale than I to look at the matter. Could we get the Engineering committee to review our policy, whatever it currently is, and to
rule on this work. While it is not feasible to meet the current deadlines of these proceedings, they can be published in the next conference (assuming they are publishable). The committee might want to change the current publication policy. Is there

another paper that John Holman is concerned with?

Until the Engineering Committee reviews the policy and these papers
then let me be arbitrary and reiterate what is my probably unwritten
policy: We are not going to publish papers on product or process
that are product related until the product in question is announced.

MCArelated papers particularly bother me because the producti is so
far away in time, and I perceive all we are doing is helping IBM and
the Japanese who are already ahead of us to tune their design processes.

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<from>PEATMAN, JOHN B.
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<message>URGENT! I NEED TOKNOW BY NEXT FRIDAY, OR MONDAY. SHOULD WE RUN THIS COURSE? PLS. EMS ME.
<answer>PEAT IS SCHEDULED VIA SAM TO GIVE A TALK 8/14 OR 15--

6/9/80
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<subj>RESUME' - WAYNE C. MIDDLETON
<from>MIDDLETON, WAYNE C.
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<subj>SOLAR VENTURES
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<from>HILL, DENNIS M.
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<date>80/4/17
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<dispo/date>JOHN DIPIETRO - 4/29/80
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<subj>LOCKSON SERVICES LTD PACKING & SHIPPING
<from>ARMITAGE, DAVID
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<date>80/4/15
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<subj>KALBA BOWEN ASSOCIATES INC.
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<from>OLDFIELD, J.V.
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<subj>PLENUM PUBLISHING CORPORATION
<from>TASH, MARTIN E.
<to>BELL, GORDON
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<from>RICKS, ROSENA A.

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<from>TATOSIAN, HAIG A.
<to>BELL, GORDON
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<date rec>4/17/80
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<dispo/date>BERNIE LACROUTE (CC: CROWTHER, HOLMAN, M/C, DEMMER, BJ, KUR, ECKHOUSE, HEFFNER, DALEY, KEATING
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<answer>
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<from>SHENTON, ROBERT
<to>BELL, GORDON
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<subj>RESUME' - RICHARD TRAUBEN
<from>TRAUBEN, RICHARD
<to>BELL, GORDON
<date>80/4/9
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<log#>4-34
<dispo/date>ORIGINAL RETURNED TO GB (CC: TEICHER, ZEH, MOFFA) - 4/23/80
<message>PLEASE CALL HIM.
<dispo/date>ARMAND LA VALLE - 5/16/80
<message>PLS. HANDLE - THIS HAS BEEN SENT TO MOFFA, TEICHER, + ZEH. THE APPLICANT IS WAITING FOR SOME RESPONSE.
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<subj>BUSINESS & SOCIAL RESEARCH INSTITUTE
<from>VEDIN, BENGT-ARNE
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<from>TAYLOR, BARRY N.
<to>BELL, GORDON
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<from>STERN, STEVE M.
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<dispo/date>STU WECKER - 5/19/80
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<date>80/4/11
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August 17, 1978

Dr. Yugo Araki
Koyoto Sangyo University
KYOTO. JAPAN

Dear Dr. Araki,

Reference is made to Gordon Bell's letter sent to you the first week in August.

Following is the information regarding where the TBM (Terabit Memory) can be obtained:

Zasar Syed
Systems Development Corporation
2500 Colorado Avenue
Santa Monica, Calif. 90406

Telephone Number: 213-829-7511
extension 2336

Sincerely,

Mary Jane Forbes
Secretary to Gordon
Bell

MJF:ljp

I'm honored to have this award for three reasons: First as an engineer in the tradition started by Eckert and Mauchly, second as a founder of the Digital Computer Museum, and third as an author. First, as an engineer I am very proud to have the award, and I have many others to thank for it. Like Eckert and Mauchly, I worked with and built on the work of others. Most computer innovations are not made by one person: As a writer my co-authors, especially Allen Newell, and also Dan Siewiorek, Craig Mudge, John McNamara, and John Grason need to be thanked. As a museum founder, Ken Olsen and Gwen Bell, who is now the President of the Museum Corporation, are important. And as an engineer, the first people to thank are Ken Olsen and Ben Gurley, who were responsible for conceptualizing a commercial computer, the PDP-1, based on their development of the TX-0 and TX-2. I want to acknowledge Ed DeCastro who implemented the PDP-5 and 8, Alan Kotok who worked with me on the PDP-6 for the first timesharing system. Roger Cady and Harold McFarland on carrying ideas for the 11 and although I lead the early design group on VAX, it's really Bill Strecker's work with Bill Demmer leading the development. Dave Cutler was responsible for the design and building of VMS. Many others also contributed.

As a founder of the Digital Computer Museum, this talk gives me a chance to tell you about it.

<>Entrance DCM. When I talk about the Digital Computer Museum, the image in my mind is of the American Museum of Natural History -- where twelve acres are devoted to the collection and study of the natural world. Similarly, the Computer Museum will collect and preserve all computing history for its study and interpretation. Computing is large and important enough to have its own, special, centralized Museum. Science is too large. National, corporate and local museums don't provide good comparative history.

<>Hollerith. The Digital Computer Museum is a public non-profit charitable foundation whose purpose is to preserve the history of all of information processing. That means that you and your organizations can give the Museum equipment and money and receive a full tax deduction. The Museum, in turn, is obligated to preserve artifacts. The collection not only includes computers, but also calculators, memories, links and switches, transducers, controls, and robots, that is the whole range of components that Newell and I outlined in the PMS notation. Already the collection has grown to the extent that we can claim to have the most comprehensive exhibits of the origins and evolution of computers.

<>TI exhibit. Its fitting that I'm speaking in Texas because Texas Instruments was the first outside donor giving us the heart of an ASC and really helped establish an industry wide effort.
<>Another shot. I want to invite all of you to come see the Museum, join the Association so that you can receive its quarterly report, and consider it for a depository of the important papers and artifacts of computing history. (And, by the way maybe this will help me lure Pres Eckert to come and give a Museum Lecture -- He has a standing invitation from us.

<>Computer Generations Cycle. As an author I need a deadline -- like this one. The talk is evolutionary and I hope it will be part of a biographical monograph on Computer Evolution.   Although the examples are historical, I can't claim to be a historian only a biographer. The focus in this talk is the middle of the evolutionary process, that is, the computer engineering needed to implement ideas before they become obsolete.

The revolution started by ENIAC generated this evolutionary cycle. The need for making ballistics calculations started the cycle. This generated resources that allowed a team to integrate technologies into a new machine for satisfying the need. The moment ENIAC started to calculate, it's use set the cycle off again. Users identify new things to do with computers and provide market resources for new machines. Fred Brooks makes this point clearly in THE MYTHICAL MAN-MONTH, stating, "the incompleteness and inconsistencies of our ideas become clear only during implementation." (p.15) If idea generators, and builders aren't involved in use, they won't understand the evolutionary trend enforced by feedbacks. Closing the loop results in computer evolution -- not revolutionary new machine design.

Like all cycles this one has periodicity. New technologies, needs, or uses can trigger a small spurt -- and the coincidence of all three mark a new generation and a branching of the family tree of computers.

<>Light bulbs. Technology provides the base tools from which computers are developed. Inventor's ideas are the bright lights floating between technology and society's dreams. At the dawn of a new generation a number of inventor's concepts converge into a project. Eckert and Mauchley are rightly given the major credit for ENIAC, but Atanasoff's work preceding it is recognized as influential, and their colleagues -- Burks, Sharpless, Goldstein, von Neumann and many others -- also deserve credits. With each generation, the technological floor becomes higher, the user's aspirations rise, and the gap that spurs invention is constant.

<>Generation tree. Computer generations can also be seen as a tree, starting with its roots in scientific and business calculation with ENIAC, a scientific; and UNIVAC, a business, machine. In the second generation, super computers branched from the scientific root and continue on an evolutionary path determined by Seymour Cray. At the same time early scientific and business machines merged into the class of general purpose mainframes ranging in price from 100 thousand to 10 million dollars. Although the idea of the mini, for minimal computer as in the PDP-8 was developed at Digital in the second generation, it flowered as its own branch in the third generation when IC's permitted numerous variants and companies to start. The fourth generation is marked by the branching of the micro processor on a chip. It's too early to see the fifth generation, but either it or the sixth must be identified by a means -- such as ethernet -- for all classes of computers to communicate on a network forming a computing mesh with an interlacing of branches to keep them from collapsing by their own weight.

<>Op rate. During the 400 year, ten generation period from 1600 to 2000, the technological change is roughly a factor of 10**12. Using the product of processing rate and the memory size to measure computing power, then the computer has evolved almost 20 orders of magnitude
<>toes. since stone-based, manual, single register devices for counting supplemented fingers and toes.
<>Generation is marked by. Three ingredients are needed to create a new computer generation: a steady supply of funds, a useable technology, and the machine design.
<>Babbage. Babbage only had the machine design and was destined to work alone because he had no funds.   He tried the patience of government agencies and friends by repeatedly requesting funds without producing results. He always promised the next machine that he had in his mind if only monies were available, even though the technology was not within grasp.
Two of the three is not enough. And having only one of the three -- only the machine design as Babbage had -- dooms a project to failure.

<>Stibitz. George Stibitz at Bell Labs had the funds and was working on the same type ballistics problems as Eckert and Mauchly. He was constrained by the technology of the telephone company; that is to use ... alot of telephone relays. The 1939 machine was the first calculator that could do complex arithmetic and it operated via Teletypes in an interactive fashion. In September 1940, the calculator was demonstrated at a meeting of the American Mathematical Society at Dartmouth. An interface to the teletype designed by S.B. Williams allowed attending mathematicians to transmit problems from Dartmouth for solution by the calculator in New York.

<>BTL2. Bell Labs produced four advanced versions of the machine, and by the mid-fifties this line had died out. Thus, it can be seen that a useable, but traditional technology is inadequate in forming a new generation.

<>ENIAC. ENIAC had all three: Herman Goldstine insured a steady flow of funds from the Army; a variety of technologies, including

<>tubes. vacuum tubes, teletype and card equipment for i/o; magnetic recording in the form of drums; diodes and triodes;

<>flipflop. the Eccles Jordan flip-flop; and switching algebra were available for use under the careful engineering of Pres Eckert, and a new machine design was inspired by John Mauchly.

<>SubProcess. In any machine design, a number of separate, concurrent processes give rise to decision points leading to suspension, continued development, or recycling.

<>Generating a computer structure. Seven processes interact in the evolutionary cycle of a new computer structure. The first process involves defining the problem: understanding the constraints, setting the goals, and determining the objective function of the design. Then, three mutually exclusive decision processes determine the architecture. Selecting the null architecture is calm and peaceful -- not exciting until implementation when almost insurmountable technology problems emerge; choosing an evolutionary architecture that copes with new technology or needs, is like guerrilla warfare -- a few people die on the line and some get caught in the crossfire;   but generating a new architecture means a bloody revolution.

The process of physical design for implementation is concurrent with the architectural design process.

The building process requires complete understanding so that no unplanned side effects occur. The complexity of building computers is so great that even with the greatest care side effects are free. For the lucky designers they're also positive!

The final Process, using the machine, is essential for understanding the next step in evolution and the issues that could lead to revolution. Within the context of the whole cyclical feedback, each process will be considered individually. The process of problem definition sets the constraints, goals and the objective function based on cost, performance and other measureable factors. The physical laws governing materials with respect to electromagnetic energy and heat transfer are obvious constraints. Yet engineers still try to violate them. And we never win.

<>ENIAC plugs. ENIAC was bounded by the reliability of both vacuum tubes and plugboard programming. Mauchly reasoned that even if ENIAC only ran a few minutes it would accomplish more than Bell Labs slow relay machines. It contained 18,000 vacuum tubes each with a predicted 500 hour life. If the machine had been designed using the tubes at capacity, the exponentially increasing repair time would have bootstraped the machine to its death, that is, if it ever lived. Goldstine recorded that by derating the filament and plate only three tube failures occurred per week. The actual failure rate of about one million hours was achieved only by very conservative engineering. Because of the potentially compound problems of tube failure and plugboard connections all problems were run twice to insure accuracy. Franz Alt, commenting on the 40 plugboards and extensive cabling, estimated a five percent utilization rate. Taking into account the amount of time the machine ran, ENIAC was still 25 to 50 times faster than the relay machines. The fact that such a large system ran is a tribute to conservative engineering, mostly on the part of Eckert.

<>Whirlwind. In contrast, Jay Forrester, on the Whirlwind, tackled problems at their source. Concerned with highly reliable, real time computing, he knew that the estimated tube reliability of 500 hours had to be increased by several orders of magnitude. An outside review prodded at the gradual failure mechanism of the tubes and led to marginal checking. By understanding the tube failure mechanism, the manufacturing process, and introducing marginal checking, reliability was raised to five million hours.

<>Von Neumann. In the later forties Von Neumann, determined to build IAS, put his faith in new undeveloped technology for a fast parallel memory promised by RCA. After two years of work on the Selectron tube, with vague but optimistic quarterly reports, not one had worked.

<>Selectron tube photo. Julian Bigelow reports, "No one in the IAS team was sufficiently expert in electron tube design and manufacture to be able to assist it, but in conference with Von Neumann I made an attempt to list the variables which would have to be kept under control to produce a 50% yield of successful selectron tubes, covering a range of digital capacities from the original goal of 4096 digits per tube, down through 2048, 1024, 512, etc. It appeared that...the goal of 4096 per selectron was far too ambitious, and that acceptable production yields might be far sooner attained if the goal were reduced to 128 digits per tube." This 256 bit Selectron finally became available in 1953 for Rand's Johnniac.

What did Von Neumann do for his memory? He sent an expedition to Manchester where Fred Williams had built random access memory tubes with 1,000 bits, each.

<>WW Tube Memory. Jay Forrester did the same. The two Mhz clock and 50 K ips speed using MIT adapted Williams Storage tubes cost $16,000 per month to operate. Impressive, but expensive. Searching for a better solution Jay Forrester started to investigate using magnetic cores.

<>Ceramic Core. At first they used wound magnetic tape Deltamax cores. Then beautifully made, but little understood, ceramic cores were found at Philips. According to Forrester, the manufacturers claimed that they could not be used for storage. Theoretically this was true, but it didn't stop Jay Forrester from trying ceramic cores and succeeding. Forrester commented, "This is an example of where the art was substantially ahead of the theory. Cores worked and could be made by trained ceramicists. Years later scientists understood how and why, but for many years production of ceramic cores was a materials art."

<>Forrester and Core. Forrester did not depend on outside suppliers but started his own experimental development on the core memory. MIT's University Research Corporation did not see fit to patent the core because they considered its commercial applicability would be negligible. Forrester got MIT to patent it, and to his chagrin (and probably many others) kept many patent lawyers in business for years. He stated, "The Patent effort and litigation took about 1000 times the effort of the design. It took six years to convince industry to use the core and then six years to convince them they hadn't invented it." In this case, IBM lost the suit against Forrester and MIT, but they still will not readily admit it. I was recently told that IBM invented the co-incident current core memory; An Wang and Jan Rachjman of RCA also claim invention of the core.

<>Turing. In 1958, I visited Wilkinson, who while working for Turing, designed the Pilot ACE, the prototype of English Electric's Deuce that I had been programming. I told him about a symbolic assembly program that two of us built to optimize instructions in a delay line in conjunction with a backing drum memory providing one of the first one-level memories. He asked me for a benchmark. I compared it with the results using a new program language called Fortran, which he was even more skeptical of. A matrix routine could be coded a factor of 10 faster than the current method of hand allocating, assembling and key punching programs in row binary but still a factor of 4 slower than using Fortran. He said, none of this matters, "I can write any matrix program in machine language in 15 minutes: why should we waste the machine's time in doing it?"

While, I admit that the Turing influence was extreme, after initial funding, most of us still take ourselves as the archetype user.

<>GB and average man. All of us, including myself, want to design computers and languages as if we're the average man. This proves it to you. I'm absolutely average, so I can do it and tell others how to as well. A greater pitfall than designing for yourself, is designing for a proprietary user. Paraphrasing a remark by Charles Wilson of GM: "What's good for General Motors may not be good for anyone else."

<>Photo of PDP-14. I don't know how many of you recognize the PDP-14 for controlling transfer machines. This doesn't mean we shouldn't have built a machine to solve the control problem. The designer should formulate the NEXT problem for the machine, not just the one at hand.

<>Military. The ultimate in vanity architectures are computers built for one of the world's largest organizations, the Defense Department. I've never met ANYONE who admits to being either the designer or specifier. The current Military Computer Family effort is designed to take incredible engineering resources out of circulation, guarantee high prices, and worst of all, insure obsolete equipment. Their Russian counterparts base computer designs on US commercial architectures and probably their implementations. No real benefits will come from building the MCF VANITY architecture.

<>Generating #1. While need orients designs and generates resources; as the sole constraint, exact need is detrimental to progress. Standards represent the ultimate in constraints. Getting the right standards at the right time is essential for widespread implementation. If a defacto standard exists, such as the IBM channel and Unibus, let it be. If a standard is needed, then go all out to create it so that others can avoid the hassle of having to invent in an area that will generally make work. Alternatively anarchy can reign until IBM makes an ad hoc decision, and then it can be accepted in a de facto fashion and we can all try to implement it.

The ultimate in standards is implementing a computer based on an existing architecture; this is the null architecture design process.

<>EDSAC. Maurice Wilkes, who took the 1946 summer course on the ENIAC and EDVAC at the Moore School, returned to Cambridge University and built and programmed the EDSAC. This first, full scale operational stored program computer, was based on a simplified version of the EDVAC and IAS. In 1949, only one month after EDSAC was operational, Maurice Wilkes perceived the value of a series of computers sharing the same instruction set. He stated, "When a machine was finished, and a number of subroutines were in use, the order code could not be altered without causing a good deal of trouble. There

would be almost as much capital sunk in the library of subroutines as the machine itself, and builders of new machines in the future might wish to make use of the same order code as an existing machine in order that the subroutines could be taken over without modification."

<>EDSAC or Maurice. This advice is even more applicable today than it was then and must constantly be reiterated to us all! In a recent editorial in Computer Design, the editor in chief commented: "the microprocessor revolution ... has more or less stiffled CPU architects except for those involved in mainframe and military or highly specialized system. ... the upswing in 16-bit microprocessor chips is again going to put somewhat of a crimp in architectural innovation... The real renaissance in smaller cpu architectures is just within grasp as the VLSI gate array moves into the realm of the smaller computer manufacturer ... Once again the CPU architect can return to innovations in internal cpu structures." I couldn't disagree more.

New architecture, particularly hardware architecture, should be the last resort because it is the beginning of what is fundamentally a six or seven stage work amplifier.

Given that I've introduced null architecture, building successor machines that are compatible with or built on the past, I feel duty bound to state a lesson that RCA ignored and the Japanese eventually learned.

If you copy a machine, do it exactly -- not just closely. The test has to be that the software, including all user data and files can't know the difference between the original and the copy. Furthermore, if there is a desire to attract, and then entrap, a given set of users to your machine (or language), then build it with extensions that other machines don't have, and that your users will feel duty-bound to use.

<>Fortran. When no process for standardization exists then a plethora of language dialects develop like Fortran V, stemming from Fortran IV. Similarly, the designer of the 8080 added instructions to the architecture and created the Z80, insuring two architectures, and the attendant waste, when one was adequate. At least the Z80's a superset.

On the other hand, conservative users and manufacturers want to preserve their economic and emotional investments as long as they can. Enticed by a user base, almost every company produces one too many of a given machine design.

<>Hollerith. The card which was the savior of the 1890 census became so tied to some corporations approach to computing that they could see no alternative methods for input or output. When the 80 column card was on the way out, true believers in card computing evolved a 132 column card. This too was an expensive evolution requiring new equipment. This dinosaur, a large beast created on a small bone structure (or architecture) was created just when the technology should have been let go.

<>Generating #3. The key is to know which machine is one too many, -- to question whether the bone structure will support the architecture -- and if the limits are close, don't build it. Compatibility extends life in the process of evolving an architecture.

<>abacus. The original Chinese abacus represents up to 15 in a digit with a combination of 5 and 2 beads. It is the bi-quinary system we invented several times.

<>SOROBAN. Ultimately the Japanese refined the abacus, first using 5 and 1, and then 4 and 1 beads for lower cost and

faster operation while not radically affecting the installed base.

<>soroban/calc. This 1979 calculator/soroban is ideal in several ways: low cost storage of a second number is provided; simple operations can be done traditionally and more rapidly on the soroban; users can be gradually trained on the new machine without losing any traditional computational capability; the market is larger; and a culture is preserved.

<>Core. And like the core memory, the idea is so good that many claim the invention.

<>PDP-1 and 4. One of the earliest computers I worked on was the PDP-1, an 18-bit computer, grandchild of Whirlwind and a direct descendant of the TX-0. None of us thought of using the Whirlwind ISP because we needed 2 more than the 16 bits of Whirlwind. Both Whirlwind and TX-0 had excellent system software. Then with the design of the great grandchild, PDP4, to tune the implementation exactly to the architecture saving at most 10% over the PDP-1, I introduced a further ISP and switched to two's complement. Thus, in a family tree of 4, three architectures were probably unnecessary. The world ended up being modulo 8 bits anyway, just as in the original Whirlwind. Perhaps an even greater sin was committed by Computer Controls Corporation because they changed the name PDP to DDP and added a bit to the PDP-1 to come out with the DDP 19. They only sold a half dozen.
<>12 bit. The history of 12-bit computers is similar. The architectural differences of the CDC 160, the LINC, PDP-5 and 8, the 6600 and 7600 ppu's, and those of Honeywell and SDS whose names I forget weren't significant. If we had all copied the 160 the implementations could have remained unique.

<>PDP-5. Computer architects and their implementers who did not make either exact or evolutionary copies of a predecessor machine have cost the entire industry unaccountable billions. In the second generation all that a number of our architectures provided were noncompatible versions of Whirlwind and the 160.
<>Generating #4. New architectures are needed for new forms of computing. Obsolete computers are characterized by inadequate bone structures for coping with different, more modern environments. Several companies who tried to go into business by buying up a bunch of old computer designs, had no chance of high growth. They were self-limited by existing conservative users of these machines. Growing by user base acquistion is like trying to get fat eating tapeworms.

High growth comes from the new architecture of new organizations like Apple, or converting to the VAX base at Digital. But, believe me, when you're dealing with an existing organization with a set of happy and content users, suggesting change, and implementing it, is difficult, but critical, for success.

Now that we've looked at both null architecture and architectural evolution processes, what will the architecture of a revolutionary machine look like?

<>Thomas arithmometer. At the beginning every new structure appears to be quite complex. When Thomas and successors manufactured a calculator, the machine appeared to be very complicated to scientists used to simple slide rules with two moving parts. In 1849, SCIENTIFIC AMERICAN wrote, the Thomas machine "is said to be one of the most astonishing pieces of mechanism that has ever been invented, but to our view, its complexity shows its defectability."

<>Millionaire. Subsequent manufacturers evolved the machine and continued to make and sell them into the twentieth century.

<>Deuce Drum. In 1957, when I saw a moving head drum on the DEUCE computer, I was awestruck. Two independent 16 track read and write heads were used to select 1 of 256 tracks. The control was via a potentiameter sense in an open loop fashion. The complexity was beyond my imagination. I was biassed because my program also turned out to be the best diagnostic.

<>CDC 6600 refrigerators. When Cray's 6600 was introduced in 1964, the refrigerators in each quadrant seemed to create a complex maze of plumbing. But it's really a simple and natural method after its understood. With the high power densities, a built in refrigerator is the best way to cool a computer.

<>Generating #5. The principles of design help in understanding essential versus non-essential complexity both in architecture and it's implementation.

<>Communications Poster. In 1968, Melvin Conway hypothesized that organizations are constrained to produce designs that copy the communications structures of their own organization. This tells us why n people may create an n pass compiler, or why several strong persons will partition a design into separate functional units.

<>Dupont. One of our customers conceptualized their need for interconnection as nearly total communication among nodes.

<>First level of the tree. Yet, when the network was designed the thoughts, like the organization turned to a three level tree, the first level of which is shown here.

<>IBM telecommunications tree. This explains the difference why SNA,

<>ARPA network. ARPA-net,

<>Dec net. and DEC's approach to networking is different.

<>Unibus. With the Unibus each computer component operates to a well defined protocol and can be developed and evolved independently of any other. Hierarchy is imposed by use and convention, not by structure. In this way various groups inside and outside of DEC could build components to a common protocol. This is also why the structure was copied by all micros.

<>Ethernet. Ethernet, a direct evolution of the Unibus, ties computers together in a local area without dependence on central networking functions, central power, or on a particular node.
<>IBM 360. The IBM 360 may mirror IBM. Memory is the focus for all work and the single central processor controls all significant decisions in the 360. This authoritarian top down structure has fat but not very smart subordinates doing the i/o.
<>CDC 6600. In the Cray computers, everything is oriented around a single, very high performance processor at the center. Unlike the IBM approach, the peripheral computers operate effectively autonomous.

Keep in mind that we've looked at some very good designs. Now consider what Watts, the Father of Radar said: "Designers always build the 3rd best system. The First is ideal and the Second best takes too long." Clearly guidelines are needed to avoid building the 4th best.

<>Wilkinson quote. Jim Wilkinson tells how Turing's obsession with building the highest speed machine was kept in line: "in deciding whether or not a feature should be included, the question we asked ourselves was, could we do without it?" This can be translated into Keep It Simple, Stupid.

<>Hoare quote. Tony Hoare's statement can be reduced to three design criteria: 1) exclude what you can, 2) only include what you know and 3) since a machine never diminishes over time, allow for growth - don't build to it's limits.

<>Cost per gate. Increasing memory sizes based on continually decreasing cost insure that users will demand extensible machines. Every 3 years another bit is needed to address the memory. Lack of understanding of this phenomena has been the fatal flaw in nearly every design since 1950. Most designs cannot be extended gracefully more than once.

Large committees usually violate principles of simplicity, in fact guarantee complications. A corollary of KISS, for Keep It Simple, Stupid might be coined KICC, or Kill It by Complexity and Committees. ADA, as it is proceeding; and Algol 68 are good examples of KICC.

<>Wheel of complexity. The wheel of complexity starts with naivete, or extreme simplicity, usually as a reaction to too much generality. No one of us ever wants to introduce unnecessary complexity. But one person's simplicity can be another's complexity.

<>Simplicity. For whom is it simple? The conceptualizer, or architect? The person who has to implement the machine? The person who has to write the compiler? or the ultimate user of a system? The hardware stack mechanism, the theme of various machines, is simple for only one small part of the compiler writer. For everyone else, this extreme simplicity can easily result in comlexity.

<>Bowmar & HP. Don't get me wrong, stacks are great but I believe they have limits; I've always put in hardware to support them. If stacks are the central theme of an architecture, they can a create complex implementation that runs slow. The system programmer will have a complicated problem because there's too much bound in hardware. Stacks usually have little or no effect on the ultimate user.

<>Elegance. True simplicity is pure elegance. One of our engineers says elegance occurs when Every feature contributes 2 benefits; every working part has to do double duty, insuring that excess is left out. Building architects say Less is more.

<>Comptometer Keys. Note how complement arithmetic on a Comptometer allows every digit to represent one of two numbers.   Thus, the user had to do the complementation and was reminded of it by having the digit and its complement written on the keys.

<>Comptometer Ad. A trained operator could do addition and subtraction faster than on machines with complentation mechanisms.

<>Burroughs. Burroughs original calculators that used sign magnitude were more complicated and thus more costly to maintain. Their physical elegance and simpler operation insured their appearance on bank manager's desks.

<>Burroughs copy. Burroughs then copied Comptometers to get the elegance of operation through simpler, faster and thus cheaper mechanisms.

<>Generality. The highest leveled elegance, generality, may increase complexity somewhere in the system. The best example is the general purpose stored program computer. Eckert commented on the how the stored program concept came about. Various priced memories were available such as Williams tubes, delay lines and drums. Von Neumann coined the phrase "memory hierarchy". The ENIAC team speculated that it would be very difficult to determine how much memory should be available for various kinds of data, functions and programs. This led to the notion of a common memory pool and the computer which we all know and love.

<>ENIAC. The ENIAC was elegant. Nearly all of its parts could be used for two purposes: multiple accumulators carried out arithmetic in parallel and were temporary memory; the function tables, originally used for storing constants and functions, ultimately stored sequences of a program; and the relay buffers for i/o were also fast access memory; the calculator as a whole was ready for generality, or the exploitation of elegance.

In my own case, I've gone for generality, three times but I'll only talk about the general register.

<>Table of General registers use. Strachey invented the notion of general registers for the Pegasus in 1956. In the sixties the 635 and 3600 were evolutionary 1 address, 1 accumulator machines. Then, the Univac 1107 was first with relatively general registers, and the 6600, 360 and PDP-6 all used them. The 6 provided the most generality for use. Now, nearly all machines have a large number of general registers.

<>Trickery. Three pitfalls may be associated with extreme generality: trickery, loss in performance, and impracticality. One example of trickery is the concept of operator overload by allowing redefinition of operators. Multics and the IBM 360/67 TSS were the second system reaction to CTSS, written for the 7090. In Multics' case, while it appears elegant to have files mapped into memory, thereby extending primary memory generality to yet another function, and hence increasing generality, loss of performance resulted.   The reaction to Multics done jointly at MIT and Bell Labs, and to IBM's TSS was back to simplicity with Unix at Bell Labs, and CP/CMS at IBM.

The last pitfall of increasing generality is caused by using every known idea. Stretch used and pioneered many ideas: The simpler 360 was a reaction.

Trying to use all the new ideas around in one design is often fatal. Huffman coding to have the fewest bits conflicts with simple ISP's that usually require longer strings to express a program. RISC can be carried too far if the data types the programs use aren't included. The notion of not having interrupts because they interfere with reliable software may conflict with building a real time system. Predication of multiprocessors conflict with lowest cost. Building a wholly distributed system on a local area network may conflict with cost, performance and reliablity. Very secure or very reliable systems can conflict with, easy and shared access to data.

<>PDP1. The reduced instruction set computers is a reaction to the complexity that occurs because so many data types are bound in the architecture because microcode looks so cheap. With RISC, the idea is to get back to a machine that perhaps has NO microcode, a return to the simple machine all built in hardware, like Seymour Cray always builds. It runs fast and the complexity is in the compiler and for fast machines, in the implementation.

Whether the instruction set is large or small, we should remind ourselves that an instruction set of some sort must be bound versus building the fully general purpose microprogrammed interpreter that's always looked so enticing. Recall the slowness and expense of several machines built about 1975 that allowed binding to the bit for the ultimate in generality. Papers, academic acclaim, and the talks about them reminded me of the trickery of the snake oil salesman because they could do everything. They could if you had enough money and could wait long enough. Decide exactly what's to be executed and then encode the machine to do it. It probably can not do everything well.

<>Generating #6. Let's turn our attention from design of the architecture and implementation to building, the sixth of the seven subprocesses of generating a computer. Carver Mead argues for the tall, thin man, a person who understands all parts of chip design including architecture. I'd like the individual to be even taller including the design of the operating software and then applications. If at all possible, don't separate architecture and implementation at least more than a few feet. The single designer is better still: Pascal is the sole product of Wirth.

<>7600. Cray is the only one person who architects, implements and then designs and builds the software. For the last 20 years, he has built the highest performance computers and provided a catalog of ideas to use in other computers.

Small groups are not only essential for design, but all segmentation has to be kept to minimum. The greater the division the larger the time and segmentation. This is how we get n pass compliers when one should do, separation of operating system and language, partitioning of the secondary memory into blocks, records, files, data managment, and database languages.

Segmentation may be necessary to build large systems quickly and to get the right disciplines applied to the right level. Make it work for you, otherwise the reverse is to have everyone always working with and redesigning the lower level components and not the overall system.

<>vax. In the case of VAX, DEC started with a small architecture task force consisting of the most talented people we could find who kept the architecture, documented it, built the first machine and wrote the base software for it. If this was second best to having a single individual do it, it was the only humanly feasible way to get to the market fast. The designers were all experienced in design and had all warmed up on other computers, operating systems and languages.

<4004 ad>. Ted Hoff and Bob Noyce wrote about the small team effort for first microprocessor. The 4004 was designed to be useful in a calculator, yet was not constrained to be only used to build calculators. MOS technology enabled several thousand gates to be placed on a chip. Ted's first experience was the PDP-8, and he knew the power of the minimal computer. Without this knowledge of minimal, general purpose computers, or had Ted only used a 360 or Fortran, the micro might have been invented several years later. Here, function, (the computer) follows form (the chip).

Brooks make a statement about segmenting the technical direction from adminstration. He says, a man with strong management and strong technical talent is rarely found. "Thinkers are rare; doers are rarer; thinker-doers are rarest." Musashi tells us to understand the way of the carpenter as both architect and builder.
<>Distributed. My own role is now that of a foreman carpenter or perhaps a city planner and developer. I worry about the architecture of the set of buildings and how they relate to one another, together with where the roads go. Architecture of Networks and Local Area Networks in particular are extremely important. Rome's streets, viaducts and sewers have been permanent, although great architectural changes have occurred.

Base the design on a small set of well defined components. If all the designers have done their jobs properly, then the set of components from which one builds a system will be elegant, yet complete. In this way, higher levels can be aggregated quickly because the behavior of each part is well defined. The Cray 1 was built from 2 IC types. The chips that never get completely finished are usually filled with circuit tricks, which aren't enumerated or understood.

<>Kludge. The super kludges come from committees because they usually contain no designers of any kind. Designers are typically doers and not committee goers. A large committee occasionally produces a useful design, such as Cobol, because the committee can get commitment from its constituents.

The three rules I'd like to see for people who attend committee meetings: 1. the attendees should have implemented something; 2. a proposed protocol or standard should be in operation somewhere, and; 3. the committee members are responsible for building what they design!

<>Babbage. Don't be so ego-centric that you can't borrow ideas and technology. Babbage himself freely used ideas of others. The Jacquard card-driven loom gave him inspiration for program storage sequencing machine control.

<>Jacquard loom. Jacquard only made a minor tweak on Bouchon's card controlled loom.

<>Early Computer. If the Computer Pioneers would have used each others ideas more then the computer revolution might have happened faster. The Harvard MARK I could have used relay technology and some of the design techniques developed for the Bell Labs machines; Bell Labs and ENIAC could have used some control mechanisms of MARK I avoiding the large tube counts.

<Atanasoff drum>. Having received the ideas, be gratuitous about crediting everyone who contributed. The ENIAC and Regenerative Memory patent claims of Eckert and Mauchly were so broad that they could not be enforced. Atanasoff's early capacitor drum memory, using regeneration, is the basis of most all primary memory schemes.

<>PDP-6 bit slice. Borrowing, can help avoid changing everthing at once. I learned this the hard way in designing the PDP-6 about 1964. This bit slice module is my memento. We thought we could change everything: that there would be little risk in doubling the circuit speed; or using a mechanical packaging technique placing connectors on both the front and back of the modules in order to get the requisite numbers of pins; specifying a new architecture with a megabyte address when everyone else was at most 256K; organizing a flexible structure that would permit building a large multi-processor in an evolutionary fashion so that we could build subsequent machines on the same base; presenting a straight forward interface which as a side effect probably started the whole idea of third party vendors at Stanford, and; predicating the design on timesharing -- a concept that was just being breadboarded at BBN, MIT, Stanford, and SDC.
<>PDP-6. Only 20 PDP 6s were made and several are still in service. The team stayed together and gained experience for the PDP 10. I would have hated to say to customers at the time that we were selling them an advanced development effort for our own, and others, interactive computing. Thinking of the 6 as a breadboard, probably the main mistake was not changing the packaging more to allow automatic wirewrapping. As a side effect, wirewrapping then allowed computers to be mass-produced and not handcrafted. This was one key to the minicomputer population explosion.

<>Generating #7. The cycle includes using the machine -- something I've always wanted to have more time to do.

<>Whirlwind use. Generality allows systems to be used for some different purposes than those intended. Whirlwind was built to demonstrate the SAGE air defense system, the forerunner of modern air traffic control. In addition, Whirlwind was used for at least two purposes not conceived in its design but that fell out of it: the first computer speech research and Linvill's work on digital control.

<>WW. Forrester was interested in sound engineering practices, stating, "Experimental equipment, merely for demonstration of principle and without inherent possibility of transformation to designs of value to others, does not meet the principle of systems engineering." MIT never got into the computer business -- but the Whirlwind did provide many businesses with proven designs and trained engineers.

<>WW Module. The Whirlwind modules were taken verbatim by Burroughs and by ERA for the 1101, and the machine itself was built by IBM to serve the SAGE system. ENIAC was the breadboard for the UNIVAC machines. These real, engineered efforts at universities were significant spurs to American industry, the economy, and computing.

<>WW. Forrester not only realized computers should be used but that understanding and training about a revolutionary new device requires the device. Can you conceive of universities without the computer? In 1948 that was the case. Forrester argued: "If a high speed computer capable of 1 to 20 thousand instructions per second were sitting here today, it would be nearly two years before the machines were in effective and efficient operation. ... this represents one-half of the viscious cycle in which an adequate national interest in computer training cannot be developed until the equipment is actually available." I believe this two year period should be called the Forrester constant.

The problem is still here. The 1979 Feldman report argued for funding experimental computer science equipment. Universities still need more computing power for training tomorrow's pioneers.

<>Fortran. Perhaps the overwhelming reason to use computers before you build them is that Hardware follows Software. Nearly all mechanisms that appear in computer hardware structures start with software implementations. John Backus of IBM tells the story on the introduction of floating point. He observed that many customers were running their 701s with a floating-point interpreter, slowing the machine to 50 multiplications were second. He tried to get the engineers to include floating point hardware, but they were more interested in speeding up the drum. He then created, "The most incredible design for building floating point into the 704." It involved adding four or five new registers, which was unheard of in those days. At the next meeting of the engineering design committee, he remembers, "I stood up and spent an hour describing my insane design and people listened. At the next meeting Gene Amdahl got up and said, 'Backus, you're an absolute idiot; you can build in floating point without adding any registers at all to the computer, and it will cost almost nothing, and here's how to do it.' And that's how it happened."

<>Fortran marked..

On occasion, software may follow hardware. This is rare and often wrong. The first Fortran had instructions to manipulate the sense lights, sense switches and tape of the 704. Also, the DO loop was oriented to the index register instructions. Some of these primitives have stayed with us, but most were dropped. All the algorithmic languages should have been extended to handle vectors and arrays. Had this happened, we would have these operators in machines. The Cray 1 is causing this extension so that software is following hardware.

<>Drafting. Finally, use it and describe it so it can be evolved. Go around again. Those who build machines say it's like playing Pinball.

<>Pencils. The reward of building the machine is to build the next machine. No matter how good a design is the next one can always be better as Pentel, has shown in their evolution of the homely, but important pencil.

GB3.S3.24

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Subject: **Architectecture in Terminals and Small Systems**

To: Dick Clayton, ML12-2/E71
Bruce Delagi, MR2-1/M64

Date: 4/11/79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

CC: Sam Fuller, TW/A08
Bill Johnson, ML3-5/H33
Bill Keating, ML12-3/A62
Larry Portner, ML12-3/A62

follow up 4/30/79

Following our discussion today, I believe it is necessary to get the above architectural effort in place quickly. This effort should connect into the corporate architecture, especially as it relates to interconnecting with other, larger computer systems. The goal will be the documentation and control of various interfaces within terminals and small systems such that they can fit within the overall Corporate Product Strategy. The need, I believe comes from pressure to have a number of point products which are both technology and market driven, while at the same time being responsive to the strategy, compatible with the past, and not requiring inordinate software to support the new features.

<u>Terminals Architecture</u>
In the terminals area, I believe the architectural control problem is roughly proportional to the number of terminals raised to the <u>fourth</u> power, but more exactly, the number of unique terminal systems is potentially:

the number of basic terminal types (e.g., LA34, VT100, VT100W) <u>times</u>
the number of specific, functional variations (implemented in either ROM software, or specific hardware such as the TU58) <u>times</u>
the number of specific hardware line interfaces (e.g., 20ma, EIA) <u>times</u>
the number of specific line protocols (e.g., ASCII, DDCMP, x25, SDLC).

Note, the hardware interfaces include all the modem, auto dial, auto answer variations, etc.

Given the situation above, there is no evidence that we have any method of handling the design, verifying the correctness of the programs and hardware, and generally responding to the potential demand that is implicit in the base. If we don't understand this yet as a problem, can I refresh our collective memories as to the nebulous system responsibility when DCG offered a buffered LA36, with integral modem and editing line interface. (In this case there wasn't even a significant line protocol involved.)

Small Systems Architecture

There is a similar, but larger, problem here surrounding options at the Qbus, it's evolution, and next generations. There are in turn variations at the various box, and packaged systems levels. Although I shudder to attempt to formulate it, I believe the potential variations are larger than the terminal variations. Can the two of you get together and formulate this?

When can I have a name?
GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST: Dick Clayton ML12-2/E71 Bruce Delagi MR2-1/M64
Sam Fuller TW/A08 Bill Johnson ML3-5/H33
Bill Keating ML12-3/A62 Larry Portner ML12-3/A62

The Archivist/Registrar processes, files and documents all papers, manuals, books, audio and video tapes, photographs and other artifactual maerials.

The collections are processed by computer company and are then separated into series based on the individual computers reproduced and then by the manuals, prospecti. These materials are stored in acid-free folders, obtained from either Conservation Resources International, Inc. in Alexandria, VA or University Products in Holyoke, MA. If the volume is too thick for one folder they are divided at a convenient point into two or three or more folders. The folders are labeled as follows:

Company name/computer name or number/any subdivision within the company/title of the material in the folder, volume # (folder number if the material is in more than one folder, e.g. I or II/
year

If the year, month, and day are needed or the material covers a span of time the date is as follows: year, month, day - month, day, year.

The box and folder numbers are not on each folder because

these collections
may not be complete and should be kept fluid. Having the box listings on a floppy permits the archivist to move the box number along the list to match any additions to or deletions from the collections. By keeping the box list up to date there should be no problem about materials not being in their proper location.

The folders are stored in acid-free boxes. The contents of each box (and folders within) are listed on floppy ARCBOX. At the beginning of each list is the following information which is listed in the abbreviation library <ar>:

COLLECTION NAME (in caps)

<id> AR + number
<na> Company name and collection name
<so> Source (if applicable)
<hw> How acquired (if applicable)
<lo> Location (range/section/shelf e.g. I/A/1)
<rf> Reference - X, XD, D, and B list numbers
<ph> Photograph catalog numbers
<at> Audio tape catalog numbers
< >

The box number is at the left margin. The first tab is the computer name
or number. A new line is begun at a different tab for each of the categories listed between //'s above. Therefore, the whole box list is in outline form. Each collection is a distinct document on the floppy. In this way anyone can access any collection directly.

The catalog numbers from X, XD, D, and B lists which applied to the Archives collections are entered in the <rf> field. The Archives catalog numbers are entered under <rf> on the above lists. These cross references will eventually allow retrieval of all information in the Museum on a given artifact.

Indexes have been developed for the current box list. One is an alphabetical list by company or collection name which includes the catalog number, the location, and the number of boxes in the collection. The other index is a numerical list by the catalog number which includes the company or collection number, the location, and the number of boxes.

In the storage room, the collections are located by Range (wall location), Section (within Range) and Shelf (e.g. I/A/1)

Periodicals are stored in acid-free boxes by Name and Volume # or Date.

AUDIO AND VIDEO TAPES

The audio tape catalog file is on the AUDTAP floppy. The fields in the catalog form can be called up with GOLD, Abbrev. at and include:

<id> AT + # + year
<na> Name of speaker
<ti> Title of the talk
<da> Date the talk was given
<se> Series (i.e. Pioneer Lecture, Bits & Bites)
<cp> Number of copies of the tape
<tr> Transcript status
<rs> What restrictions exist if any
<lo> Location
<rf> References (to other collections in the Museum)
<lt> Length of the tape or the talk
<bl> Blurb

The AT refers to Audio Tape, and VT refers to Video Tape. Nothing has been
done yet with video tapes.

Future projects include transcribing all audio tapes.

In connection with tapes are two forms sent to speakers at the Museum once the transcript has been completed:

Letter to the speaker with which is enclosed a transcript of the talk and

Permission form for the use of material in the talk in Museum publications.

only a few good people
we ask them to doeverything
context swithcihng
poor segmentation of work
charters unclear,
etc

March 16, 1979

Mr. Michael Sleppin
National Sales Manager
Argus International
Hopewell, New Jersey 08525

Dear Mr. Sleppin:

We received your letter dated February 9, 1979 regarding Argus equipment. It is unfortunate that the information passed on to you was taken out of context. It has been stated in the past that your equipment has design features that do not meet Digital's requirements. Digital is always seeking and looking at new technology; further, it is our policy to be fair to all suppliers.

Digital is willing, at your convenience, to plan a review of your equipment at our Acton Plant. If you wish, please contact Don Pucci, Printed Circuit Board Engineering Group, or Dick Rhodes, Capital Equipment, Purchasing Department, to discuss arranging your meeting.

Respectfully,

Gordon Bell
Vice President,
Engineering

GB:ljp
GB0001/46
March 12, 1980

Peter Delehar
146 Portobello Road
London W11
ENGLAND

Dear Mr. Delehar:

Gordon Bell instructed his bank to transfer funds (dollars) from his account and deposit 480# for the Arithmometer in your account as of March 12.

Sincerely yours,

Mary Jane Forbes
Secretary to Gordon Bell

MJF:swh
GB1.S2.50
March 7, 1980

Middlesex County National Bank
25 Nason Street
Maynard, Mass. 01754

Attn: NOTE DEPARTMENT

Please send a draft for 480# (transfer dollars from my account)
to the account of: Peter Delehar
                    Midland Bank Limited
                    152 Port Obello Road
                    London W11, ENGLAND

                    Account #80-277-584

Sincerely,

C. Gordon Bell
Account #____________

Arithmometer

GB1.S2.43
e 3

e 3.16

Following sent via ARPANET on 10/4/82 (@ISI)
Dr. Elliot Levinthal
Director of Defense Sciences
ARPA

cc: Bob Kahn and Bob Cooper, at ARPA (@ISI)

ARPA/LEVINTHAL GB3.S8.3

I would like to encourage ARPA to stimulate the availability of suitable, high speed circuitry such as Gallium Arsenide, HEMT of Josephson Junction. We desperately need these chips in order to build competitive, high speed machines during the foreseeable future. The Japanese Super Computer effort is directed at evaluating these three technologies, followed by a choice which would direct production at one of the circuit types. Also, I believe that the Japanese have already moved to put GaAs circuits into manufacture for their next generation supercomputers.

Ultimately, it may not be necessary to have this lower density high speed circuit type (some researchers believe that HEMT will be of the same density as CMOS) either because CMOS technology is made sufficiently fast or that we can organize large arrays of relatively high speed microprocessors to work on a single problem.

ARPA could encourage a good, supply that would serve both industrial AND military needs. Let me encourage you to select a vendor who has experience in high speed circuitry and who could be an indsutrial supplier (TI, Motorola, Fairchild, AMD, National would all be fine). I don't believe it would be worthwhile to select a standard military only house who is only interested in a cost plus supply arrangement, because I doubt if you'll ever get the chips and I know we then will have to buy chips from Japan.

Sincerely,

Gordon Bell

GB3.S10.11

00 CORE DECGRAM ACCEPTED S 003164 O 157 03-NOV-82 15:43:57

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TO: see "TO" DISTRIBUTION DATE: WED 3 NOV 1982 10:16 AM
FROM: GORDON BELL
cc: DAVE DUTTON DEPT: ENG STAFF
GRANT SAVIERS EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5180664732

SUBJECT: GETTING ARPA HELP IN H/S SEMIS

Note from Elliot Levinthal

"Gordon

We (ARPA/DEC) need to find a schema that brings together the somewhat disparate goals and risk taking progrensities of

a) the computer industry
b) the commercial chip suppliers
c) the DOD system supplier
d) the DOD

The DOD cannot address directly the nation's problems as represented by the needs of a) & b). We also cannot support the needs of a) & b) in the hope that they would then respond to needs of c) & d).

We would be responsive to proposals from members of a) & b) (perhaps best jointly from a team with a member from each group) that addresses the needs of c) & d) and at the same time meets their own goal.

Elliott (Levinthal) "

I talked to John Payne from National about h.s. Rams and other ckts. They're not doing anything. Why don't we get into this area?

Elliot suggests we help by investing in Gigabit. He also suggested we contact Joe Barrera, and Dick Soshea at Harris Microwave Semi, 408-262-2222 in Milpitas as a new group who broke away with HP GaAs.

I see no U.S. high speed semiconductor work outside of IBM and BTL. Is there some? (Note the situation in high speed rams)

"TO" DISTRIBUTION:

BOB GLORIOSO JEFF KALB STEVE TEICHER
JOE ZEH

ID#368

```
+---------------------------+
|   |   |   |   |   |   |   |
| d | i | g | i | t | a | l |
|   |   |   |   |   |   |   |
+---------------------------+
```

i n t e r o f f i c e   m e m o r a n d u m

Subject: **Getting an Interconnect Soon/Now for**

Internetting of ARPA Contractor Computers

To: Distribution

Date: 28 NOV 78
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

follow up 12/12/78

Bob Kahn at ARPA says he is tearing his hair out trying to get a good system of interconnecting their computers. All his contractors are playing in this area and he just wants a standard interconnect mostly for 10's and 11's they currently have. I said the problem of getting it is trivial. Just tell us what you want, and we will build it. He is challenged and said he'll do it. The commitment I made to start the ball was that we would send him a spec of the VAX interface. Sam, will you get him to sign the appropriate disclaimers so we can proceed ahead to get him involved?

He'd like to have something over 100 Mbits/sec. so that a large number of computers could be interconnect, but will listen to the economics and he understands the need for orderly progressions based on the introduction of technology. He is advocating using active taps with appropriate diagnostics because it gives such an orderly, well defined set of signals and the performance is highest. He cited the works at MIT by Al Vezza (360 chips with DMA to an 11) and Chaosnet (120 chips running at 8 Mbits and connected to an 11, with no DMA, using the unmodified Farber interconnects LNI?).

Forest Baskett stated that with only one chip, Zilog has a ring interconnect running at 800 Kbit using their standard SIO running a modified SDLC protocol. Their interface is apparently some form of the Farber interface tap. Here, have they solved the large number of chips to interconnect at a reasonable speed problem? Let's get Forest Baskett to help on this problem?

Note, the Japanese have a 50 Mbit, 50 Km line with no repeaters in service. The length is limited by the number of cable splices.

I want the ARPA community to buy and try our first I/C. Quick!

GB:ljp

Distribution

Bill Demmer	TW/D19	George Plowman	ML5-5/E97
Ulf Fagerquist	MR1-2/E78	Wayne Rosing	TW/C03
Sam Fuller	TW/A08	Bob Savell	ML5-2/E50
Bill Johnson	ML21-3/E87	Bill Strecker	TW/A08
Alan Kotok	MR1-2/E47	Rollins Turner	ML3-2/E41
Tony Lauck	ML5-5/E97	Don Vonada	ML3-3/E67
John McNamara	ML3-2/E41	Fred Wilhelm	MR1-1/M85

D I G I T A L INTEROFFICE MEMORANDUM

DIST:	Bill Demmer	TW/D19	George Plowman	ML5-5/E97
	Ulf Fagerquist	MR1-2/E78	Wayne Rosing	TW/C03
	Sam Fuller	TW/A08	Bob Savell	ML5-2/E50
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	Alan Kotok	MR1-2/E47	Rollins Turner	ML3-2/E41
	Tony Lauck	ML5-5/E97	Don Vonada	ML3-3/E67
	John McNamara	ML3-2/E41	Fred Wilhelm	MR1-1/M85

TYPE 22
<-
----Message 22 (2372 chrs) is----
Date: 7 Aug 83 15:55:33 EDT
From: gottlieb@NYU.ARPA
To: NEW-GEN@CSNET-SH
Subject: late response to initial query

Please forgive my delayed reply as I was out for the week.

Within the "high-flux" class of Ullman, one may wish to compare the machines that have multiple processors sharing a central memory (the "dancehall" architecture with all the processors on one side of the room and the memory modules on the other) with those where the processors have the own local memory and communicate via message passing. I believe that machines like the Homogeneous machine (Cube) and Jack Schwartz's original ultracomputer (shuffle-exchange) in which the memory is local and the interconnection topology is made visible to the programmer, offer higher peak performance than the current NYU Ultracomputer (dancehall) but at the cost of more difficult programming. Indeed, we were able to obtain suffle-exchange implementations of several important algorithms but when we first studied the Burroughs proposed NASF (numerical aerodynamic simulation facility - NASA's "digital wind tunnel") we concluded that such shared memory machines were easier to program. I know that this view is far from universal and that many believe that what shared memory facilitates is the creation of parallel bugs. I can only add that we have parallelized a number of medium size (up to a few thousand lines) programs and have not changed our view.

Jim Browne has remarked that there are two problems to solve in parallel processing, communication and synchronization. For some architectures one problem is much easier that the other. For example, shared memory solves communication but makes synchronization more difficult. SIMD machines like the Illiac IV have no synchronization problem but are poor for interprocessor communication.

An important question to ask is how many processors does one expect to have on a single chip (or other unit with limited I/O). If that number is large (as NON-VON postulates) then trees look favorable since 2**k processors can be placed with only four external connections. If the number is not large then the bottleneck at the root makes trees appear unatractive.

Allan Gottlieb
<-
<-
<-TYPE 23
----Message 23 (1964 chrs) is----
Date: 8 Aug 1983 1217-PDT
From: RAPHAEL.HP-HULK@Rand-Relay
Subject: [RAPHAEL@HP-HULK: [ABell.PA@PARC-MAXC: Second Question]]
To: new-gen.csnet-sh@RAND-RELAY
Cc: RAPHAEL.HP-HULK@Rand-Relay

fyi.

Date: 8 Aug 1983 1215-PDT
From: RAPHAEL@HP-HULK
Subject: [ABell.PA@PARC-MAXC: Second Question]
To: rdn.lanl@RAND-RELAY
cc: RAPHAEL

retransmittal.

Mail-From: HP-VENUS received 5-Aug-83 11:29:41
Date: Fri, 5 Aug 83 09:09 PDT
From: ABell.PA@PARC-MAXC
Received: by HP-VENUS via CSNET; 5 Aug 1983 11:29:12-PDT (Fri)
Received: from csnet-sh by rand-relay.ARPA ; 5 Aug 83 10:57:07 PDT (Fri)
To: NEW-GEN@CSNET-SH
Via: UDel; 5 Aug 83 11:29-PDT
Subject: Second Question
Cc: ABell.PA@PARC-MAXC
Message-Id: <428956153.27739.hplabs@HP-VENUS>

The disscussion so far has been excellent though sometimes a bit independent of the question. Many good points and issues have been raised. Several responses illustrated the importance of first understanding the application areas before
creating the hardware and software systems to support them.

What are the applications where New-Gen computers will be used? I would like to see us create both a taxonomy of areas and specific applications. What are the characteristics
of each of these areas?

I wonder if we, as computer scientists, have too limited breadth to envision and specify many of the new applications. Is this the case? What groups of people should become

involved to illustrate the application areas to us? How do
we involve and work with these new groups?

<-

<-<-<-TYPE 24
----Message 24 (6974 chrs) is----
Date: Mon 8 Aug 83 16:22:12-PDT
From: Al Davis@SRI-KL
Subject: First Question Reply
To: new-gen@CSNET-SH

I have read the comments to date, and due to their number, I
will not
make a point of agreeing with item X and disagreeing with
item Y.
The following points indicate my views on the issues raised
by the
initial question and the responses to date.

Fifth Generation Architecture Definition (I do not feel that
the
distinction between "new", "fifth", or supercomputer needs to
be
discussed, and I use the terms synonomously.)

It is sad in a sense that the Japanese coinage of the 5th
generation
term has generated so much press, since the 4th generation
will happen
also. Still the architectures of the 4th generation will
mainly be
based on the same architectural paradigm that supported the
previous 3
generations. In my view machines of this so called fifth
generation
will be fundamentally based on concurrent principles. The
problem is

that there are many forms of concurrency:

1. Spatial - I use this term to mean things which are independent
and can therefore be distributed to different physical resource sites.

2. Temporal - pipelining. In pipelined processing the stages of
the pipe are not functionally independent but the distribution is a
result of different time stages of the processing. It is certainly
true that the multiple resources are also spatially distributed as
well (and hence the defect in the terminology, but the idea hopefully
is clear).

3. Specific vs. Forall - in some concurrent models the concurrency
is obtained by having homogeneous tasking applied to some data
structure (e.g. FORALL X Do FOO) while other models specifically
indicate concurrent operation by doing something special:

a. Delaying the CONS

b. Detecting independence and taking advantage of it.

c. ....

The point is that concurrency comes in many flavors and, as has been
mentioned by many of the members of the net conference, the grain of
the parallel operations, the type, the communication, etc. are all
important. I feel however that after the first round of 5th
generation attempts, the "mature" 5th generation machines will exploit

concurrency in a variety of forms at all levels of the system.
Doing this will require a consistent incorporation of a number of currently disparite ideas about how concurrent systems can be constructed.

For example at the largest grain level, I envision future concurrent systems to look like a network connected set of special 5th generation engines. I do not see these engines being as "general purpose" as the mainframe machines of the past. The reason for concurrency at programming time can be made on a number of qualitative grounds but my contention is that at run time the use of concurrency is quantitative in its goal. General purpose implies compromise and compromise implies loss of speed. At the mid-grain level we will see the types of 5th generation multiprocessor systems (homogeneous would be my guess, but somebody is bound to try and do it the hard way too!) that have been worked on for the last 10 or 15 years. At the lowest grain we might see very specialized pipelines for doing arithmetic, control, etc. and memory systems which concurrently look for chunks of data which match the search criteria. My contention is that mature 5th generation systems will consistently exploit concurrency at many levels of granularity.

Lastly I don't think AI is intrinsically involved and in this I concur with Ullman. Certainly some of the results from the AI

community will
be incorporated in a general search for machines which a qualitatively
better from the human use point of view AND quantitatively better in
terms of MIPS, KIPS, LIPS, BIPS, FLOPS, BOPS or any other hokey metric
that anybody chooses to invent. To view AI as the sole source of the
ideas for the new generation of machines is absurd. There is a lot of
good work out there and it needs to be combined properly if there is
to be a real win. Some database people feel (for example) that Prolog
is a small grain relational database system. Ah well - enough said.

The emphasis has got to be on the system being consistent - NOT on
just the software or the hardware. The advent of the microprocessor
has taught us at least two things:

1. Significant reduction in the cost of a processor can effectively move the art of programming back to the dark ages for awhile (Dijkstra essentially said this at IFIPS '77 in Toronto).

and

2. Multiprocessors are easier to build than to program if you are lazy and don't think about things before you design them.

5th Generation Software

New programming methods, languages, operating systems, etc. are

definitely needed. Logic programming, dataflow, reduction, etc.
models proliferate and only scratch the surface in my opinion, but
these results are likely to form the basis for the 5th generation
software models. The topic that to my surprise has been missing so
far in our discussion is the problem of how program concurrency is to
be mapped onto the physical resources. I call this the resource
allocation strategy. To date, there haven't been too many distinctly
different approaches:

1. Regular data and similar topology machine - SIMD style stuff.

2. Static analysis of the program structure and a "smart compiler"
which generates the right set of load modules which end up in the
right physical spot.

3. Dynamic strategies where a first guess allocation is made and then
(usually with a great deal of overhead) things are moved later if they
are in the wrong spot.

4. Random allocation - let things just grow and hope that everything
works out somehow (unfortunately in every case that I know about in
which this strategy was used it was a failure).

The main problem is that the allocation must be done so that
communication delays don't effictively sequence otherwise concurrent
activities.

____

The goals of Fifth Generation research should be to incorporate enough
of the sensible good ideas into a consistent efficient system's
framework and to build real systems (not just unprogrammable heaters)
and get together with the applications people to continue to develop
the machine use paradigms which will guide the work to its mature
state.

Sorry for the length of this but I just got back in town and there was
a lot to read - so all this just sort of spilled out.

Al Davis

Fairchild AI Labs

<-TYPE 25
----Message 25 (3065 chrs) is----
Date: 10 Aug 1983 1248-PDT
From: RAPHAEL.HP-HULK@Rand-Relay
Subject: Mailboxes and Status Report
To: new-gen.csnet-sh@RAND-RELAY
Cc: RAPHAEL.HP-HULK@Rand-Relay

The following is the current distribution list for this teleconference, and

an indication of individual participation. If there is a "?" or "O" after
your name, please come on in, and help move the discussion in whatever
direction you think is most important or productive.

MAILBOX

NAME

ACTIVITY

fernbach@csnet-sh

Sidney Fernbach

O
thomas@csnet-sh

Lee Thomas

?
sumney@csnet-sh

Larry Sumney

?
bsuther@csnet-sh

Bert Sutherland

?
isuther@csnet-sh

Ivan Sutherland

?
trimberg@csnet-sh

Stephen Trimberger
B
wallich@csnet-sh

Paul Wallich

M
braphael@csnet-sh

Bert Raphael (Don't use this mailbox)
yeh@csnet-sh

Raymond Yeh

?
GJS@MIT-MC

Gerry Sussman

O
KUNG@CMU-CS-A

H.T.Kung

C
GUY.STEELE@CMU-CS-A

Guy Steele

A
FAHLMAN@CMU-CS-C

Scott Fahlman

A
david@columbia-20

David Shaw

C
KAHN@ISI

Bob Kahn

?
CONWAY@ISI

Lynn Conway

?
BASKETT@SCORE

Forest Baskett

O
ADAVIS@SRI-KL

Al Davis

A
HOUSE.HP-LABS@RAND-RELAY
Chuck House

M

RAPHAEL.HP-LABS@RAND-RELAY
Bert Raphael

M
COHEN@ISIB

Danny Cohen

?
UNCAPHER@ISI

Kieth Uncapher

?
EWALD@LANL

Bob Ewald

?
BUZBEE@LANL

Bill Buzbee

C
DOUGLASS@LANL

Robert Douglass

A
DANNY@MIT-AI

Danny Hillis

?
DAVIS%OZ@MIT-MC

Randy Davis

A
GOTTLIEB@NYU

Alan Gottlieb

A
SCHWARTZ.CMCL1@NYU

Jack Schwartz

C
SNYDER@PURDUE

Larry Snyder

?
FEIGENBAUM@SUMEX-AIM

Ed Feigenbaum

O
LENAT@SCORE

Doug Lenat

?
ULLMAN@SCORE

Jeff Ullman

A
CSL.LAB.DRA@SCORE

Dennis Allison

?
RHAYES-ROTH@SRI-KL

Rick Hayes-Roth

A
waltz.uiuc@RAND-RELAY

Dave Waltz

?
ABELL@PARC-MAXC

Alan Bell

M
BOBROW@PARC-MAXC

Dan Bobrow

?
STEFIK@PARC-MAXC

Mark Stefik

?
BRIANSMITH@PARC-MAXC

Brian Smith

?
edmiston@csnet-cic

Dick Edmiston (monitoring for CSnet)
EBLOCH.YKTVMT.IBM-SJ@RAND-RELAY
Erich Bloch

O
G.LEVINTHAL@COLUMBIA-20
Sy Levinthal

O
G.CHRIST@COLUMBIA-20
Nornam Christ

O
GB28@CMU-CS-A

Gordon Bell

?

kgw@cornell

Ken Wilson

A

Activity key:

A   Active-- has submitted bio and comments
B   Bio submitted, but no comments
C   Comments submitted, but no bio
M   Moderator
O   Observing-- Known to be receiving mail, but not yet participating
?   No acknowledgement-- unknown whether messages are getting through

----

<-TYPE 26
----Message 26 (6237 chrs) is----
Date: Wed, 10 Aug 1983 16:08 EDT
From: Scott E. Fahlman@CMU-CS-C.ARPA
To: new-gen@UWISC.ARPA
Cc: fahlman@CMU-CS-C.ARPA
Subject: Tasks for the new generation

There seem to be a couple of distinct conversations going on here, both useful, but probably worth identifying as separate. If we look at what we want the new generation of computers to do (and it would be pretty silly to build them before we have looked hard at this) we can either look at the overall picture that the new systems should present to the user or at the key low-level problems that have to be solved in order to get at some of tasks that we cannot handle well at present. We've had several good messages on each of these topics.

When thinking about the appearance of the new generation to the user, we see the need for extremely transparent communication (text, color pictures, voice...) with other users anywhere in the world, integrated tools with good online training and help facilities, easily sharable program modules and data bases (either through standardization of languages or through intelligent interface managers), and so on.

A lot of this can be accomplished without much innovation in hardware -- all it will take is something like the current Lisp machines with color displays, easily portable, cheap enough to be on everyone's desk, excellent worldwide networking, and huge banks of online video-disk libraries. The software is the hard part, but again nothing revolutionary is required -- just about ten more years of very hard work by good people.

All of this is just straightforward extrapolation of what is going on now in dozens of places. It is going to happen. No major revolutions are required, and the payoff is clear enough that market forces can probably drive the whole devleopment without any help. It would probably be helpful if there were some coordinating body to apply gentle pressure in the direction of standardizing things wherever that makes sense (or at least avoiding gratuitous incompatibility). It would be

also be very helpful if the necessary equipment were made available to
the most active developers (universities and small innovative software
organizations) as soon as possible -- if these people have to wait till
the hardware is cheap, they will have no opportunity to add their ideas
and software to the new generation while it is still new, and the
resulting systems will be much worse for this omission.

So that's one thing that could be meant by "new generation", and a
number of people on the list have addressed these issues. To me, this
stuff is really finishing the software for the current generation of
machines, but that's just quibbling over terminology -- the effort is
critically important, whatever we call it. I might add that at the
level being discussed above, issues such as parallelism and
inter-process connectivity should not come up. There is probably a lot
of parallelism going on in these machines, but the less the user has to
know about it, the better.

On a different level, however, I do see the need for innovative (and
therefore risky) explorations of machine archtiectures. While existing
von Neumann hardware (with a few special purpose processors for graphics
and communication) can handle most of what was described above, there
are important tasks that require more cycles than we are going to get
from such machines. One class of problems is number-crunching, and a
lot of work has gone into making that faster, giving rise to

the Crays
and HEPs and DAPs. For other tasks, these architectures seem to be
inappropriate. I've listed these in earlier messages: pixel munching,
animation, making intelligent use of a LOT of assorted knowledge,
recognizing things (images or spoken words or diseases or stock market
trends), planning, big simulations in non-continuous non-numeric
domains, and so on. We know that we're cycle-bound in these areas, but
we don't yet agree on what to do about it, or even how to characterize
where the crunch is occuring.

To me the next generation of hardware/architecture research is a matter
of identifying those places where important tasks cannot be done because
we lack the computing cycles, analyzing these tasks to see where the
computational bottleneck is, developing a good crisp theory of what has
to be done in that bottleneck and what the dependencies are, and then
applying the right kind of parallelism to get the job done. Often, we
will discover that the architecture developed for problem A is also
useful for problem B, but that should not be a requirement.

That kind of research does not have an obvious and predictable payoff,
so it is generally not done by industry. Some of the preliminary
studies can be done in universities and think-tanks, but building
prototype hardware has in the past been too expensive for such
organizations. A single computer architecture project (with

the
associated software effort) has generally tied up a major
chunk of a
university a period of several years: think of Multics,
Illiac IV,
the MIT Lisp Machine effort, C.mmp, the S1...

So it seems to me that this is where we need some sort of
national
initiative. All of the usual solutions apply: we need more
money for
this sort of exploratory construction in the universities,
more joint
projects between universities and industry (with less hassle
and
secrecy), better access to facilities for simulating high-
speed parallel
designs so that only the most interesting ones will actually
be built,
and better tools for mini-projects in computer architecture
(the
half-million-dollar six-month project, as opposed to the 5-
year
behemoth). It looks to me like the weakness of the current
U.S. R&D
system is not in producing the basic good ideas and not in
exploiting
those ideas (however expensive) once they are shown to be
right, but in
doing the risky but expensive exploration in between.

-- Scott Fahlman, CMU
<-TYPE 27
----Message 27 (3042 cTYPE 28
----Message 28 (500 chrs) is----
Date: 11 Aug 83 1105 EDT (Thursday)
From: Decfive
To: :INCLUDE: "DSKB:PEOPA.DST[C321DE5C]"
Subject: Stoney's Beer TG Friday

In response to overwhelming popular demand, we are trying a
keg of

Stoney's beer for the TG this Friday. This is a locally
brewed
beer that is made without preservatives. The TG begins at
4:30
in the Lounge on Friday. Munchies too, of course.
<-TYPE 29

----Message 29 (672 chrs) is----
Date: 11 Aug 1983 10:58:13-CDT
From: fernbach@csnet-sh.ARPA
Reply-to: fernbach@csnet-sh.ARPA
To: new-gen@Uwisc.ARPA
Subject: answers to first 2 questions

/n/g-/m/o/d@/c/s/n/e/t-/s/h
  1. favorite issues - what can be accomplished in next 10
years?
      can u.s. muster proper spirit to beat japan?

  2. sid fernbach, now a gen
eral consultant on computers, primarily
      supercomputers, retired from llnl where he was
responsible for the
      computer facility for several decades.

-/d

/d
<-TYOE   PE 30
----Message 30 (1249 chrs) is----
Date: 11 Aug 1983 11:17:29-CDT
From: fernbach@csnet-sh.ARPA
Reply-to: fernbach@csnet-sh.ARPA
To: new-gen@Uwisc.ARPA
Subject: /reponse to first question

/n/e/w-/g/e/n@/c/s/n/e/t-/s/h
/for me, it is important to distinguish between
"/supercomputer" and "/new
or /fifth /generation." /supercomputers should be considered

as numerical
or scientific devices. new (or fifth) generation may or may
not include
them.
/the "/new" generation is one that is friendly, responsive,
as easy
to communicate with as another human being. /no doubt the
architecture will
derive from non-von concepts. the structures will vary from
single processors
to heterogeneous multiprocessors.

/the technology will not mature for 10-20 years. /when it
does, we will
have as our friends, the third generation, the robots.

yes, i believe there will be many different efforts heading
to different
goals. this new generation will be another intermediate one.
the 21st
century will bring many more into existence. /we are still
in childhood,
not knowing what directions to take for our future goals.
<-TYPE 31
----Message 31 (817 chrs) is----
Date: Thu, 11 Aug 83 11:24 PDT
From: ABell.PA@PARC-MAXC.ARPA
Subject: Request for info
To: New-Gen@Uwisc.ARPA
cc: , ABell.PA@PARC-MAXC.ARPA
Reply-To: ABell.PA@Parc-Maxc.ARPA

I would like to create a bibliography of documents
related to the issues being described and to collect
synopses of the projects working in this area. I
will distribute this information after it has been
collected.

Could you please send me (ABell@PARC-MAXC) a
message listing any technical reports or other
documents that might be included in this bibliography.

Could the project leaders of the relevant projects
please send me a short synopsis (1 paragraph) of
your project.

Thanks,
Alan Bell
<-TYPE 31
----Message 31 (817 chrs) is----
Date: Thu, 11 Aug 83 11:24 PDT
From: ABell.PA@PARC-MAXC.ARPA
Subject: Request for info
To: New-Gen@Uwisc.ARPA
cc: , ABell.PA@PARC-MAXC.ARPA
Reply-To: ABell.PA@Parc-Maxc.ARPA

I would like to create a bibliography of documents
related to the issues being described and to collect
synopses of the projects working in this area. I
will distribute this information after it has been
collected.

Could you please send me (ABell@PARC-MAXC) a
message listing any technical reports or other
documents that might be included in this bibliography.
Could the project leaders of the relevant projects
please send me a short synopsis (1 paragraph) of
your project.

Thanks,
Alan Bell
<-TYPE 32
----Message 32 (1762 chrs) is----
Date: 11 Aug 1983 20:14:18-CDT
From: wallich@csnet-sh.ARPA
Reply-to: wallich@csnet-sh.ARPA
To: new-gen@Uwisc.ARPA
Subject: Third question

So far, we've seen discussions about specific architectures move to become discussions about principles for selecting architectures, and then discussions about the need for funds and methods to experiment with architectures and applications. People also seem to agree about the need to involve applications people (including non-computer-scientists) in the early stages of machine and environment development. So how do we do that?

How can we coordinate the creative activities of applications people, environment builders, machine architects, VLSI designers, and others, so that they can learn of and build on each other's work, and results in one disciple can build on results in the others? How can we have work on a new machine at one site interact synergistically with work on a software environment at another site, for example?

What are the barriers that are keeping this kind of interaction from happening now? What needs to be done to lower them?

(For example, why are certain people sending lots of messages in this conference and others not?)

Paul Wallich
Alan Bell
Chuck House
Bert Raphael

<-TYPE 33

----Message 33 (1231 chrs) is----
Date: 12 Aug 1983 1453-PDT
From: RAPHAEL.HP-HULK@Rand-Relay.ARPA
Subject: Mail Error Messages
To: new-gen.csnet-sh@RAND-RELAY.ARPA
Cc: RAPHAEL.HP-HULK@Rand-Relay.ARPA

Some of you have experienced some of the following problems recently:

* Receiving many copies of the same error message about a down machine;
* An error message coming back days or even weeks after it should;
* Failure to get mail to someone at mit-oz or mit-ai.

I'm told the first two problems have been fixed; let me know if they turn up again.

The third problem seems to be at the MI end. We have taken -oz and -ai off our distribution list. I think most of the same users can be reached at MIT-MC, but haven't confirmed this.

Overall, I think we have had excellent service and reasonable success using a relatively experimental system. Thanks for bearing with the occasional lapses.

Bert

<-} i

TYPE 34
----Message 34 (2375 chrs) is----
Date: 12 Aug 83 21:15:20 EDT (Fri)
From: kgw@Cornell
Subject: Third Question
To: NEW-GEN@Uwisc.ARPA

Cc: kgw@Cornell.ARPA

I can only describe my own experience in dealing with bringing the
relevant people together. The most important requirement is to
find computer users, computing support people, computer scientists,
computer designers, etc , who have a willingness or recognized need
to cooperate. Fortunately more and more people from all these areas
are recognizing a need to emerge from their niches and join forces.
This has made possible a number of projects I am involved in which
combine people from different areas as everyone recognizes is required.
I have a software productivity project which combines high energy
physicists and computer scientists and will add other application areas as
time goes on. Cornell is embarking on a parallel processing project
with support from both IBM and Floating Point Systems and cooperation
from scientific users, Cornell computer services, Electrical Engineering,
and ultimately the GIBBS software productivity project. Fermilab
has an 'experimental Computer Science' project that brings together
Fermilab researchers and outside computer scientists. The Common
denominator of these efforts is to bring together members of many
different disciplines, chosen because they all are needed in order
to reach the projects goals and all are willing to help. I am starting
a Theory Center at Cornell to unite all theoretical science, enginerring,

and agricultural disciplines at Cornell and provide a common
computing
support umbrella; again there is a lot of enthusiasm for this
project,
and both the GIBBS project and the Parallel proceesing
project will
be part of the Broader theory center effort. Representatives
of
Computer manufacturers and industrial computer users will be
encouraged
to participate in these efforts. The most important step
needed
to help this kind of effort nationwide is to make Computer
Networking
more widely known and accessible, with more people trained to
use
networking effectively.
<-
<-TYPE 35
----Message 35 (1561 chrs) is----
Date: 14 Aug 83 09:25:31 EDT
From: gottlieb@NYU.ARPA
To: NEW-GEN@Uwisc.ARPA
Subject: third question

At NYU we have had "applications people" involved in the
project
(Ultracomputer) from the beginning. From very early on, we
have had a
working simulator and have run simulations of programs
selected by the
applications folks. Of course due to memory constraint (and
the
inherent slowness of simulations) we have not been able to
run the
largest programs on their full data sets for the normal
number of
cycles, but we have done realistic examples. One tenet was
that the
applications people decided what portions of the program to
omit and
how small the data could be and still be realistic.

I must add, however, that the applications people while not computer scientists, do use computers every day for their normal scientific work, which might be classified as computational science. How to involve so called naive users (i.e. sophisticated professionals who happen not to be familiar with computers) might well be more difficult.

In summary, for applications that are already heavily computerized, I believe that having a working simulator as a major part of the project is extremely helpful. It should also go without saying that the results of the simulations must be considered important to the entire project and that design decisions must be tested against these simulations.

Allan Gottlieb
<-TYPE 36
----Message 36 (5699 chrs) is----
Date: Sun 14 Aug 83 22:17:42-PDT
From: ULLMAN@SU-SCORE.ARPA
Subject: Stanford projects/barriers to communication
To: new-gen@UWISC.ARPA

SYNOPSIS OF PROJECTS AT STANFORD

There are a number of projects at Stanford that are concerned with
"new generation" computing, some ongoing, some in the planning stage.
As not all the PI's are in the survey, I'll take the liberty of
summarizing them here.
1. John Hennessy is implementing a language, SAL, that has the
single-assignment property, and plans to build a memory-linked
multiprocessor that supports this language, i.e., it uses the
special properties of single-assignment languages to avoid expensive
solutions to the problem of cache consistency.
2. Joe Oliger has been working with others on campus interested in

the solution to numerical problems, in a project called CLASSIC, to develop massively parallel solutions to numerical problems.
3. Tom Binford has a project to do real-time computer vision. Well along is a chip that does very fast raster processing, for low level feature detection as well as a number of other applications.
4. Ed Feigenbaum is planning to develop a "blackboard machine," a special-purpose machine for solving signal detection problems via the "blackboard model," a data model where data is viewed simultaneously at several levels of abstraction, and cooperating processes make inferences about one level from data at various levels. I trust Ed will say more about this himself.
5. A group led by Mike Flynn is looking to begin work in emulation of massively parallel machines.
6. John McCarthy is planning the implementation of a parallel version of LISP.
7. I am contemplating development of some ideas in language design, n1ere the periodic sorting of data allows communication between processes with a cost like that of closely coupled processors, even though the processors are really loosely coupled.
8. Christos Papadimitriou, Ernst Mayr, and I plan to do some theoretical studies of the limits of parallelism, the design of parallel algorithms, and the development of realistic models of parallel computation.

To support much of this work we plan to buy commercial multiprocessing hardware, run as a shared facility for the above projects and others on campus interested in applications of multiprocessing or in systems aspects.

There is not too much written at the moment, but I shall try
to
follow up with a bibliography of Stanford publications.

QUESTION #3; BARRIERS TO COORDINATION OF RESEARCHERS

We have also been trying to deal with the fact that
supercomputer
system development is a job that requires coordination
between
many specialists. I would go much further than the several
recent
messages that support the need for applications people to sit
down with computer scientists. I'm not terribly proud of the
situation, but it appears that most CS people are rather too
specialized
to see the big picture, even forgetting about applications
that lie
outsk{de CS proper. Therefore, a group of faculty from EE
and CS have,
since March, been meeting weekly to share ideas and present
their own
views of their specialty. These people come from hardware,
software
systems, theory, network operating systems, network
protocols, numerical
analysis, robotics, and occasionally a few other specialties.

I don't want to speak for the motivation of the group's
members,
but my own motivation for encouraging this process is a
perception
that
a) Computer scientists divide into subspecialties too easily.
These subgroups develop their own notation and paradigms. I
have too many
examples where two or more groups work on the same problem
unaware of each
other's existence, not to believe that if I had a broader
outlook I would see

the problem of interspecialty noncommunication as endemic. The factionalization of what should be a unified field is a significant barrier to interaction; probably it is a barrier to progress.
b) The problem of "new generation" computing is among those where the solution depends on a xm{ facilities working together, a chain like application-area problem->algorithm->language->system support->supercomputer architecture->processor architecture. It is too easy for people to insist on working at one point in the chain, ignoring the others. The best way to avoid this problem is to have cooperating researchers each with a good view of the overall picture.

It is too early to call the Stanford group a success; I'll claim that when people from one field start solving problems in another. But there is no doubt that the sessions have been educational, and I predict that the minimum benefit will be the avoidance of unimplementable algorithms, languages that are easily implementable but admit no programs that do anything useful, and so on-- this is the generalization to the next level of detail of the previously expressed fears concerning machines that serve only has "heaters." After a slow start, there has been a degree of enthusiasm worked up, to the extent that I can recommend the experiment to other sites wishing to try "lowering the barriers."

A significant failure has been our inability to attract much interest from our colleagues in AI. Another problem is that the group has

been limited to faculty and a few others. I don't see how to
expand it to the point where it serves the needs of students
as
well as the faculty, yet allows the sort of give-and-take
that
we have found valuable.

---Jeff Ullman

<-{{_~rTYPE 36
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To: new-gen@UWISC.ARPA

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we have found valuable.

eff Ullman

<-TYPE 37
----Message 37 (5583 chrs) is----
Date: 16 Aug 1983 1539-PDT
Subject: Re questions 1 and 3.
From: Danny Cohen@USC-ISIB.ARPA
To: New-Gen@UWISC.ARPA

I apologize for joining the conference so late. I found the entries
to be very interesting and educating.   I would like to add to some
points which did not get enough attention.

*** Inter-Site Cooperation ***

In order to build significant machines which perform important tasks
we need the contribution of several discipline, such as the actual
problem area itself, algorithm analysis, software/programming,
operating systems, architecture, and VLSI.

As a matter of style, some groups start from the problem and look
for the solution and some groups traverse this route in the opposite
direction. The former risks having to face the "how do I solve my
problem?" question. Their machines are expected to be put to good
use as soon as they are assembled, or even soon as soon as

they are
partially assembled (like the Cosmic-Cube at caltech).

The latter might have to face the "now that we are done what can we
do with this programmable heater?" question. Both interesting questions.

Doing a good job requires the cooperation among several discipline.
Only few sites are able to get all of them under one roof, as Cornell
and NYU say. I dare suspect that not all of us can do that. It would
be nice if all of us could benefit from the contribution of such groups
across site boundries, such that not each and every project at every
site would have to start at square one thinking about every issue.

It would be a pity to see that a project at some site, having terrific
ideas and breakthroughs in domain A (say archifecture) fails because
of lack of some capabilities in domain B (say compilers) which is
perfectly handled in another site.

Communication, like the ARPAnet, can free us from the need to organize
projects according to geographic proximity such that each has to invent
all of its own wheels. We can do better than that. We have
done so in the past and we sure can do it again.

We should be able to share not only ideas, but also tools like programs
and cell libraries, and most important, conventions which y2future
use of various tools not developed or even defined yet. CIF has played

an essential role for the tremendous cooperation in the VLSI community
supported by ARPA in spite of it being far from perfect to the point
that every researcher has its own list of CIF flaws.

I do not advocate to impose immeadetaly premature standards
(aka bureaucrats' heaven) -- but it is never too early to start thinking
about possible coordination, interfaces (aka interchange format) and
tool sharing.
More? (Yes, No) [Yes]: {
Y

*** On large N's ***

I have the feeling (sorry, no proofs) that the transition from one processor to N processors changes in nature, not just in quantity, as N changes. Some things cease to scale linearly at some point. I believe that 64 processor system is sort of twice a 32 processor system, belonging to the same class. However, an N-thousands processor system is in another class, in which the graceful degradation issue is a cornerstone of the architecture, not just an afterthought.

Applying elementary statistics to the MTBF of systems with Kilos of processors (Megas?) each of which is powerful, probably O(MIPS) or O(MFLOPS), and have enough memory 4 be interesting, probably O(Mbyte), -- yield a shockingly short time between failures.

This may suggest that logical addresses of units (i.e., which task this processor performs when) is not necessarily bound permanently to their physical addresses units (i.e., to which other processors this one is directly connected). This additional level of differed binding (logical/physical addressing) has some non-trivial "switching" cost and also several significant advantages, which for large number of processors may overweigh the switching cost.

This separation of logical addresses from the physical

addresses may
also prove important for dynamic reconfiguration of the system both
for runtime bypass of failed units and for matching algorithm structures
(hyper-cubes, trees, and other topological marvels).

*** On Parallelizing Algorithms (without paralizing them) ***

One cannot exaggerate the importance of "parallelizing" algorithms.
It turns out that it possible to "parallelize" nearly all arithmetic
algorithms and to reach the ultimate N-fold speedup. IBM's Shmuel Winograd
has proved many interesting theorems to this effect, including even the
Horner scheme, which may be the epidomy of sequentialism.

This is true in general to most of arithmetics, and obviously to most
grid oriented problems which are typically modelled by finite differences,
and -- most important -- obey some continuity/preservation principles.

parallelism may be abused in many ways. It is easy to envision a
"parallel matrix invertion algorithm" (suggested first by Finnegan)
which is based on the search of the space of all possible
matrices for the one that when multiplied by the given yields the
unit matrix. Since this search can be performed in parallel, and
since VLSI makes processors cheaper and smaller we can afford many
of them..... (How about "Search the space of arm positions and velocities
for the minimum-energy solution"? how about calculus of

variations
instead).

Danny Cohen, ISI

[]

<-TYPE 38

----Message 38 (1362 chrs) is----

Date: 17 Aug 1983 17:22:22-CDT
From: wallich@csnet-sh.ARPA
Reply-to: wallich@csnet-sh.ARPA
To: new-gen@Uwisc.ARPA
Subject: Fourth question

This conference has been taking place by means of a
distribution
list on the CSNET service host, which is sponsored by the
NSF.
Most of the participants are on the ARPAnet, which is
sponsored
by DARPA. Many people have reached those nets via
intracompany or
intrauniversity nets such as those at HP, PARC, IBM, CMU, and
MIT. [There have been some adventures in trying to find
people on
these nets, which points to an interesting question for
future
co-operation.]

If computer networks are going to be an important part of multi-site
cooperation for next-generation research, who is going to sponsor
them, how will they be connected, and who will have access to them? If
other facilities are to spring up for such cooperation, such as
hardware and software prototyping and simulation services, who will
pay for them? In short who is going to sponsor next-generation
research and how will the resources get where they should go? How will
work sponsored by different agencies be co-ordinated?

----Message 39 (2552 chrs) is----
Date: Thu 18 Aug 83 13:46:39-EDT
From: Norman Christ@COLUMBIA-20.ARPA
Subject: Parallel computation and user driven design
To: NEW-GEN@UWISC.ARPA

As a physicist woefully ignorant of computer science
(I'm not even sure what the previous four computer generations
were!) perhaps I can best contribute to this interchange by
describing the particular application that a group of us at
Columbia is addressing, the parallel computer architecture that
we believe will provide a practical, cost-effective, near-term
solution to our problem and the approach we have taken to
acquire the needed hardware. (The work that I will describe is
being done with my colleague Anthony Terrano and two graduate
students, all physicists.)

<-TYPE 40
----Message 40 (4880 chrs) is----
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i) Physics application.

We are interested in the physics of quarks and how they bind to form the more familiar protons, neutrons pi-mesons etc. that are found in the atomic nucleus. This problem can be approached numerically (using a formaulation due to Ken Wilson) by replacing space-time by a finite lattice of points, often a four-cube with as many as 16 points on a side. With a minimum of 32 real degrees of freedom per lattice site (in the form of four 3x3 unitary matrices), this is a problem with 2 million variables. Many interesting questions can be answered by averaging over an ensemble of points in this high-dimensional configuration space generated by the Metropolis method used in statistical mechanics. The interaction between these variables is nearest-neighbor and is represented as traces of products of the unitary matrices.

This is currently a very important subject in high energy physics to which the devotion of significant resources is appropriate. Estimates of the time required for a

thorough
treatment of the problem easily range as high as hundreds of "Cray-years". On a personal level, I am willing to devote a significant fraction of two or three years to the acquisition and exploitation of the resources necessary to answer some of these questons.

ii) Computer architecture.

The nearest-neighbor interactions and homogeneity of the problem suggest a synchronous grid of processors (a two-dimensional torous appears best in this case). Each processor is based on an Intel 80286/287 microprocesor and is supplemented
by a pair of fast TRW arithmetic chips controlled by a primative
microcode so that the repetitive matrix multiplication can be executed at a rate of 16 million 22-bit floating point operations per second. An array of 256 of these processors will
provide a 4 Gigaflop speed - computational power probably adequate for at least some aspects of our problem. Since each
processing element costs about $2500. and is made from off-the-shelf components our cost-effective and near-term requirements are also met.

iii) Acquisition of resources.

We quickly discovered the difficulties referred to in Question 3 and many of the previous comments regarding useful interdisplinary communication. In fact, we decided that the electrical engineering and computer science aspects of this project were sufficiently simple that it would be easier to learn by our mistakes than to develop the interdisiplinary communication necessary to avoid making them in the first place.
Likewise the possibility of persuading a computer manufacturer
to fabricate what we needed in a short time at a reasonable cost
appeared remote. Thus we set about designing and building the
system described in ii) ourselves last winter. Because of the

importance of the problem and the apparent economy of our approach, we have had no difficulty in obtaining the funding necessary to build 16 and now 64 nodes from conventional high energy physics sources.

It is too early to pronounce our efforts a success. We have a single processor working, a second built and are in the
middle of fabricating 18 more. We remain enthusiastic and optimistic about our prospects.

Although we have decided to proceed quite independently, I am certainly interested in the problems addressed in question
3. Obviously, we would be pleased to contribute to the understanding of some of the important issuses in parallel processing referred to by the other particiants. Perhaps by offering time and support to computer scientists or users in other disciplines (over an appropriate network) we could get some assistance in software development for our array - especially to use it in an asynchronous mode not really required
for our primary physics problem. Surely developing such fruitful communication would make some sort of collaborative, subsequent project more likely.

Norman Christ

Date: 20 Aug 1983 21:05:28-CDT
From: wallich@csnet-sh.ARPA
Reply-to: wallich@csnet-sh.ARPA
To: new-gen@Uwisc.ARPA
Subject: Wrap-up

Our plan was to wrap up this "teleconference" this week and use the
material submitted by then as the basis for the IEEE article. Therefore this
is the last formal request from the Moderators:

1. Please review the previous Questions (copy attached

below), and submit
any new thoughts you may have in light of the past discussion.

2. What is the most critical action that U.S. government, industry, or
acadamia should take (or should not take) with respect to these issues?

3. Do you think this Teleconference has been worthwhile? What comments
have you found most surprising, instructive, or insightful?
Do you think this discussion should be continued, in this or some
modified form, in the near future?

Paul Wallich

Alan Bell

Bert Raphae

Chuck House

==

Question 1

Whtdoes "fifth r"new" or "supercomputer" generation computing mean? What should the goals of these programs be? What will be theform of their structures, architectures, developments, et. What will the results of this research look
like after the tchnology has matured? Will there be several different effort going to occur which are heading toward

different goals ith similar names (superscientific, fifth gen, etc.)
How can each of hem be characterized and distinguished?

===

Question 2

Thsdiscussion ofr has been excellent though sometimes a bit independen of the question. Many good points and issues have beenraised. Several responses illustrated the importance of fist understanding the application areas before creating the harware and software systems to support them.

What are t{he aplcations where New-Gen computers will be used? I woul like to see us create both a taxonomy of areas and specifc applications. What are the characteristics of each of theseareas?

I wonder if we,a computer scientists, xahe too limited breadth to envison and specify many of the new applications. Is this the case What groups of people should become involved to illutrate the application areas to us? How do we involve and wrk with these new groups?

==
=

Question 3

So fr, we've sendiscussions about specific architectures move to
become discussios about principles for selecting architectures, and
then discussionsabout the need for funds and methods to experiment
with architecturs and applications. People also seem to agree about
the need to invove applications people (including non-computer-scintists) in the early stages of machine and

environment deveopment. So how do we do that?

How can we coodnte the creative activities of applications people,
environment builers, machine architects, VLSI designers, and others,
so that they canlearn of and build on each other's work, and results
in one disciple an build on results in the others? How can we have
work on a new mahine at one site interact synergistically with work
on a software enironment at another site, for example?

What are the barers that are keeping this kind of interaction from
happening now? Wat needs to be done to lower them?

(For example, wyare certain people sending lots of messages in this
conference and ohers not?)

===

Instructions for Using ARPAnet

What you type is underlined and bolded.

Dial **8-617-491-1150**

Machine will respond with MIT TIP 410 #:

You type **@L 78**

Machine will respond with Trying...

Open (or Host not responding if the system is busy or down)

When you get the .

type **login N600GB28**

Password is **gbell**

(To send mail just type **mail** and the system will lead you through it)

When you are ready to log off type **k/p@c**

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+---------------------------+
|   |   |   |   |   |   |   |
| d | i | g | i | t | a | l |   i n t e r o f f i c e   m e m o r a n d u m
|   |   |   |   |   |   |   |
+---------------------------+
```

Subject: **ARPA net Graphics Protocol**

To: Len Halio, ML1-2/H26
Charlie Rupp, ML3-2/E41

Date: 17 JAN 79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

follow up 2/7/79

Is the ARPA net graphics protocol used? Is it applicable to us? Is it compatible with SIGRAPH?

GB:ljp
---Message 18 (877 chrs) is----
Received: from CMU-CS-PT by CMU-CS-A; 15 Jun 83 12:12:29 EDT
Received: from LANL by CMU-CS-PT; 15 Jun 83 12:08:49 EDT
Date: 15 Jun 1983 10:06:15-MDT
From: Bill Buzbee C-DO@lanl
Reply-to: blb@lanl

To: gordon bell
Subject: msg for Tom Gannon, re 784
Cc: douglass@LANL, rhe@lanl

Tom, we have decided to continue our effort to acquire an AFP for our
research on the use of parallelism to support AI applications. Thus, we
must decline DEC's generous offer to site a 784 here. However, and as
indicated in my previous msg, we would welcome opportunity to

1. be an active listener to 784 R&D activites at the sites that get them,
2. get more tech info on the PPA,
3. and be a candidate site/experimenter for the PPA.

Thanks again for your visit and DEC's offer.

Bill Buzbee

+---------------+ ID#0165
! d i g i t a l ! i n t e r o f f i c e m e m o r a n d u m
+---------------+

Subject: **ARPA Five + Year VLSI Effort**

To: OOD, Jim Bell,
Lloyd Dickman, Bill Green,
Craig Mudge, Dan Siewiorek

Date: 11 JULY 78
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

follow up 7/25/78

There has been money allocated for the above.

I'd like us to figure out how we can couple into it. Bob Kahn, Chief Scientist of ARPA, is heading it.

We should no doubt visit them in the fall.

Can we find out what's happening with it?

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Dick Clayton	ML12-2/E71	Jim Cudmore	ML1-5/E30
Bill Demmer	TW/D19	Ulf Fagerquist	MR1-2/E78
Bill Johnson	ML21-3/E87	John Kevill	ML1-3/E58
John Meyer	ML12-1/A11	Larry Portner	ML12-3/A62
Bob Puffer	ML12-2/E38		
Lloyd Dickman	ML3-2/E41	Bill Green	ML1-4/B34
Craig Mudge	Cal Tech	Dan Siewiorek	CMU

Dear Arthur:

It was really nice to hear from you again. Enclosed are some of the Museum's Reports to give you an idea of what it's all about. As you can see, it attempts to cover all of information processing, not just computers. In this regard, I hope you can find some of your important earlier work, including that having to do solely with communications that could go in the Museum. I would hope that some of the artifacts and manuals on the switching computers would be available too.

I appreciate the fact that you are totally committed to supporting your current work from your foundation, and as such don't have any spare cash. However, I would like to encourage you and/or the company to become a founding member at this time. We now have quite an impressive list of founders and supporters and we'd clearly like your support (and artifacts) too.

As a seperate issue, I do hope you'll consider Encore as an outlet when your current work reaches the state that it can be productized.

Again, I do hope to see you in the future either in Dallas or here. I would enjoy taking you through the Museum.

Sincerely,

Gordon Bell
Chief Technical Officer

GB3.S10.28

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!   !   !   !   !   !   !   !
! d ! i ! g ! i ! t ! a ! l !         I n t e r o f f i c e
M e m o
!___!___!___!___!___!___!___!
```

TO: BILL JOHNSON   DATE: FRI 3 DEC 1982
4:16 PM

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

MESSAGE ID:
5183614265

SUBJECT: ARTIFICIAL INTELLIGENCE MARKET POTENTIAL

It was our intent to have such a group charter - as a follow-on to
BJ's announcement; the only question is a month (while we get some
status info).

The only problem now is that we don't have very much of quality to
market and we don't have a good base product (eg. LISP) to build on.
There are products such as MacSyma that could be sold as add-

ons.

I wanted to have the two days open review (conference) in January
before we did this though. It's likely to be open stores, then work
on product. Suggest you talk to BJ, Dennis and Mahendra about whether
to wait the month before we make such a plan/group.

ATTACHED: MEMO;41

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*****************
* d i g i t a l *
*****************
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TO: WIN HINDLE
5:34 PM EDT

cc: OPERATIONS COMMITTEE:

DATE: TUE 30 NOV 1982

FROM: JACK SMITH
DEPT: MFG ADMINISTRATION
EXT: 223-2231
LOC/MAIL STOP: MLO1-4/A54

MESSAGE ID: 5183408480

SUBJECT: ARTIFICIAL INTELLIGENCE MARKET POTENTIAL

Our manufacturing folks have been working in the area of Artificial Intelligence for the past couple of years. Lately they have become very excited about the possibilities of this marketplace being penetrated with our product families. They believe the market potential is much greater than most market areas we are currently involved in. They view the market as evolving very rapidly and unless we decide to participate now, we could miss the boat. How do we go about getting some focus on this issue?

These applications are not an obvious extension of existing market groups. One suggestion is to form a point-marketing group (my term) as we did with Andy and personal comupters. Given my understanding of the potential of this marketplace, it may be the way to go.

I'm concerned that, while we are holding and attending seminars to further our awareness, other folks will be developing   marketing plans and selling product.

1-DEC-82 8:54:11 S 01675 CLEM
CLEM MESSAGE ID: 5183391856

July 6, 1978

Professor Arvind
Indian Institute of Technology Kanpur
IIT Post Office
Kanpur-16, U.P.
INDIA

Dear Professor Arvind:

I'm sending under separate cover the Unibus specifications, some more recent processor manuals and an ISPS description of the PDP-11.

I'd recommend that you purchase the various processor manuals or other information from Hinditron Computers Pvt. Ltd., 69/A. L. Jagmohandas Marg., Bombay 400 006 India.

Also, several of us are writing a book, Computer Engineering, which might provide some more information. It will be available from Ms. Heidi Baldus at Digital Press for $19.95 plus postage in September.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:ljp
ID#: 0158

CC: Hement Sonowala

February 15, 1984

Professor Joel Moses
Head of the Department
Electrical Engineering
Massachusetts Institute of Technology
Cambridge, Massachusetts 02139

Dear Joel:

I would like to recommend that Arvind be given tenure. I've enjoyed the interaction with him on various parallel computing approaches, especially dataflow. While only a few organizations are engaged in this research, he has the most balanced and promising view. Everyone believes some form of dataflow is the key to parallelism.

The Multiprocessor Emulation Facility looks quite interesting and should be built as quickly as possible! In a recent taxonomy of computer structures, Jack Schwartz at NYU lists about 55 computers. I would venture an estimate that at most 15 could be useful, if properly engineered. It's unclear how many computers will actually be built, or for that matter whether any of the useful 15 will be built. The emulation facility will hopefully provide a way of testing many of these structures.

Arvind has taken a risky approach to his own career in doing design and empirical work, i.e. along traditional engineering. I would hope MIT is still able to take such risks and support engineering-oriented research. This work is needed both in the universities and in industry, but for a researcher who doesn't have tenure it is hard because it is the long route and it means building real things. The arrangement with IBM is both important and good in this regard.

As an alumni of MIT and honorary alumni of Carnegie-Mellon, I believe the CMU environment is now much more intellectually alive because of the extensive engineering they do in parallel and AI systems. Whirlwind and Multics were built as large-scale, non-toy systems, but they occured 15 years ago. It is essential to have people who will dream and build real systems. I hope you'll keep Arvind, but in the event you don't, please let me know immediately because I'll help see that the project continues without interruption.

Sincerely,

Gordon Bell
Chief Technical Officer

April 9, 1979

Dr. Ir. F. G. Insinger
Chairman
A.S.I.
Posbus 20011
2500 EA 's-Gravenhage

Dear Dr. Isinger:

Although I'm going to Berlin in May, I have already made plans and don't have the time to speak at Gravenhage this trip. I would like to put your request in my files so that I can integrate it into a future European trip in the Fall or Spring of 1980.

Sorry I can't be more specific at this time.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:ljp
GB0002/13

January 5, 1981

Ms. Sheila Grinell
Association of Science-Technology Centers
Interim Executive Director
1016 16th St., N.W.
Washington, DC 20036

Dear Sheila:

I feel especially strong on issue about what computers do (their function) is based mostly on what computers are (their structure). To this end, let me urge you to explain explicitly, implicitly or as a guiding principle, the notion of there being a small number of information processing primitives out of which all systems (including people) are built. Allen Newell and I wrote this set down in 1970 in the Computer Structures book which I'm sending you. (See Chapter 2). I assure you this extends beyond hardware to all software levels. The book update (1981) goes further and uses a Kiviat graph to measure the amount of essential information processing primitives: processing, primary memory, secondary memories, information flow (links) with people, links to other computers, and links to other processors. Mapping your 7 what they do into the PMS system:

. Calculate or compute (Pc-Mp)

. Simulate (Pc-Mp) because of their general purpose ability, one information processing system can be programmed to behave like another one (given enough time and memory).

.Simple information storage and retrieval (Mp-Pc) - mostly your examples were with small computers with <u>NO</u> secondary memory where only a few numbers were held.

.File, retrieve, and edit (Ms-secondary memory + Pc-Mp) - a file with computing attached to it.

.Link (L-communicate) with other computing or systems that transmit information electronically - eg. switch, teletype messages electronically.

. Link and control (L-Pc-Mp)

.Link to humans via human transducers (T)

. T.video to eyes (in form of pattern)

. T.audio to ears (in music, speech)

. Tactile/touch from fingers, feet, etc. to T.Keyboards, etc.

Please believe me that there are a small number of primitives out of which all systems can be built.

You might have a section entitled: "Common Ways People Use Computers as a Scapegoat" or "Computers (usually) Don't Make Errors, People Do". Describe the common stories: programmer error, input error, human support system failure. It could have cartoons, etc.

The persons who might be useful to consult with vis a vis toys and games: Wendell Doyle, Ms. Holly Doyle, and Bob Doyle. Certainly Papert and Minsky will have ideas and Papert will most likely be willing to discuss.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:swh
GB2.S1.6

Enclosure: _Computer Structures_
Contact Article

Dr. Ronald Zelazo
Astronautics Corporation of America
P. O. Blox 523
Milwaukee, Wisconsin 53201-0523

Dear Dr. Zelazo:

I am writing in response to Mr. Schumann's letter to Ken Fisher of March 9, where he suggested that we might work with your Madison group building the high performance computer in regard to some sort of joint marketing arrangement.

We believe the group, formerly Vector Scientific, was doing an excellent job in the market positioning of their product in terms of cost, performance and general characteristics. We are enthusiastic about helping fine-tune such a plan including defining how it would work with other computers and the details of the operating system, etc. For example, Encore has a product that we believe would make an excellent I/O and/or memory subsystem for the Madison group. If our product could be used in this fashion, we believe many benefits would occur including a shorter time to market, less development (for example in networking), a richer product set including a variety of languages at initial introduction, etc. In short, we have a product that would be synergistic with your product.

We believe we could help Astronautics realize the full potential by being a significant sales and service outlet for selected markets that would not otherwise be reached. Since Encore is building a first rate, general purpose sales and distribution company capable of addressing both the OEM and various commercial end user markets, we would very much like to discuss being the sales and service outlet for the computer in these market segments. It is our understanding that Astronautics is in the military and aerospace market, and hence we would not have a conflict with products reaching the same customer via several channels of distribution.

We remain enthusiastic about your product and would like to discuss these opportunities with you at your earliest convenience.

Sincerely,

C Gordon Bell
Chief Technical Officer

CC:
Ken Fisher
Robert W. Schumann
Astronautics Corporation of America
2270 S Park St.
Madison Wisconsin 53713

JUNE 25, 1981

Mr. Joe D. Wetherington
American Telephone and Telegraph Company
5 Wood Hollow Road
Parsippany, NJ 07054

Dear Mr. Wetherington:

We recently received your Presentation Level Protocol Manual. We find the information it contains very useful.

We are interested in obtaining ten (10) more copies of this manual. If you could send them at your earliest possible convenience, we would greatly appreciate it.

Please send to: Gordon Bell
Digital Equipment Corporation
146 Main Street
Maynard, MA 01754
ML12-1/A51

Thank you very much for your time and effort.

Sincerely,

Gordon Bell
Vice President, Engineering

GB/ml

AT&T'S ADVANCED COMMUNICATIONS SERVICE (ACS)

WHAT IS IT

- SHARED, SWITCHED DATA COMMUNICATIONS NETWORK SERVICE

WHAT ARE THE GOALS OF ACS?

- ALLOW USERS TO DERIVE GREATER UTILIZATION AND CONTROL OF ALL

  RESOURCES INVOLVED IN THEIR DATA COMMUNICATIONS SYSTEMS.

- RESPOND TO EXISTING AND EMERGING NEEDS OF A BROAD SPECTRUM OF

  DATA COMMUNICATIONS USERS FOR MORE VERSATILE, COMPREHENSIVE AND

  EFFICIENT DATA COMMUNICATIONS SERVICES.

- RESPOND TO NEEDS OF LARGE AND SMALL USERS BY OFFERING A BROAD

  GEOGRAPHIC SERVICE AND A WIDE RANGE OF ACCESS ARRANGEMENTS.

January 26, 1981

Murray A. Thompson
University of Wisconsin-Madison
Physical Sciences Laboratory
3725 Schneider Drive, Route 4
Stoughton, WI 53589

Dear Murray,

We're enclosing several pieces of information on John Atanasoff that I hope will be helpful to you. In particularly, the article by him in Brian Randell's book and the portion of the Sperry-Rand vs. Honeywell trial in which the judge evaluates the contribution of Atanasoff. We hope that these will be helpful in reaching a decision. Professor Arthur Burks, of the University of Michigan, has completed an article for the ANNALS OF COMPUTING HISTORY (that is not yet published) that further enforces the contributions that Atanasoff made. He was part of the ENIAC project and therefore was around at the time that Eckert and Mauchly were making design decisions.

Thanks for getting onto this problem.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:swh
GB2.S1.30

Enclosures: Atanasoff Information
October 21, 1980

Professor John Atanasoff
Route 2, Box M12
Monrovia, MD 21770

Dear Professor Atanasoff,

Some copies of the poster invitation for your lecture on the 11th are enclosed. We are very pleased with them and hope that you are as well.

We have received the drum from Dr. Maple and it is displayed near the entrance to the Museum. It is very nice to have it prior to the lecture and I am truly amazed by it.

Enclosed please find a simple agreement regarding our holding and displaying your breadboard replica of the Atanasoff Berry Computer. Stan Schultz should have called you by now to make arrangements to come and pick up the machine. He is the engineer who is keeping up our early machines and will also have the care and oversee cleaning and fixing up the ABC for display. Since he will pick it up personally and drive it back to Massachusetts, I am confident that it will be in good hands.

We're looking forward to seeing you on the 11th. If you would come directly to Marlboro with your son by 3:30 PM on Tuesday then there will be time prior to the 5 PM lecture, if it works out, to hold a press conference. (We will hold the hotel room at the Colonial Inn in Concord for late arrival.) The reception will then follow the lecture in the museum itself. On Wednesday we will arrange for you to see the old woolen mill where Digital has its headquarters, our semi-conductor facility in Hudson, and a tour of part of Marlboro with some chance to view the museum again. You can discuss the restoration with Stan again on Thursday. On Wednesday evening we will plan a small dinner party at our house and transportation to the airport will be arranged for Thursday.

We're looking forward to your visit.

Cordially,

Gordon Bell
Keeper, Digital Computer Museum

GB1.S7.36

Enclosures: Agreement
Poster/Invitations

Agreement between John Atanasoff and Gordon Bell, Keeper, Digital Computer Museum

The Digital Computer Museum will restore the replica of the Atanasoff-Berry Computer for display within the Museum. If, for any reason, the Museum decides not to display the A-B Computer then, we will inform John Atanasoff and either return it to him or put it in our warehouse, whatever he prefers. The Digital Computer Museum will, in no case, loan the computer to any other party or move it from the Museum without the consent of John Atanasoff. Any damage to the machine incurred on Digital premises will be replaced on the replica, using J.V. Atanasoff's drawings. At any time John Atanasoff can request the return of the machine to him at the full expense of the Digital Computer Museum.

------------------------ ------------------------

Gordon Bell, Keeper
Digital Computer Museum

John Atanasoff

Date: ____________

Date: ____________

Foreword

On 11 November, 1980 John V. Atanasoff presented his work on digital computation at a Pioneer Computer Lecture at The Computer Museum. I urged him to write a fuller account and told him I would be honored to write a foreword. This is the first real account of his work outside of his August 1940 manuscript (reprinted in Randell's book) and 1338 pages of testimony in a Federal court trial.

The paper is important because it:

.<u>is a primary source</u> and, as such, its value will only become apparent with its use by historians. It should be valuable in the understanding of how science and technology develop, in general, and how the computer was invented, specifically.

.provides insight about people and organizations. For example, the controversary on the number base pervaded organizations for many years, and he turned out to be right in selecting base 2.

.documents his inventions of many important concepts in digital computation, especially the notions of serial computation and regeneration for memory, which he called jogging. Regeneration is the basis for delay line, drum delay line, Williams tube, and charged coupled device memories.

.gives an insight into how Atanasoff himself thinks, how he approaches ideas and problems. For me, it provided an inside view of a creative and brilliant person who provided significant ideas on computation.

Now, I urge you to read it.

Gordon Bell
20 February 1983

GB8.2

July 15, 1980

Professor Atanasoff
Route 2, Box M12
Monrovia, MD 21770

Dear Professor Atanasoff,

Enjoyed talking with you on the phone on the 9th and am delighted that you will be speaking on November 11.

As an aside, Gwen (my wife) who is also the assistant keeper of the Museum and I are from Prairie du Chien, Wisconsin, and Kirksville, Missouri, and it was just pleasant to hear your voice. Anyway we hope that you and your wife will come to our home for dinner on the 9th or 10th so that we can talk informally and you could meet a few other people in our computer community.

Is there any chance that you would loan your replicated machine for a few months? As an engineer, I really enjoy working on the museum because the physical computing devices can be seen and not just read about or shown in pictures. Having your replicated machine for display would truly be significant. I would be happy to have it shipped or have you bring it here and help us arrange the display, perhaps sometime in October. As a complement to the real machines I have found it informative to have photos of the original installation. If you have any other photographs or diagrams besides those in Randell's book could you please send them to us? Or, do you know if any might exist in the archives at the University of Iowa that we might obtain?

In preparation for the lecture, we need some photos of you from which we can choose to prepare a poster/invitation for the event. For your information we're sending you several museum posters, including one announcing the Forrester lecture. I look forward to receiving your short abstract from the trial decision.

Please feel free to call Gwen or me collect (617-493-2236) if you would like to talk further on any of these matters.

Sincerely yours,

C. Gordon Bell
Vice-President Engineering
Keeper, Digital Computer Museum

GB1.S5.24
February 12, 1982

Professor Link
Auburn University
Department of Economics
107 Thach Hall

Auburn University, Alabama 36849

Dear Professor Link:

I found the executive report you sent me to have no value whatsoever, except as single sided scratch paper. I'm sorry we participated then. I'm returning your questionnaire unfilled, of course.

Regretfully,

Gordon Bell
Vice President,
Engineering

GB:mal
GB3.S2.13

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<subj>NAE - INFORMAL STATUS ON NOMINEE PEER CO ASSIGNMENT
<from>ABRAMSON
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<date rec>8/12/80
<log#>8-27
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<subj>RESUME - CANDIDATE #1103, EMMONS-LABUS & ASSOCIATES
<from>HIZER, DAVE
<to>GB
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<date rec>8/12/80
<log#>8-26
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<message>PLEASE HANDLE
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<subj>XEROX - 3 PAPERS RE SMALLTALK
<from>SUTHERLAND, BERT
<to>GB
<date>80/8/?
<date rec>8/12/80
<log#>8-25
<dispo/date>
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<subj>CM* REVIEW - COPY ENCLOSED
<from>JONES, ANITA
<to>GB
<date>80/8/6
<date rec>8/12/80
<log#>8-24
<dispo/date>
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<subj>YELLOW BOOK--JULY 1980
<from>MAYER, DIANA
<to>BELL, GORDON
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<from>CADWALLADER, JOHN F. -- FRUSZTAJER, BORUCH B.
<to>BELL, GORDON
<date>80/8/4
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<log#>8-22
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<from>VAN VALKENBURG, M.E.
<to>BELL, GORDON
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<subj>LAKE SYSTEMS
<from>KELLEY, WALTER

<to>BELL, GORDON
<date>80/8/5
<date rec>8/7/80
<log#>8-20
<dispo/date>CIRC: KOTOK,COPP,KO,+RET 8/15/80 Fri 10:01
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<answer>
<f/u>
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<subj>RESUME' -- RAYMOND GRAGLIA
<from>GRAGLIA, RAYMOND
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<dispo/date>ARMAND LA VALLE - 8/7/80
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<from>NELSON, MRS. E. HENRIETTE
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<from>FREAS, MARK S.
<to>BELL, GORDON
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<from>MULLIN, AL
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<date>80/8/6
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<dispo/date>FILE #13--RECEIVED A BETTER HARDCOPY. - 8/6/80
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<from>FERRARI, LORRAINE D.
<to>BELL, GORDON
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<date rec>8/4/80
<log#>8-9
<dispo/date>GALLEY PROOF RETURNED TO FERRARI 9/2/80 TUE 16:29
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<f/u>
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<subj>TWX--USE OF SMBU DISABLES TRAPS ON 11/70'S
<from>DAVEY, MIKE (RDGB)
<to>ALL MUMPS SUPPORT SPECIALISTS
<date>80/8/4
<date rec>8/4/80
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<from>VAN DAM, ANDY
<to>BELL, GORDON

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<dispo/date>DICK ECKHOUSE
<message>ARE WE GOING TO VISIT?
<answer>
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<subj>TWX--DISCOUNT RATE FOR PRODUCT INVESMENT ANALYSIS
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<to>BELL, GORDON
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<subj>DEAN WITTER REYNOLDS INC.
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<from>STOCKTON, C.G.
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<subj>NATIONAL RESEARCH COUNCIL
<from>BLACKBURN, JACK F.
<to>MEMBERS
<date>80/7/30
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<subj>GENERAL ELECTRIC COMPANY--RESUME' EDWARD T. BARRON
<from>BARRON, EDWARD T.
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June 20, 1978

Professor I. G. Ross, F.A.A.
Chairman
Australian Research Grants Committee
Department of Science
Scarborough House, Phillip,
P.O. Box 449, Woden, A.C.T. 2606

Dear Sir:

Because the proposal you asked me to review is outside my area of expertise, I will not be commenting on it.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:ljp

00 CORE DECGRAM ACCEPTED S 002010 O 279 04-JAN-83 10:54:32

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.___.___.___.___.___.___.___.
!   !   !   !   !   !   !   !
! d ! i ! g ! i ! t ! a ! l !        I n t e r o f f i c e
M e m o
!___!___!___!___!___!___!___!
```

TO: see "TO" DISTRIBUTION   DATE: TUE 4 JAN 1983 10:53 AM EST

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5186857217

SUBJECT: AUSTRALIAN VAX/VMS/DECNET INPUT

GB4.S1.5
They're afraid of the DG machine at 2 x 750. What's it do?

Also the Prime 850. Why isn't the 782 the answer?

We sure need to supply clear commercial benchmarks.

The salesmen regard DECnet as a major competitive weapon albeit nearly
a concealed one.

Pluto

They really want Pluto to do FMS and local echoing to off load VMS.
Does it? Does Pluto do load balancing across multiple network links
to same destination? (Australia doesn't have high speed lines and
they use multi-low speeds.)

Office Micro 11 vs Pluto

It really appears that Micro 11 is the best way to handle the concentrator, because with it one gets a full 11/70 capable of much
office processing and connected to Ethernet! We really have to look
at this structure as the most cost-effective form of personal computing for the office . . . the competition is both PC clusters and
low cost concentrators that will be built by the emerging Ethernet
industry!

Encryption of Files/Fields

Our commercial customers want it (eg. DES).

Could a software version benefit by a DES microcoded instruction?

"TO" DISTRIBUTION:

BOB DALEY   BILL DEMMER   SAM FULLER
MIKE GUTMAN   BILL HEFFNER   DICK
HUSTVEDT
BILL JOHNSON   BERNIE LACROUTE   JULIUS
MARCUS
MAHENDRA PATEL   BRUCE A RYAN   BILL

```
.___.___.___.___.___.___.___.
!   !   !   !   !   !   !   !
! d ! i ! g ! i ! t ! a ! l !        I n t e r o f f i c e
M e m o
!___!___!___!___!___!___!___!
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TO: see "TO" DISTRIBUTION   DATE: TUE 4 JAN 1983
11:06 AM EST

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

MESSAGE ID:
5186857256

SUBJECT: THANKS FOR THE FINE AUSTRALIAN HOSPITALITY

GB4.S1.6

Gwen and I had a thoroughly enjoyable and productive visit during the
recent trip to the Local Area Network Conference in Sydney. We were
pleased and delighted to attend the Christmas dinner. I especially
enjoyed the interaction with you, your mates and our commercial
customers. It was great to see such enthusiasm for using VAX and

DECnet in the commercial world!

MANUFACTURING/ENGINEERING IN AUSTRALIA

The visit to CSS and viewing the statistical multiplexor convinced me again that it's worthwhile to do engineering in small groups, and that Australia could be an even bigger product producer. I met the former minister for technology in South Australia at Craig Mudge's house, and he's established an industrial park there to promote high technology. Also, Craig has a first class VLSI group who could process VLSI chips for us. Right now, I'd recommend having someone from CSS do a special chip there because he has the cost and volume structure, together with the training. Also, let me urge you to look into making Ethernet products and modifying the LA12 to become a fully protable Personal Computer.

DISTRIBUTED COMMERCIAL AND OFFICE SYSTEMS

Was impressed with how far our commercial customers had advanced. I think part of the reason for the advance is the fact there are only seven major cities, and hence a starnet will operate fine with Central and distributed processing. It's ideal for the DEC products.

FULLY DISTRIBUTED, ETHER-NETWORKED OA TESTBED

Let me urge you to make a showcase for DEC, Australia and the world in office automation and distributing processing using Digital Australia

as a testbed. Every center would be Ethernetted and all your
centers
would be interconnected by Telecom! The goal would be a
drastic
increase in productivity by having every process on line,
including
quotes using XCON and XSEL (the program that checks computer
configurations and provides quotes and space layouts).

We need an Ethernet test demo site there -- both Australia
and
the U.K. are building Ethernets today.

"TO" DISTRIBUTION:

GERALD V BUTLER FRANK WROE @SYDA MAX BURNETT
@SYDA
JACK SHIELDS JACK SMITH JERRY
WITMORE

00 BURT DECGRAM ACCEPTED S 356 O 03 27-MAY-81 01:20:38

****
* d i g i t a l *
****

TO: BILL THOMPSON DATE: TUE 26 MAY 1981
23:46 EST

FROM: GORDON BELL
cc: DICK HOUGH DEPT: ENG STAFF
OPERATIONS COMMITTEE: EXT: 223-2236

LARRY PORTNER LOC/MAIL STOP: ML12-1/A51

SUBJECT: FLEECE OR FAMINE AWARDS

We gotta do something. I propose we all come in a describe all the fleecing we are doing. I just got back from DECUS and could count about a dozen people from engineering who were clearly irrelavant. Each week we ought to have a contest.

There ought to be another kind of award too, which I was trying to win, but am having a bitch of a time with that has to do with productivity. I proposed to change the Journal Voucher system (all on paper, no change in computer programs, only procedure) that would free a high level secretary and/or manager and FA of about 1 day per month... this is big (about 4%). I want it done right now, and intend to propose it at the next OC even though I can't get it started or a committee or anyone in the Finance organization to take charge or help. Can you, so I could go after the anti-fleece award?

PS
Am going to trade show in Atlanta, taking the jet (filled with some of my developer friends so we can discuss the products, have a design review and compare notes on competitiors) but really can't find out how much it really costs incrementally, given we have the damn thing. Don't see how to understand or justify it or even why we have the jet. Given we have it, I intend to use it up until the point its use will tell our flyboys that they should get us another one because it is so heavily used. ... a true paradox.

GB2.S6.51

****
* d i g i t a l *
****

TO: WAYNE ROSING DATE: TUE 22 JUL 1980

8:21 AM EDT

FROM: GORDON BELL
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

cc: see "CC" DISTRIBUTION

SUBJECT: RE: AZTEC EMS

The intent is to organize and segment a single fixed plus removeable drive into 2 (or more) virtual drives, and separate the removeable part and not use it for any purpose other than load/unload (i.e. think of it as a low cost, tape unit). This then allows use to be segmented on a virtual drive basis the way we do now in terms of user vs. system. Thus if now an Aztec is 4 x 5 mbyte drives + the removeable part, the segmentation would be to use 3 virtual drives for the system and 1 for user. Removeability would then be at a granularity of 5 mbyte units.
Now what do you say? Will it work? How does it feel? does it solve F/R problem?

GB1.S5.28

"CC" DISTRIBUTION:

DAVE CUTLER	DAVE SAGER @TWSK	DICK HUSTVEDT
MIKE GUTMAN	BERNIE LACROUTE	NAT PARKE @TWSK
MIKE RIGGLE	GRANT SAVIERS	HERB SHANZER
JIM WILLIS		

May 17, 1984

Bernard Gordon
Chief Executive Officer
Analogic
10 Centennial Drive
Centennial Park
Peabody, MA 01960

Dear Bernard,

This is to follow up our phone conversation of May 15th. The Computer Museum needs both corporate and personal level support right now in order to open on November 12 and demonstrate its capablity. Enclosed is various material, including a short letter on why the Museum.

Our goal is to have 200 companies who provide annual support between $2500 and $25,000. This will create the needed additional annual funds and insure that the museum is industry wide.

Digital is providing $600,000 annually (paying the building costs and a variety of operating costs), for the next four years. After that, The Computer Museum must be on its own. A large portion will come from visitors and other earned income, but the Museum also needs annual membership from a large number of corporations. At present, **the annual membership is $2500** (and Analogic can also become a Corporate Founder if this happens **prior to June 24.)**

$2500 annual support would insure that Analogic could use the archives, hold several membership cards for employee check out, and help us insure that such machines as the LINC and its documentation are saved. This already has directly benefited your corporation, I understand. The Museum will also make its facilities available after hours and on closed days, only to Corporate members. Gwen will be happy to prepare any documents for your contributions committee or appear before them.

On the other hand, the capital campaign to raise $10,000,000 is largely directed towards individuals. At the level of $100,000 gifts we are willing to consider a wide variety of commemorative and other opportunities to insure given exhibitions and collections. One possiblity is the "Bernard Gordon Collection and Archive of Analog-Digital Computers", that would be archived and targetted as a special exhibit. You could also make sure that the right things were saved just by creating the "shopping list" of things to go after.

We are seeking about $1.5M for the November 12 opening, of which we have commitment now for about $350K from various companies, board members and others. Mike Spock, a board member and the director of the Children's Museum, believes we will have an audience of over 240,000. Our breakeven is about 120,000 so the push now is to get the Museum open in Boston in order to really test the market. I believe we have the plan and capability to do it, provided we get the money to open. The past five years have proven that The Museum can deliver what it promises. **This is why I sollicit the $100,000 from you now.**

On my side of it, I believe that your college that teaches real engineering can be an important addition to the educational scene. However, as you know, I have left DEC (and my large salary and benefits) and Encore is not yet established. I'm in a real start up. However, I will help you raise $100,000 or more, and take some interest in the program. Now I serve on the advisory board at the Wang Institute and since hardware is much more my strength I'd be willing to work on your project after we get open. If Encore ever goes then my own giving pattern can improve.

Sincerely,

Gordon Bell

GB13.18
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<fa>Single Register
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<ma>Pickworth, Charles N.
<na>Instructions for the use of A.W. Faber's improved Calculating Role
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<ge>Linear slide rule
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<co>UK
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<fo>
<tc>Craft
<yr>1892
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<s#>
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<cx>Speed of Lift or rope haulage (in feet per min) Motor speed, gear ratio, and rope drum diameter in inches.
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<$c>10
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<so>Prairie du Chien flea market
<$c>10
<$v>
<lo>D-Bells
<bl>See 36.79
<>

<id>B310.84
<ma>
<na>Day's American Ready Reckoner, by B. H. Day, Esq., New York: Dick & Fitzgerald, Publishers
<sn>
<#>1
<oc>Read only memory
<fa>
<ge>
<cp>
<fo>
<tc>
<yr>1866
<co>USA
<s#>
<si>

<cr>
<mt>
<cx>192 pp.
<pt>
<hw>Buy
<so>Amherst Howlands Antique market
<$c>3
<$v>
<lo>D-Bells
<bl>The book contains "tables for rapid calculations of agreegate values, wages, salaries, board, interest money, timber, plank, board, wood, and land measures with explanations of the proper methods of calculating them, and simple rules for measuring land. These tables are wholly original and have been carefully revised by an expert mathematician."
<>

<id>B311.84
<ma>Otis King
<na>
<sn>Cylindrical slide rule
<#>2
<oc>Analog calculator
<fa>2-3 moving parts
<ge>
<cp>
<fo>
<tc>
<yr>
<co>
<s#>?, b1597
<si>
<cr>
<mt>
<cx>
<pt>
<hw>Buy
<so>Historical technology
<$c>84 (84) ? (86)
<$v>
<lo>D-Bells

<bl>
<>

<id>B312.84
<ma>Brevete
<na>
<sn>Circular slide rule
<#>1
<oc>
<fa>
<ge>
<cp>
<fo>
<tc>
<yr>
<co>
<s#>
<si>
<cr>
<mt>nickel
<cx>
<pt>
<hw>Buy
<so>
<$c>150
<$v>
<lo>D-Bells
<bl>
<>

<id>B313.84
<ma>Keuffel & Esser Co
<na>radial planimeter
<sn>
<#>1
<oc>Analog Calculator
<fa>multiple part
<ge>
<cp>
<fo>
<tc>
<yr>

<co>Germany
<s#>22280
<si>
<cr>
<mt>steel
<cx>
<pt>case and instrument
<hw>Buy
<so>
<$c>60
<$v>
<lo>D-Bells
<bl>
<>

<id>B314.84
<ma>
<na>Abacus
<sn>
<#>1
<oc>
<fa>
<ge>
<cp>
<fo>
<tc>
<yr>
<co>
<s#>
<si>
<cr>9 digit
<mt>
<cx>
<pt>and instruction book
<hw>Buy
<so>
<$c>3
<$v>
<lo>D-Bells
<bl>
<>

<id>B315.84
<ma>Iacobus Matinensis
<na>sector
<sn>
<#>1
<oc>
<fa>
<ge>
<cp>
<fo>
<tc>
<yr>1687
<co>Italy
<s#>
<si>
<cr>
<mt>brass
<cx>
<pt>
<hw>Buy
<so>Antiquarian Scientist
<$c>12,000
<$v>
<lo>D-Bells
<bl>
<>

<id>B316.84
<ma>Jason
<na>Slide Rule
<sn>No. 803
<#>1
<oc>Analog Calculator
<fa>2-3 part
<ge>linear
<cp>
<fo>
<tc>
<yr>ca 1955
<co>Japan
<s#>
<si>

<cr>
<mt>plastic laminated wood
<cx>
<pt>case and rule
<hw>Buy
<so>NE Trade Show
<$c>5
<$v>
<lo>D-Bells
<bl>
<>

<id>B317.84
<ma>Keuffel & Esser Co.
<na>Slide Rule
<sn>
<#>1
<oc>Analog Calculator
<fa>2-3 part
<ge>Linear slide rule
<cp>
<fo>
<tc>
<yr>ca 1930
<co>USA
<s#>54308
<si>
<cr>
<mt>laminated wood
<cx>
<pt>leather case and rule
<hw>Buy
<so>NE Trade Show
<$c>5
<$v>
<lo>D-Bells
<bl>
<>

<id>B318.84
<ma>Lawrence Engineering Service, Peru, Indiana
<na>Slide Rule

<sn>
<#>1
<oc>Analog Calculator
<fa>2-3 part
<ge>linear slide rule
<cp>
<fo>
<tc>
<yr>ca 1950
<co>USA
<s#>
<si>
<cr>
<mt>Paper on wood
<cx>"Waddy Hogue" written on the table side
<pt>
<hw>Buy
<so>NE Trade Show
<$c>5
<$v>
<lo>D-Bells
<bl>slide rule on one side tables on the reverse. These include Decimal equivalents of one foot, weight metals, and ultimate strength.
<>

<id>B319.84
<ma>
<na>"Unique" Universal II Slide Rule
<sn>
<#>2
<oc>Analog Calculator
<fa>2-3 parts
<ge>linear slide rule
<cp>
<fo>
<tc>
<yr>
<co>England
<s#>
<si>
<cr>

<mt>plastic pinned on wood
<cx>
<pt>
<hw>Buy
<so>NE Trade Show
<$c>5
<$v>
<lo>D-Bells
<bl>
<>

<id>B320.84
<ma>Kenyon Instrument Co., Inc., Huntington, L.I., N.Y.
<na>"The Kenyon Calculator"
<sn>Circular Slide Rule
<#>1
<oc>Analog Calculator
<fa>2-3 parts
<ge>Circular slide rule
<cp>
<fo>
<tc>
<yr>1937
<co>USa
<s#>
<si>
<cr>
<mt>plastic laminate on wood
<cx>
<pt>
<hw>Buy
<so>NE Trade Center
<$c>5
<$v>
<lo>D-Bells
<bl>A nautical slide rule. The outer circule has distance and speed in land miles & miles per hour and nautical miles and knots. The inner circle has time ranging from one minute to 10 hours. The reverse side has a compass, map measure scale ratio for 1/20,000, 40,000 and 80,000. Beaufort wind scale, knots and weather bureau description.
<>

<id>B321.84
<ma>Keuffel and Esser
<na>"K & E Compensating Polar Planimeter with Adjustable Arms"
<sn>planimeter
<#>1
<oc>Analog Calculator
<fa>Multiple parts
<ge>planimeter
<cp>
<fo>
<tc>
<yr>ca 1940
<co>USA
<s#>Model 4242, Serial Number 9120
<si>
<cr>
<mt>
<cx>
<pt>Instrument and velvet lined case
<hw>Buy
<so>NE Trade Show
<$c>75
<$v>
<lo>D-Bells
<bl>The adjustable tracer arm with vernier and adjustable pole arm allows the reading of areas in square inches to 0.01 sq. in. or .0.04 sq. cm. The range of the trace arm is 1.5-7 inches and the pole arm lenght is 6 to 13 inches. The maximum area "Pole out-side figure" is about 12 inches and "pole within figure" a 39 inch circle and 27 inch square.
<>

<id>B322.84
<ma>Keuffel & Esser co.
<na>"Paragon protractor No. 1225"
<sn>protractor
<#>1
<oc>Drawing instrument
<fa>
<ge>

<cp>
<fo>
<tc>
<yr>ca 1920
<co>USA
<s#>
<si>
<cr>
<mt>nickel, mahogany case with velvet
<cx>
<pt>
<hw>Buy
<so>NE Trade Center
<$c>65
<$v>
<lo>D-Bells
<bl>The semicircular protractor has a horncenter and movable arm capable of being set at .5 degrees.
<>

<id>B323.84
<ma>Richmond School Furniture Co., Munci, Indiana
<na>"Junior Spelling and Number Board No. 50"
<sn>Calculator
<#>1
<oc>Digital Calculator
<fa>Single Register
<ge>Manual
<cp>
<fo>
<tc>
<yr>ca 1940
<co>USA
<s#>
<si>
<cr>Red
<mt>cardboard
<cx>
<pt>
<hw>Buy
<so>NE Trade Show
<$c>20

<$v>
<lo>D-Bells
<bl>
<>

<id>B324.84
<ma>Stanley
<na>Electronic Calculator
<sn>
<#>1
<oc>
<fa>
<ge>
<cp>
<fo>looks like a 16 ft stanley powerlock rule
<tc>
<yr>ca 1980
<co>USA
<s#>
<si>
<cr>
<mt>
<cx>
<pt>
<hw>Buy
<so>NE Trade Fair
<$c>2
<$v>
<lo>D-Bells
<bl>
<>

<id>B325.84
<ma>Contina Ag Mauren
<na>"Curta" Type II
<sn>
<#>3
<oc>Digital Calculator
<fa>3 Register
<ge>Rotary
<cp>
<fo>

<tc>Mechanical
<yr>
<co>Liechtenstein
<s#>513508;513329;555503
<si>
<cr>
<mt>
<cx>
<pt>Instrument and Case; one with leather belt carrying case
<hw>Buy
<so>NE Trade Fair
<$c>300(84); ?: 265 (87)
<$v>
<lo>D-Bells
<bl>See 87.80
<>

<id>B326.87
<ma>Bauernfeind, Dr. G. M.
<na>Die Planimeter
<sn>
<#>1
<oc>Analog Calculator
<fa>3 or more parts
<ge>planimeter
<cp>
<fo>instruction book
<tc>Mechanical
<yr>1853
<co>Munchen, Germany
<s#>
<si>
<cr>
<mt>
<cx>Pamphlet with cardboard cover from Harvard Library; 48 pages with one pull out page of figures showing the planimeter von hanlen.
<pt>
<hw>Buy
<so>Antiquarian Scientist
<$c>150(87)
<$v>

<lo>D-Bells
<bl>
<>

<id>B327.84
<ma>D'Ocagne, M.
<na>Le Calcul Mecanique par L. Jacob, Paris Octave Doin et fils, Editeurs, 8, Place de L'Odeon, 8
<sn>
<#>1
<oc>Book
<fa>
<ge>
<cp>
<fo>
<tc>
<yr>1911
<co>
<s#>
<si>
<cr>
<mt>
<cx>
<pt>
<hw>Buy
<so>
<$c>
<$v>
<lo>D-Bells
<bl>
<>

<id>B328.84
<ma>Albert Newstler A.G. Lahr i/B
<na>"Rechen-Walze System Cylindrical Slide Rule"
<sn>Cylindrical Slide Rule
<#>1
<oc>Analog Calculator
<fa>3-4 parts
<ge>slide rule
<cp>
<fo>

<tc>
<yr>ca 1930
<co>Germany
<s#>
<si>cylinder 6 1/4" diameter and 23" long
<cr>
<mt>paper faced aluminum on dark oak base
<cx>
<pt>
<hw>Buy
<so>Historical Technology
<$c>629.57
<$v>
<lo>D-Bells
<bl> "This super slide rule appears to combine features of Hannyngton's linear grid slide rule and Thacher's cylindrical calculator. It differs from the former in that there is no overlap of scales on the base cyliner and from the latter in that each grid bar contains only one scale and that these scales are half the length of the base one. The Rouleau Calculator (Item 164 in the Science Museum catalog) is another Swiss variant of the same design. There are 50 scales, 20" long each on the main cylinder (for a total scale length of 1000 inches) and the same number, 10" long each, on the sliding grid." Historical Technology Catalog 127.
<>

<id>B329.84
<ma>Stanley, Philip E.
<na>Boxwood & Ivory, Stanley Traditional Rules, 1855-1975, The Stanley Publishing Co., Westborough, 1984
<sn>
<#>1
<oc>
<fa>
<ge>
<cp>
<fo>Book
<tc>
<yr>
<co>
<s#>

<si>
<cr>
<mt>
<cx>
<pt>
<hw>Buy
<so>
<$c>22
<$v>
<lo>D-Bells
<bl>
<>

<id>B330.78
<ma>de Beauclair
<na>Rechnen mit Maschinen Eine Bildgeschichte der Rechentechnik, Friedr Vieweg & Sohn, Braunschweig, 1968
<sn>
<#>1
<oc>
<fa>
<ge>
<cp>
<fo>
<tc>
<yr>
<co>
<s#>
<si>
<cr>
<mt>
<cx>
<pt>
<hw>Buy
<so>
<$c>
<$v>
<lo>D-Bells
<bl>
<>

<id>B331.85

<ma>Jevons, William Stanley
<na>The Principles of Science, a treatise on logic and scitentific method, London: Macmillan and Co.
<sn>
<#>1
<oc>
<fa>
<ge>
<cp>
<fo>book
<tc>
<yr>1883
<co>England
<s#>
<si>
<cr>
<mt>original brown bead-grain cloth, gilt spine lettering
<cx>870 pp., advertisements, wood-engraved frontispiece of Jevons' 'logical piano";
<pt>
<hw>Buy
<so>Pickering and Chatto Ltd
<$c>100
<$v>
<lo>D-Bells
<bl>Based on the first edition of 1874, this is Jevon's biggest and most celebrated book. Jevons' "logical piano', capable of performing logical operations on data fed in via the keyboard is shown in the frontispiece and described on pp. 107-114.
<>

<id>B332.85
<ma>Hollerith, Herman
<na>Complete specification. Improvements in the methods of and apparatus for compiling statistics
<sn>
<#>1
<oc>
<fa>
<ge>
<cp>

<fo>patent application
<tc>
<yr>1889
<co>
<s#>
<si>
<cr>
<mt>
<cx>
<pt>Folio, 7 pages and 5 plates on 3 sheets; disbound in a cloth folding case
<hw>Buy
<so>Pickering and Chatto
<$c>1,500
<$v>
<lo>D-Bells
<bl>The original patent specification, and thus the first printed account, of the Hollerith electric tabulating machine.
<>

<id>B333.85
<ma>Peurbach, Georg
<na><u>Tractatus Georgii Peurbachii super propositiones Ptolemaei de sinibus & chordis.</u>
<sn>
<#>1
<oc>
<fa>
<ge>
<cp>
<fo>
<tc>
<yr>1468 - 1501
<co>
<s#>
<si>
<cr>
<mt>
<cx>First edition, folio, 1-G4-Gr blank, small tear in E3 affecting a few figures, repaired in margin, minor water
<fo>

<tc>
<yr>1468 - 1501
<co>
<s#>
<si>
<cr>
<mt>
<cx>First edition, folio, 1-G4-Gr blank, small tear in E3 affecting a few figures, repaired in margin, minor waterstain, mostly marginal; a large crisp copy in antique style blindstamped calf.
<pt>
<hw>Buy
<so>Chatto and Pickering
<$c>1250
<$v>
<lo>D-Bells
<bl>The first printed trigonometrical tables. They were computed y Regiomontanus during his stay in Hungary in 1468. He had first computed a sexagesimal sine table and then realised the advantage of a decimal base and computed a decimal sine table; both tables are printed here. The tables are preceeded by Regiomontaus' essay on the construction of since tables and an essay on the computation of sines and chords by Peurbach. The work was edited bythe astronomer Johann Schoner (Adams P 2283, Zinner 1781).
<>

<id>B334.85
<ma>Capra, Balthasar
<na>Vsvs et Fabrica Circini Cvivsdam Proportionis, Per quem omnia fere tum Euclidis, tum Mathematicorum omnium problemate facili negotio refoluunter, H.E. de Duccijs, Bononiae (Bologna)
<sn>book
<#>1
<oc>
<fa>
<ge>
<cp>
<fo>
<tc>

<yr>1655
<co>Italy
<s#>
<si>
<cr>1st Ed.,
<mt>Modern leather binding and use.
<cx>86 pages, many text woodcuts incluing a full page one of the sector.
<pt>
<hw>Buy
<so>Historical Technology
<$c>255
<$v>
<lo>D-Bells
<bl>The author (1580-1626) an Italian astronomer and philosopher is best known for his challenge of Galileo as the inventor of the compass of proportion or sector. This book was written in 1607 although not published until 1655 after Galileo's first disclosure about 1598.
<>

<id>B335.85
<ma>Galilei, Galileo
<na>Le Operazioni del Compasso Geometrico et Militare, Terza, Paolo Frambotto, Padova
<sn>
<#>1
<oc>
<fa>
<ge>
<cp>
<fo>
<tc>
<yr>1649
<co>Italy
<s#>
<si>80 pp. folding engraved plate of the sector and many text woodcut illustrations.
<cr>
<mt>Hard vellum binding
<cx>3rd Edition.
<pt>

<hw>Buy
<so>Historical Technology
<$c>635
<$v>
<lo>D-Bells
<bl>Galileo seems to have invented his "compasso geometrico" also called compass of proportion or sector about 1597 and disclosed it about 1598. The first edition of this, his first book, was published in 1606 with less than 60 copies issued. it was reprinted in 1619. A second, improved edition was issued in 1640 by the same publisher of the third.
<>

<id>B336.85
<ma>Ozanum, Jacques
<na>Usage du compas de Proprotion et de L'instrument Universel, Claude-Antoine Jambert, Fils, Paris.
<sn>
<#>1
<oc>
<fa>
<ge>
<cp>
<fo>
<tc>
<yr>1769
<co>France
<s#>
<si>240 pp., 12 foldout engraved plates
<cr>
<mt>original leather binding
<cx>
<pt>
<hw>Buy
<so>Historical Technology
<$c>165
<$v>
<lo>D-Bells
<bl>The first edition of this work was published in Paris in 1688 becoming the standard text on the sector in France. Ozanam (1640-1753) was one of the leading French

mathamaticians of this time.
<>

<id>B337.85
<ma>Fowler's Calculators Ltd.
<na>"Jubilee Magnum"
<sn>Circular Slide Rule
<#>1
<oc>Analog Calculator
<fa>1-2 parts
<ge>circular slide rule
<cp>
<fo>
<tc>
<yr>1948
<co>England
<s#>
<si>
<cr>
<mt>nickel plated boy with white dial face rotated under an index line.
<cx>
<pt>
<hw>Buy
<so>Historical Technology
<$c>145
<$v>
<lo>D-Bells
<bl>"Designed to mark the 50th anniversary of the firm and to meet the wants of a great number of people, whose primary requirements are for a device for solving problems of muliplicaton and division in a rapid and accurate manner." The entire sacle is 79" long resulting in almost one full figure increase in accuracy over the 10" slide rule.
<>

<id>B338.85
<ma>T. Heath fect
<na>Gunter type sector
<sn>
<#>1
<oc>

<fa>
<ge>
<cp>
<fo>
<tc>
<yr>1720-40
<co>England
<s#>
<si>
<cr>
<mt>Bright brass, restored lacquer finish, pivoted strut which fold into a slot for added support.
<cx>
<pt>
<hw>Buy
<so>Historical Technology
<$c>395
<$v>
<lo>D-Bells
<bl>Thomas Heath started in business in 1714. In 1740 he made his apprentice Tycho Wing a partner and Heath & Wing remained in business until Heath's death in 1773.
<>

<id>B339.85
<ma>
<na>"the Mechanical Engineer"
<sn>circular slide rule
<#>1
<oc>
<fa>
<ge>
<cp>
<fo>
<tc>
<yr>
<co>Switzerland
<s#>
<si>
<cr>
<mt>nickel, brass case
<cx>

<pt>
<hw>Buy
<so>Historical Technology
<$c>75
<$v>
<lo>D-Bells
<bl>
<>

<id>B340.85
<ma>Todd Protectograph Co., Rochester, NY
<na>"Star Adding Machine"
<sn>Adding Machine
<#>2
<oc>Digital Calculator
<fa>Single Register
<ge>
<cp>
<fo>
<tc>Mechanical
<yr>1921
<co>USA
<s#>
<si>
<cr>Black with red and green
<mt>Metal
<cx>
<pt>
<hw>Buy
<so>MacGregor Ia.; NE Trade Fair
<$c>8(85) 35(87)
<$v>
<lo>D-Bells
<bl>One has a feature to leave the desk and keep the information.
<>

<id>B341.85
<ma>L. C. Stephier
<na>Coggeshall rule
<sn>
<#>1

<oc>Analog Calculator
<fa>2-3 part
<ge>
<cp>
<fo>
<tc>craft
<yr>
<co>USA
<s#>No. 23
<si>320x40x4 mm
<cr>
<mt>boxwood
<cx>
<pt>
<hw>Buy
<so>
<$c>
<$v>
<lo>D-Bells
<bl>
<>

<id>B342.85
<ma>
<na>Hinged slide rule
<sn>
<#>1
<oc>Analog calculator
<fa>2-3 parts
<ge>
<cp>
<fo>
<tc>craft
<yr>1800
<co>English, overstamped French
<s#>
<si>320x40x4 mm
<cr>
<mt>boxwood and brass
<cx>
<pt>
<hw>Buy

<so>Peter Delahar
<$c>70
<$v>
<lo>D-Bells
<bl>Unusual hinged slide rule with navigational scales.
<>

<id>B343.85
<ma>Wittnaur Watch Co.
<na>Map measure
<sn>
<#>1
<oc>Analog Calculator
<fa>2-3 Part
<ge>Linear calculator
<cp>
<fo>
<tc>
<yr>
<co>USA
<s#>
<si>
<cr>
<mt>
<cx>centimeters to inches
<pt>
<hw>Buy
<so>Amherst flea market
<$c>8
<$v>
<lo>D-Bells
<bl>
<>

<id>B344.85
<ma>Kueffel & Esser Co.
<na>Map measure
<sn>
<#>1
<oc>Analog calculator
<fa>2-3 parts
<ge>linear measure

<cp>
<fo>
<tc>
<yr>
<co>USA
<s#>Model 1744T
<si>
<cr>
<mt>
<cx>inches to feet
<pt>Box and measure
<hw>Buy
<so>Amherst flea market
<$c>8
<$v>
<lo>D-Bells
<bl>
<>

<id>B345.85
<ma>Watkins
<na>drawing instruments
<sn>
<#>1
<oc>
<fa>
<ge>
<cp>
<fo>
<tc>
<yr>1824 newspaper inside
<co>England
<s#>
<si>"pocket scale set"
<cr>ivory sector, boxwood rule
<mt>lizard case
<cx>
<pt>
<hw>Buy
<so>Amherst antique market
<$c>300
<$v>

<lo>D-Bells
<bl>
<>

<id>B346.85
<ma>W. L. Jones, 50 Holborn, London
<na>pantograph
<sn>
<#>1
<oc>Analog calculator
<fa>multiple parts
<ge>proportional copier
<cp>
<fo>
<tc>
<yr>ca 1850
<co>England
<s#>
<si>
<cr>
<mt>Brass
<cx>
<pt>case and instrument
<hw>Buy
<so>Amherst antiques
<$c>450
<$v>
<lo>D-Bells
<bl>
<>

<id>B347.85
<ma>integrator
<na>209478
<sn>
<#>1
<oc>
<fa>
<ge>
<cp>
<fo>
<tc>

<yr>
<co>USA
<s#>
<si>
<cr>painted red, blue and yellow by Arthur Hall
<mt>
<cx>Bur. Ord. Assembly Drg. No. 194077, U.S. No. 38
<pt>
<hw>
<so>
<$c>
<$v>
<lo>D-Bells
<bl>
<>

<id>B348.85
<ma>integrator
<na>209478
<sn>
<#>1
<oc>
<fa>
<ge>
<cp>
<fo>
<tc>
<yr>
<co>
<s#>
<si>
<cr>Bur. Ord. Assembly Drg. No. 194077-1, Serial No. 3532
<mt>
<cx>
<pt>
<hw>Buy
<so>
<$c>30
<$v>
<lo>D-Bells
<bl>
<>

<id>B349.85
<ma>Keuffel & Esser Co.
<na>Slide Rule (N4053-3)
<sn>
<#>1
<oc>Analog Calculator
<fa>2-3 part
<ge>
<cp>
<fo>
<tc>
<yr>patent June 1900
<co>USA
<s#>#364384
<si>
<cr>
<mt>
<cx>
<pt>leather case and rule
<hw>Buy
<so>
<$c>5
<$v>
<lo>D-Bells
<bl>
<>

<id>B350.87
<ma>Jacobi, C.G.J.
<na>Canon Arithmeticus sive tabulae quibus exhibentur pro singulis numeris primis
<sn>
<#>1
<oc>Memory
<fa>
<ge>
<cp>
<fo>
<tc>
<yr>1839

<co>
<s#>
<si>
<cr>
<mt>
<cx>Softbound, uncut pages
<pt>
<hw>Buy
<so>Antiquarian Scientist
<$c>225
<$v>
<lo>D-Bells
<bl>
<>

<id>B351.86
<ma>Otis King
<na>Otis King's Pocket Calculator
<sn>Cylindrical slide rule
<#>1
<oc>Analog caclulator
<fa>2-3 moving parts
<ge>
<cp>
<fo>
<tc>
<yr>
<co>
<s#>B1597
<si>
<cr>
<mt>
<cx>
<pt>Leather case and rule
<hw>Buy
<so>England
<$c>
<$v>
<lo>D-Bells
<bl>
<>

<id>B352.87
<ma>Picket
<na>'powerlog'
<sn>Slide rule
<#>1
<oc>Analog Calculator
<fa>2-3 moving parts
<ge>linear slide rule
<cp>
<fo>
<tc>
<yr>1960
<co>USA
<s#>model N 3-es
<si>
<cr>
<mt>metal
<cx>
<pt>rule and leather case
<hw>Buy
<so>NE Trade Fair
<$c>10(87)
<$v>
<lo>D-Bells
<bl>
<>

<id>B353.86
<ma>"Unique"
<na>Log Log Slide Rule
<sn>
<#>1
<oc>Analog Calculator
<fa>2-3 moving parts
<ge>linear slide rule
<cp>
<fo>
<tc>
<yr>
<co>England
<s#>
<si>

<cr>
<mt>plastic pinned on wood
<cx>
<pt>
<hw>Buy
<so>England
<$c>8
<$v>
<lo>D-Bells
<bl>
<>

<id>B354.86
<ma>"Unique"
<na> Slide Rule
<sn>
<#>1
<oc>Analog Calculator
<fa>2-3 moving parts
<ge>linear slide rule
<cp>
<fo>
<tc>
<yr>
<co>England
<s#>
<si>
<cr>
<mt>plastic pinned on wood
<cx>
<pt>
<hw>Buy
<so>England
<$c>7
<$v>
<lo>D-Bells
<bl>
<>

<id>355.86
<ma>"Unique"
<na>Universal Slide Rule

<sn>
<#>1
<oc>Analog Calculator
<fa>2-3 moving parts
<ge>linear slide rule
<cp>
<fo>
<tc>
<yr>
<co>England
<s#>
<si>
<cr>
<mt>plastic pinned on wood
<cx>
<pt>
<hw>Buy
<so>England
<$c>8
<$v>
<lo>D-Bells
<bl>
<>

<id>356.86
<ma>Faber-Castell
<na>Castell
<sn>slide rule
<#>1
<oc>Analog Calculator
<fa>2-3 moving parts
<ge>linear slide rule
<cp>
<fo>
<tc>
<yr>
<co>Germany
<s#>
<si>
<cr>
<mt>plastic and wood
<cx>

<pt>plastic case and rule
<hw>Buy
<so>England
<$c>
<$v>
<lo>D-Bells
<bl>
<>

<id>B357.86
<ma>
<na>"Coggeshall" Slide Rule
<sn>
<#>1
<oc>Analog Calculator
<fa>2-3 moving parts
<ge>linear slide rule
<cp>
<fo>
<tc>
<yr>
<co>England
<s#>
<si>
<cr>
<mt>Wood and brass
<cx>Engraved, E. Routledge Engineer Bolton
<pt>
<hw>Buy
<so>England
<$c>50
<$v>
<lo>D-Bells
<bl>
<>

<id>B358.86
<ma>Elliott Bros, 440 Strand
<na>Sector
<sn>
<#>1
<oc>

<fa>2-3 moving parts
<ge>sector
<cp>
<fo>
<tc>
<yr>
<co>England
<s#>
<si>
<cr>
<mt>Ivory and brass
<cx>
<pt>
<hw>Buy
<so>England
<$c>75
<$v>
<lo>D-Bells
<bl>
<>

<id>B359.86
<ma>J. Archbutt & Sons
<na>parallel rule, compass and rule
<sn>
<#>1
<oc>
<fa>
<ge>
<cp>
<fo>
<tc>
<yr>
<co>
<s#>
<si>
<cr>
<mt>
<cx>
<pt>
<hw>Buy
<so>England

<$c>135
<$v>
<lo>D-Bells
<bl>See B259.83
<>

<id>B360.86
<ma>H. Huges & Sons Ltd. London
<na>"Capt Field's Improved Parallel"
<sn>parallel rule and compass
<#>1
<oc>Analog Calculator
<fa>2-3 moving parts
<ge>
<cp>
<fo>
<tc>
<yr>
<co>England
<s#>
<si>
<cr>
<mt>Wood
<cx>
<pt>
<hw>Buy
<so>England
<$c>45
<$v>
<lo>D-Bells
<bl>
<>

<id>B361.86
<ma>Charles Augustus Schmalcalder
<na>Protractor
<sn>
<#>1
<oc>Analog calculator
<fa>Circular protrator
<ge>
<cp>

<fo>
<tc>
<yr>ca 1810
<co>England
<s#>
<si>
<cr>
<mt>brass
<cx>double cantilever arm and geared
<pt>wood case and instrument
<hw>Buy
<so>Peter Delahar
<$c>650
<$v>
<lo>D-Bells
<bl>Illustrated in G. Adams, rev W. Jones, Geometrial and Graphical Essays, 4th Ed. London 1813.
<>

<id>B362.86
<ma>J. Halden & Co. Ltd
<na>"HALDEN CALCULEX"
<sn>Circular Slide Rule
<#>1
<oc>Analog Calculator
<fa>2-3 part
<ge>circular slide rule
<cp>
<fo>
<tc>
<yr>ca 1910
<co>England
<s#>
<si>60 mm diameter
<cr>
<mt>
<cx>
<pt>Aluminum cse with velvet interior and instrument
<hw>Buy
<so>England
<$c>
<$v>

<lo>D-Bells
<bl>See B158.81
<>

<id>B363.86
<ma>A. Jeffery Camborne, Wilton St. Day
<na>Circular protractor
<sn>
<#>1
<oc>Analog Calculator
<fa>circular protrator with one arm
<ge>
<cp>
<fo>
<tc>
<yr>ca 1900
<co>England
<s#>
<si>
<cr>
<mt>Brass
<cx>
<pt>Wood case and instrument
<hw>Buy
<so>England
<$c>
<$v>
<lo>D-Bells
<bl>
<>

<id>B364.86
<ma>Elliott Brothers, London
<na>Proportional rule and protractor
<sn>
<#>1
<oc>Analog Calculator
<fa>Fixed
<ge>Rule and Protractor
<cp>
<fo>
<tc>

<yr>ca 1890
<co>England
<s#>
<si>
<cr>
<mt>Ivory
<cx>
<pt>
<hw>Buy
<so>England
<$c>35
<$v>
<lo>D-Bells
<bl>Engraved H. F. Mackay; Horizontal equivalents for 20 feet of vertical engraved on one side; rule for degree of slope on the other.
<>

<id>B364.86
<ma>Elliott Brothers, London
<na>Propotional rule and protrctor
<sn>
<#>1
<oc>Analog Calculator
<fa>Fixed
<ge>Rule
<cp>
<fo>
<tc>
<yr>ca 1890
<co>England
<s#>
<si>
<cr>
<mt>Ivory
<cx>
<pt>
<hw>Buy
<so>England
<$c>30
<$v>
<lo>D-Bells

<bl>6 to M. Yards on one side; 8 to M paces or yards on the other.
<>

<id>B366.86
<ma>Thompson, Silvanus P. and Eustace Thomas
<na>Electrical Tables and Memoranda
<sn>E. F. N. Spon, Ltd., 125 Strand, London; Spon & Cahmberlain, 12 Cortlandt St, New York
<#>1
<oc>Memory
<fa>
<ge>
<cp>
<fo>
<tc>
<yr>1898
<co>
<s#>
<si>
<cr>
<mt>
<cx>
<pt>plastic case, leather binding and book
<hw>Buy
<so>England
<$c>
<$v>
<lo>D-Bells
<bl>Small pocket size. 120 pages, plus an index. marked up by the owner.
<>

<id>B367.86
<ma>Schoten, Francois
<na>Tables de Sinus, Tangents, et Secantes
<sn>Chez Lambert Marchant, Libraire au Marche aux Herbes, a Brusseles
<#>1
<oc>Memory
<fa>
<ge>

<cp>
<fo>
<tc>
<yr>1683
<co>
<s#>
<si>
<cr>
<mt>Leather binding, one wormhole
<cx>
<pt>
<hw>Buy
<so>Pickering and Chatto Ltd
<$c>200
<$v>
<lo>D-Bells
<bl>Pocket sized.
<>

<id>B368.86
<ma>MacNeill, Sir John Benjamin
<na>Tables for Calculating the Cubic Quantity of Earth Work in the Cuttings and Embankments of Canals, Railways, and Turnpike Roads
<sn>Roake and Varty, London
<#>1
<oc>Memory
<fa>
<ge>
<cp>
<fo>
<tc>
<yr>1833
<co>
<s#>
<si>
<cr>
<mt>
<cx>
<pt>
<hw>Buy
<so>Pickering and Chatto

<$c>150
<$v>
<lo>D-Bells
<bl>First edition, 8vo9, pp. xxxvii, 253, dedication to Telford misbound before contents, errata on verso of title, and four engraved plates tipped in at end; contemporary green vellum, gilt lettering on spine, boards warped.

Sir John MacNeill was at this stage in his career one of Telford's principal assistants, and this work is dedicated to him. The uses he sets out for t hese tables reflect the type of engineering work he was engaged on. In his preface he refers to Charles Babbage's investigations on the type of paper nad print best suited for tables. At about this time MacNeill invented device to measure the irregularities of road surfaces which anticipated a similar invention by Babbage.
<>

<id>B369.86
<ma>Bessel, Friedrich Wilhelm
<na><u>Tabulae Regiomontanae Reductionum Observationum Astronomicarum ab anno 1750 usque an annum 1850 cumputai</u>
<sn>Regiomonti Prussorum, Konigsberg (now Kalinengrad), sumptibus fratrum Borntraeger
<#>1
<oc>
<fa>
<ge>
<cp>
<fo>
<tc>
<yr>1830
<co>
<s#>
<si>
<cr>
<mt>
<cx>
<pt>
<hw>Buy
<so>Pickering and Chatto Ltd

<$c>350
<$v>
<lo>D-Bells
<bl>First edition, 8vo, pp. (Iv), lxiii, (i), 542, errata, verso lank; foxed; blue library buckram, from the Royal Greenwich Observatory, release stamp on end paper.

The star positions given for one century, constitute the first modern reference system for the measurement of the positions of the sun, the moon, the planets, and the stars, and for many decades the Konigsberg tables were used as ephemeerrides. With their aid, all observations of the sun, moon, and planets made since 1750 at the Royal Greenwich Observatory could be reduced; and thus these observations could be used for the theories of planetary orbits.
<>

<id>B370.86
<ma>Victor Adding Machine Co., 36 Second St., Sand Francisco 5, Ca.
<na>Adding machine
<sn>
<#>1
<oc>Digital Calculator
<fa>1-2 register
<ge>Pascal key and print
<cp>
<fo>
<tc>
<yr>ca 1935
<co>USA
<s#>W867 metal plate; 936307 C 7 83 4 stamped in plastic
<si>
<cr>black and green
<mt>plastic "art nouveau" form
<cx>
<pt>
<hw>Buy
<so>Palo Alto antiques
<$c>30
<$v>
<lo>D-Bells

<bl>
<>

<id>B371.86
<ma>Starhe & Hammerer
<na>Planimeter
<sn>
<#>1
<oc>Analog Calculator
<fa>Variable Part
<ge>Variable Ratio Polar Planimeter
<cp>
<fo>
<tc>
<yr>ca 1870
<co>Austria
<s#>874
<si>
<cr>
<mt>Brass and iron
<cx>
<pt>Wooden case and instrument
<hw>Buy
<so>Peter Delahar
<$c>350
<$v>
<lo>D-Bells
<bl>A very rare instrument, modifying the Amsler design.
<>

<id>B372.86
<ma>Felt & Tarrant Mfg. Co.,
<na>"Comptometer"
<sn>
<#>2
<oc>Digital Calculator
<fa>Single Register
<ge>Keyed Wheel, Electric
<cp>
<fo>
<tc>
<yr>ca 1930

<co>USA
<s#>
<si>
<cr>
<mt>metal
<cx>
<pt>
<hw>Buy
<so>Palo Alto Antiques
<$c>25
<$v>
<lo>D-Palo Alto
<bl>
<>

<id>B373.86
<ma>Scheffellts, Michael
<na>Pes Mechanicus Artificialis, Proportiones dr ganzen Matheis ohne muhfames rerechen, Ulm Berleges Daniel Bartholomai,
<sn>
<#>1
<oc>
<fa>
<ge>
<cp>
<fo>Book
<tc>
<yr>1718
<co>Germany
<s#>
<si>
<cr>
<mt>Leather binding, some worming, 264 pp, some fold out plates, including one of a rule
<cx>
<pt>
<hw>Buy
<so>Antiquarian Scientist
<$c>450(87)
<$v>
<lo>D-Bells

<bl>
<>

<id>B374.87
<ma>Kempenich, H., Palo Alto, Ca.,
<na>"Prestolog"
<sn>Circular Slide Rule
<#>1
<oc>Analog Calculator
<fa>2-3 part
<ge>Circular slide rule
<cp>
<fo>
<tc>
<yr>1935
<co>USA
<s#>
<si>
<cr>
<mt>plastic
<cx>
<pt>
<hw>Buy
<so>NE Trade Fair
<$c>10 (87)
<$v>
<lo>D-Bells
<bl>"This instrument computes accurately per cent profit on selling price. If Cost is given by the case of one or more dozens, set t he line showing the number of dozens opposite your cost. Read cost of each unit opposite arrow and selling price opposite percent of profit desired ... to figure discount: Set per cent opposite list price. Read net value opposite arrow."
<>

<id>B375.87
<ma>
<na>"Perfection Self-adding ruler"
<sn>Pascal strip adder
<#>1
<oc>Digital calculator

<fa>Single register
<ge>Pascal strip
<cp>
<fo>
<tc>
<yr>1908
<co>USA
<s#>
<si>
<cr>
<mt>Wood, Plastic, and Brass
<cx>
<pt>
<hw>Buy
<so>NE Trade Fair
<$c>40 (87)
<$v>
<lo>D-Bells
<bl>Directions found on the back of the ruler. The adder is in the center of the ruler.
<>

<id>B376.87
<ma>
<na>"Acu-math"
<sn>Slide rule
<#>1
<oc>Analog Calculator
<fa>2-3 part
<ge>Slide rule
<cp>
<fo>
<tc>
<yr>ca 1940
<co>USA
<s#>1211
<si>
<cr>
<mt>metal and plastic
<cx>
<pt>leather case and rule
<hw>Buy

<so>NE Trade Center
<$c>10
<$v>
<lo>D-Bells
<bl>
<>

<id>B377.87
<ma>Hemmi "Sun"
<na>Slide rule
<sn>
<#>1
<oc>Analog Calculator
<fa>2-3 part
<ge>slide rule
<cp>
<fo>
<tc>
<yr>ca 1955
<co>Japan
<s#>2664
<si>
<cr>
<mt>metal, plastic bonded onto wood
<cx>cm rule on one side; inch on the other; K, DF, D, and A scales set; TI1,TI2,SI1,SI2 rules on one side of slider; CF, C1 and C on the other.
<pt>
<hw>Buy
<so>NE Trade Fair
<$c>10 (87)
<$v>
<lo>D-Bells
<bl>
<>

<id>B378.87
<ma>Acu-Math
<na>"ACU-MATH No. 150"
<sn>Slide rule
<#>1
<oc>Analog Calculator

<fa>2-3 part
<ge>Slide rule
<cp>
<fo>
<tc>
<yr>ca 1960
<co>USA
<s#>
<si>
<cr>
<mt>Plastic
<cx>a log log, deci trig rule; 10 scales on each side
<pt>
<hw>Buy
<so>NE Trade Fair
<$c>10(87)
<$v>
<lo>D-Bells
<bl>
<>

<id>B379.87
<ma>Keuffel & Esser Co.
<na>"Log Log Duplex Decitrig"
<sn>Slide rule
<#>2
<oc>Analog Calculator
<fa>2-3 part
<ge>slide rule
<cp>
<fo>
<tc>
<yr>1947
<co>USA
<s#>640386: 253308
<si>
<cr>
<mt>plastic bonded on wood
<cx>
<pt>rule and leather case
<hw>Buy
<so>NE Trade Fair

<$c>10 (87)
<$v>
<lo>D-Bells
<bl>
<>

<id>B380.87
<ma>Hemmi
<na>Versalog geotec
<sn>Slide rule
<#>1
<oc>Analog Calculator
<fa>2-3 part
<ge>slide rule
<cp>
<fo>
<tc>
<yr>ca 1960
<co>Japan
<s#>
<si>
<cr>
<mt>Plastic
<cx>12 rules on each side
<Pt>rule and plastic case
<hw>Buy
<so>NE Trade Fair
<$c>10 (87)
<$v>
<lo>D-Bells
<bl>
<>

<id>B381.87
<ma>Pickett
<na>"microline 120"
<sn>Slide rule
<#>1
<oc>Analog Calculator
<fa>2-3 part
<ge>slide rule
<cp>

<fo>
<tc>
<yr>ca 1960
<co>USA
<s#>
<si>
<cr>Yellow
<mt>Plastic
<cx>9 rules only on one side
<pt>Instruction page, rule and plastic case
<hw>Buy
<so>NE Trade Fair
<$c>10 (87)
<$v>
<lo>D-Bells
<bl>
<>

<id>B382.87
<ma>Hemmi "Sun"
<na>"Universal"
<sn>Slide rule
<#>1
<oc>Analog Calculator
<fa>2-3 part
<ge>slide rule
<cp>
<fo>
<tc>
<yr>ca 1960
<co>Japan
<s#>imprinted "The Frederick Post Co No. 1452W"
<si>
<cr>
<mt>plastic bonded on wood
<cx>cm scale on one side; inch on the other; A D and K scales set;   B C1 and C on one side;S,L,T on the other. Tables on the reverse.
<pt>
<hw>Buy
<so>NE Trade Center
<$c>10 (87)

<$v>
<lo>D-Bells
<bl>
<>

<id>B384.87
<ma>Aston and Mander Ltd.
<na>Slide Rule Mark IV
<sn>
<#>1
<oc>Analog Calculator
<fa>2-3 part
<ge>slide rule
<cp>
<fo>
<tc>
<yr>1915
<co>UK
<s#>
<si>
<cr>
<mt>nickel
<cx>shows minutes in apex angle or battery range in yards
<pt>Leather case and rule
<hw>Buy
<so>Perceptions Scientifica, Idaho
<$c>75 (87)
<$v>
<lo>D-Bells
<bl>
<>

<id>B385.87
<ma>Lawrence Engineering Serivce, Peru, Indiana
<na>
<sn>slide rule
<#>1
<oc>Analog Calculator
<fa>2-3 part
<ge>slide rule
<cp>
<fo>

<tc>
<yr>ca 1960
<co>USA
<s#>
<si>
<cr>
<mt>wood
<cx>A,B,C1,C,D,K scales on one side, instructions on the other
<pt>
<hw>Buy
<so>NE Trade Fair
<$c>10 (87)
<$v>
<lo>D-Bells
<bl>
<>

<id>B386.87
<ma>Keuffel & Esser Co.
<na>Polyphase 4053-3
<sn>slide rule
<#>2
<oc>Analog Calculator
<fa>2-3 part
<ge>slide rule
<cp>
<fo>
<tc>
<yr>1960
<co>USA
<s#>557042; 358556
<si>
<cr>
<mt>plastic on wood
<cx>cm and inch scales; 5 scales on each side
<pt>cardboard case and scale; scale
<hw>Buy
<so>NE Trade Fair
<$c>10 (87); 10(87)
<$v>
<lo>D-Bells

<bl>
<>

<id>B387.87
<ma>Keuffel & Esser
<na>Slide Rule
<sn>
<#>2
<oc>Analog Calculator
<fa>2-3 part
<ge>slide rule
<cp>
<fo>
<tc>
<yr>1947
<co>USA
<s#>560403; 351299
<si>
<cr>
<mt>plastic with metal
<cx>patent 2086502
<pt>rule and leather case
<hw>Buy
<so>NE Trade Fair
<$c>10 (87) 10(87)
<$v>
<lo>D-Bells
<bl>
<>

<id>B388.87
<ma>Keuffel & Esser
<na>"DECI-LON"
<sn>slide rule
<#>1
<oc>Analog Calculator
<fa>2-3 part
<ge>slide rule
<cp>
<fo>
<tc>
<yr>1961

<co>USA
<s#>185530
<si>
<cr>
<mt>plastic with metal
<cx>13 rules on each side
<pt>rule and leather case
<hw>Buy
<so>NE Trade Show
<$c>10 (87)
<$v>
<lo>D-Bells
<bl>
<>

<id>B389.87
<ma>D'Ocagne, Maurice
<na>Traite de Nomographie; Theorie des Abaques, Applications Pratiques, Paris, Gauthier-Villars, Imprimeur-Librairie, Du Bureau des Longitudes, de L'Ecole Polytechnique, Quai des Grands-Augustins, 55
<sn>
<#>1
<oc>
<fa>
<ge>
<cp>
<fo>book
<tc>
<yr>1899
<co>
<s#>
<si>
<cr>
<mt>
<cx>480 pp
<pt>
<hw>Buy
<so>Antiquarian Scientist
<$c>175 (87)
<$v>
<lo>D-Bells

<bl>
<>

<id>B390.87
<ma>D'Ocagne, Lieutenant-Colonel
<na>Principes Usuels de Nomographie avec application a divers problemes concernant L'artillerie et L'aviation, Paris Gauthier-Villars et C Editeurs
<sn>
<#>1
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<co>France
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<na>Nomographie. Les Calculs Usuels effectues au moyen des abaques. Paris, Gauthier-Villars et fils, imprimeurs-libraires.
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June 18, 1984

Mr. Bob O. Evans
Vice President
International Business Machines
Old Orchard Road
Armonk, New York 10504

Dear Bob:

I'd like to thank you for all the help you've given the Museum, and especially in getting IBM to become a Corporate Founder. It is great to be able to get IBM photos and artifacts for the November opening. With good exhibits, we believe it will be possible to get attendance of over 200,000 per year. Enclosed is a new brochure on the Capital Campaign. If you have any ideas that might help get IBM support for the campaign or exhibits, I'd certainly welcome them. Also, I would like your thoughts on the key IBM inventions and systems that should be represented in the Museum. After your talk last year, I prepared my list, but I'd sure like yours.

Given the difficulty of obtaining corporate support for public institutions, it is vital to get support from individuals. I hope you'll consider becoming a "Core" supporter to the campaign.

Your talk and paper in the recent Museum Report were greatly appreciated, and gives the best "long overview" of IBM that I've seen.

Sincerely,

Gordon Bell

Enclosure

00 BURT DECGRAM ACCEPTED S 2716 O 19 27-SEP-79 11:08:15
FROM: GORDON BELL DATE: THU 27 SEP 1979 11:05 AM EST
DEPT: OOD
EXT: 223-2236
TO: KEN OLSEN
MARY JANE FORBES
MARCIA KENAH
TED JOHNSON @CLEM

SUBJECT: CHARLES BABBAGE INSTITUTE

II met with Paul Armer of CBI, their Exec. Director, about a week ago
and showed him the work on the museum, including model, etc. He asked
for my support on our giving $ to them as a corp. Contribution. I said Ken
had given money personally, and I think he meant that we not give money
from a corporation. However, they could give money to CBI and that
was up to his soliciting the Corp Cont. Committee. However, I warned
that I would not support our giving money there, because I wanted to spend
any money we had for this purpose on our own stuff and we have much need
to archive, store and display, write-up and I think I can spend the
money better than CBI and do more good for computer history. I offered
to loan them pieces, give them copies of our charts, etc. and be helpful
including publishing theses that would be suitable for our historical
book series that digital press is doing. We must collaborate with them
but I want the money... and to build on our museum.

Command >
January 21, 1980

Paul Armer
Executive Secretary
The Charles Babbage Institute
Suite 224, 701 Welch Rd.
Palo Alto, CA 94304

Dear Paul:

Right now the database for the museum is at a standstill until we get a computer installed in our library so that I can extract the data in report form but we are working hard on a number of other projects. The attributes (and values) is attahced. A listing will be sent when we get it. I am sending you a printout from the museum directory which is an interactive system on the VAX in Marlboro. In addition we have the archives indexed -- but this is rather a bulky inventory. This summer we intend to have a college student programmer expand the system and bring it up-to-date. We will alert this person to let you have any results from the efforts that are made. Do hope that this will help you at least get a feel for what we have.

My wife, Gwen, and I are working on a poster illustrating six generations of pre-computing devices. We will have a working draft in several weeks and I wonder if I could send you a copy for comments.

We have hired a museum coordinator, Jamie Parker, and are working on more exhibits for a May 8 opening to the scientific community (especially locally) and a September 22 public opening. I will send you invitations to both and do hope that you can be with us at one or both of these occasions. If you are in Boston at some other time, I would be pleased to arrange a museum tour for you.

Cordially,

Gordon Bell
Vice President,
Engineering

GB:swh
GB1.S1.33
Enclosure - Museum Directory
Archival Attribute Sample

EMS 7-JUN-79
10:15:47 170 1
To: Dick Clayton
CC: Mike Tomasic, Stanton Pearson
CC: Bill McBride, Herbert Shanzer
From: Gordon Bell
Date: THU 7-JUN-79 10:15:47 EDT
Subject: BI
----
also copy to Ward McKenzie, Rose Ann Giordano

Just had a very productive meeting with Ward and Art Campbell where I
reiterated my position to solve the PAX problem by BI versus the 11/23. In
essence, I want to go flat out for the right solution so we can beat Intel
versus doing incremental, poorer products.

Right now, we don't know for sure that we can do BI because it looks too good.

Ward and Art seem happy to wait for a month till we can make a good decision.
Could you meet with Roger and Andy prior to EBOD so we don't have to go in to
a hostile environment to make a decision in the face of little data on this
proposal?

Gordon

Command:

EMS 26-APR-79 16:02:37

260 1
To: Gordon Bell
CC: William Strecker, Grant Saviers, Bill Demmer, Bill Johnson
From: Jim Marshall
Date: THU 26-APR-79 16:02:37 EDT
Subject: BI TASK FORCE

RE YOUR EMS 25-APR-79

A MEETING HAS BEEN SET UP FRIDAY, MAY 4 IN MARLBORO TO DISCUSS THE ISSUES SURROUNDING THE BI. THE ATTENDEES ARE:

ROSING, PLATZ, BLACKLEDGE, LIPCON, STRECKER, AMUNDSON, SUPNICK, J. KING, FULLER (IN B.J.'S ABSENCE), MCNAMARA.

STRECKER, SUPNICK, MCNAMARA, AND I ARE IN BASIC AGREEMENT AS TO THE GENERAL DEFINITION OF THE BUS. LIPCON WANTS AN 8 BIT WIDE BUSS, THE REST OF US THINK THAT IS TO NARROW. CERTAINLY WE CAN RESOLVE THIS ISSUE EASILY.

BILL AND I THINK THE TASK FOR FRIDAY IS TO SURFACE ANY ISSUES THAT WOULD PREVENT USE OF THE BI ON NEBULA, MERCURY, HSC, L70 AND MICROVAX. SECOND, WE WANT TO ASK EVERYONE TO DO THEIR HOMEWORK FOR A WEEK LONG TASK FORCE MEETING IN ABOUT THREE WEEKS FROM NOW.

THE MAIN OBJECTIONS TO THE BI COME FROM THE HSC FOLKS. THEY SAY:

IT IS NOT DEFINED. (TRUE) IT IS TO SLOW. (NOT NECESSARILY SO, WE ARE THINKING ABOUT 10MB) IT CAUSES THEM TO CHANGE THEIR ARCH. AND PACKAGING STYLES. (TRUE, BUT THEN THE REST OF THE COMPANY CAN USE THEIR SUBSYSTEMS FOR OTHER THINGS. IF THEY ARE ON EXTENDED HEX THIS IS IMPOSSIBLE.)

PLEASE BE A LITTLE PATIENT. WE HAVE TO LIVE WITH THE DECISION WE
ARE ABOUT TO
MAKE FOR TEN YEARS. THE IMPORTANT THING IS TO RESOLVE WHAT IS THE
LEVEL OF
PARTICIPATION FROM HSC. IF THAT IS DONE, THEN I THINK WE CAN SPEC
THE BI OUT
IN A MONTH OR SO.

SENT BY WAYNE ROSING

REGARDS

Command:

EMS   26-APR-79 16:06:02
320 1
To: Gordon Bell
CC: Grant Saviers, John Kevill, Michael S. Gutman
From: Jan Praisner
Date: THU 26-APR-79 16:06:02 EDT
Subject: BI

THIS MESSAGE IS FROM RALPH PLATZ.

I have been told that you believe that no action is in progress
relative to
the BACKPLANE INTERCONNECT. The contrary is true.

1) We have reviewed the initial concepts of the "Backplane
Interconnect" as
Rosing described them over the phone. (We have received no
documents.)
Blackledge from here and Strecker from Tewksbury have had a couple
of
technical discussionns on this topic. Blackledge has documented the
set ofof
issues that are of concern to us and has documented a proposal for
the BI.
Strecker is getting this document via phone connection -- (303) 576-
3811
[30,4] HSC password, filename = newbi.doc.

2) A teleconference call is sheduled for tomorrow between here and Tewksbury
so that we can discuss with the HYDRA and MERCURY groups what is commonly
acceptable and useful in a BI.

3) All day 4-May-79 is reserved for meeting with Rosing et al. in Tewksbury to
work on the BI definition.

Regards, Ralph Platz

Command:

EMS 26-APR-79 16:45:01
100 1
To: Grant Saviers, John Kevill, Bill Demmer
CC: Bill Johnson, Larry Portner, Jim Marshall, Peter van Roekens
CC: Bernie Lacroute
From: Gordon Bell
Date: THU 26-APR-79 16:45:01 EDT
Subject: Backplane interconnect task force

I want to get this backplane settled down quickly. The goal I have is to use
Mercury and HSC to define it such that they use the identical backplane,
cabinet, , ps, modules for Pc, some Mp, K.ICCS, and common diagnostics for
this subset. K.disk and any bubble or ccd buffering and mass storage sw will
be unique.

I expect slip in HSC done this way, but Ibelieve the attendent commonality,
product longevity will result in a better product and cheaper and a smaller
engineering budget.

I am distyurbed at the behavior of platz and as John indicated, we want some
responsible Colorado-type design engineer in TW or wherever at the beginning
of the week to start work with the taskforce. As of now, I believ you should
regard the work on HSC as only a breadboard, but the programming,
architecture of sw etc. should remain totally intact.

I look forward to the review on Thursday and expect that this backplane and
packaging will be resolved along these lines.

Bill Demmer is responsible for the overall architecture of systems including
the interconnect and as such should be part of this loop.

Command:

EMS 27-APR-79 16:34:06
510 1
To: Gordon Bell
CC: Bill Demmer, Bill Johnson, John Kevill, Grant Saviers
CC: William Strecker
From: Wayne Rosing
Date: FRI 27-APR-79 16:34:06 EDT
Subject: BI Telcon with Platz, et. al.

We had a good conversation today and have resolved at least one way to
incorporate BI into HSC. We will keep talking daily and hope to have things
ironed out prior to Thursday.

There are other things that can be explored. (double buffered Kio) to make
things easier on the BI at the expense of more HSC redesign. We will also
explore these alternatives during the next week.

I've taken the liberty of inviting Strecker to your Thursday

meeting. Dave
Rodgers agrees Strecker and I will be the technical drivers from Tewksbury.

Have a nice day.

Command:

EMS 1-MAY-79 08:42:24
190 1
To: Wayne Rosing, William Strecker
From: Gordon Bell
Date: TUE 1-MAY-79 08:42:24 EDT
Subject: bi

Be careful about comprising what will be a long term design for one particular

implementation. I doubt if we will end up with the current schedule on hsc
because there arent adequate budgets for it and disks and I have trouble
understanding how we sell hsc with no disks. Also, is there a need for hsc
earlier than venus and 2080 if we don't put it on the first versio of hydra?

Command:

EMS 7-JUN-79
10:15:47 170 1
To: Dick Clayton
CC: Mike Tomasic, Stanton Pearson
CC: Bill McBride, Herbert Shanzer
From: Gordon Bell
Date: THU 7-JUN-79 10:15:47 EDT
Subject: BI
----
also copy to Ward McKenzie, Rose Ann Giordano

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where I
reiterated my position to solve the PAX problem by BI versus the 11/23. In
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versus doing incremental, poorer products.

Right now, we don't know for sure that we can do BI because it looks too good.

Ward and Art seem happy to wait for a month till we can make a good decision.
Could you meet with Roger and Andy prior to EBOD so we don't have to go in to
a hostile environment to make a decision in the face of little data on this
proposal?

Gordon

Command:
****
* d i g i t a l *
****

TO: BERNIE LACROUTE DATE: MON 10 MAR 1980 12:08 PM EST
PETER VAN ROEKENS FROM: GORDON BELL
DAVE RODGERS DEPT: OOD
BILL DEMMER EXT: 223-2236
GEORGE PLOWMAN LOC/MAIL STOP: ML12-1 A51

SUBJECT: MERCURY BACKPLANE FOLLOW UP: 3/21/80

At our meeting on I/C the other day it was suggested that Hg be based
on the Q22 backplane, given it's an 11 (and BI is for VAX-11). Also,
we need good comm. on 11's in the future. I sure think it

makes sense
to pick a bus and ride with it, rather than switching, and waiting on
2 or 3!

Given the I/C meeting last week what's the current thinking here?

GB:swh
GB1.S2.45

C O M P A N Y   C O N F I D E N T I A L

Preliminary Draft for Commment by Digital Engineering Community

HEURISTICS AND COMMENTS FOR BUILDING GREAT PRODUCTS

Gordon Bell, Vice President, Engineering

Product goodness is somewhat like pornography, it can't fully be described, but we're told people know it when they see it. If we can agree on heuristics about product goodness and how to achieve it - then we're clearly ahead.   Five sets of dimensions for building great products need be attended to (roughly in order of importance):

. a responsible, productive and creative engineering group;
. product and design metrics (competitiveness);
. design goals and constraints;
. product evolution, revolution and death; and
. the ability to get the product built and sold.

ENGINEERING GROUP

As a company managed primarily by engineers, groups are encouraged to form and design products. With this right, are responsibilities.

<u>The Team</u> must have:

. <u>a chief designer/chief programmer to formulate and lead</u> the resolution of the problems encountered in the design; No matter how large the project, it must be lead from a "single head". We often make two errors in leadership: having no clear technical leader/problem resolver, and abdicating to a committee.

Committees do not do design! They are never held responsible, nor are they rewarded or punished. Committees can review.

. <u>management who understand the product space and who has engineered successful products</u>; The two most important jobs are:
  . making sure that everyone knows their job; and
  . setting and reviewing work on a timely basis, ie. MBO.
. <u>team skills and resources to implement the proposal</u> so that we adhere to the cardinal rule of Digital, "He Who Proposes, Does"; A plan must include the chief designer, team, project organization and resources (eg. computers). Supporting skills and disciplines are essential in the respective product areas, eg. ergonometrics, acoustics, radiation, microprogramming, data bases, security, reliability.
. <u>an understanding of the design, design production (eg. CAD) processes, and manufacturing processes;</u> Learning curves apply to all processes! The organization must be staffed with people who understand the product, the design process (CAD and management discipline) and the production introduction process. One or two out of three isn't enough.

<u>Behaviorally</u>, the team must:
. <u>do it right the first time;</u> Being correct has the highest payoff everywhere: timeliness, quality, lack of rework, and mfg. cost.
. <u>execute the project in a timely fashion;</u> Virtually ALL of our projects are late because we start too late, don't get it done on time because some critical invention is required, take too long to get it introduced, etc. For the very long, very late projects, the failure is lack of planning, tools and organization. Finally, people burn out. This suggests we:
  . <u>limit projects to two years by a small team.</u> We often make an aggressive business plan, then hire the

team. They then find out they have neither tools nor technology to do the project.

. not predicate a project on scheduling inventions in the design, process and CAD areas. If we can't see how to do the work in 2 years, then let's not start the project! This means the product must be cut down to fit the tools, people and process. Advanced developement is to insure that we can do development.

. have a written design methodology that includes: all design processes in the form of manuals, design conventions, conflict resolution, criteria for task completion, PERT structure, etc.;

. be open and have external reviews, and clearly written product descriptions for inspection;

For new product areas, we require breadboards in addition to the above heuristics. When the product gestation time equals the generation time, a full advanced development effort is the only way to be successful.

. start small, be reviewed and grow on its demonstrated success;

. learn, in order to handle the increase in complexity that comes with technology. Until there's a formal sabbatical program, individuals would do well to consider taking the equivalent of a semester of technical courses each 10 years.

PRODUCT METRICS KNOWLEDGE includes:

. products for which there'll be no competitor;

. all product cost metrics (cost, cost of ownership, cost to operate and use);

. all product performance and cost/performance metrics; These are the goodness measures of a product and tell how easily it will be to sell, and if we have improved. Cost and performance is measured against a state-of-the-art line represented by the first shipment of a more advanced product. Alternatively, when there's no direct comparison, the time goodness is determined from the day the product could have shipped. For example, because of parts availability, Nebula and CT could have shipped two and three years ago based on component availability.

. reasons why the product will succeed against present and likely future competition; sure success in the market is to introduce a needed function (eg. 32-bit address) by which all other products have to be measured.

. major competitor products by cost, performance and functionality; This should cover the past and future five years.

. leading edge, innovative, small company products;

. productivity, quality and design process metrics for projects.

DESIGN GOALS AND CONSTRAINTS

Design constraints are generally set as various kinds of standards. These are useful because they limit the choice of often trivial design decisions, and let us deal with important free choices, the goals. Goals are vitally important because they target our uniqueness.

Poor "mind-set" standards can create poor products, even though they may have made sense at one time. The historical English measures is a good case in point. Currently, the 19" rack and the metal boxes Digital makes to fit in them, and then ship on pallets to customers, act as constraints on building cost-effective PDP-11 Systems. This historical "mind set" standard often impedes the ability to produce products that meet the 20% per year cost decline curve.

. Goals and constraints must be written down and updated from the day the project starts. Virtually every product failure and period of product floundering is a result of no clear goals and constraints since everyone has a different idea of the product.

. A product can only have a few goals and constraints. The ranking is usually: it must work and have improved cost of ownership, be the shortest time to market, highest performance and lowest cost.

We must adhere to standards which we either follow or set!

. If a standard exists, follow it or change it for all! We lost the IEEE Floating Point format. It is likely we will eventually have to support it.

. If a standard is forming go all out to set it. When formed, then follow it. We didn't make DDCMP a standard. When HDLC came, we didn't use it. The result: expensive, low performance products.

Standards can be grouped into four distinct sets:

. DEC Engineering Standards; These cover most physical structures and design practice for producibility, and assimilate critical external standards, such as UL, VDE, and FCC.

. professional society, industry and area information processing standards, from EIA, CBEMA, ECMA, ANSI, ISO etc. such as Cobol '74, Codasyl, IEEE 488;

. defacto industry wide information processing and communication standards such as IBM SNA, Visicalc;

. standards implied by the architecture of existing DEC products to insure our customer software investments are preserved include:

  . architecture of computers, terminals, mass store and communications links; Our current ISP's include 8, 11's, 10/20, VAX, 8048, 8080, 8086, 68000; VT52, VT100, keyboards, Regis; MCP; HDLC, CI, NI, SI.

  . physical interconnect busses for computers and for interconnecting them CT, Q, U, NI, CI, etc. These insure that future system products can evolve from component and computer options between generations.

  . operating system interface file commands, command language, human interface, calling sequence, screen/form management, keyboard, etc.

. <u>Products must be designed for easy translation into in any natural language since we are an international company.</u>

. <u>All products must have be customer installable and maintainable.</u>

. <u>Portability is an important goal.</u> Personal computers must be portable! We must achieve this for all systems ASAP!

WHEN TO CREATE, WHEN TO EVOLVE AND WHEN TO STOP PRODUCTS

Engineering is responsible for designing evolutionary products in our markets AND for producing products that are natural to our tradition of supplying the most interactive, cost-effective computing. If a new product such as personal computing emerges and we do not have a product, engineering has failed, independent of being asked for it!

Given all the constraints, can we ever create a new product, or is everything just an evolutionary extension of the past? If revolutionary do we know or care where product ideas come from? The important aspect about product ideas is:

- **<u>Ideas must exist to have products</u>! If we don't have ideas to redefine or extend a market, then we should not build a product.**

It is hard to determine whether something is an evolution or just an extension. The critically successful products are likely to occur the second time around. Some examples: PDP 6,KA10,KI10,KL10,2080; Tops 10,Tenex,TOPS20; PDP5,8,8S,8I/L,8E/F/M; OS8-RT11; 11/20,40,34,44; RSX-A... M, M+; TSS-8,RSTS; various versions of Fortran, Cobol and Basic follow this; LA30,36,120; VT05,50/52,100, 101 etc.; RK05,RL01/2.

- <u>A product tree MUST be maintained by each engineering group</u> showing roots, gestation time and life.

<u>Goodness and Greatness</u>

All products whether they be revolutionary, creating a new base, or evolutionary, should:

- <u>be elegant and high quality;</u> Russ Doane's working definition is: "every feature contributes two benefits", like a double pun. Quality means no excess. Elegant, high quality designs, do double duty with a minimum use of resources. Quality is also the absence of errors, by being right the first time so that it doesn't have to be inspected or redone.
- <u>offer at least a factor of two in terms of cost-effectiveness over a current product</u>; We have classic failures because a CPU cost has been minimized, only to find the total system cost has barely changed 10% and the total cost to the customer is only 5% lower! If each product is unique then we will have funds to build good

products.

. <u>be based on an idea which will offer an attribute or set of attributes that no existing products have</u>; For example, the goals and constraints for VAX included factor of two algorithm encoding and also offering ability to write a single program in multiple languages. VT100 got distinction by offering 132 columns and smooth scrolling.

. <u>build in generality, and extensibility;</u> Historically we have not been sufficiently able to predict how applications will evolve, hence generality and extensibility allow us and our customers to deal with changing needs. Extendable products also permit mid-life kickers to products. We have built several dead end products with the intent of lower product cost, only to find that no one wants the particular collection of options. In reality, even the $200 calculators offer a family of modular printer and mass storage options. For example, our 1-bit PDP-14 had no arithmetic ability, nor could it be a general purpose computer. As customers used it, ad hoc extensions were needed to count, compare, etc. and it finally evolved into a really poor, general purpose digital computer.

. <u>be a complete system, not piece parts</u>; The total system is what the user sees. A word processing system for example includes: memory, keyboard, tube, modems, cpu, documentation including how to unpack it, the programs, table (if there is one, if not then the method of using at the customer table), and shipping boxes.

. <u>be a great system because the components are great;</u> We should not depend on system markups and software functionality to cover poor components and high overhead.

. <u>if we don't make it, buy it</u>; We must carefully decide what components to make versus buy. It is very hard for an organization to be competitive without competing in the marketplace, hence unless we sell it, we should buy it.

<u>Product Evolution</u>

A product family evolution is described on page 10 of Computer Engineering along the paths of lower cost, and relatively constant performance; constant cost and higher performance; and higher cost and performance. In looking at our successful evolutions:

- <u>lower cost products require additional functionality too</u>; A lower cost product, with constant performance or constant function is risky because a new customer base and new way of marketing may be required. Some other company may, however, be successful with the concept. The PDP-8, based on new technology, was radically more successful than its higher priced predecessor, the PDP-5, because it was 2/3 the price and 6 times more performance. The PDP-8/S was a failure at 2/3 the price and 15 <u>less</u> performance than the PDP-8. There are similar stories about the LA 34, VT50/52 and PDT as replacement products.
- <u>constant cost, higher performance products are likely to be the most useful</u>; Economics of use, the marketing channel and customer base are already established and a more powerful system such as the LA120 will allow higher productivity (see Computer Engineering for the understanding and economics). In the 11's there was a successful evolution: 20, 40, 34 anChied 44. Not the 60. The 11/70 was probably our greatest success; it was billed as a mid-life kicker to the 11/45-55.

<u>Revolutionary New Product Bases</u>

- <u>A new product base,</u> such as a new ISP, physical interconnection, Operating System, approach to building Office Products, <u>must start a family tree from which significant evolution can occur.</u> The investment for a point product is so high that the product is very likely not to payoff. In every case where we have successful evolutionary products, the successors are more successful than the first member of the family. Point products with no follow-on will probably fail all roi tests.

<u>Product Termination</u>

- <u>A product evolution is likely to need termination after successive implementations, because new concepts in use have obsoleted its underlying structure.</u> All structures decay with evolution, and the trick is to identify the last member of a family, such as the 132 column card, and then not build it. This holds for physical components, processors, terminals, mass storage, operating systems, languages and applications. Some of the signs of product obsolescence:

- It has been extended at least once, and future extensions render it virtually unintelligible.
- Better products using other bases are available.

SELLING AND BUILDING THE PRODUCT

"Buy in" of the product can come at any time. However, if all the other rules are adhered to, there is no guarantee that it will be promoted, or that customers will find out about it and buy it. Some rules about selling it:

- it has to be producible and work, AND be useful to software; This, although seemingly trivial rule, is often overlooked when explaining why a product is good or not. If it is a piece of hardware that requires software to support it, the hardware must be available to the programmers who must support it. Software engineers approach new hardware with much caution! The often ask: is it significant? is it needed? why isn't it compatible with the past? If a hardware is viewed with distrust by software engineers it may be met with the same distrust by customers!
- a business plan with orders and marketing plans from several marketing persons and groups needs to be in place; Just as it is unwise to depend on a single opinion in engineering for design and review, it is even more important that several different groups are intending to sell the product. Individual marketers are just as fallible as unchecked engineers. This rule can and must be violated for revolutionary products!
- never build a product for a single customer, although a particular customer may be used as an archetype user; predicating a product on one sale is the one sure way to fail! Paraphrasing a remark by former GM executive Charles Wilson: if it's good for General Motors, it may only be good for GM.
- it must be done in a timely fashion according to the committed schedule, price and functions as previously described;

. <u>it must be understandable and easy to use</u>. The small size, complete hardware books were the DEC trademark that established the minicomputer. We must revive these such that a particular user never need access more than one. Simplicity must be the rule for our documentation.

What heuristics are missing? What heuristics do you disagree with?

What heuristics could be removed? reordered?

Could I please have your feedback before this becomes a final draft?

3/13/82 Sat 19:47:01 GB3.S2.5

ID#0187

d i g i t a l **interoffice memorandum**

Subject: **AUSTRALIA -- Bad Report on 310's**

To: John Clarke, Dick Clayton, John Kevill, Chuck Youse

Date: 78 AUG 14
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

Got a bad report on 310's here. Thirty percent still apparently arrive DOA! In this low end, the successful supplier will build SONY consumer-like products. They work the first time and run forever.

GB:ljp

d i g i t a l interoffice memorandum

+---------------------------+

SUBJ: DEC CONTRACT BADGE

TO: Mary Bonner ML2-2/A18

Date: 1/17/80 Thu
From: Gordon Bell
Dept: OOD
MS: ML12-1/A51 Ext: 223-2236
EMS: @CORE

Please issue a CONTRACT BADGE to Gwen Bell. She is in charge of the Digital Computer Museum at the Marlboro Digital Facility. In this capacity, she is required to visit many of the DEC facilities in Massachusetts in the search of information and hardware.

Cost Center 383
24 hours a day
From 1/1/80 thru 1/1/81

____
Gordon Bell

GB1.S1.22

FROM: GORDON BELL
DATE: FRI 14 SEP 1979 10:01 AM EST
DEPT: OOD
EXT: 223-2236
TO: DICK SNYDER

SUBJECT: RE: BASIC + 2 ON VAX

This is in answer to your EMS message of 10 SEP 79 on BASIC + 2 on VAX.

New BASIC look good. Let's get all the stuff necessary to pre-announce/demo/etc. at fall DECUS.

Gordon

Command >

BASIC CPU - SLIDE 1

GET TINY - USE IN MAKING SMART TERMINALS AND CONTROLLERS AND PROTECT

OUR FLANK FROM THE MICRO SUPPLIERS (MORE OEM'S ARE ASKING

FOR PDP-11 ISP COMPATIBILITY).

GET FONZ - PROVIDE 11/34 FUNCTIONALITY AT SIGNIFICANTLY LESS COST

WITH SLIGHTLY LESS PERFORMANCE (2 CHIP CUSTOM NMOS/LSI FOR

USE IN BOARD AND SYSTEM APPLICATION) FCS/Q379, TRANSFER

COST $60 IN FY79 GOING TO BE $30 IN FY82. PROTECTS

AGAINST SYSTEMS BUILT ON 21 BIT MICROS.

CANCEL - SINGLE MODULE, LOW COST(?), 11/04, LOW LEVEL 34

UNIFONZ REPLACEMENT USING FONZ CHIP SET--CANCEL WITH THE

ASSUMPTION THAT LOW END (NON-UNIBUS) SYSTEMS CAN MEET THE

MARKET NEED. APPEARS TO BE OEM PRODUCT ONLY SO USERS CAN

PRESERVE UNIBUS OPTION DESIGN.

GET 44 - TOP END OF 11/34 MARKET WITH GREATER FUNCTIONALITY AND

PERFORMANCE AT 11/34 COST. ALSO ADDRESSES LOW END OF

11/70 FUNCTION MARKET AT LOWER THAN 11/70 COST. PROVIDES

MORE EFFECTIVE TRAX VIA INCREASED ADDRESS SPACE & CIS.

CANCEL 48 - TOO FAR OUT (FCS 82) FOCUS PDP-11 DEVELOPMENT EFFORTS ON

11/44, 11/68, F11 AND T11.

BASIC CPU - SLIDE 2

GET 68 - MAJOR ENHANCEMENT TO 11/70 CLASS PRODUCT; USE AS HEDGE

AGAINST ANY SLIP IN COMET OR VAX AND MARKET ACCEPTANCE.

PROTECT AGAINST HOT NEW DG MACHINE (= 1.3 TO 1.6X11/74.

FCS=Q4/FY80. TRANSFER COST = 5-6K.

CANCEL MINNOW - MINNOW HARDWARE ALLOWS TOPS-20 TO BE RUN ON AN

11/68/COMET PRICE LEVEL MACHINE. MINNOW IS A BOUNDED

SYSTEM APPROACH. FOUR BOARDS IN AN RM03 TYPE CABINET.

ONE CPU, ONE DISK CONTROLLER, AND TWO 256 KWORD MEMORY

BOARDS. RL02 DISK GOING TO R80 LATER. PROTOTYPE

WORKING IN FY79, TARGETED FCS IN FY80.

CANCEL 74 - MINOR ENHANCEMENT TO 11/70 (FCS Q3/FY79). (1 TO 2 TIMES

11/70) TRANSFER COST = 15K. NEW MARKET OPPORTUNITY.

CANCELLING AVOIDS FIELD TRAINING REQUIREMENT AND NEED FOR

FIELD SPARES. DEPEND ON HYDRA 32 BIT MULTIPROCESSOR EFFORTS.

GET COMET - 65% OF STAR PERFORMANCE AT 35% THE COST BY FY80.

GET HYDRA - 32 MULTIPROCESSOR EFFORT, OPENS NEW MARKETS.

GET SUPER STAR - TWICE STAR PERFORMANCE AT 65% THE COST.

GET DOLPHIN - ENHANCE CURRENT PRICE LEVEL IN VAX SUPER STAR AND 10'S.

ALSO ENHANCES KL10 RELIABILITY FEATURES.

<u>BASIC INTERCOMMUNICATION (UNIBUS)</u>

7 - not explicit in

original paper

1 PC 2

evoke

1 mhz 2

inst/ evoke data
data

4

KT
0 1 khz

response
6 6A

MP
info.**

3
5 MS
*

*(KT) or (Pio-K-T/Ms) or (Cio-K-T/Ms)

**INFO., INSTRUCTIONS + INFORMATION

<u>LOGICALLY</u>
<u>PHYSICALLY</u>

P...

KMP S KT P Mp KT
KMS

Mp...

unibus

BASIC MODEL (1973)

$\underline{\text{BITS/DIE} = 2}^{t-1962}$

CORRECTION FACTORS

BIPOLAR	R/W	-2 YEAR
BIPOLAR	ROM	-1 YEAR
MOS	R/W	-
MOS	ROM	+1
PRODUCTION	-1 -2 YEAR	

RESULTS

BIPOLAR	R/W	16	69 - 70
		64	71 - 72
		1024	75 - 76
MOS	R/W	16K	77 - 78
		65K	79 - 80

		256K	**81 - 82**
BIPOLAR	**RO**	**256**	**71 - 72**
		1024	**74 - 75**
		2048	**75 - 76**

ID#354 COPY #_____ ASSIGNED TO:

BASIC PRODUCT STRATEGY

Provide a set of homogeneous distributed computing system products so a user can interface, store information and compute, without re-programming or extra work in many styles and the following computer system sizes:

- .as a single user computer within a terminal;
- .at a small, local shared computer system; or
- . via a large central computer or network.

Achieve a single VAX, distributed computing architecture by 1985 (as measured by revenue)through:

- . focusing on homogeneous distributed computing with varying computing styles including high availability and ease (economy) of use as the DEC advantage;
- . building new 11 hardware to fill the product space below VAX;
- .building new 11 software products that also run on VAX; and
- . developing software for 11-VAX migration and 11 user base protection.

Provide essential standard IBM and international network interfaces.

Define, and make clear statements internally and to our users about programming for DEC compatibility.

Provide general applications-level products that run on 8, 10/20 and 11/VAX-11 above the language-level to minimize user costs, including:

- .word processing, electronic mail, and profession-based CRT-oriented calculators;
- . transaction processing and data base query;
- . general libraries, such as PERT, simulation, etc. aimed at many professions that cross many institutions (industry, government, education, home); and
- . general management libraries for various sized business.

Provide specific profession (e.g. electrical engineering, actuarial statistician) and industry (e.g. drug distributor, heavy manufacturer) products as needed via the product line groups.

Provide cost-effective 8, 10/20 systems through:

- . building hardware that runs current operating systems; and
- . making market support and DEC-standard language enhancements.

This strategy is intended to cover the full range of DEC's future products. Since technology shifts rapidly and market opportunities emerge that we don't now understand, it may be necessary to provide non-compatible, point products. These should be proposed and reviewed accordingly.

Essence and Rationale of the Strategy

The essence of the strategy is simplicity through adopting a single architecture. This simplicity is needed so that we can build the network and distributed processing structures which our customers are now demanding. The strategy is an evolutionary result of the 1975 choice to extend the 11 architecture and cover its customer base.

Given that the architecture and early customer acceptance are in place, the strategy moves to build our subsequent products on VAX, while continuing to sell 8's, 10/20's and 11's. Focus is imperative in order to avoid the redundant development efforts across base hardware and software, and to move development to fully distributed computing and to applications. The strategy also minimizes manufacturing and field start-up costs and takes advantage of the learning effect by moving to a single architecture.

The motivations for the homogeneous architecture are numerous and include the customer desires for a range of products on which to build products (in the case of OEMs) and applications (in the case of end users). Such a range in size and over time, allows planning and investment of software and it permits computers to be associated with various organizational units (eg. central group, small group, office, the person, or the home) on an "as needed" basis. Although, superficially it appears to be possible to have numerous architectures that are segmented by size and by market, the user requirements to cross both size and applications boundaries are significant. In fact, given that IBM is segmenting its products both by size and application, the main strength of the strategy is to have a single architecture with which a user can be comfortable rather than bounded by a manufacturer segmentation.

The most compelling reason for basing the strategy on the single VAX architecture, besides the technical excellence of the product is the belief that we can not build the truly distributed computing system of the 80's with heterogenous architectures. It is possible to build distributed computing networks as we do today, but the homogeneous architecture approach insures that programs may be assigned to any node, where they will give the same results. There is no need for the organizational and computation overhead signified by different manuals, separate training, recompilation of programs, and translation of data among machines in the network.

This strategy is aimed at beating the competition using our existing highly tuned minicomputer hardware and software to support and grow our existing user base. It provides us with a unique offering in the marketplace of the '80's which is likely to be based on the defacto standard IBM 360/370 architecture and the ensuing defacto architectures coming from the semiconductor companies. Since VAX is fundamentally better than either of these architectures, we must make it the standard architecture via transition from the PDP-11, which has been the standard architecture of the 70's.

The strategy is aimed at high volume through multiple channels of distribution, versus a more stable, low growth through support of an existing multi-system, customer base.

How Can We Win Against IBM?

A competive viewpoint is the most important check on strategy. Both the recently accounced IBM 8100 Distributed Processsing system and the System 38 computers are the first computers from IBM that, on the surface, look worth owning. They may be as significant as the 360 and their Selectric typewriter. The System 38 with a 48-bit virtual address is technically unique and may offer the user some very large benefits.

The 8100 is a radical departure from IBM pricing as 0.5 Megabytes of primary memory and a 60 Megabyte disk are $ 29 K. A comparable DEC product sells for several times this now. The 8100 is exactly in the price range of the systems we sell and where we make most of our revenue. It is the second product in this price range within a year; the Series 1 minicomputer family patterned after the 11/04-11/34 was the first product. On the surface, the product is low priced, with lots of capability, but it also has a new communications structure (versus the one we have used substantially unchanged since 1961). This structure permits easy peripheral and terminal interfacing for both the office and factory environment. There is an extensive range of peripherals, terminals and communications to the 360/370. Since the product is sold by DPD, the strategy seems to keep account control and to make the money on the numerous locked-in, generally overpriced terminals.

IBM will have: a 360/370 line in the $100 K to $10 M price range with lots of plug compatible competitors, several operating systems to support, a large backlog, a newly announced 8100 for Distributed Processing around the mainframe; a System 32/34/38 for Distributed Processing and as a Mainframe for small organizations; the Systems 3 to 15 for Distributed Processing; the System 1 for the would-be minicomputer buyer; the 5100-series Personal Computers for the scientist, engineer, analyst and small business; and several inevitable products for computing in the terminal. All of these are incompatible, except for a communications link and the fact that they all use the 8-bit EBCDIC byte. Products are relatively segmented to customer clauses and different languages are used to further segment and hinder application mobility. Finally, they've sold via DPD and GSD, with Office Products no doubt looking on and waiting for an entry via electronic mail and word processing.

While on the surface, the 8100 stands to be IBM's most significant product, it seems to be a serious mistake as it introduces another incompatible computer system with which customers will have to deal. This means that the making of a compatible, fully distributed processing system will be essentially impossible. However, since IBM feels it can not move very rapidly in any product space because of the installed base, product options are limited. Hence new products seem to be highly targeted at specific, new non-IBM markets in an incompatible fashion to get incremental revenue and growth.

How Can We Win Against Other Competition?

There are established competitors too, such as DG, HP and Prime. DG and Prime have very simple, single architectures and have been most profitable and have grown most rapidly. HP is converging on a single architecture around the 3000, but it will have to be extended eventually. The NOVA will also be extended. The large manufacturers (Univac, Honeywell and Burroughs) which operate with an established base are less profitable, have grown slowly and have multiple, poor architectures. Honeywell, with a simple, but adequate minicomputer architecture seems to be doing well by selling minis to its old line, mainframe base. There is no evidence that they're developing or pursuing the mainframe business actively.

There are probably more significant threats from the companies that can be easily founded to build systems into disks by using the newly announced zero-processor-cost, 16-bit microprocessors which have 22-bit address spaces and the performance of the 11/34-11/45. All of these architectures need to be extended for multiprogramming and to handle larger virtual memories. High level systems, functionally equivalent to our systems such as RSTS can be built easily and cheaply and can quite possibly target a specific existing, trained user base.

There are also the Japanese and TI which can be lumped together because of their similar behavior. Both believe in targeted, high-volume products with forward pricing. Neither have an adequate architecture. TI is strictly limited to 16-bits with almost no escape, and the Japanese are aimed at copying, using U.S. companies to distribute hardware. It's inevitable that they'll supply IBM compatible 360/370's to the Service Bureaus for distribution. This later channel of distribution is another formidable competitor.

The strategy supports very high volumes for dumb, pre-programmed (smart) and programmable (intelligent) terminals using the 11 until VAX is appropriate in terms of price and functionality. In the mid and high priced minis, the strategy is compatibility and volume, phasing as appropriate from 11 to VAX. For example, since there is not a high priced 11 after the 11/74 and the 11/44, there is a phasing to VAX (through COMET) and lower priced 11's based on 11 microprocessor implementation. The question here will be how fast we can provide high performance microprocessors using HMOS and narrower line VLSI technologies.

PRODUCTS IN 1981-82

HARDWARE COOMPONENTS

HMOS LSI, with first "test" product

Interconnection hierarchy with software compatibility
1-10 Mhz and/or 10-100 Mhz inter-computer bus ICCS
50+ Khz comm.-compatible multidrop for terminals, peripherals, and small systems;
0.3-19.2 Khz comm.-compatible for low cost terminals.

Significant competitive memories
Solid state modules for software
Low end floppies and low cost tape
Removeable and low cost disk RL04
Hi-volume mid- and hi-end disks in R80/R81 with backup

Terminals for everyone!
Low cost (dumb) and block mode (VT162)
Office environment for quality printing, electronic mail, and full-page text
Professional using graphics (and/or color) with target application software
Factory environment terminals and interface systems

HARDWARE SUBSYSTEMS

Remoteable printers, job entry, concentrators, sensor-control
Communications concentrator - Mercury
Memory (Hierarchy) Management - HSC50
for R80/R81, RL04, tape and disk cache

KERNEL SYSTEMS based on processor-disk-communications (see family tree figure)

780 replaced by Superstar (const. price >3x

performance)

780 - Memory Manager - Comm. Concentrator

780 - Multiprocessor

780 - RP/R80-81 + RL02-04

780 - RK/RL04

Comet - RP/R80-81 + RL

Hydra (Including Memory Manager - Comm. Concentrator)

Nebula - R80-81 + RL

Nebula- RL02/RL04 (higher cost, quick to market personal computer)

LSI VAX - RL04 - Graphics Terminal (personal computer)

11/74 with no hi end replacement

11/74 - multiprocessor

11/74 - RP/R80-81 + RL02-04

11/74 - RK/RL04

11/44 replaced by HMOS LSI-11 with >256 Kbytes

11/44 -
RP/R80-81 + RL

11/44 -
RL

11/23 -
Unibus Fonz RL replaced by HMOS >256 Kbyte

11/22 -
Q-Fonz RL

11/22 -
Q-Fonz - RX (floppy)

PDT Fonz - RX (floppy)

PDT Fonz - TU58

Tiny chips, replaced by HMOS tiny <256 Kbytes

SOFTWARE

Diminish the 11 software investment for mature products (RSTS, IAS, MUMPS) and provide only minor enhancements to recent 11 based products (TRAX, SCS-11, PDT Software) to extend the market life and limit the VAX transition risk. Orient new development on VAX and 20 toward IBM compatibility and explicitly invest in tools designed to permit easy customer movement between VAX and 20. DEC 20 development will be aimed at high level tools and applications support. Shift the bulk of the PDP-11 software investment to VAX, tracking VAX hardware and aggressively moving to round out commercial capability.

Develop a single VMS operating system to span the product range if technically and operationally feasible; "low end" products will mask the VMS capability for the unsophisticated users or, if efficiency demands, new code compatible at all interfaces with compilers and utilities will be developed. VMS will offer full mainframe capabilities allowing concurrent batch transaction, processing, and time-sharing, along with limited real-time.

- Provide superior data-base capabilities in the two - three year time frame.

. Focus on data access and data manipulation tools for the non-programmer, heavily based on graphics terminals.

. Provide word processing and electronic mail as applications on the general purpose VAX systems.

. Data integrity will be a feature available independent of high-availability (non-stop) operation through Hydra.

. High-availability (Hydra) will be a standard attribute of VAX systems at the customer option.

. Fire-wall funds to stimulate acquisition of cross-industry applications packages. Provide industry specific applications via internal development or acquisition. Leverage field resources by investing heavily in product quality assurance and self installing systems capacity including remote software update and diagnostic strategies.

. Move systems-level code for 11 based software (SCS-11, TRAX) to VAX compatibility mode if technically or strategically viable (under investigation now) otherwise provide user-level compatibility via native mode VMS layered products.

. Shift DECNET strategy to strong IBM interconnect and VAX binary image compatibility for distributed processing; constrain PDP-11 DECNET FUNCTIONALITY EXTENSIONS, speed up DEC 20 network capabilities.

. Converge on ease of DEC 20 to VAX movement through common language definitions, (common implementations where feasible) common user-level utilities and data conversion routines. For each new DEC 20 or VAX customer, as time progresses, make the movement between systems more attractive.

BASIC SOFTWARE - SLIDE 1

RT-11 - ROLL BACK TO AN EASY TO USE, SINGLE USER SYSTEM THAT DOESN'T REQUIRE SYSTEM BUILDING, PUT SUBSETS OF RT INTO ROM.

SCS-11 - GENERAL PURPOSE LOW END COMMERCIAL O/S FOR USE WITH 11/44 SYSTEM (AND U-FONZ)???

RSX M, M+, S - STOP M+ WORK FOR 11/74 SUPPORT, ENHANCE M O/S FOR REAL TIME MARKET NEEDS ONLY, DON'T ENHANCE M O/S FOR COMMERCIAL MARKETS, FIRST PRIORITY IS FOR REAL TIME LANGUAGE AND DATA SERVICES CAPABILITY; SECOND PRIORITY IS RELIABILITY AND EASE OF USE; DELAY OR CANCEL LANGUAGE AND DATA SERVICES INVESTMENTS ON M, M+, AND S.

TRAX-11 - CONTINUE TO ENHANCE AS A UNIQUE PRODUCT OFFERING INTO THE TRANSACTION PROCESSING MARKET. FOCUS ON BETTER APPLICATION TERMINAL CAPABILITIES; E.G., MULTIDROP.

BASIC SOFTWARE - SLIDE 2

RSTS - USE AS GENERAL PURPOSE PDP-11 TIME SHARING. ANSWER THE QUESTION THAT CURRENT RSTS USERS ARE ASKING--I.E., HOW CAN I MOVE DEVELOPMENT OF NEW APPLICATIONS TO VAX? DON'T DO DEVELOPMENT WORK THAT WILL MAKE RSTS CONVERGE WITH TRAX; E.G., DBMS, BETTER APPLICATION TERMINAL HANDLING.

IAS/RSX-D - NO O/S ENHANCEMENTS, THE ASSUMPTION IS THAT THE SYSTEM IS COMPETITIVE NEAR TERM REAL TIME AND MULTIFUNCTION MARKETS; ONLY ADD THOSE LANGUAGES AND DATA SERVICES (DBMS/RMS) THAT REQUIRE ONLY INTEGRATION AND TEST.

VMS - AGGRESSIVELY FOCUS O/S ENHANCEMENTS TO SUPPORT; (1)HYDRA NEEDS, (2) SATISFYING REAL TIME NEEDS, (3)COMMERCIAL EXTENSIONS, (4)DATA MANAGEMENT.

T10 & T20 - NO O/S ENHANCEMENTS, ONLY IMPROVED PERFORMANCE RELIABILITY

AND INTERCONNECTIVITY VIA DECNET.

ID#0302

| d | i | g | i | t | a | l | **i n t e r o f f i c e m e m o r a n d u m**

Subject: **Basic Corporate Product Development Strategy**

To: OOD, OOD Direct Reports, Corporate Meeting Attendees

Date: 18 OCT 78
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

follow up 11/1/78

The attached slides were presented at the corporate meeting on October 13, reflecting our main product direction. These support what the Operations Committee has decreed to be our key product development goal:

> Provide a compatible set of VAX and 11 distributed computing products so a user can compute (in a transparent fashion) in any of the following styles and sizes without reprogramming (or extra work):

.As a single user within terminal

.Small, local shared system for a group

.Large system serving several

groups

As you can see the theme is:

.Simplicity (of base hardware and software architecture)

.Distributed processing like no other vendor now, or is likely to provide (especially IBM)

. Terminals for everyone, with compatible computers placed appropriate to the task or organization

Any comments?

GB:ljp

Attachments

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Annette Albright	TW/E16	Ted Baker	MR1-
2/E78			
Paul Bauer	ML3-3/B91	Dick Becker	ML1-
3/E58			
Gordon Bell	ML12-1/A51	Jim Bell	ML3-
2/E41			
Leo Bennett	ML4-4/E99	Ron Bingham	MR1-
2/E85			
Peter Christy	ML12-3/A62	Dick Clayton	ML12-
2/E71			
Brian Croxon	TW/C04	Jim Cudmore	ML1-
5/E30			
Bill Demmer	TW/D19	Michel Depeyrot	ML3-
3/B91			
Mike Donnelly	ML3-3/E54	Ulf Fagerquist	MR1-
2/E78			
Ed Fauvre	MK-2/E6	Lorrin Gale	
TW/D19			
Bill Green	ML1-4/B34	Mike Gutman	ML21-
2/E32			
Bill Heffner	TW/C10	Steve Heiser	MR1-
2/E37			
Per Hjerppe	MR1-2/E78	George Hoff	MR1-
2/E47			
Bill Howerton	ML12-3/A62	Bob Hranek	ML1-
5/B98			
Bob Jack	ML1-3/E58	Bill Johnson	ML21-
3/E87			
Justin Kelleher	ML12-3/A62	Bill Kelly	ML3-
6/E95			
John Kevill	ML1-3/E58	Oleh Kostetsky	ML5-
5/E39			
Mitchell Kur	ML12-2/A16	Bernie Lacroute	
TW/A08			
Richard Leslie	MR1-2/E78	Tomas Lofgren	MR1-

2/E89
Jim Marshall TW/A03 Ed McDonough MO-2
John Meyer ML12-1/A11 John Miville MR1-
2/E78
Gene Mondani ML1-5/E30 Ken Nisbet
TW/D19
Stan Pearson ML12-2/E38 George Plowman ML5-
5/E97
Larry Portner ML12-3/A62 Bob Puffer ML12-
2/E38
Larry Rasile ML12-2/E71 Mike Riggle ML4-
1/B32
John Rose ML12-3/A62 Geoff Sackman ML1-
4/A97
Frank Sanjana ML12-2/E71 John Sartory ML4-
4/E99
Grant Saviers CZ Dick Snyder MR1-
2/E37
Joe St. Amour ML1-5/E29 Steve Sur MR1-
1/A43
Phil Tays ML11-4/E53 Mike Tomasic ML12-
2/E71
Pete van Roekens TW/E07 Jane Ward ML12-
3/A62
George Wood AC/E44

Steve Coleman PK3-1/M28 Pierre-Yves
Tiberghien GE
Ken Olsen ML12-1/A50 Win Hindle ML5-
2/A53
Bill Long ML5-2/A53 Helmuth Coqui ML12-
1/F41

Al Bertocchi PK3-2/A56 George Chamberlain
MS/B80
Al Crawford PK3-2/F34 Ed Finn
MS/B87
John Fisher PK3-2/A93 Joe Gaffney MR2-
L/A89
Al Mullin PK3-2/F40 Ed Schwartz
MS/F17

D I G I T A L INTEROFFICE MEMORANDUM

DIST: Continued

Shel Davis PK3-1/C21 Romney Biddulph PK3-
1/C21
Barry Burns PK3-1/C18 Ron LeBleu PK3-1
George Rossi PK3-1/C16 John Sims ML1--
5/B15
Geraldine Weathers ML1-5/B15 Ted
Johnson PK3-2/A55
Dennis Bjork PK3-2/Pole 3B Bruno Durr PK3-
2/S56
Gene Gross PK3-2/A55 Carl Janzen AK
Gerry Moore PK3-2/A66 Jack Shields PK3-
2/A58
Jean-Claude Peterschmitt GE Geoff Shingles GE
Bobby Choonavala GE Dick Pascal PK3-
2/A66
Bill Steul GE

Andy Knowles ML5-2/A53 Gus Ashton PK3-
2/M18
Dick Berube PK3-2/M18 John Leng MR1-
1/A65
Larry Bornstein ML5-2/A53 Si Lyle MR1-
1/M42
Ward MacKenzie PK3-1/A60 Al Pilon MR1-
1/A65
Jim Pitts PK3-1/M51 Joel Schwartz MR2-
4/M51
Harvey Weiss MR1-1/M85 Jerry Witmore PK3-
1/M40

Julius Marcus MK1-2/C37 Roger Cady MK1-1
Jack Clifford MK1-2/F35 Bob Hughes MK
Irwin Jacobs MK1-2/H32 Harvey Jones ML1-
4/A98
Bill Kiesewetter MR1-1/M81 Clem Lamarre MK1-
2/F35

Charlie Spector	ML5-2/M17		
Stan Olsen	MK1-2	John Alexanderson	NQ
Jack Gilmore	MK1-1/J14	John Holman	PK3-1/P84
Ed Kramer	MR2-4/A67	Pat Kress	MK1-2/E33
Bob Lane	MK1-2/B11	Les Strauss	MR2-2/F21
Jack Smith	ML1-4/F31	Henry Crouse	ML1-5/B98
Bill Hanson	ML1-4/P11	Dave Knoll	ML1-4/P14
Bill Thompson	ML12-1/F41	Sheldon Aronoff	ML12-1/F41
Joe Fargano	ML1-4/P11	Dan Infante	ML1-4/F31
Mitch Kur	ML12-2/A16		

FROM: GORDON BELL DATE: WED 20 FEB 1980
2:25 PM EST
DEPT: OOD
EXT: 223-2236
TO: AL CRAWFORD
cc: TOM VLACH

SUBJECT: 2400 BAUD SEEMS LIKE ENOUGH

For the first time since using EMS, I am over my frustration with line speed. There are some things to tune up here to make it go faster from screen to screen and to make sure a whole screen can get up if things are close. (Remove the last line with the instructions as how to move ahead...and compress the header.)

From my standpoint, I was considering giving up on EMS and getting an operator. (I submit that the secretaries are about 6 months short of rebelling because of the time it takes compared with conventional mail.) To me, the way around EMS for most people is to simply go and ask for a dump once a day and get it printed and then go and mark somehow quickly what is to be done with each document and then go in and deal with them as quickly as possible. My guess is that they are just leaving them in the system and that there are two files READ and SENT. Namely, they are using it like a TWX.

I can now see the possibility that the system can work and save time. It has to compete with me plowing through a stack of paper documents and throwing them in the waste basket...still I can type CR, (possibly Control Z), D, CR, CR pretty fast. But having the whole page come up in the same time it would take me to bring it up form a stack of papers is the key. I do find it satisfying to type D, CR, CR, CR and knowing that my pointer is removed and that no one has to file, dispose, or otherwise deal with the information that was there.

GB:swh
GB1.S2.8

```
+---------------------------+                                ID#0299
|   |   |   |   |   |   |   |
| d | i | g | i | t | a | l |   i n t e r o f f i c e   m e m o r
a n d u m
|   |   |   |   |   |   |   |
+---------------------------+
```

Subject: **9600 Baud Is Coming In Terminals**

To: Vince Bastiani, MK1-1/M37
Ulf Fagerquist, MR1-2/E78
Bill Heffner, TW/C10
Bill Johnson, ML21-3/E87
Bill Keating, ML12-3/A62
Tony Lauck, ML5-5/E97
George Plowman, ML5-5/E97
Chuck Stein, ML5-5/E97

Date: 16 OCT 78
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

CC: Dick Clayton, ML12-2/E71
Len Halio, ML5-2/E93 follow up 10/30/78

Are you aware?

I believe our systems will die faced with 9600 baud.

What are you doing to get improved performance in communications hardware and software?

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST: Vince Bastiani MK1-1/M37 Dick Clayton ML12-2/E71
Ulf Fagerquist MR1-2/E78 Len Halio ML5-2/E93
Bill Heffner TW/C10 Bill Johnson ML21-3/E87
Bill Keating ML12-3/A62 Tony Lauck ML5-5/E97
George Plowman ML5-5/E97 Chuck Stein ML5-5/E97

February 15, 1980

Carroll A. Greathouse, President
Baxter Associates, Inc.
Association Management
196 North Street
Stamford, Conn. 06905

Dear Mr. Greathouse:

Jim Cudmore gave me your request of the IOSA 9-11 June 1980. Clearly semiconductors are an important component of IOSA as they determine when and whether each of the systems you are examining can exist. It would no doubt be useful to get someone from the 8 semiconductor industry to speak at this seminar.

I regret that Jim nor I can participate in your seminar.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:swh
GB1.S1. 73

CC: Jim Cudmore, Digital
****
* d i g i t a l *
****

TO: WILL THOMPSON
11:40 AM EDT

cc: LARRY PORTNER
JACK SMITH

DATE: THU 18 SEP 1980

FROM: GORDON BELL
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: BEIGE BOOK REVIEW

The review was quite informative. It was an overview. Thanks.
We exchanged some views, and I'd like the following:

1. Send me informator later resolutions.

2. Action on your part

3. Minutes of the meeting with action items.

Please schedule another meeting which is in line with the original
request. Let's concentrate one hour on each technical area.

Please proceed to produce a Red and Beige Book that's in line with the
rest of Engineering.

The Red Book should contain our technology position in each area,
together with goals for next few years, and a description of where
each technology and service goal will be.

The Beige Book would have the project plans (3 years) that achieve the
strategy.

GB:swh
GB1.S6.45

EMS 23-JUN-79
11:20:41 160 1
To: OOD
CC: Paul Bauer
From: Gordon Bell
Date: SAT 23-JUN-79 11:20:41 ED
Subject: Beige Books for R and D, EIS and Engineering Services
----
Let me be positive. The information contained in these books is probably
necessary... and should remain in them, perhaps as an appendix. I'd sure like
us to use the simpler organization charts because these take up lots of space
and I can't see them all on 1 sheet and obviously we have too much
secretarial and other capacity becuse they have to waste times putting boxes
around everyone. But that's not the issue.

There were absolutely no performance metrics. These areas are key to our
future and to our success. Our users continue to always stretch the
capabilities that are available and then bitch about the poor response ttime.

Without some performance metrics and with the high degree of central
management that is exerted here, we will have the same situation.
Furthermore, we will probably get longer and longer lklead times. I would like
each of us to go over these books so that we can help them put together
metrics that are meaningful so that we know how we are doing over time and
where we have to get to.

Let's make the next Stratton devoted to our processes.

Command:

EMS 25-JUN-79 10:50:38 250 1

To: Ulf Fagerquist, Per Hjerppe
CC: Bill Johnson
From: Gordon Bell
Date: MON 25-JUN-79 10:50:38 ED
Subject: June 5, 1979 LCG Beige Book

I'm having trouble understanding how Software Co-existence is going to occur
if there are no projects to do it. It feels like CIS, Ext. FP are still as
strong as ever. Is 30-bit address space in too? I can accept the
direction...but worry about doing about the same for less.

Follow-Up: 7/5/79

Gordon

Command:

EMS 29-JUN-79 17:17:23 500 1

To: Gordon Bell
CC: Ron Bingham, Dick Snyder, Bill Johnson, Ulf

Fagerquist
From: Per Hjerppe
Date: FRI 29-JUN-79 17:17:23 ED
Subject: LCG Beige Book
----

1) We are currently funding the conversion of the 10/20 APL towork under VMS. The FORTRAN 10/20 funding is to make FORTRAN 78 compatible with VMS FORTRAN.

2) There is about $700K allocated for loosely coupled systems in TOPS-20. We are also doing DECnet under TOPS-10 in order to be able to communicate with the rest of DEC's products. The long term strategy is also to have TOPS-10 part of the loosely coupled networks. The only thing that we have not funded at this point in time is the COBOL-68/74 conversion aid to COBOL 79/VMS.

3) I have asked for evaluation of the KL10 CIS proposal to find out if we should implement it or not.

4) Extended Exponent is in deed being funded by ESG as part of the commitment to Phillips. There is no way we can get out of that commitment. I was personally part of making that commitment two years ago when I was in the ESG product line.

5) We have been using extended addressing in the monitor for about a year. and we will in deed support extended addressing in MACRO-20. Extended addressing will not be used anywhere else.

6) Red Book vs. Beige Book

The model we are working under is that the Red Book sets the
strategic direction and the Beige Book is Engineering's quote on
implementing the strategy. As of today the Beige Book does not reflect
completed the Red Book strategy.
In the Interconnect area the major task I see coming up for us
is to make sure there is a corresponding commitment on the VMS side to
the coexistence Interconnect strategy.

Forwarded message:
EMS   25-JUN-79 10:50:38 250 1
To: Ulf Fagerquist, Per Hjerppe
CC: Bill Johnson
From: Gordon Bell
Date: MON 25-JUN-79 10:50:38 ED
Subject: June 5, 1979 LCG Beige Book

I'm having trouble understanding how Software Co-existence is going to occur
if there are no projects to do it. It feels like CIS, Ext. FP are still as
strong as ever. Is 30-bit address space in too? I can accept the
direction...but worry about doing about the same for less.

Follow-Up: 7/5/79

Gordon

Command:

EMS   2-JUL-79 08:15:27 030 1
To: Gordon Bell

CC: Ulf Fagerquist, Per Hjerppe, Bill Johnson, Ron Bingham
From: Dick Snyder
Date: MON 2-JUL-79 08:15:27 ED
Subject: TOPS/VMS Co-existence

What Per forgot to mention on this subject is that LCG Software Engineering
was funded $200K out of the central SE budget for coexistence/migration. We
are using the money to cause the implementation of the Data INterchange
Utility so that we can convert files back and forth between a 36 bit and 32
bit host and more importantly so that we can do record level access between a
32 and 36 bit host. The approach here is that a guy will buy a VAX to offload
his 10/20 and will want to put new applications on the VAX which will still
need to get at data files on the 10 or 20 while the 10 or 20 is still using
the files. Hence the very important need for record level access.

Command:
****
* d i g i t a l *
****

TO: OOD: DATE: TUE 2 SEP 1980 4:41 PM EDT

FROM: GORDON BELL
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: BEIGE BOOK - WHETTED APPETITE

Was impressed by quality of Beige Books. Unfortunately they whetted appetite for just a few more numbers, which I hope

are
already available. They are:

1. Computer resources measured some way, both in terms of machines installed and projected to come in or are on order. This would be equivalent to a flow, and to a balance sheet in much the same way expenses and capital are measured. Note, it
should show how intensive we are. Also, I would like to know
the intensity of terminals for our various engineers including
those at home, and how much they use the machines. Rather than
spending a lot of time digging, show what data you have that you
use to manage this resource. If you are unhappy with what information your're using then show the metrics you would like to
use some day.

2. Mix of people into some reasonable cuts that reflect direct
engineering and overhead. This will vary with organization, but
I'd sure like to see what's happened over the last few years and
what we project in terms of direct engineers versus integrators,
managers, etc. This could be plotted on absolute and % mix basis
and should be really trivial, given the space, people and $'s you
have already.

Am anxious to have the reviews, cause I like the books.

Gordon

GB1.S6.31

I don't like to do research because I'm basically an engineer and need the closer in gratification. When I do (did) it, it was mostly because I'd convinced myself that it was just a high risk project. I like catalyzing research because I think I understand when research is needed versus straight forward engineering. My attention span is short now.

I'm sad that I stopped engineering products, but I was bored then, and the company wasn't and may not be big enough to let me go after the risky projects that I'd like to do. My interests have gotten too broad for a long project.

I like problem solving of two types: structuring very complex problems into clear, group size efforts in a taxonomic fashion; and individual sized problems where I can formulate and solve the whole problem. Computer and Human (Organizations) Information processing systems are quite similar.

Small problems (eg. a paper, speech, some product parameter, a new way to describe systems, Venus, Epip or FTA, Microvax, licensing chips) are what keep me going because one gets enough gratification to work on the big ones.

The big systems are also satisfying and include: the product strategy; restructuring product flow across the company; the engineering organization and how to make it operate at peak efficiency; computing from B.C. to 2001.

I like being a technical leader, mentor and sponsor.
I appreciate management, and would like to work with the best possible management leader and mentor in getting effective engineering management.

Everything must be written down. Ambiguity can only exist for a short time. Inner directed engineers hate the verbal.

I hate personal politicing, ie. having to get buyin on a one on one basis. I really want to be able to say "do it" because this ultimate weapon really speeds convergence. I like to fight evil, greed, obesity and incompetence, I ignore it in the world except on very rare occasions, I harass those within DEC when I see it, and I won't tolerate it in the engineering organzation.

ADMINISTRATION After substantive goals are set, then getting the resources to carry them out involves too much hassle whether it be space, equipment, personnel, or capital equipment. I don't like to be directly responsible for routine processes (eg. signing reqs, forms) and seeing that we stay on budget.

TIRING BUT NECESSARY Reviewing group effectiveness, going over people and the organization, hiring. I like the content of reviews and the contract setting, but I don't have the energy to push routine processes. Therefore I want help.

OVERALL I understand and can invent information processing systems and processes. I don't like the routine of implementing and operating the processes, but like to participate when the focus is on content and not form. Personal problem solving is an essential reward to me for managing.

I want to continue to run Engineering during these radical transitions.
I believe I understand computing and want to continue to lead us here.

B200.82 Mileage reader, Analog Calculator, 2-3 part, Integrator, Mechanical, ca 1950,
35 mm diameter; 112 mm with handle, Chrome, glass, and paper, Buy, Portobello Rd, 33 (82), D-Bells.
This mileage reader was clearly made for scientific map distance readings. On one side there are scales for 1:2000; 4000; 8000; and 10,000. On the other side the scales read 1:25,000; 50,000; 75,000; and 200,000.

B201.82 Chambon & Baye, 1 "TACHYLEMME" Table, Writable or Readable Memory, Mechanically stable,
Cyclic, Craft, ca 1880, France, 175x100x35 mm, Black, Glass, wood, sliver plate and paper, Buy, Delahar, 260 (82), D-Bells.
A calculating device with four printed cyclinders 1-9; 10-90; 100-900; and 1000-9000 so arranged that percentages for every half percent from one to six percent can be read through slits. The total of say 6,216 at 4 percent could be figured by adding the sums shown in the four rows. One was presented to the Science Museum by M. Malassis in 1936. Chambon also introduced similar "calculators" for the multiplication tables, called "Multiplicateur Enfantin".

B202.82 1 "The MP Handy Guide for Knitting and Crochet" Table, Readable or Writable Memory,
Paper, Fixed, Craft, ca 1930, England, 118x90x2 mm, Metal and paper, Stained and worn, Buy, Bermondsey market, 3 (82), D-Bells.
Indicators can keep track of rows, increase, and times. Holes on the side provide a guage for the needles. And a 4 and a half inch rule is along the bottom.

B203.82 Tavernier Gravet, 1 Mannheim slide rule, Analog Calculator,
2-3 part, slide rule, Craft, ca 1880, France, 260x28x8 mm, Boxwood with brass

cursor, Buy, Delahar, 74 (82), D-Bells.

Colonel Amedee Mannheim designed a slide rule with a cursor about 1850. Tavernier Gravet manufactured this in France and after 1880 exported a large number to England and Germany.

B204.82 1 slide rule, Analog Calculator, 2-3 part, slide rule, Craft, 9-37, 350x30x8 mm,
German silver, Slide rule and wood case engraved with owners name, Buy, Maitland, 222 (82), D-Bells.

An engineering surveyors slide rule primarily used for calculating distances.

B205.82 Dring & Fage, 1 Slide RuleGuagers slide rule, Analog `Calculator, 2-3 part,
Slide rule, Craft, England, 314x50x5 mm, Ivory, Buy, Maitland, 277 (82), D-Bells.

Two-sided revenuers rule with two sliding guages.

B206.82 Duss, 1 Slide ruleGuagers slide rule, Analog Calculator, 2-3 part, Slide Rule,
Craft, England, 315x50x5 mm, Boxwood, Buy, Bermondsey Market, 90 (82), D-Bells.

Similar to B205.

B207.82 Loftus, 1 RuleGuagers rule, Analog Calculator, Single part, Rule, Craft, England,
260x30x30 mm folded, Boxwood, Buy, Bermondsey Market, 10 (82), D-Bells.

B208.82 1 Guagers rule, Analog Calculator, Single Part, Rule, Craft, England, 260x30x30 mm
folded, Boxwood, Buy, Bermondsey Market, 10 (82), D-Bells.

B209.82 T.O. Blake Ltd., 1 Guagers cased rule, Analog Calculator, Single Part, rule, Craft,
England, 6 cylinders each 25 mm by 3 mm diameter that fit together, Boxwood with a leather case, Six rules in a fitted leather case, Buy, Bermondsey Market, 10 (82), D-Bells.

B210.82 Lyons: Barth. Vincentius, 1620, 1 "Logarithmorum canonis descriptio...Sequitur
tabula canonis logarithmorum... Mirifici logarithmorum constructio...cum annotationibus Henrici Briggii in eas, et memoratam appendice. Book, Readable or Writable Memory, Paper, Random, Two volumes in one, Craft, 1620, England, First title in red and black. Woodcut diagrams in the text and printer's device on titles. Copy of G. S. Franckenius (1592-1654) and contemporary manuscript notes in the margins are likely in his hand. First title a bit worn in outside margin., Buy, Antiquarian Scientist, 1400(82), D-MR2.

In 1614, John Napier (1550-1617) published his epochal work on the "invention of logarithms. Posthumously published was his description of the method of construction of logarithmic tables (1619). the present first continental edition of both works was based on the joint issue of them at Edinburgh in 1619, with the addition here of Henry Brigg's annotations, pp. 58-62 of the last part. Briggs (1556-1631) played an important role in further development and utilization of logarithms.

B211.82 1 "Consul" Educated Monkey, Table, Readable or Writable

Memory, Paper, Linear,
Craft, 1916, USA, 139x148 mm, Red, Yellow, Blue and Brown, Tin, Buy, Jeremy Norman and Co., 175(82), D-Bells.

B212.82 Jehu Hatfield, 1 Clock interest table, Readable or Writable Memory, Mechanically
stable, Cyclic, Craft, 1844, USA, 300x450x170 mm, wood and paper, Buy, Jeremy Norman & Co., 475(82), D-Bells.

B213.82 1 Ratchet Adder, Digital Calculator, Single Register, Ratchet, Mechanical, ca 1850,
USA, 313x313x10 mm, Brown with Black ink, Brass and Cardboard, Buy, Jeremy Norman, 360(82), D-Bells.

B214.82 C. X. Thomas de Colmar, 1 Arithmometer, 1852, Buy, Peter Delahar, 3000 (82), D-Bells.
See B3.76

B215.82 Hamilton Watch Company, 1 Map Mileage Reader, Analog Calculator, 2-3 part,
Linear measure, Mechanical, ca 1950, USA, 110x5mm 35mm diameter, Chrome, glass, paper, Model number 331, Buy, Garrison House Antiques, 25(82), D-Bells.

One-sided with two scales for centimeters and inches.

B216.82 1 Planimeter, Analog Calculator, Multiple Part, Areal Measure, Mechanical, ca 1900,
Switzerland, 28460, 220x30x40mm case, Steel instrument, Engraved with Crosby Steam Gage & Valve Co., Boston, Swiss Manufacture, Buy, Garrison House Antiques, 95 (82), D-Bells. See B49.79

B217.82 Arnof, 1 Map Mileage Reader, Analog Calculator, 2-3 part, Linear Measure, Mechanical,
ca 1935, Germany, 8x76 mm 35 mm diameter, Nickel, glass, and paper, Case and instrument, Buy, 10 (82), D-Bells.
Two sided scale with nautical miles, kilometres and statue miles on one side and centimetres to kilometres and inches to miles or versiers on the other.

B218.82 Manloves, 1 "Boucher's Calculator" Circular slide rule, Analog Calculator, 2-3 parts,
Slide rule, Craft, England, 15mm x 50mm diameter, Nickel, glass and paper, Buy, 85 (82), D-Bells.

B219.82 Stanley Rule & Level Co., 1 Coggeshall Slide Rule, Analog Calculator, 2-3 Part,
Slide Rule, Craft, USA, Model No. 12, 320x40x4 mm, Boxwood and Brass, Buy, Brimfield, 30 (82), D-Bells. See B146.81

B220.82 Hoffman, 1 Slide Rule, Analog Calculator, 2-3 Part, Slide Rule, Craft, Denmark,
Model No. 601, 147x35x4 mm, Plastic, Case and Slide Rule, Buy, Brimfield, 1 (82), D-Bells.

Distributed by R. W. Mitscher Co., Inc., Electronic & Electrical Supplies, Ellicott Square Building, Buffalo, New York.

B221.82 Addac, 1 "Addac", Digital Calculator, Single Register, Mechanical, USA, 5751,
205x135x140 mm, Black with Cream and Red Letters, Cover and calculator, Buy, Brimfield, 15 (82), D-Bells. Patent no. 1,661,605.

B222.82 NAPIER, 1 Rabdologiae., 1617, First edition, Buy, Jeremy Norman, 6010 (82), D-Bells.

B223.82 Longman, London, 1 Babbage, Charles, Passages from the life of a philosopher, First
edition, 1864, England, xii, 496 pp., Buy, Antiquarian Scientist, 500 (82), D-Bells.

Babbage (1792-1871), in his interesting autobiography,
devotes four chapters to his invention of the "difference engine'. The last four pages are a bibliography of Babbage's papers.

B224.82 1 "Trignometrie Rectiligne et Spherizue avec la construcion des tables des sinus,
des tangentes, des secantes et des logarithmes," Par M. Rivard, Professeur de Philosophie en L'Universite de Paris.Tables, Readable or Writable Memories, Paper, Random, Craft, 1750, Universite de Paris., 150x220x35mm, Leather binding, Buy, Alain Brieux, 100(82), D-Bells.

B225.82 Theodore Audel & Co., 1 Hand Book of Calculations for Engineers and firemen relating
to the steam engine, the steam boiler, pumps, shafting, etc. by N. Hawkinsbook, Readable or Writable Memories, Paper, Random, Craft, 1898, USA, 140x215x25mm, Paper, binding loose, Buy, Amherst flea market, 4 (82), D-Bells.

B226.82 Wm. Jas. Hamersley, Hartford, 1 A System of Geometry and Trigonometry with a Treatise
on Surveying in which the Principles of Rectangular Surveying without Plotting are Explained, by Abel Flint enlarged with additional tales by George Gillet, New Edition, Revised containing a new rule for correctin deviations of the compass by L. W. MeechBook, Readable or Writable Memories, Paper, Random, Craft, 1854, USA, 130x208x27mm, Leather binding, 112 pages, Buy, Museum Store, 20 (82), D-Bells.

B227.82 1 "Biomate" Circular moving nomographs, Readable or Writable Memory, Mechanically
Stable, Cyclic, 82, Japan, 110x90x12mm, Aqua and cream, plastic, Buy, 8(82), D-Bells.

B228.82 Goody Manufacturing Co., 1 "Goody Magic Multiplier Pencil Box", Readable or Writable
Memory, Paper, Cyclic, ca 1950, USA, 38dx230mm, blue and orange, paper, Buy, Amherst flea market, 2 (82), D-Bells.

B229.82 Walt Disney Productions, 1 "Mickey Math", Readable or Writable Memory, Mechanically
Stable, Linear, ca 1950, USA, 360x38x5mm, black and white, plastic, Buy, 2 (82), D-Bells.

B230.82 L. Appoullot, Saint-Birce-sous-Foret, Seine et Oise, France, 1 "Cercle a claculd"appoullot"nomograph, Readable or Writable Memory, Mechanically Stable, Cyclic, ca 1890, France, 203d mm, painted metal, case and circle, Buy, Alain Brieux, 75 (82), D-Bells.

B231.82 Wolverine, 1 "Modern Math Addition", Readable or Writable Memory, Mechanically Stable, Cyclic, ca 1950, USA, 154x180x97mm, red, metal, Buy, Museum Store, 5 (82), D-Bells.

B233.84 A. M. Maurand, 1 "Le Prompt Calculateur des arts industriels et du commerce", Readable or Writable Memory, Paper, Random, ca 1863, France, 105d x 18mm, blue, pink, yellow and green cards, Brass, glass, cardboard, brass case with glass lid, 30 cardboard tables, Buy, Peter Delehar, 480 (82), D-Bells.

B234.82 Stanley, 1 "Boucher's Calculator" Circular slide rule, Analog Calculator, 2-3 part, Slide Rule, Craft, ca 1876, England, 50dx13mm, nickel, glass, leather and stain case, calculator, Buy, Peter Delahar, 240 (82), D-Bells.

The model made by Stanley is an improvement by the addition of a third index hand on the back dial, which indicates the total movement of the front dial, so that continuous workings show a final result, either + or -, thus indicating the correct reading of the result.

B235.82 Stanley, 1 Slide rule for calculating annuities, Analog Calculator, 2-3 part, Slide Rule, 1860, England, 304x10x22mm, Boxwood, Case and sliderule, Buy, Peter Delahar, 280 (82), D-Bells.

The device was described by Benjamin Beran (1822).

B236.82 Tavernier-Gravet, Rue MAyet, 19-Paris, 1 "Regle a Eclimetre" du Colonel du Genle GoulierSlide rule with a site, Analog Calculator, 2-3 part, Slide Rule, ca 1878, France, 186, 320x50x90mm, Boxwood and a metal instrument, Case, slide rule, and instrument, Buy, Peter Delahar, 640 (82), D-Bells.

B237.82 1 "Calculator" Pascal strip, Digital Calculator, Single Register, Pascal strip, ca 1950, Germany, 85x7x138mm, gold, red, and black, metal, Buy, Amherst fleamarket, 3 (82), D-Bells.

B238.82 Sharp, 1 "ELSI MATE EL-835" Solar cell electronic calculator, Digital Calculator, 3-4 Registers, Electronic, 1982, Japan, 17095530, 54x96x3mm, metal, Buy, D-Bells.

B239.82 Panasonic, 1 "CompuVoice"Talking electronic calculator, Digital calculator, 3-4 registers, Electronic, 1982, Japan, 22300192, 75x27x143mm, metal, Gift, New York Decus, D-Bells.

B240.82 Stanley, 1 "Barnard's Coordinate Spiral Slide Rule"

Spiral Slide Rule, Analog
Calculator, 2-3 Parts, Spiral slide rule, ca 1880, England, 83dx260mm, wood, paper mache, brass, Wooden case, handle, instrument, Buy, Peter Delahar, 180 (82), D-Bells.

Similar to Fuller's, but the logarithmic scale is repeated twice and occupies in all only about one-third of the helix. The upper part of the helix carries a sine scale.

B241.82 Palatine Engineering Co. Ltd. Liverpool, 1 "Bryan's Patent Planimeter" Analog
Calculator, Multiple Part, non-linear planimeter, ca 1880, England, 70x105x405mm, Brass, Case, instrument, five cams, track made my Peter Delahar, Buy, Peter Delahar, 560 (82), D-Bells.

B242.82 Oliver, 1 "The Oliver Typewriter Model 9" 1916, USA, 405x370x250mm, khaki, metal,
Buy, 50 (82), D-Bells.

The Oliver typewriter is the only successful down-strike-from-the-side class, was invented by Rev. Thomas Oliver in 1888 and patented in the USA in 1892 and Great Brtain in 18996. The Oliver Typewriting company was founded in 1895 with Model Number 1 (on view at the Science Museum). The models appearred in the following order No. 2 (1894), No. 3 (1898), No. 5 (1907), No. 7 (1915), No. 9 (1916) and the standard Model II 'Speedster' in 1922.

The 28 type-bars, each of which resembels an inverted U, are arranged in two banks to the right and left of the printing point, so providing complete visibility of the writing, the type striking on to the vertical centre line of the platen. Each bar carries three characters, the machine printing 84 characters by double shift. The use of a bar pivoted at each end is claimed to secure and preserve accurate alignment. The bars rest one within another and, as the length of the extremities vary, the shorter type-bars are provided with heavier type-heads with the object of equalixing the impressions. The paper cylinder is fitted with three rollers, the pressure of which can be released for adjusting the paper. The register pawl can be lifted to free the roller when linving by pencil. Single or double spacing is actuated by a striking motion operated by the marginal stop.

B243.82 Ludwig Spitz & Co., 1 "TIM Time is Money" arithmometer, Digital Calculator,
3-4 register, stepped wheel, ca 1880, USA, 420x200x160 mm, black, metal, eight digits, engraved The Oskar Muller Co. New York, Buy, Peter Delahar, 220 (82), D-Bells.

B244.82 Dalton, 1 Adding and listing machine, Digital Calculator, 1-2 register, Pascal
key, USA, Black, Metal, Buy, Amherst fleamarket, 35 (82), D-Bells.

B245.82 Hitachi, 1 c-mos i c, tie clasp, 1982?, Japan, Buy, D-Bells.

B246.82 Hilliard, Gray, Little, and Wilkins, 1 "Elements of Technology" by Jacob Bigelow, M.D.,
Book, , 1829, USA, Original cloth-covered boards with original paper label, uncut. xii, 507 pp. With a large folding, engraved frontispiece + 10 engraved plates (6 folding) + 11 woodcut plates (1 folding) + many text figs. Spine somewhat worn and repaired, cloth partially faded and frayed at edges., Buy, The Antiquarian Scientist, 160(82), D-Bells.

Jacob Bigelow (1786-1879) was appointed in 1816 to the chair which Count Rumford had endowed at Harvard for the instruction of the application of the sciences to the useful arts, a first attempt to create a meeting ground for self-made inventors and academic scientists. There being no good name for such a field, Bigelow coined for it the name 'technology', which has passed into common language.

B247.82 Macmillan and Co., 1 "A treatise on the calculus of finite differences," George Boole.
Book, 1860, England, First edition., Cloth cover., Buy, The Antiquarian Scientist, 275 (82), D-Bells.

B248.82 Patrick Adie, Optician, Mathematical & Scientific Instrument Maker, Broadway Works,
Westminster, London., 1 "Eidograph" pantograph, Analog calculator, Multiple part, Drawing instrument, Mechanical, c 1860, England, 33 3/4" long with two 29" long 1/2 inch square rods, brass, instrument and large hand-dovetailed case made form mahogany, trade label, instruction set, and original key, Buy, The Antiquarian Scientist, 975(82), D-Bells.

Each of the rods, marked 'A' and 'B' slip into corresponding channels of the pulleys of the body. Here their lengths are varied and rad by verniers in the pulleys. The length of the main body rod which pivots on a central circular support, can be set and read by a vernier. The pulleys move in unison by virtue of the adjustable stell band with brass fittings coursing over them. One very large weight of brass and lead is used to balance the main rod and two smaller weights for the two side rods.

The eidograph is essentially a more preceise and versatile pantograph. Variable ratios can be set on the instrument for enlarging or reducing work. The eidograph was invented by William Wallace in 1801 based on the 17th century pantograph.

B249.82 1 protractor and T-square, analog calculator, 2-3 part, drawing instruments,
mechanical, c 1830, USA, 23 1/2" with 6" radius protractor scale, brass, Buy, The Antiquarian Scientist, 225 (82), D-Bells.

A nicely made brass t-square with an adjusting arm which allows it to be set to a particular angle as read off the protractor scale.

B250.82 1 Trigonometer, Analog Calculator, Multiple Part, Mechanical, c 1840, USA, 12"x6",
brass, Buy, The Antiquarian Scientist, 1,875(82), D-Bells.

The instrument is constructed so that a swinging arm carrying two sight vanes piots away from a stationary arm, also with two sight vanes, over an attached 90' scale with an intricate grid for reading the sine of the subtended angle by vernier directly to three places. A bubble level on the stationary arm allows horizontal or vertical reading. A ratcheted chain counter is also fixed to the stationary arm. A removable box compass can be fitted onto either arm by a neatly devised, quick action device.

The instrument was once the equipment of a Virginia surveyor and retains a fine hand-worked character with great attention to detail, such as fine knurling of the many thumb screws. Smart illustrates a similar instrument by Francis Whiteley of Standardsville, Virginia on p. 165. Both examples are elaborations of Whiteley's patent of 1836, but with the additions of the sine grid. The patent model and its type were made first, then the design with the sine grid, and finally the most advanced type with serial numbers and an added verneir on the swinging arm for reading the protractor scale as illustrated in Smart.

B251.82 Troughton, London, 1 proportional compass, Analog Calculator, 2-3 parts, drawing instruments, Mechanical, c 1800, England, 6 1/4inch long, Brass with stell points, hand-engraved, shaped sharskin case and instrument, Buy, The Antiquarian Scientist, 500(82), D-Bells.

Edward Troughton (1753-1836), the 'celebrated' English instrument maker, is well known for his very fine astrnomical and navigational instruments. In 1826, Troughton took in William Simms, and the firm flourished as Troughton 7 Simms, even after Troughton's death.

The instrument is used for enlarging or reducing a drawing with ratios marked along the slot, set by moving the screw pivot in it.

B252.82 1 planimeter, Analog Calculator, multiple parts, Mechanical, planimeter and case, Buy, Margaret Weiner Kennedy, 75(82), D-Bells.

B253.82 1 Computing Mechanisms and Linkages by Antonin Svoboda, edited by Hubert M. James, New York, Dover Publications 1965, unabridged republication of the work first published by McGraw-Hill Book Company, Inc. 1948., 1948, USA, Buy, D. Rubinstein, 5(82), D-Bells.

B254.82 1 Logic Machines and Diagrams by Martin Gardner, McGraw Hill Book Company, Inc. New York, 1958, 1958, USA, Buy, D. Rubinstein, 5(82), D-Bells.

Contents include: The Ars Magna of Ramon Lull, Logic Diagrams, A Network Diagram for Propositional Calculus, The Stanhope Demonstrator, Jevons Logic Machine, Marquand's Machine, Window Cards, Electrical Lobic Machines, The Future of Logic Machines.

B255.82 1 The Trachtenberg Speed System of Basic Mathematics translated and adapted by Ann Cutler and Rudoph McShane, Doubleday & Co., Garden City, N.Y., 1960, Buy, 5(82), D-Bells.

B256.82 1 The Japanese Abacus, its use and Theory by Takashi Kojima, Charles E. Tuttle Co., Publishers, Vermont and Japan, abacus, book, Buy, D-Bells.

B257.82 1 Faster than Thought, edited by B. V. Bowden. Sir Isaac Pitman & Sons, Ltd., London, 1953, Buy, D-Bells.

B258.82 1 Blaise Pascal "auvergnat" la famillle a l'oeuvre, Musee D'art de Clermont-Ferrant, 6 octobre - 8 novembre 1981, Buy, A Brieux, 10(82), D-Bells.

B259.83 J. Archbutt & Sons, 20 Bridge Road, Lambeth, 1 parallel rule, compass and rule, analog calculator, 2-3 part, parallel rule, craft, ca 1850, England, 44x150x2 mm, ivory, Buy, Woburn antiques show, 135(83), D-Bells.

B260.83 The Lightning Adding Machine Co. Inc., Los Angeles,

1 "The Lightning Adder"Pascal
wheel, Digital Calculator, Single Register, Pascal Wheel, Mechanical, ca 1950, USA, 350x90x45 mm, green and brown, plastic holder and metal adder, holder, mechanism, stylus, Buy, Colorado Springs, 10(83), D-Bells.

See 150.80 and 96.80.

B261.83 1 Calculating Instruments and Machines by Douglas R. Hartree, Plummer Professor of
Mathematical Physics, University of Cambridge, The University of Illinois Press, Urbana, 1949, USA, 174x260x17 mm, cloth cover, 138 pp., 68 illustrations, index, Buy, D. Rubinstein, 60 (83), D-Bells.

The first chapters are devoted to differential analyzers which were still being used and developed for computational needs. The last chapters discuss digital calculators starting with Babbage's analytical engine and including extensive discussions of ENIAC and the Harvard Mark I.

B262.83 Addiator, 1 "Arithma", Digital Calculator, Single Register, Pascal Strip, Mechanical,
ca 1935, Germany, 155x40x3 mm, Black and red, aluminum, case, stylus, instructions, and instrument, Buy, Colorado Springs, 6(83), D-Bells.

B263.83 Globe Ticket Company, 4201 Brighton Blvd, Denver, Co., 3 punch card, advertisement
on a calendar blotter, March 1960, November 1961, January 1962, USA,98x230 mm ,blotting paper, Buy, Colorado Springs, 3(83) each, D-Bells.

B264.83 1 On the Economy of Machinery and Manufactures by Charles Babbage, Esqre A.M., Charles Knight, Pall Mall East, London, Book, 1831, England, 48x208x23 mm, Red leather binding, With Edward Ryan's bookplate and inscribed by the author, "To Sir Edward Ryan from his friend, the Author", Buy, The Antiquarian Scientist, 750(83), D-Bells.

B265.83 1 Planimeter, Analog Calculator, two-three part, Planimeter, Mechanical, 290x110x20 mm,
nickel, instrument and case, Buy, Tesseract, 135(83), D-Bells.

B266.83 Automatic Adding Machine Co., New York, 1 "Golden Gem Adding Machine"Pascal strip,
Digital Calculator, Single Register, Pascal Strip, Mechanical, 1906, USA, 103x80x20 mm, red and green, metal, case and instrument, Buy, Woburn Antique Show, 15(83), D-Bells.

B267.83 The Adding Pencil Co., St. Louis, 1 The Adding Pencil, Model B, Digital Calculator,
Single Register, Pascal Wheel, Mechanical, ca 1930, USA, 10dx155 mm, Orange, Metal, Paper instruction case and pencil, Buy, Colorado Springs, 19(83), D-Bells.

B268.83 Eugene Dietzgen Co., 1 Catalogue and Price List of Eugene Dietzgen Co.book, 1912,
USA, Ninth Edition, 110x158x23 mm, green, paper, 555 pages, well-illustrated, index, Buy, Tesseract, 39(83), D-Bells.

Excellent section on slide rules and calulators, pp 216-236, and on planimeters, integrators and integraphs, pp 500-507.

B269.83 Keuffel & Esser Co., 1 Catalogue of Keuffel & Esser Co.book, 1921, USA, 36th edition,
150x227x30mm, Red, Hard bound, paper, 482 pages, index, well-illustrated, Buy, Tesseract, 34 D-Bells.
From 229-264, calcuators, slide rules, planimeters, pantographs, and integraphs are illustrated and explained.

B270.83 S.A. Main BSc, 1 Ballistic Coefficient Slide Ruleslide rule, Analog Calculator,
2-3 parts, linear slide rule, ca 1910, USA, 470x78x20 mm, yellow, Wood, paper, ivory and brass slide, hand lettered in red and black, Buy, 145, D-Bells.
Top scale is the ballistic coefficient; bottom is coefficient of form; center sliding scale has weight in pounds nad diameter in includes. Instructions: with Slide set the Diameter to the Coeff of Form; with Cursor set the value of Theta to the Weight; Read off Ballistic Coeff against Value of T. Reservse side has two sliders. Top stationery rule is ballistic coefficient. Slider has range-yards; time of flight-seconds; height of vertex - fee; angle of elevation or descent. Stationery rule has velocity reduced time in seconds. Slider has velocity and reduced elevation and reduced angle of descent. Botoom stationery rule has velocity. "Deisgned by S.A. Main, B.Sc.

B271.83 DeMarre, 1 Ballistic Slide RuleSlide Rule, Analog Calculator, 2-3 parts, Linear
Slide Rule, ca 1910, USA, 420x70x15 mm, yellow, Wood, paper, brass, Hand written lettering, Buy, 145, D-Bells.
Designed for solving DeMarre's Formula:

$$T^{7} = \frac{W^{.5}\ V}{D^{.75}} \times \frac{1}{\log^{-1}\ 3.00945}$$

Top scale has plate thickness; slider has striking velocity in foot/seconds and diameter of shot in inchdes; bottom scale has weight of shot in pounds. Sliding cursor has two more scales that are not identified.

B272.83 A Toyes, Chex Sainton, Pere et Fils, Imprimeurs du Departement, 1
Tables de Comparaison entre les Mesures Anciennes usitees dan le Departement de L'Aube, et celles qui les remplacent dans le nouveau System metrique, avec des observations sur les Mesures locales et l'explication a l'usage des Tables. Suivies du vocabulaire des nouvelles Mesures, de Notions elementaires sur le nouveau systeme. book, 1800, France, 125x200x10 mm, paper, 120 pp. sheep-backed boards, Buy, Jonathan Hill, 100, D-Bells.
May be a first edition. A rare explication of the new metric system.

B274.83 William Jones, 1 (Edmund Gunter), The Description and Use of the Sector.
The Crosse-staffe and other instruments. For such as are studious of Mathematicall practise. and Canon Triangulorum or tables of Artificiall Sines and Tangents to a Radius of 10000,0000 parts, and each minute of the Quadrant.Book, 1624, England, 135x177x40 mm, Leather and paper, First edition, 2 parts with the engraved title depicting the use of the istruments. Engraved plate of rules after the title, woodcuts in the text, signature A misbound after B, lower fore-edge corners of first few leaves worn, wormhole through some 40 leaves., Buy, Harriet Wynter Ltd,

400, D-Bells.

B275.83 Nystrom, J.W., 1 A Treatise on Screw Propellers and their Steam Engines, also A full Description of a Calculating Machine, Analog Calculator, 2-3 parts, Circular slide rule, Book, 1852, USA, Buy, Jeremy Norman, 350, D-Bells.

Plate XXXII has a drawing of Nystrom's calculating machine that he said was exhibited at the Franklin Institute Exhibition in 1849. Pages 179-229 give a complete description of the calculator.

B276.83 Saxton, E., 1 Saxton's Logs for Four-place Work. Table and TextBook, 1908, USA, 100x290x10 mm, paper, Case and book, Buy, JOe Stamps, 36, D-Bells.

B277.82 Briggs, Henry, 1 Arthmetica Logarithimicabook, 1624, England, 1st edition, Buy, Antiquarian Scientist, 1300, D-Bells.

B273.82 Newton, John, 1 Trigonometria Britanica and A Table of Logarithms to 100,000 with Artifical Sinces and Tangents Book, 1658, Buy, Antiquarian Scientist, 675, D-Bells.

B279.83Vlacq, 1 Trigonometria artificialis, Book, 1633, England, Buy, Antiquarian Scientist, 600, D-Bells.

Vlacq (1600-1667) of Gouda, the illustrious successor of Napier, lived in London and then in Paris as a bookseller and publisher, but was driven out and returned to Holland. This work contains his treatise of 52 pages on plane and spherical triangles and his table on trigonometry as well as the table of logarithms of numbers.

B280.83 Good, J., 1 Measuring made Easy: or the Description and Use of Coggeshall's Sliding Rule, Analog Calculator, 2-3 part, Book, Craft, 1744, England, 96 pages, several fold outs, Buy, The Antiquarian Scientist, 275, D-Bells.

B281.83 Speidell, Euclid, 1 Logarithmotechnia, or The Making of Numbers called Logarithms to Twenty-five Places from a Geometrical Figure with Speed, Ease and Certainty. London. London Printed by Henry Clark for the Author.Book, 1688, England, 145x192x8 mm, Leather binding, 50 pages, one worm hole through book, Buy, Antiquarian Scientist, 450, D-Bells.

B282.83 M. Thomas de Colmar, 1 Instruction pour se servir de L'arithmometre, machine a calculerBook, Digital Calculator, 3-4 registers, Book, 1852, France, Bound for A.S.A.R. Louise Marie de Bourbon, Regente des Duches de Parme et de Plaisance etc., Buy, D-Bells.

B283.78 Casio, 1 Mini Card fx-48 Scientific Calculator, Digital Calculator, 1978, Japan, 256023,
90x53x3 mm, Metal, Case, instruction book, unit conversion table, physical constants table, calculator, Buy, D-Bells.

B284.83 Commodore US*14, 1 Digital Calculator, Digital Calculator, ca 1970, USA, 11619,
195x290x75 mm, Black and White, Plastic case, transistors, Cord and calculator, Buy, 3 (83), S-Under vestibule-Bells.

B285.83 HDC Industries, 1 "Human Digital Calculator: Add'em up Finger Machine", ca 1980,
USA, 140x88x2 mm, Red and White, Cardboard, Buy, D-Bells.

B286.70 M.V. Wilkes, D. J. Wheeler, and Stanley Gill, 1 <u>Programs</u> <u>for</u> <u>and</u> <u>Electronic</u> <u>Digital</u>
<u>Computer,</u> Addison Wesley Publishing Company, 1951, USA, Second Edition, 1957, 160x233x19 mm, Paper, 238 pp, Buy, D-Bells.

B287.55 Richard Stevens Burrington, 1 <u>Handbook of Mathematical Tables and Formulas,</u> Handbook
Publishers, Inc. Sandusky, OhioBook, Memory, 1933, USA, Reprinted with corretions, 1953, .137x200x20 mm, Navy blue, Paper, 296 pp. index, Buy, D-Bells.

B288.83 Wolverine, 1 Adding MachineCalculator, Digital Calculator, Single register, Pascal
strip, ca 1935, USA, 135x225x105 mm, Red, Blue, Cream, Tin, Buy, D-Bells.
Patent 2243884

B289.79 Designsense, Inc., Atlanta, Ga., 1 "mileage minder" circular slide rule, Analog
Calculator, 2-3 parts, circular slide rule, 1979, USA, 195x108x2 mm, Black, red and white, Paper and aluminum, Instructions and instrument, Buy, Jordan Marsh, 5 (79), D-Bells.
The left rule with input of odometer start and odometer end shows miles driven. The right rul inputting midles driven and miles per gallon, shows gallons used.

B290.83 Simplex, 1 "Simplex Typewriter Model A"Typewriter, ca 1940, USA, 170x120x75 mm,
Red, yellow and blue, Tin, Box, instructions and typewriter, Buy, D-Bells.
Model A prints 36 characters, on 6 inch paper and cost $1.00; Model C, 42 characters on 7 inch paper and cost $1.50; Model D prints 68 characters both capital and small on 7 inch paper and cost $3.00; and Model E prints 72 characters capitals and small letters on 8 inch paper and cost $4. Sold as "useful where speed of pen suffices and carbon capy is not needed. They fascinate and teach children. Their Elders find them useful."

B291.83 Barron's Educational Services, Inc., Woodbury, NY, 1 "Metric Converter"Slide rule,
Analog Calculator, 2-3 parts, slide rule, USA, 212x82x2 mm, red, orange, and yellow on white, cardboard, Buy, D-Bells.

B292.83 1 Typewriter, ca 1900, Wooden case and base, steel, tin, rubber, case and machine, Buy,
Margaret Weiner Kennedy, 150 (83), D-Bells.
No maker yet this was manufactured.

B293.83 IBM, 1 plug board for 911, USA, Type 911, #121854, 290x170x30, Stainless steel,
plastic coated plugs, Board and plugs, Buy, Computer Museum, -, D-Bells.

B294.83 DEC, 1 PDP-10 Cable connector, D-Bells.

B295.83 DEC, 1 UART, 1979, 132x215x2 mm, green board, D-Bells.

B296.83 DEC, 1 Core plane, Memory, 1974, 208x265x20, D-Bells.
Late PDP-11 core plane.

B297.83 DEC, 3 modules, Transistor, 1960, USA, 43x43x170 mm, D-Bells.

B298.83 George Fisher, 1 <u>Arithmetic in the Plainest and most Consise Methods Hitherto Extant,</u>
Peter Brynberg, Londonbook, 1800, 160x96x30 mm, leather binding, Buy, 55 (83), D-Bells.

B299.80 Monroe, 1 "Monroe" calculator, Digital Calculator, 3-4 registers, ca 1950, USA,
Model LA7-160; #J716387, 190x150x280 mm, grey, Buy, 25 (80), D-Bells.

B200.82

Mileage reader, Analog Calculator, 2-3 part, Integrator, Mechanical, ca 1950, 35 mm diameter; 112 mm with handle, Chrome, glass, and paper, Buy, Portobello Rd, 33 (82), D-Bells.

This mileage reader was clearly made for scientific map distance readings. On one side there are scales for 1:2000; 4000; 8000; and 10,000. On the other side the scales read 1:25,000; 50,000; 75,000; and 200,000.

B201.82

Chambon & Baye, 1 "TACHYLEMME" Table, Writable or Readable Memory, Mechanically stable, Cyclic, Craft, ca 1880, France, 175x100x35 mm, Black, Glass, wood, sliver plate and paper, Buy, Delahar, 260 (82), D-Bells.

A calculating device with four printed cyclinders 1-9; 10-90; 100-900; and 1000-9000 so arranged that percentages for every half percent from one to six percent can be read through slits. The total of say 6,216 at 4 percent could be figured by adding the sums shown in the four rows. One was presented to the Science Museum by M. Malassis in 1936. Chambon also introduced similar "calculators" for the multiplication tables, called "Multiplicateur Enfantin".

B202.82

1 "The MP Handy Guide for Knitting and Crochet" Table, Readable or Writable Memory, Paper, Fixed, Craft, ca 1930, England, 118x90x2 mm, Metal and paper, Stained and worn, Buy, Bermondsey market, 3 (82), D-Bells.

Indicators can keep track of rows, increase, and times. Holes on the side provide a guage for the needles. And a 4 and a half inch rule is along the bottom.

B203.82

Tavernier Gravet, 1 Mannheim slide rule, Analog Calculator, 2-3 part, slide rule, Craft, ca 1880, France, 260x28x8 mm, Boxwood with brass cursor, Buy, Delahar, 74 (82), D-Bells.

Colonel Amedee Mannheim designed a slide rule with a cursor about 1850. Tavernier Gravet manufactured this in France and after 1880 exported a large number to England and Germany.

B204.82

1 slide rule, Analog Calculator, 2-3 part, slide rule, Craft, 9-37, 350x30x8 mm, German silver, Slide rule and wood case engraved with owners name, Buy, Maitland, 222 (82), D-Bells.

An engineering surveyors slide rule primarily used for calculating distances.

B205.82Dring & Fage, 1 Slide Rule, Guagers slide rule, Analog `Calculator, 2-3 part, Slide rule, Craft, England, 314x50x5 mm, Ivory, Buy, Maitland, 277 (82), D-Bells.

Two-sided revenuers rule with two sliding guages.

B206.82

Duss, 1 Slide rule, Guagers slide rule, Analog Calculator, 2-3 part, Slide Rule, Craft, England, 315x50x5 mm, Boxwood, Buy, Bermondsey Market, 90 (82), D-Bells. Similar to B205.

B207.82

Loftus, 1 Rule, Guagers rule, Analog Calculator, Single part, Rule, Craft, England, 260x30x30 mm folded, Boxwood, Buy, Bermondsey Market, 10 (82), D-Bells.

B208.82

1 Guagers rule, Analog Calculator, Single Part, Rule, Craft, England, 260x30x30 mm folded, Boxwood, Buy, Bermondsey Market, 10 (82), D-Bells.

B209.82

T.O. Blake Ltd., 1 Guagers cased rule, Analog Calculator, Single Part, rule, Craft, England, 6 cylinders each 25 mm by 3 mm diameter that fit together, Boxwood with a leather case, Six rules in a fitted leather case, Buy, Bermondsey Market, 10 (82), D-Bells.

B210.82

Lyons: Barth. Vincentius, 1620, 1 "Logarithmorum canonis descriptio...Sequitur tabula canonis logarithmorum... Mirifici logarithmorum constructio...cum annotationibus Henrici Briggii in eas, et memoratam appendice. Book, Readable or Writable Memory, Paper, Random, Two volumes in one, Craft, 1620, England, First title in red and black. Woodcut diagrams in the text and printer's device on titles. Copy of G. S. Franckenius (1592-1654) and contemporary manuscript notes in the margins are likely in his hand. First title a bit worn in outside margin., Buy, Antiquarian Scientist, 1400(82), D-MR2.

In 1614, John Napier (1550-1617) published his epochal work on the "invention of logarithms. Posthumously published was his description of the method of construction of logarithmic tables (1619). the present first continental edition of both works was based on the joint issue of them at Edinburgh in 1619, with the addition here of Henry Brigg's annotations, pp. 58-62 of the last part. Briggs (1556-1631) played an important role in further development and utilization of logarithms.

B211.82

1 "Consul" Educated Monkey, Table, Readable or Writable Memory, Paper, Linear, Craft, 1916, USA, 139x148 mm, Red, Yellow, Blue and Brown, Tin, Buy, Jeremy Norman and Co., 175(82), D-Bells.

B212.82

Jehu Hatfield, 1 Clock interest table, Readable or Writable Memory, Mechanically stable, Cyclic, Craft, 1844, USA, 300x450x170 mm, wood and paper, Buy, Jeremy Norman & Co., 475(82), D-Bells.

B213.82

1 Ratchet Adder, Digital Calculator, Single Register, Ratchet, Mechanical, ca 1850, USA, 313x313x10 mm, Brown with Black ink, Brass and Cardboard, Buy, Jeremy Norman, 360(82), D-Bells.

B214.82

C. X. Thomas de Colmar, 1 Arithmometer, 1852, Buy, Peter Delahar, 3000 (82), D-Bells. See B3.76

B215.82

Hamilton Watch Company, 1 Map Mileage Reader, Analog Calculator, 2-3 part, Linear measure, Mechanical, ca 1950, USA, 110x5mm 35mm diameter, Chrome, glass, paper, Model number 331, Buy, Garrison House Antiques, 25(82), D-Bells.

One-sided with two scales for centimeters and inches.

B216.82

1 Planimeter, Analog Calculator, Multiple Part, Areal Measure, Mechanical, ca 1900, Switzerland, 28460, 220x30x40mm case, Steel instrument, Engraved with Crosby Steam Gage & Valve Co., Boston, Swiss Manufacture, Buy, Garrison House Antiques, 95 (82), D-Bells. See B49.79

B217.82

Arnof, 1 Map Mileage Reader, Analog Calculator, 2-3 part, Linear Measure, Mechanical, ca 1935, Germany, 8x76 mm 35 mm diameter, Nickel, glass, and paper, Case and instrument, Buy, 10 (82), D-Bells.

Two sided scale with nautical miles, kilometres and statue miles on one side and centimetres to kilometres and inches to miles or versiers on the other.

B218.82

Manloves, 1 "Boucher's Calculator" Circular slide rule, Analog Calculator, 2-3 parts, Slide rule, Craft, England, 15mm x 50mm diameter, Nickel, glass and paper, Buy, 85 (82), D-Bells.

B219.82

Stanley Rule & Level Co., 1 Coggeshall Slide Rule, Analog Calculator, 2-3 Part, Slide Rule, Craft, USA, Model No. 12, 320x40x4 mm, Boxwood and Brass, Buy, Brimfield, 30 (82), D-Bells. See B146.81

B220.82

Hoffman, 1 Slide Rule, Analog Calculator, 2-3 Part, Slide Rule, Craft, Denmark, Model No. 601, 147x35x4 mm, Plastic, Case and Slide Rule, Buy, Brimfield, 1 (82), D-Bells.

Distributed by R. W. Mitscher Co., Inc., Electronic & Electrical Supplies, Ellicott Square Building, Buffalo, New York.

B221.82

Addac, 1 "Addac", Digital Calculator, Single Register, Mechanical, USA, 5751, 205x135x140 mm, Black with Cream and Red Letters, Cover and calculator, Buy, Brimfield, 15 (82), D-Bells. Patent no. 1,661,605.

B222.82

NAPIER, 1 Rabdologiae., 1617, First edition, Buy, Jeremy Norman, 6010 (82), D-Bells.

B223.82

Longman, London, 1 Babbage, Charles, Passages from the life of a philosopher, First edition, 1864, England, xii, 496 pp., Buy, Antiquarian Scientist, 500 (82), D-Bells.

Babbage (1792-1871), in his interesting autobiography, devotes four chapters to his invention of the "difference engine'. The last four pages are a bibliography of Babbage's papers.

B224.82

1 "Trignometrie Rectiligne et Spherizue avec la construcion des tables des sinus, des tangentes, des secantes et des logarithmes," Par M. Rivard, Professeur de Philosophie en L'Universite de Paris.Tables, Readable or Writable Memories, Paper, Random, Craft, 1750, Universite de Paris., 150x220x35mm, Leather binding, Buy, Alain Brieux, 100(82), D-Bells.

B225.82

Theodore Audel & Co., 1 Hand Book of Calculations for Engineers and firemen relating to the steam engine, the steam boiler, pumps, shafting, etc. by N. Hawkinsbook, Readable or Writable Memories, Paper, Random, Craft, 1898, USA, 140x215x25mm, Paper, binding loose, Buy, Amherst flea market, 4 (82), D-Bells.

B226.82

Wm. Jas. Hamersley, Hartford, 1 A System of Geometry and Trigonometry with a Treatise on Surveying in which the Principles of Rectangular Surveying without Plotting are Explained, by Abel Flint enlarged with additional tales by George Gillet, New Edition, Revised containing a new rule for correctin deviations of the compass by L. W. MeechBook, Readable or Writable Memories, Paper, Random, Craft, 1854, USA, 130x208x27mm, Leather binding, 112 pages, Buy, Museum Store, 20 (82), D-Bells.

B227.82

1 "Biomate" Circular moving nomographs, Readable or Writable Memory, Mechanically Stable, Cyclic, 82, Japan, 110x90x12mm, Aqua and cream, plastic, Buy, 8(82), D-Bells.

B228.82

Goody Manufacturing Co., 1 "Goody Magic Multiplier Pencil Box", Readable or Writable Memory, Paper, Cyclic, ca 1950, USA, 38dx230mm, blue and orange, paper, Buy, Amherst flea market, 2 (82), D-Bells.

B229.82

Walt Disney Productions, 1 "Mickey Math", Readable or Writable Memory, Mechanically Stable, Linear, ca 1950, USA, 360x38x5mm, black and white, plastic, Buy, 2 (82), D-Bells.

B230.82

L. Appoullot, Saint-Birce-sous-Foret, Seine et Oise, France, 1 "Cercle a clacul d"appoullot"nomograph, Readable or Writable Memory, Mechanically Stable, Cyclic, ca 1890, France, 203d mm, painted metal, case and circle, Buy, Alain Brieux, 75 (82), D-Bells.

B231.82

Wolverine, 1 "Modern Math Addition", Readable or Writable Memory, Mechanically Stable, Cyclic, ca 1950, USA, 154x180x97mm, red, metal, Buy, Museum Store, 5 (82), D-Bells.

B233.84

A. M. Maurand, 1 "Le Prompt Calculateur des arts industriels et du commerce", Readable or Writable Memory, Paper, Random, ca 1863, France, 105d x 18mm, blue, pink, yellow and green cards, Brass, glass, cardboard, brass case with glass lid, 30 cardboard tables, Buy, Peter Delehar, 480 (82), D-Bells.

B234.82

Stanley, 1 "Boucher's Calculator" Circular slide rule, Analog Calculator, 2-3 part, Slide Rule, Craft, ca 1876, England, 50dx13mm, nickel, glass, leather and stain case, calculator, Buy, Peter Delahar, 240 (82), D-Bells.

The model made by Stanley is an improvement by the addition of a third index hand on the back dial, which indicates the total movement of the front dial, so that continuous workings show a final result, either + or -, thus indicating the correct reading of the result.

B235.82 Stanley, 1 Slide rule for calculating annuities, Analog Calculator, 2-3 part, Slide Rule, 1860, England, 304x10x22mm, Boxwood, Case and sliderule, Buy, Peter Delahar, 280 (82), D-Bells.

The device was described by Benjamin Beran (1822).

B236.82

Tavernier-Gravet, Rue Mayet, 19-Paris, 1 "Regle a Eclimetre" du Colonel du Genle Goulier Slide rule with a site, Analog Calculator, 2-3 part, Slide Rule, ca 1878, France, 186, 320x50x90mm, Boxwood and a metal instrument, Case, slide rule, and instrument, Buy, Peter Delahar, 640 (82), D-Bells.

B237.82

1 "Calculator" Pascal strip, Digital Calculator, Single Register, Pascal strip, ca 1950, Germany, 85x7x138mm, gold, red, and black, metal, Buy, Amherst fleamarket, 3 (82), D-Bells.

B238.82

Sharp, 1 "ELSI MATE EL-835" Solar cell electronic calculator, Digital Calculator, 3-4 Registers, Electronic, 1982, Japan, 17095530, 54x96x3mm, metal, Buy, D-Bells.

B239.82

Panasonic, 1 "CompuVoice"Talking electronic calculator, Digital calculator, 3-4 registers, Electronic, 1982, Japan, 22300192, 75x27x143mm, metal, Gift, New York Decus, D-Bells.

B240.82 Stanley, 1 "Barnard's Coordinate Spiral Slide Rule" Spiral Slide Rule, Analog Calculator, 2-3 Parts, Spiral slide rule, ca 1880, England, 83dx260mm, wood, paper mache, brass, Wooden case, handle, instrument, Buy, Peter Delahar, 180 (82), D-Bells.

Similar to Fuller's, but the logarithmic scale is repeated twice and occupies in all only about one-third of the helix. The upper part of the helix carries a sine scale.

B241.82

Palatine Engineering Co. Ltd. Liverpool, 1 "Bryan's Patent Planimeter" Analog Calculator, Multiple Part, non-linear planimeter, ca 1880, England, 70x105x405mm, Brass, Case, instrument, five cams, track made my Peter Delahar, Buy, Peter Delahar, 560 (82), D-Bells.

B242.82

Oliver, 1 "The Oliver Typewriter Model 9" 1916, USA, 405x370x250mm, khaki, metal, Buy, 50 (82), D-Bells.

The Oliver typewriter is the only successful down-strike-from-the-side class, was invented by Rev. Thomas Oliver in 1888 and patented in the USA in 1892 and Great Brtain in 18996. The Oliver Typewriting company was founded in 1895 with Model Number 1 (on view at the Science Museum). The models appeared in the following order No. 2 (1894), No.

3 (1898), No. 5 (1907), No. 7 (1915), No. 9 (1916) and the standard Model II 'Speedster' in 1922.

The 28 type-bars, each of which resembels an inverted U, are arranged in two banks to the right and left of the printing point, so providing complete visibility of the writing, the type striking on to the vertical centre line of the platen. Each bar carries three characters, the machine printing 84 characters by double shift. The use of a bar pivoted at each end is claimed to secure and preserve accurate alignment. The bars rest one within another and, as the length of the extremities vary, the shorter type-bars are provided with heavier type-heads with the object of equalixing the impressions. The paper cylinder is fitted with three rollers, the pressure of which can be released for adjusting the paper. The register pawl can be lifted to free the roller when linving by pencil. Single or double spacing is actuated by a striking motion operated by the marginal stop.

B243.82

Ludwig Spitz & Co., 1 "TIM Time is Money" arithmometer, Digital Calculator, 3-4 register, stepped wheel, ca 1880, USA, 420x200x160 mm, black, metal, eight digits, engraved The Oskar Muller Co. New York, Buy, Peter Delahar, 220 (82), D-Bells.

B244.82

Dalton, 1 Adding and listing machine, Digital Calculator, 1-2 register, Pascal key, USA, Black, Metal, Buy, Amherst fleamarket, 35 (82), D-Bells.

B245.82Hitachi, 1 c-mos i c, tie clasp, 1982?, Japan, Buy, D-Bells.

B246.82

Hilliard, Gray, Little, and Wilkins, 1 "Elements of Technology" by Jacob Bigelow, M.D., Book, , 1829, USA, Original cloth-covered boards with original paper label, uncut. xii, 507 pp. With a large folding, engraved frontispiece + 10 engraved plates (6 folding) + 11 woodcut plates (1 folding) + many text figs. Spine somewhat worn and repaired, cloth partially faded and frayed at edges., Buy, The Antiquarian Scientist, 160(82), D-Bells.

Jacob Bigelow (1786-1879) was appointed in 1816 to the chair which Count Rumford had endowed at Harvard for the instruction of the application of the sciences to the useful arts, a first attempt to create a meeting ground for self-made inventors and academic scientists. There being no good name for such a field, Bigelow coined for it the name 'technology', which has passed into common language.

B247.82

Macmillan and Co., 1 "A treatise on the calculus of finite differences," George Boole. Book, 1860, England, First edition., Cloth cover., Buy, The Antiquarian Scientist, 275 (82), D-Bells.

B248.82

Patrick Adie, Optician, Mathematical & Scientific Instrument Maker, Broadway Works, Westminster, London., 1 "Eidograph" pantograph, Analog calculator, Multiple part, Drawing instrument, Mechanical, c 1860, England, 33 3/4" long with two 29" long 1/2 inch square rods, brass, instrument and large hand-dovetailed case made form mahogany, trade label, instruction set, and original key, Buy, The Antiquarian Scientist, 975(82), D-Bells.

Each of the rods, marked 'A' and 'B' slip into corresponding channels of the pulleys of the body. Here their lengths are varied and rad by verniers in the pulleys. The length of the main body rod which pivots on a central circular support, can be set and read by a vernier. The pulleys move in unison by virtue of the adjustable stell band with brass fittings coursing over them. One very large weight of brass and lead is used to balance the main rod and two smaller weights for the two side rods.

The eidograph is essentially a more preceise and versatile pantograph. Variable ratios can be set on the instrument for enlarging or reducing work. The eidograph was invented by William Wallace in 1801 based on the 17th century pantograph.

B249.82

1 protractor and T-square, analog calculator, 2-3 part, drawing instruments, mechanical, c 1830, USA, 23 1/2" with 6" radius protractor scale, brass, Buy, The Antiquarian Scientist, 225 (82), D-Bells.

A nicely made brass t-square with an adjusting arm which allows it to be set to a particular angle as read off the protractor scale.

B250.82

1 Trigonometer, Analog Calculator, Multiple Part, Mechanical, c 1840, USA, 12"x6", brass, Buy, The Antiquarian Scientist, 1,875(82), D-Bells.

The instrument is constructed so that a swinging arm carrying two sight vanes piots away from a stationary arm, also with two sight vanes, over an attached 90' scale with an intricate grid for reading the sine of the subtended angle by vernier directly to three places. A bubble level on the stationary arm allows horizontal or vertical reading. A ratcheted chain counter is also fixed to the stationary arm. A removable box compass can be fitted onto either arm by a neatly devised, quick action device.

The instrument was once the equipment of a Virginia surveyor and retains a fine hand-worked character with great attention to detail, such as fine knurling of the many thumb screws. Smart illustrates a similar instrument by Francis Whiteley of Standardsville, Virginia on p. 165. Both examples are elaborations of Whiteley's patent of 1836, but with the additions of the sine grid. The patent model and its type were made first, then the design with the sine grid, and finally the most advanced type with serial numbers and an added verneir on the swinging arm for reading the protractor scale as illustrated in Smart.

B251.82

Troughton, London, 1 proportional compass, Analog Calculator, 2-3 parts, drawing instruments, Mechanical, c 1800, England, 6 1/4inch long, Brass with stell points, hand-engraved, shaped sharskin case and instrument, Buy, The Antiquarian Scientist, 500(82), D-Bells.

Edward Troughton (1753-1836), the 'celebrated' English instrument maker, is well known for his very fine astrnomical and navigational instruments. In 1826, Troughton took in William Simms, and the firm flourished as Troughton 7 Simms, even after Troughton's death.

The instrument is used for enlarging or reducing a drawing with ratios marked along the slot, set by moving the screw pivot in it.

B252.82

1 planimeter, Analog Calculator, multiple parts, Mechanical, planimeter and case, Buy, Margaret Weiner Kennedy, 75(82), D-Bells.

B253.82

1 Computing Mechanisms and Linkages by Antonin Svoboda, edited by Hubert M. James, New York, Dover Publications 1965, unabridged republication of the work first published by McGraw-Hill Book Company, Inc. 1948., 1948, USA, Buy, D. Rubinstein, 5(82), D-Bells.

B254.82

1 Logic Machines and Diagrams by Martin Gardner, McGraw Hill Book Company, Inc. New York, 1958, 1958, USA, Buy, D. Rubinstein, 5(82), D-Bells.

Contents include: The Ars Magna of Ramon Lull, Logic Diagrams, A Network Diagram for Propositional Calculus, The Stanhope Demonstrator, Jevons Logic Machine, Marquand's Machine, Window Cards, Electrical Lobic Machines, The Future of Logic Machines.

B255.82

1 <u>The Trachtenberg Speed System of Basic Mathematics</u> translated and adapted by Ann Cutler and Rudoph McShane, Doubleday & Co., Garden City, N.Y., 1960, Buy, 5(82), D-Bells.

B256.82

1 <u>The Japanese Abacus, its use and Theory</u> by Takashi Kojima, Charles E. Tuttle Co., Publishers, Vermont and Japan, abacus, book, Buy, D-Bells.

B257.82

1 <u>Faster than Thought</u>, edited by B. V. Bowden. Sir Isaac Pitman & Sons, Ltd., London, 1953, Buy, D-Bells.

B258.82

1 <u>Blaise Pascal "auvergnat" la famillle a l'oeuvre,</u> Musee D'art de Clermont-Ferrant, 6 octobre - 8 novembre 1981, Buy, A Brieux, 10(82), D-Bells.

B259.83

J. Archbutt & Sons, 20 Bridge Road, Lambeth, 1 parallel rule, compass and rule, analog calculator, 2-3 part, parallel rule, craft, ca 1850, England, 44x150x2 mm, ivory, Buy, Woburn antiques show, 135(83), D-Bells.

B260.83

The Lightning Adding Machine Co. Inc., Los Angeles, 1 "The Lightning Adder"Pascal wheel, Digital Calculator, Single Register, Pascal Wheel, Mechanical, ca 1950, USA, 350x90x45 mm, green and brown, plastic holder and metal adder, holder, mechanism, stylus, Buy, Colorado Springs, 10(83), D-Bells.

See 150.80 and 96.80.

B261.83

1 Calculating Instruments and Machines by Douglas R. Hartree, Plummer Professor of Mathematical Physics, University of Cambridge, The University of Illinois Press, Urbana, 1949, USA, 174x260x17 mm, cloth cover, 138 pp., 68 illustrations, index, Buy, D. Rubinstein, 60 (83), D-Bells.

The first chapters are devoted to differential analyzers which were still being used and developed for computational needs. The last chapters discuss digital calculators starting with Babbage's analytical engine and including extensive discussions of ENIAC and the Harvard Mark I.

B262.83

Addiator, 1 "Arithma", Digital Calculator, Single Register, Pascal Strip, Mechanical, ca 1935, Germany, 155x40x3 mm, Black and red, aluminum, case, stylus, instructions, and instrument, Buy, Colorado Springs, 6(83), D-Bells.

B263.83

Globe Ticket Company, 4201 Brighton Blvd, Denver, Co., 3 punch card, advertisement on a calendar blotter, March 1960, November 1961, January 1962, USA,98x230 mm ,blotting paper, Buy, Colorado Springs, 3(83) each, D-Bells.

B264.83

1 On the Economy of Machinery and Manufactures by Charles Babbage, Esqre A.M., Charles Knight, Pall Mall East, London, Book, 1831, England, 48x208x23 mm, Red leather binding, With

Edward Ryan's bookplate and inscribed by the author, "To Sir Edward Ryan from his friend, the Author", Buy, The Antiquarian Scientist, 750(83), D-Bells.

B265.83

1 Planimeter, Analog Calculator, two-three part, Planimeter, Mechanical, 290x110x20 mm, nickel, instrument and case, Buy, Tesseract, 135(83), D-Bells.

B266.83

Automatic Adding Machine Co., New York, 1 "Golden Gem Adding Machine"Pascal strip, Digital Calculator, Single Register, Pascal Strip, Mechanical, 1906, USA, 103x80x20 mm, red and green, metal, case and instrument, Buy, Woburn Antique Show, 15(83), D-Bells.

B267.83

The Adding Pencil Co., St. Louis, 1 The Adding Pencil, Model B, Digital Calculator, Single Register, Pascal Wheel, Mechanical, ca 1930, USA, 10dx155 mm, Orange, Metal, Paper instruction case and pencil, Buy, Colorado Springs, 19(83), D-Bells.

B268.83

Eugene Dietzgen Co., 1 Catalogue and Price List of Eugene Dietzgen Co.book, 1912, USA, Ninth Edition, 110x158x23 mm, green, paper, 555 pages, well-illustrated, index, Buy, Tesseract, 39(83), D-Bells.

Excellent section on slide rules and calulators, pp 216-236, and on planimeters, integrators and integraphs, pp 500-507.

B269.83

Keuffel & Esser Co., 1 Catalogue of Keuffel & Esser Co.book, 1921, USA, 36th edition, 150x227x30mm, Red, Hard bound, paper, 482 pages, index, well-illustrated, Buy, Tesseract, 34 D-Bells.

From 229-264, calculators, slide rules, planimeters, pantographs, and integraphs are illustrated and explained.

B270.83

S.A. Main BSc, 1 Ballistic Coefficient Slide Rule, Analog Calculator, 2-3 parts, linear slide rule, ca 1910, USA, 470x78x20 mm, yellow, Wood, paper, ivory and brass slide, hand lettered in red and black, Buy, 145, D-Bells.

Top scale is the ballistic coefficient; bottom is coefficient of form; center sliding scale has weight in pounds nad diameter in includes. Instructions: with Slide set the Diameter to the Coeff of Form; with Cursor set the value of Theta to the Weight; Read off Ballistic Coeff against Value of T. Reservse side has two sliders. Top stationery rule is ballistic coefficient. Slider has range-yards; time of flight-seconds; height of vertex - fee; angle of elevation or descent. Stationery rule has velocity reduced time in seconds. Slider has velocity and reduced elevation and reduced angle of descent. Botoom stationery rule has velocity. "Deisgned by S.A. Main, B.Sc.

B271.83

DeMarre, 1 Ballistic Slide RuleSlide Rule, Analog Calculator, 2-3 parts, Linear Slide Rule, ca 1910, USA, 420x70x15 mm, yellow, Wood, paper, brass, Hand written lettering, Buy, 145, D-Bells.

Designed for solving DeMarre's Formula:

$$T^{7} = \frac{W^{.5}\ V}{D^{.75}} \times \frac{1}{\log^{-1}\ 3.00945}$$

Top scale has plate thickness; slider has striking velocity in foot/seconds and diameter of shot in inchdes; bottom scale has weight of shot in pounds. Sliding cursor has two more scales that are not identified.

B272.83

A Toyes, Chex Sainton, Pere et Fils, Imprimeurs du Departement, 1 Tables de Comparaison entre les Mesures Anciennes usitees dan le Departement de L'Aube, et celles qui les remplacent dans le nouveau System metrique, avec des observations sur les Mesures locales et l'explication a l'usage des Tables. Suivies du vocabulaire des nouvelles Mesures, de Notions elementaires sur le nouveau systeme. book, 1800, France, 125x200x10 mm, paper, 120 pp. sheep-backed boards, Buy, Jonathan Hill, 100, D-Bells.

May be a first edition. A rare explication of the new metric system.

B274.83

William Jones, 1 (Edmund Gunter), The Description and Use of the Sector. The Crosse-staffe and other instruments. For such as are studious of Mathematicall practise. and Canon Triangulorum or tables of Artificiall Sines and Tangents to a Radius of 10000,0000 parts, and each minute of the Quadrant.Book, 1624, England, 135x177x40 mm, Leather and paper, First edition, 2 parts with the engraved title depicting the use of the istruments. Engraved plate of rules after the title, woodcuts in the text, signature A misbound after B, lower fore-edge corners of first few leaves worn, wormhole through some 40 leaves., Buy, Harriet Wynter Ltd, 400, D-Bells.

B275.83

Nystrom, J.W., 1 A Treatise on Screw Propellers and their Steam Engines, also A full Description of a Calculating

Machine, Analog Calculator, 2-3 parts, Circular slide rule, Book, 1852, USA, Buy, Jeremy Norman, 350, D-Bells.

Plate XXXII has a drawing of Nystrom's calculating machine that he said was exhibited at the Franklin Institute Exhibition in 1849. Pages 179-229 give a complete description of the calculator.

B276.83

Saxton, E., 1 Saxton's Logs for Four-place Work. Table and TextBook, 1908, USA, 100x290x10 mm, paper, Case and book, Buy, JOe Stamps, 36, D-Bells.

B277.82

Briggs, Henry, 1 Arthmetica Logarithimicabook, 1624, England, 1st edition, Buy, Antiquarian Scientist, 1300, D-Bells.

B273.82

Newton, John, 1 Trigonometria Britanica and A Table of Logarithms to 100,000 with Artifical Sinces and Tangents Book, 1658, Buy, Antiquarian Scientist, 675, D-Bells.

B279.83

Vlacq, 1 Trigonometria artificialis, Book, 1633, England, Buy, Antiquarian Scientist, 600, D-Bells.

Vlacq (1600-1667) of Gouda, the illustrious successor of Napier, lived in London and then in Paris as a bookseller and publisher, but was driven out and returned to Holland. This work contains his treatise of 52 pages on plane and spherical triangles and his table on trigonometry as well as the table of logarithms of numbers.

B280.83

Good, J., 1 Measuring made Easy: or the Description and Use of Coggeshall's Sliding Rule, Analog Calculator, 2-3 part, Book, Craft, 1744, England, 96 pages, several fold outs, Buy, The Antiquarian Scientist, 275, D-Bells.

B281.83

Speidell, Euclid, 1 Logarithmotechnia, or The Making of Numbers called Logarithms to Twenty-five Places from a Geometrical Figure with Speed, Ease and Certainty. London. London Printed by Henry Clark for the Author.Book, 1688, England, 145x192x8 mm, Leather binding, 50 pages, one worm hole through book, Buy, Antiquarian Scientist, 450, D-Bells.

B282.83

M. Thomas de Colmar, 1 Instruction pour se servir de L'arithmometre, machine a calculerBook, Digital Calculator, 3-4 registers, Book, 1852, France, Bound for A.S.A.R. Louise Marie de Bourbon, Regente des Duches de Parme et de Plaisance etc., Buy, D-Bells.

B283.78

Casio, 1 Mini Card fx-48 Scientific Calculator, Digital Calculator, 1978, Japan, 256023, 90x53x3 mm, Metal, Case, instruction book, unit conversion table, physical constants table, calculator, Buy, D-Bells.

B284.83

Commodore US*14, 1 Digital Calculator, Digital Calculator, ca 1970, USA, 11619, 195x290x75 mm, Black and White, Plastic case, transistors, Cord and calculator, Buy, 3 (83), S-Under vestibule-Bells.

B285.83

HDC Industries, 1 "Human Digital Calculator: Add'em up Finger Machine", ca 1980, USA, 140x88x2 mm, Red and White, Cardboard, Buy, D-Bells.

B286.70

M.V. Wilkes, D. J. Wheeler, and Stanley Gill, 1 Programs for and Electronic Digital Computer, Addison Wesley Publishing Company, 1951, USA, Second Edition, 1957, 160x233x19 mm, Paper, 238 pp, Buy, D-Bells.

B287.55

Richard Stevens Burrington, 1 Handbook of Mathematical Tables and Formulas, Handbook Publishers, Inc. Sandusky, OhioBook, Memory, 1933, USA, Reprinted with corretions, 1953, .137x200x20 mm, Navy blue, Paper, 296 pp. index, Buy, D-Bells.

B288.83

Wolverine, 1 Adding MachineCalculator, Digital Calculator, Single register, Pascal strip, ca 1935, USA, 135x225x105 mm, Red, Blue, Cream, Tin, Buy, D-Bells.

Patent 2243884

B289.79

Designsense, Inc., Atlanta, Ga., 1 "mileage minder"circular slide rule, Analog Calculator, 2-3 parts, circular slide rule, 1979, USA, 195x108x2 mm, Black, red and white, Paper and aluminum, Instructions and instrument, Buy, Jordan Marsh, 5 (79), D-Bells.

The left rule with input of odometer start and odometer end shows miles driven. The right rul inputting midles driven and miles per gallon, shows gallons used.

B290.83

Simplex, 1 "Simplex Typewriter Model A"Typewriter, ca 1940, USA, 170x120x75 mm, Red, yellow and blue, Tin, Box, instructions and typewriter, Buy, D-Bells.

Model A prints 36 characters, on 6 inch paper and cost $1.00; Model C, 42 characters on 7 inch paper and cost $1.50; Model D prints 68 characters both capital and small on 7 inch paper and cost $3.00; and Model E prints 72 characters capitals and small letters on 8 inch paper and cost $4. Sold as "useful where speed of pen suffices and carbon capy is not needed. They fascinate and teach children. Their Elders find them useful."

B291.83

Barron's Educational Services, Inc., Woodbury, NY, 1 "Metric Converter"Slide rule, Analog Calculator, 2-3 parts, slide rule, USA, 212x82x2 mm, red, orange, and yellow on white, cardboard, Buy, D-Bells.

B292.83

1 Typewriter, ca 1900, Wooden case and base, steel, tin, rubber, case and machine, Buy, Margaret Weiner Kennedy, 150 (83), D-Bells.

No maker yet this was manufactured.

B293.83

IBM, 1 plug board for 911, USA, Type 911, #121854, 290x170x30, Stainless steel, plastic coated plugs, Board and plugs, Buy, Computer Museum, -, D-Bells.

B294.83 DEC, 1 PDP-10 Cable connector, D-Bells.

B295.83DEC, 1 UART, 1979, 132x215x2 mm, green board, D-Bells.

B296.83DEC, 1 Core plane, Memory, 1974, 208x265x20, D-Bells.

Late PDP-11 core plane.

B297.83 DEC, 3 modules, Transistor, 1960, USA, 43x43x170 mm, D-Bells.

B298.83

George Fisher, 1 <u>Arithmetic in the Plainest and most Consise Methods Hitherto Extant,</u> Peter Brynberg, Londonbook, 1800, 160x96x30 mm, leather binding, Buy, 55 (83), D-Bells.

B299.80

Monroe, 1 "Monroe" calculator, Digital Calculator, 3-4 registers, ca 1950, USA, Model LA7-160; #J716387, 190x150x280 mm, grey, Buy, 25 (80), D-Bells.

B301.84

1 "SWIFT" HANDY CALCULATOR, Digital Calculator, Single Register, Mechanical, ca 1960, USA, 130x140x86 mm, Blue, Plastic, Buy, Palo Alto Thrift Store, 2(84), D-Bells.

B302.84

1 "Consul" The Educated Monkey, Table, Readable or Writable Memory, Linear, Craft, 1916, USA, 139x148 mm, Red, Yellow, Blue and Brown, Tin, Device, Cardboard case, and replaceable table for adding, Buy, Boston Antique Show, 65 (84), D-Bells.

See letter from Donald Davies in files and instruction book; same as B211.82

B303.84

Hine and Robertson Co. New York, 1 The Lippincopt PlanimeterPlanimeter, Analog Calculator, Multiple Part, Areal Measure, Mechanical, 1898, USA, 190, Nickel, May be missing one dial, Buy, Irwin and Rita Margolis, Brockton, 100 (84), D-Bells.

B304.84

Butterfield (1674-1722), 1 Sector, Analog Calculator, 2-3 Part, Sector, Craft, 1700, France, Brass, Buy, Peter Delahar, 450 (84), D-Bells.

B305.84

Tavernier-Gravet, Rue Mayet, 19-Paris, 1 Mannheim slide rule, Analog Calculator, 2-3 part, slide rule, Craft, ca 1890, France, 260x28x8 mm, Boxwood with metal cursor, stamped with "Medailles D'or 1878 et 1889, Buy, Peter Delahar, 130 (84), D-Bells.

See B203.82

B306.84

Marion & Co., London, 1 Hurter & Driffield's Actinograph, Readable or Writable Memory, Craft, 1892, England, Wood and paper, Box, instrument, instructions, Buy, Peter Delahar, 165 (84), D-Bells.

B307.84

A W Faber, 1 Slide Rule, Analog Calcula, 2-3 Part, Slide Rule, Craft, ca 1935, Germany, 371190, 33x9x270 mm, Ivory, Ivory bonded to wood, Inch and centimeter scales are on opposite sides, Leather case and rule, Buy, Flea market, 10, D-Bells.

See also 189

B308.84

Philco, 3 Circuit boards from the Philco 212, Digital computer, ca 1960, USA, D-Bells.

B309.84

Tasco, 1 "Pocket Arithmometer", Digital calculator, Single register, Pascal strip, ca 1940, USA, 10x180x60 mm, tin, calculator, case, stylus, Buy, Prairie du Chien flea market, 10, D-Bells.

See 36.79

B310.84

1 Day's American Ready Reckoner, by B. H. Day, Esq., New York: Dick & Fitzgerald, Publishers, Read only memory, 1866, USA, 192 pp., Buy, Amherst Howlands Antique market, 3, D-Bells.

The book contains "tables for rapid calculations of agreegate values, wages, salaries, board, interest money, timber, plank, board, wood, and land measures with explanations of the proper methods of calculating them, and simple rules for measuring land. These tables are wholly original and have been carefully revised by an expert mathematician."

B311.84

Otis King, 1 Cylindrical slide rule, Analog calculator, 2-3 moving parts, Buy, Historical technology, 84, D-Bells.

B312.84 Brevete, 1 Circular slide rule, nickel, Buy, 150, D-Bells.

B313.84

Keuffel & Esser Co, 1 radial planimeter, Analog Calculator, multiple part, Germany, 22280, steel, case and instrument, Buy, 60, D-Bells.

B314.84 1 Abacus, 9 digit, and instruction book, Buy, 3, D-Bells.

B315.84

Iacobus Matinensis, 1 sector, 1687, Italy, brass, Buy, Antiquarian Scientist, 12,000, D-Bells.

B316.84

Jason, 1 Slide Rule No. 803, Analog Calculator, 2-3 part, linear, ca 1955, Japan, plastic laminated wood, case and rule, Buy, NE Trade Show, 5, D-Bells.

B317.84

Keuffel & Esser Co., 1 Slide Rule, Analog Calculator, 2-3 part, Linear slide rule, ca 1930, USA, 54308, laminated wood, leather case and rule, Buy, NE Trade Show, 5, D-Bells.

B318.84

Lawrence Engineering Service, Peru, Indiana, 1 Slide Rule, Analog Calculator, 2-3 part, linear slide rule, ca 1950, USA, Paper on wood, "Waddy Hogue" written on the table side, Buy, NE Trade Show, 5, D-Bells.

slide rule on one side tables on the reverse. These include Decimal equivalents of one foot, weight metals, and ultimate strength.

B319.84

1 "Unique" Universal II Slide Rule, Analog Calculator, 2-3 parts, linear slide rule, England, plastic pinned on wood, Buy, NE Trade Show, 5, D-Bells.

B320.84

Kenyon Instrument Co., Inc., Huntington, L.I., N.Y., 1 "The Kenyon Calculator"Circular Slide Rule, Analog Calculator, 2-3 parts, Circular slide rule, 1937, USA, plastic laminate on wood, Buy, NE Trade Center, 5, D-Bells.

A nautical slide rule. The outer circule has distance and speed in land miles & miles per hour and nautical miles and knots. The inner circle has time ranging from one minute to 10 hours. The reverse side has a compass, map measure scale ratio for 1/20,000, 40,000 and 80,000. Beaufort wind scale, knots and weather bureau description.

B321.84

Keuffel and Esser, 1 "K & E Compensating Polar Planimeter with Adjustable Arms" planimeter, Analog Calculator, Multiple part, ca 1940, USA, Model 4242, Serial Number 9120, Instrument and velvet lined case, Buy, NE Trade Show, 75, D-Bells.

The adjustable tracer arm with vernier and adjustable pole arm allows the reading of areas in square inches to 0.01 sq. in. or .0.04 sq. cm. The range of the trace arm is 1.5-7 inches and the pole arm lenght is 6 to 13 inches. The maximum area "Pole out-side figure" is about 12 inches and "pole within figure" a 39 inch circle and 27 inch square.

B322.84

Keuffel & Esser co., 1 "Paragon protractor No. 1225"protractor, Drawing instrument, ca 1920, USA, nickel, mahogany case with velvet, Buy, NE Trade Center, 65, D-Bells.

The semicircular protractor has a horncenter and movable arm capable of being set at .5 degrees.

B323.84

Richmond School Furniture Co., Munci, Indiana, 1 "Junior Spelling and Number Board No. 50"Calculator, Digital Calculator, Single Register, Manual, ca 1940, USA, Red, cardboard, Buy, NE Trade Show, 20, D-Bells.

B324.84

Stanley, 1 Electronic Calculator, looks like a 16 ft stanley powerlock rule, ca 1980, USA, Buy, NE Trade Fair, 2, D-Bells.

B325.84

Contina Ag Mauren, 1 "Curta" Type II, Digital Calculator, 3 Register, Rotary, Mechanical, Liechtenstein, 513508, Instrument and Case, Buy, NE Trade Fair, 300, D-Bells.

See 87.80

B326.84

Contina Ag Mauren, 1 "Curta" Type II, Digital Calculator, 3 Register, Rotary, Mechanical, Liechtenstein, 513329, Instrument and Case, Buy, ?, D-Bells.

See 87.80

B327.84

D'Ocagne, M., 1 Le Calcul Mecanique par L. Jacob, Paris Octave Doin et fils, Editeurs, 8, Place de L'Odeon, 8, Book, 1911, Buy, D-Bells.

B328.84

Albert Newstler A.G. Lahr i/B, 1 "Rechen-Walze System Cylindrical Slide Rule", Analog Calculator, 3-4 parts, slide rule, ca 1930, Germany, cylinder 6 1/4" diameter and 23" long, paper faced aluminum on dark oak base, Buy, Historical Technology, 629.57, D-Bells.

"This super slide rule appears to combine features of Hannyngton's linear grid slide rule and Thacher's cylindrical calculator. It differs from the former in that there is no overlap of scales on the base cyliner and from the latter in that each grid bar contains only one scale and that these scales are half the length of the base one. The Rouleau Calculator (Item 164 in the Science Museum catalog) is another Swiss variant of the same design. There are 50 scales, 20" long each on the main cylinder (for a total scale length of 1000 inches) and the same number, 10" long each, on the sliding grid." Historical Technology Catalog 127.

B329.84

Stanley, Philip E., 1 <u>Boxwood & Ivory, Stanley Traditional Rules, 1855-1975,</u> The Stanley Publishing Co., Westborough, 1984, Book, Buy, 22, D-Bells.

B330.78

de Beauclair, 1 <u>Rechnen mit Maschinen Eine Bildgeschichte der Rechentechnik,</u> Friedr Vieweg & Sohn, Braunschweig, 1968, Buy, D-Bells.

B331.85 Jevons, William Stanley, <u>The Principles of Science, a treatise on</u>

<u>logic and scitentific method,</u> London: Macmillan and Co. book, 1883, England, original brown bead-grain cloth, gilt spine lettering, 870 pp., advertisements, wood-engraved frontispiece of Jevons' 'logical piano"; Buy, Pickering and Chatto Ltd, 100, D-Bells.

Based on the first edition of 1874, this is Jevon's biggest and most celebrated book. Jevons' "logical piano', capable of performing logical operations on data fed in via the keyboard is shown in the frontispiece and described on pp. 107-114.

B332.85

Hollerith, Herman, Complete specification. Improvements in the methods of and apparatus for compiling statistics, patent application, 1889, Folio, 7 pages and 5 plates on 3 sheets; disbound in a cloth folding case, Buy, Pickering and Chatto, 1,500, D-Bells.

The original patent specification, and thus the first printed account, of the Hollerith electric tabulating machine.

B333.85

Peurbach, Georg, Tractatus Georgii Peurbachii super propositiones Ptolemaei de sinibus & chordis. 1468 - 1501, First edition, folio, 1-G4-Gr blank, small tear in E3 affecting a few figures, repaired in margin, minor waterstain, mostly marginal; a large crisp copy in antique style blindstamped calf. Buy, Pickering and Chatto, 1250, D-Bells.

The first printed trigonometrical tables. They were computed by Regiomontanus during his stay in Hungary in 1468. He had first computed a sexagesimal sine table and then realised the advantage of a decimal base and computed a decimal sine table; both tables are printed here. The tables are preceeded by Regiomontaus' essay on the construction of since tables and an essay on the computation of sines and chords by Peurbach. The work was edited bythe astronomer Johann Schoner (Adams P 2283, Zinner 1781).

B334.85

Capra, Balthasar, Vsvs et Fabrica Circini Cvivsdam Proportionis, Per quem omnia fere tum Euclidis, tum Mathematicorum omnium problemate facili negotio refoluunter, H.E. de Duccijs, Bononiae (Bologna) 1655

Italy, 1stt Ed., Modern leather binding and use, 86 pages, many text woodcuts including a full page one of the sector. Buy Historical Technology, 255, D-Bells.

The author (1580-1626) an Italian astronomer and philosopher is best known for his challenge of Galileo as the inventor of the compass of proportion or sector. This book was written in 1607 although not published until 1655 after Galileo's first disclosure about 1598.

B335.85

Galilei, Galileo, Le Operazioni del Compasso Geometrico et Militare, Terza, Paolo Frambotto, Padova, 1649, Italy, 80 pp., folding engraved plate of the sector and many text woodcut illustrations. Hard vellum binding, 3rd Edition. Buy Historical Technology, 635, D-Bells.

Galileo seems to have invented his "compasso geometrico" also called compass of proportion or sector about 1597 and disclosed it about 1598. The first edition of this, his first book, was published in 1606 with less than 60 copies issued. it was reprinted in 1619. A second, improved edition was issued in 1640 by the same publisher of the third.

B336.85

Ozanum, Jacques, Usage du compas de Proprotion et de L'instrument Universel, Claude-Antoine Jambert, Fils, Paris. 1769, France, 240 pp., 12 foldout engraved plates, original leather binding, Buy, Historical Technology, 165, D-Bells

The first edition of this work was published in Paris in 1688 becoming the standard text on the sector in France. Ozanam (1640-1753) was one of the leading French mathamaticians of this time.

B337.85Fowler's Calculators Ltd., "Jubilee Magnum" Circular Slide Rule

1, Analog Calculator, 1-2 parts, circular slide rule, 1948, England, nickel plated boy with white dial face rotated under an index line. Buy, Historical Technology, 145, D-Bells.

"Designed to mark the 50th anniversay of the firm and to meet the wants of a great number of people, whose primary requirements are for a device for solving problems of muliplicaton and division in a rapid and accurate manner." The entire sacle is 79" long resulting in almost one full figure increase in accuracy over the 10" slide rule.

B338.85

T. Heath fect, Gunter type sector,1, 1720-40, England, Bright brass, restored lacquer finish, pivoted strut which fold into a slot for added support. Buy, Historical Technology, 395, D-Bells.

Thomas Heath started in business in 1714. In 1740 he made his apprentice Tycho Wing a partner and Heath & Wing remained in business until Heath's death in 1773.

B339.85

"The Mechanical Engineer", circular slide rule, 1, Switzerland, nickel, brass case, Buy, Historical Technology, 75,D-Bells.

B340.85

Todd Protectograph Co., Rochester, NY, 1 "Star Adding Machine"Adding Machine, Digital Calculator, Single Register, Mechanical, 1921, USA, Black with red and green, Metal, Buy, MacGregor Ia. antique shop, 8, D-Bells.

B341.85

L. C. Stephier, 1 Coggeshall rule, Analog Calculator, 2-3 part, craft, USA, No. 23, 320x40x4 mm, boxwood, Buy, D-Bells.

B342.85

1 Hinged slide rule, Analog calculator, 2-3 parts, craft, 1800, English, overstamped French, 320x40x4 mm, boxwood and brass, Buy, Peter Delahar, 70, D-Bells.

Unusual hinged slide rule with navigational scales.

B343.85

Wittnaur Watch Co., 1 Map measure, Analog Calculator, 2-3 Part, Linear calculator, USA, centimeters to inches, Buy, Amherst flea market, 8, D-Bells.

B344.85

Kueffel & Esser Co., 1 Map measure, Analog calculator, 2-3 parts, linear measure, USA, Model 1744T, inches to feet, Box and measure, Buy, Amherst flea market, 8, D-Bells.

B345.85

Watkins, 1 drawing instruments, 1824 newspaper inside, England, "pocket scale set", ivory sector, boxwood rule, lizard case, Buy, Amherst antique market, 300, D-Bells.

B346.85

W. L. Jones, 50 Holborn, London, 1 pantograph, Analog calculator, multiple parts, proportional copier, ca 1850, England, Brass, case and instrument, Buy, Amherst antiques, 450, D-Bells.

B347.85

integrator, 1 209478, USA, painted red, blue and yellow by Arthur Hall, Bur. Ord. Assembly Drg. No. 194077, U.S. No. 38, D-Bells.

B348.85

integrator, 1 209478, Bur. Ord. Assembly Drg. No. 194077-1, Serial No. 3532, Buy, 30, D-Bells.

B349.85

Keuffel & Esser Co., 1 Slide Rule (N4053-3), Analog Calculator, 2-3 part, patent June 1900, USA, #364384, leather case and rule, Buy, 5, D-Bells.

B350.86

1 "Consul" The Educated Monkey, Memory, 1916, USA, 139x148 mm, Red, Yellow, Blue and Brown, Tin, Device, cardboard case and replaceable table for adding, Buy, NE Trade Center Show, 40, D-Bells.

See also 211 and 302

B351.86

Otis King, 1 Otis King's Pocket CalculatorCylindrical slide rule, Analog caclulator, 2-3 moving parts, B1597, Leather case and rule, Buy, England, D-Bells.

B352.86

"Unique", 1 Universal II Slide Rule, Analog Calculator, 2-3 moving parts, linear slide rule, England, plastic pinned on wood, Buy, England, D-Bells.

B353.86

"Unique", 1 Log Log Slide Rule, Analog Calculator, 2-3 moving parts, linear slide rule, England, plastic pinned on wood, Buy, England, 8, D-Bells.

B354.86

"Unique", 1 Slide Rule, Analog Calculator, 2-3 moving parts, linear slide rule, England, plastic pinned on wood, Buy, England, 7, D-Bells.

355.86

"Unique", 1 Universal Slide Rule, Analog Calculator, 2-3 moving parts, linear slide rule, England, plastic pinned on wood, Buy, England, 8, D-Bells.

356.86

Faber-Castell, 1 Castellslide rule, Analog Calculator, 2-3 moving parts, linear slide rule, Germany, plastic and wood, plastic case and rule, Buy, England, D-Bells.

B357.86

1 "Coggeshall" Slide Rule, Analog Calculator, 2-3 moving parts, linear slide rule, England, Wood and brass, Engraved, E. Routledge Engineer Bolton, Buy, England, 50, D-Bells.

B358.86

Elliott Bros, 440 Strand, 1 Sector, 2-3 moving parts, sector, England, Ivory and brass, Buy, England, 75, D-Bells.

B359.86J. Archbutt & Sons, 1 parallel rule, compass and rule, Buy, England, 135, D-Bells. See B259.83

B360.86

H. Huges & Sons Ltd. London, 1 "Capt Field's Improved Parallel"parallel rule and compass, Analog Calculator, 2-3 moving parts, England, Wood, Buy, England, 45, D-Bells.

B361.86

Charles Augustus Schmalcalder, 1 Protractor, Analog calculator, Circular protrator, ca 1810, England, brass, double cantilever arm and geared, wood case and instrument, Buy, Peter Delahar, 650 D-Bells.

Illustrated in G. Adams, rev W. Jones, Geometrial and Graphical Essays, 4th Ed. London 1813.

B362.86

J. Halden & Co. Ltd, 1 "HALDEN CALCULEX"Circular Slide Rule, Analog Calculator, 2-3 part, circular slide rule, ca 1910, England, 60 mm diameter, Aluminum cse with velvet interior and instrument, Buy, England, D-Bells. See B158.81

B363.86

A. Jeffery Camborne, Wilton St. Day, 1 Circular protractor, Analog Calculator, circular protrator with one arm, ca 1900, England, Brass, Wood case and instrument, Buy, England, D-Bells.

B364.86

Elliott Brothers, London, 1 Proportional rule and protractor, Analog Calculator, Fixed, Rule and Protractor, ca 1890, England, Ivory, Buy, England, 35, D-Bells.

Engraved H. F. Mackay; Horizontal equivalents for 20 feet of vertical engraved on one side; rule for degree of slope on the other.

B364.86

Elliott Brothers, London, 1 Propotional rule and protrrctor, Analog Calculator, Fixed, Rule, ca 1890, England, Ivory, Buy, England, 30, D-Bells.

6 to M. Yards on one side; 8 to M paces or yards on the other.

B366.86

Thompson, Silvanus P. and Eustace Thomas, 1 Electrical Tables and MemorandaE. F. N. Spon, Ltd., 125 Strand, London; Spon & Cahmberlain, 12 Cortlandt St, New York, Memory, 1898, plastic case, leather binding and book, Buy, England, D-Bells.

Small pocket size. 120 pages, plus an index. marked up by the owner.

B367.86

Schoten, Francois, 1 Tables de Sinus, Tangents, et SecantesChez Lambert Marchant, Libraire au Marche aux Herbes, a Brusseles, Memory, 1683, Leather binding, one wormhole, Buy, Pickering and Chatto Ltd, 200, D-Bells. Pocket sized.

B368.86

MacNeill, Sir John Benjamin, 1 Tables for Calculating the Cubic Quantity of Earth Work in the Cuttings and Embankments of Canals, Railways, and Turnpike RoadsRoake and Varty, London, Memory, 1833, Buy, Pickering and Chatto, 150, D-Bells.

First edition, 8vo9, pp. xxxvii, 253, dedication to Telford misbound before contents, errata on verso of title, and four engraved plates tipped in at end; contemporary green vellum, gilt lettering on spine, boards warped.

Sir John MacNeill was at this stage in his career one of Telford's principal assistants, and this work is dedicated to him. The uses he sets out for t hese tables reflect the type of engineering work he was engaged on. In his preface he refers to Charles Babbage's investigations on the type of paper nad print best suited for tables. At about this time MacNeill invented device to measure the irregularities of road surfaces which anticipated a similar invention by Babbage.

B369.86

Bessel, Friedrich Wilhelm, 1 Tabulae Regiomontanae Reductionum Observationum Astronomicarum ab anno 1750 usque an annum 1850 cumputaiRegiomonti Prussorum, Konigsberg (now Kalinengrad), sumptibus fratrum Borntraeger, 1830, Buy, Pickering and Chatto Ltd, 350, D-Bells.

First edition, 8vo, pp. (Iv), lxiii, (i), 542, errata, verso lank; foxed; blue library buckram, from the Royal Greenwich Observatory, release stamp on end paper.

The star positions given for one century, constitute the first modern reference system for the measurement of the positions of the sun, the moon, the planets, and the stars, and for many decades the Konigsberg tables were used as ephemeerrides. With their aid, all observations of the sun, moon, and planets made since 1750 at the Royal Greenwich Observatory could be reduced; and thus these observations could be used for the theories of planetary orbits.

B370.86

Victor Adding Machine Co., 36 Second St., Sand Francisco 5, Ca., 1 Adding machine, Digital Calculator, 1-2 register, Pascal key and print, ca 1935, USA, W867 metal plate; 936307 C 7 83 4 stamped in plastic, black and green, plastic "art nouveau" form, Buy, Palo Alto antiques, 30, D-Bells.

B371.86

Starhe & Hammerer, 1 Planimeter, Analog Calculator, Variable Part, Variable Ratio Polar Planimeter, ca 1870, Austria, 874, Brass and iron, Wooden case and instrument, Buy, Peter Delahar, 350, D-Bells.

A very rare instrument, modifying the Amsler design.

B372.86

Felt & Tarrant Mfg. Co.,, 1 "Comptometer", Digital Calculator, Single Register, Keyed Wheel, Electric, ca 1930, USA, metal, Buy, Palo Alto Antiques, 25, D-Dana Corp.

B373.86

Felt & Tarrant Manufacturing Co., 1 "Comptometer", Digital Calculator, Single Register, Keyed Wheel, Electric, ca 1930, USA, Buy, Palo Alto Antiques, 25, D-Dana Corp.

June 14, 1979

Saul Moskowitz, President
6 Mugford Street
Marblehead, MA 01945

Dear Mr. Moskowitz:

I would like to buy the Addometer, #228, from your 1979 Spring Catalog 118.

Enclosed is a check for $48.31:

Addometer	$45.00
5% Sales Tax	2.25
Shipping	1.06
	$48.31

Please ship to:

Page Farm Road
Lincoln, MA 01773

Sincerely,

Gordon Bell

GB:swh
GB0003/54
Enclosure

<id>B200.82
<ma>
<na>Mileage reader
<sn>
<#>1
<oc>Analog Calculator
<fa>2-3 part
<ge>Integrator
<cp>
<fo>
<tc>Mechanical
<yr>ca 1950
<co>
<s#>
<si>35 mm diameter; 112 mm with handle
<cr>
<mt>Chrome, glass, and paper
<cx>
<pt>
<hw>Buy
<so>Portobello Rd
<$c>33 (82)
<$v>
<lo>D-Bells
<bl>This mileage reader was clearly made for scientific map distance readings. On one side there are scales for 1:2000;

4000; 8000; and 10,000. On the other side the scales read
1:25,000; 50,000; 75,000; and 200,000.
<>

<id>B201.82
<ma>Chambon & Baye
<na>"TACHYLEMME"
<sn>Table
<#>1
<oc>Writable or Readable Memory
<fa>Mechanically stable
<ge>Cyclic
<cp>
<fo>
<tc>Craft
<yr>ca 1880
<co>France
<s#>
<si>175x100x35 mm
<cr>Black
<mt>Glass, wood, sliver plate and paper
<cx>
<pt>
<hw>Buy
<so>Delahar
<$c>260 (82)
<$v>
<lo>D-Bells
<bl>A calculating device with four printed cyclinders 1-9; 10-90; 100-900; and 1000-9000 so arranged that percentages for every half percent from one to six percent can be read through slits. The total of say 6,216 at 4 percent could be figured by adding the sums shown in the four rows. One was presented to the Science Museum by M. Malassis in 1936. Chambon also introduced similar "calculators" for the multiplication tables, called "Multiplicateur Enfantin".
<>

<id>B202.82
<ma>
<na>"The MP Handy Guide for Knitting and Crochet"
<sn>Table

<#>1
<oc>Readable or Writable Memory
<fa>Paper
<ge>Fixed
<cp>
<fo>
<tc>Craft
<yr>ca 1930
<co>England
<s#>
<si>118x90x2 mm
<cr>
<mt>Metal and paper
<cx>Stained and worn
<pt>
<hw>Buy
<so>Bermondsey market
<$c>3 (82)
<$v>
<lo>D-Bells
<bl>Indicators can keep track of rows, increase, and times. Holes on the side provide a guage for the needles. And a 4 and a half inch rule is along the bottom.
<>

<id>B203.82
<ma>Tavernier Gravet
<na>slide rule
<sn>Mannheim slide rule
<#>2
<oc>Analog Calculator
<fa>2-3 part
<ge>slide rule
<cp>
<fo>
<tc>Craft
<yr>ca 1880
<co>France
<s#>
<si>260x28x8 mm
<cr>
<mt>Boxwood with brass cursor

<cx>One stamped with "Medailles D'or 1878 et 1889
<pt>
<hw>Buy
<so>Delahar
<$c>74 (82); 130 (84)
<$v>
<lo>D-Bells
<bl>Colonel Amedee Mannheim designed a slide rule with a cursor about 1850. Tavernier Gravet manufactured this in France and after 1880 exported a large number to England and Germany.
<>

<id>B204.82
<ma>
<na>slide rule
<sn>
<#>1
<oc>Analog Calculator
<fa>2-3 part
<ge>slide rule
<cp>
<fo>
<tc>Craft
<yr>
<co>
<s#>9-37
<si>350x30x8 mm
<cr>
<mt>German silver
<cx>
<pt>Slide rule and wood case engraved with owners name
<hw>Buy
<so>Maitland
<$c>222 (82)
<$v>
<lo>D-Bells
<bl>An engineering surveyors slide rule primarily used for calculating distances.
<>

<id>B205.82
<ma>Dring & Fage
<na>Slide Rule
<sn>Guagers slide rule
<#>1
<oc>Analog Calculator
<fa>2-3 part
<ge>Slide rule
<cp>
<fo>
<tc>Craft
<yr>
<co>England
<s#>
<si>314x50x5 mm
<cr>
<mt>Ivory
<cx>
<pt>
<hw>Buy
<so>Maitland
<$c>277 (82)
<$v>
<lo>D-Bells
<bl>Two-sided revenuers rule with two sliding guages.
<>

<id>B206.82
<ma>Duss
<na>Slide rule
<sn>Guagers slide rule
<#>1
<oc>Analog Calculator
<fa>2-3 part
<ge>Slide Rule
<cp>
<fo>
<tc>Craft
<yr>
<co>England
<s#>
<si>315x50x5 mm
<cr>
<mt>Boxwood
<cx>
<pt>
<hw>Buy
<so>Bermondsey Market
<$c>90 (82)
<$v>
<lo>D-Bells
<bl>Similar to B205.
<>

<id>B207.82
<ma>Loftus
<na>Rule
<sn>Guagers rule
<#>1
<oc>Analog Calculator
<fa>Single part
<ge>Rule
<cp>
<fo>
<tc>Craft
<yr>
<co>England
<s#>
<si>260x30x30 mm folded
<cr>
<mt>Boxwood
<cx>
<pt>
<hw>Buy
<so>Bermondsey Market
<$c>10 (82)
<$v>
<lo>D-Bells
<bl>
<>

<id>B208.82
<ma>
<na>Rule
<sn>Guagers rule
<#>1
<oc>Analog Calculator
<fa>Single Part
<ge>Rule
<cp>
<fo>
<tc>Craft
<yr>
<co>England
<s#>
<si>260x30x30 mm folded
<cr>
<mt>Boxwood
<cx>
<pt>
<hw>Buy
<so>Bermondsey Market
<$c>10 (82)
<$v>
<lo>D-Bells
<bl>
<>

<id>B209.82
<ma>T.O. Blake Ltd.
<na>Rule
<sn>Guagers cased rule
<#>1
<oc>Analog Calculator
<fa>Single Part
<ge>rule
<cp>
<fo>
<tc>Craft
<yr>
<co>England
<s#>
<si>6 cylinders each 25 mm by 3 mm diameter that fit together
<cr>
<mt>Boxwood with a leather case
<cx>
<pt>Six rules in a fitted leather case
<hw>Buy
<so>Bermondsey Market
<$c>10 (82)
<$v>
<lo>D-Bells
<bl>
<>

<id>B210.82
<ma>Lyons: Barth. Vincentius, 1620
<na>"Logarithmorum canonis descriptio...Sequitur tabula canonis logarithmorum... Mirifici logarithmorum constructio...cum annotationibus Henrici Briggii in eas, et memoratam appendice.
<sn>Book
<#>1
<oc>Readable or Writable Memory
<fa>Paper
<ge>Random
<cp>Two volumes in one
<fo>
<tc>Craft
<yr>1620
<co>England
<s#>
<si>
<cr>
<mt>
<cx>First title in red and black. Woodcut diagrams in the text and printer's device on titles. Copy of G. S. Franckenius (1592-1654) and contemporary manuscript notes in the margins are likely in his hand. First title a bit worn in outside margin.
<pt>
<hw>Buy
<so>Antiquarian Scientist
<$c>1400(82)
<$v>
<lo>D-MR2
<bl>In 1614, John Napier (1550-1617) published his epochal work on the "invention of logarithms. Posthumously published was his description of the method of construction of logarithmic tables (1619). the present first continental edition of both works was based on the joint issue of them at Edinburgh in 1619, with the addition here of Henry Brigg's annotations, pp. 58-62 of the last part. Briggs (1556-1631) played an important role in further development and utilization of logarithms.
<>

<id>B211.82
<ma>
<na>"Consul" Educated Monkey
<sn>Table
<#>3
<oc>Readable or Writable Memory
<fa>Paper
<ge>Linear
<cp>
<fo>
<tc>Craft
<yr>1916
<co>USA
<s#>
<si>139x148 mm
<cr>Red, Yellow, Blue and Brown
<mt>Tin
<cx>
<pt>
<hw>Buy
<so>Jeremy Norman; Boston Antique Show; New England Trade Center
<$c>175(82) 65(84) 40(86)
<$v>
<lo>D-Bells
<bl>See letter in file from Donald Davies describing it.
<>

<id>B212.82
<ma>Jehu Hatfield
<na>Clock interest table
<sn>
<#>1
<oc>Readable or Writable Memory
<fa>Mechanically stable
<ge>Cyclic
<cp>
<fo>
<tc>Craft
<yr>1844
<co>USA
<s#>
<si>300x450x170 mm
<cr>
<mt>wood and paper
<cx>
<pt>
<hw>Buy
<so>Jeremy Norman & Co.
<$c>475(82)
<$v>
<lo>D-Bells
<bl>
<>

<id>B213.82
<ma>
<na>Ratchet Adder
<sn>Ratchet adder
<#>1
<oc>Digital Calculator
<fa>Single Register
<ge>Ratchet
<cp>
<fo>
<tc>Mechanical
<yr>ca 1850
<co>USA
<s#>
<si>313x313x10 mm
<cr>Brown with Black ink
<mt>Brass and Cardboard
<cx>
<pt>
<hw>Buy
<so>Jeremy Norman
<$c>360(82)
<$v>
<lo>D-Bells
<bl>
<>

<id>B214.82
<ma>C. X. Thomas de Colmar
<na>Arithmometer
<sn>
<#>1
<oc>
<fa>
<ge>
<cp>
<fo>
<tc>
<yr>1852
<co>
<s#>
<si>
<cr>
<mt>
<cx>
<pt>
<hw>Buy
<so>Peter Delahar
<$c>3000 (82)
<$v>
<lo>D-Bells
<bl>
<>

<id>B215.82
<ma>Hamilton Watch Company
<na>Map Mileage Reader
<sn>
<#>1
<oc>Analog Calculator
<fa>2-3 part
<ge>Linear measure
<cp>
<fo>
<tc>Mechanical
<yr>ca 1950
<co>USA
<s#>
<si>110x5mm 35mm diameter
<cr>
<mt>Chrome, glass, paper
<cx>Model number 331
<pt>
<hw>Buy
<so>Garrison House Antiques
<$c>25(82)
<$v>
<lo>D-Bells
<bl>One-sided with two scales for centimeters and inches.
<>

<id>B216.82
<ma>
<na>Planimeter
<sn>
<#>1
<oc>Analog Calculator
<fa>Multiple Part
<ge>Areal Measure
<cp>
<fo>
<tc>Mechanical
<yr>ca 1900
<co>Switzerland
<s#>28460
<si>220x30x40mm case
<cr>
<mt>Steel instrument
<cx>Engraved with Crosby Steam Gage & Valve Co., Boston, Swiss Manufacture
<pt>
<hw>Buy
<so>Garrison House Antiques
<$c>95 (82)
<$v>
<lo>D-Bells
<bl>
<>

<id>B217.82
<ma>Arnof
<na>Map Mileage Reader
<sn>
<#>1
<oc>Analog Calculator
<fa>2-3 part
<ge>Linear Measure
<cp>
<fo>
<tc>Mechanical
<yr>ca 1935
<co>Germany
<s#>
<si>8x76 mm 35 mm diameter
<cr>
<mt>Nickel, glass, and paper
<cx>
<pt>Case and instrument
<hw>Buy
<so>
<$c>10 (82)
<$v>
<lo>D-Bells
<bl>Two sided scale with nautical miles, kilometres and statue miles on one side and centimetres to kilometres and inches to miles or versiers on the other.
<>

<id>B218.82
<ma>Manloves
<na>"Boucher's Calculator"
<sn>Circular slide rule
<#>1
<oc>Analog Calculator
<fa>2-3 parts
<ge>Slide rule
<cp>
<fo>
<tc>Craft
<yr>
<co>England
<s#>
<si>15mm x 50mm diameter
<cr>
<mt>Nickel, glass and paper
<cx>
<pt>
<hw>Buy
<so>
<$c>85 (82)
<$v>
<lo>D-Bells
<bl>
<>

<id>B219.87
<ma>Wheatstone
<na>The Harmonic Diagram
<sn>Circular Slide Rule
<#>1
<oc>Analog Calculator
<fa>2-3 Part
<ge>Circular Slide Rule
<cp>
<fo>
<tc>Craft
<yr>1879
<co>UK
<s#>
<si>

<cr>
<mt>Cardboard
<cx>
<pt>Case and rule
<hw>Buy
<so>Antiquarian Scientist
<$c>350 (87)
<$v>
<lo>D-Bells
<bl>"The difficulty attending the acquirement of musical theory has been the principal cause of the little attention paid to it by the generality of practical students. The intention of the "harmonic Diagram" is to diminish this difficulty and to render the groundwork of the science more familiar. The diagram is a representation of the principles from which the Science of Museu is derived, the rules constituting the theory, from the apparent mutual connexion of their elements, are rendered more evident than they could be in a desultory treatise." from "An explanation of the Harmonic Diagram" invented by C. Wheatstone, Londe pp. 14-20 of his "Scientific Papers" London 1879.
<>

<id>B220.82
<ma>Hoffman
<na>Slide Rule
<sn>
<#>1
<oc>Analog Calculator
<fa>2-3 Part
<ge>Slide Rule
<cp>
<fo>
<tc>Craft
<yr>
<co>Denmark
<s#>Model No. 601
<si>147x35x4 mm
<cr>
<mt>Plastic
<cx>
<pt>Case and Slide Rule

<hw>Buy
<so>Brimfield
<$c>1 (82)
<$v>
<lo>D-Bells
<bl>Distributed by R. W. Mitscher Co., Inc., Electronic & Electrical Supplies, Ellicott Square Building, Buffalo, New York.
<>

<id>B221.82
<ma>Addac
<na>"Addac"
<sn>
<#>1
<oc>Digital Calculator
<fa>Single Register
<cl>Pascal drum
<cp>
<fo>
<tc>Mechanical
<yr>
<co>USA
<s#>5751
<si>205x135x140 mm
<cr>Black with Cream and Red Letters
<mt>
<cx>
<pt>Cover and calculator
<hw>Buy
<so>Brimfield
<$c>15 (82)
<$v>
<lo>D-Bells
<bl>Patent no. 1,661,605.
<>

<id>B222.82
<ma>NAPIER
<na>Rabdologiae.
<sn>
<#>1
<oc>
<fa>
<ge>
<cp>
<fo>
<tc>
<yr>1617
<co>
<s#>First edition
<si>
<cr>
<mt>
<cx>
<pt>
<hw>Buy
<so>Jeremy Norman
<$c>6010 (82)
<$v>
<lo>D-Bells
<bl>
<>

<id>B223.82
<ma>Longman, London
<na>Babbage, Charles, Passages from the life of a philosopher, First edition
<sn>
<#>1
<oc>
<fa>
<ge>
<cp>
<fo>
<tc>
<yr>1864
<co>England
<s#>xii, 496 pp.
<si>
<cr>
<mt>
<cx>
<pt>
<hw>Buy
<so>Antiquarian Scientist
<$c>500 (82)
<$v>
<lo>D-Bells
<bl>Babbage (1792-1871), in his interesting autobiography, devotes four chapters to his invention of the "difference engine'. The last four pages are a bibliography of Babbage's papers.
<>

<id>B224.82
<ma>
<na>"Trignometrie Rectiligne et Spherizue avec la construcion des tables des sinus, des tangentes, des secantes et des logarithmes," Par M. Rivard, Professeur de Philosophie en L'Universite de Paris.
<sn>Tables
<#>1
<oc>Readable or Writable Memories
<fa>Paper
<ge>Random
<cp>
<fo>
<tc>Craft
<yr>1750
<co>FUniversite de Paris.
<sn>Tables
<#>1
<oc>Readable or Writable Memories
<fa>Paper
<ge>Random
<cp>
<fo>
<tc>Craft
<yr>1750
<co>France
<s#>
<si>150x220x35mm
<cr>
<mt>Leather binding
<cx>
<pt>
<hw>Buy
<so>Alain Brieux
<$c>100(82)
<$v>
<lo>D-Bells
<bl>
<>

<id>B225.82
<ma>Theodore Audel & Co.
<na>"Hand Book of Calculations for Engineers and firemen relating to the steam engine, the steam boiler, pumps, shafting, etc." by N. Hawkins
<sn>book
<#>1
<oc>Readable or Writable Memories
<fa>Paper
<ge>Random
<cp>
<fo>
<tc>Craft
<yr>1898
<co>USA
<s#>
<si>140x215x25mm
<cr>
<mt>Paper
<cx>binding loose
<pt>
<hw>Buy
<so>Amherst flea market
<$c>4 (82)
<$v>
<lo>D-Bells
<bl>
<>

<id>B226.82
<ma>Wm. Jas. Hamersley, Hartford
<na>"A System of Geometry and Trigonometry with a Treatise on Surveying in which the Principles of Rectangular Surveying without Plotting are Explained," by Abel Flint enlarged with additional tales by George Gillet, New Edition, Revised containing a new rule for correctin deviations of the compass by L. W. Meech
<sn>Book
<#>1
<oc>Readable or Writable Memories
<fa>Paper
<ge>Random
<cp>
<fo>
<tc>Craft
<yr>1854
<co>USA
<s#>
<si>130x208x27mm
<cr>
<mt>Leather binding
<cx>112 pages
<pt>
<hw>Buy
<so>Museum Store
<$c>20 (82)
<$v>
<lo>D-Bells
<bl>
<>

<id>B227.82
<ma>
<na>"Biomate"
<sn>Circular moving nomographs
<#>1
<oc>Readable or Writable Memory
<fa>Mechanically Stable
<ge>Cyclic
<cp>
<fo>
<tc>
<yr>1982
<co>Japan
<s#>
<si>110x90x12mm
<cr>Aqua and cream
<mt>plastic
<cx>
<pt>
<hw>Buy
<so>
<$c>8(82)
<$v>
<lo>D-Bells
<bl>
<>

<id>B228.82
<ma>Goody Manufacturing Co.
<na>"Goody Magic Multiplier Pencil Box"
<sn>
<#>1
<oc>Readable or Writable Memory
<fa>Paper
<ge>Cyclic
<cp>
<fo>
<tc>
<yr>ca 1950
<co>USA
<s#>
<si>38dx230mm
<cr>blue and orange
<mt>paper
<cx>
<pt>
<hw>Buy
<so>Amherst flea market
<$c>2 (82)
<$v>
<lo>D-Bells
<bl>
<>

<id>B229.82
<ma>Walt Disney Productions
<na>"Mickey Math"
<sn>
<#>1
<oc>Readable or Writable Memory
<fa>Mechanically Stable
<ge>Linear
<cp>
<fo>
<tc>
<yr>ca 1950
<co>USA
<s#>
<si>360x38x5mm
<cr>black and white
<mt>plastic
<cx>
<pt>
<hw>Buy
<so>
<$c>2 (82)
<$v>
<lo>D-Bells
<bl>
<>

<id>B230.82
<ma>L. Appoullot, Saint-Birce-sous-Foret, Seine et Oise, France
<na>"Cercle a clacul d"appoullot"
<sn>nomograph
<#>1
<oc>Readable or Writable Memory
<fa>Mechanically Stable
<ge>Cyclic
<cp>
<fo>
<tc>
<yr>ca 1890
<co>France
<s#>
<si>203d mm
<cr>
<mt>painted metal
<cx>
<pt>case and circle
<hw>Buy
<so>Alain Brieux
<$c>75 (82)
<$v>
<lo>D-Bells
<bl>
<>

<id>B231.82
<ma>Wolverine
<na>"Modern Math Addition"
<sn>
<#>1
<oc>Readable or Writable Memory
<fa>Mechanically Stable
<ge>Cyclic
<cp>
<fo>
<tc>
<yr>ca 1950
<co>USA
<s#>
<si>154x180x97mm
<cr>red
<mt>metal
<cx>
<pt>
<hw>Buy
<so>Museum Store
<$c>5 (82)
<$v>
<lo>D-Bells
<bl>
<>

<id>B233.84
<ma>A. M. Maurand
<na>"Le Prompt Calculateur des arts industriels et du commerce"
<sn>
<#>1
<oc>Readable or Writable Memory
<fa>Paper
<ge>Random
<cp>
<fo>
<tc>
<yr>ca 1863
<co>France
<s#>
<si>105d x 18mm
<cr>blue, pink, yellow and green cards
<mt>Brass, glass, cardboard
<cx>
<pt>brass case with glass lid, 30 cardboard tables
<hw>Buy
<so>Peter Delehar
<$c>480 (82)
<$v>
<lo>D-Bells
<bl>
<>

<id>B234.82
<ma>Stanley
<na>"Boucher's Calculator"
<sn>Circular slide rule
<#>1
<oc>Analog Calculator
<fa>2-3 part
<ge>Slide Rule
<cp>
<fo>
<tc>Craft
<yr>ca 1876
<co>England
<s#>
<si>50dx13mm
<cr>
<mt>nickel, glass
<cx>
<pt>leather and stain case, calculator
<hw>Buy
<so>Peter Delahar
<$c>240 (82)
<$v>
<lo>D-Bells
<bl>The model made by Stanley is an improvement by the addition of a third index hand on the back dial, which indicates the total movement of the front dial, so that continuous workings show a final result, either + or -, thus indicating the correct reading of the result.
<>

<id>B235.82
<ma>Stanley
<na>Slide rule for calculating annuities
<sn>
<#>1
<oc>Analog Calculator
<fa>2-3 part
<ge>Slide Rule
<cp>
<fo>
<tc>
<yr>1860
<co>England
<s#>
<si>304x10x22mm
<cr>
<mt>Boxwood
<cx>
<pt>Case and sliderule
<hw>Buy
<so>Peter Delahar
<$c>280 (82)
<$v>
<lo>D-Bells
<bl>The device was described by Benjamin Beran (1822).
<>

<id>B236.82
<ma>Tavernier-Gravet, Rue MAyet, 19-Paris
<na>"Regle a Eclimetre" du Colonel du Genle Goulier
<sn>Slide rule with a site
<#>1
<oc>Analog Calculator
<fa>2-3 part
<ge>Slide Rule
<cp>
<fo>
<tc>
<yr>ca 1878
<co>France
<s#>186
<si>320x50x90mm
<cr>
<mt>Boxwood and a metal instrument
<cx>
<pt>Case, slide rule, and instrument
<hw>Buy
<so>Peter Delahar
<$c>640 (82)
<$v>
<lo>D-Bells
<bl>
<>

<id>B237.82
<ma>
<na>"Calculator"
<sn>Pascal strip
<#>1
<oc>Digital Calculator
<fa>Single Register
<ge>Pascal strip
<cp>
<fo>
<tc>
<yr>ca 1950
<co>Germany
<s#>
<si>85x7x138mm
<cr>gold, red, and black
<mt>metal
<cx>
<pt>
<hw>Buy
<so>Amherst fleamarket
<$c>3 (82)
<$v>
<lo>D-Bells
<bl>
<>

<id>B238.82
<ma>Sharp
<na>"ELSI MATE EL-835"
<sn>Solar cell electronic calculator
<#>1
<oc>Digital Calculator
<fa>3-4 Registers
<ge>Electronic
<cp>
<fo>
<tc>
<yr>1982
<co>Japan
<s#>17095530
<si>54x96x3mm
<cr>
<mt>metal
<cx>
<pt>
<hw>Buy
<so>
<$c>
<$v>
<lo>D-Bells
<bl>
<>

<id>B239.82
<ma>Panasonic
<na>"CompuVoice"
<sn>Talking electronic calculator
<#>1
<oc>Digital calculator
<fa>3-4 registers
<ge>Electronic
<cp>
<fo>
<tc>
<yr>1982
<co>Japan
<s#>22300192
<si>75x27x143mm
<cr>
<mt>metal
<cx>
<pt>
<hw>Gift
<so>New York Decus
<$c>
<$v>
<lo>D-Bells
<bl>
<>

<id>B240.82
<ma>Stanley
<na>"Barnard's Coordinate Spiral Slide Rule"
<sn>Spiral Slide Rule
<#>1
<oc>Analog Calculator
<fa>2-3 Parts
<ge>Spiral slide rule
<cp>
<fo>
<tc>
<yr>ca 1880
<co>England
<s#>
<si>83dx260mm
<cr>
<mt>wood, paper mache, brass
<cx>
<pt>Wooden case, handle, instrument
<hw>Buy
<so>Peter Delahar
<$c>180 (82)
<$v>
<lo>D-Bells
<bl>Similar to Fuller's, but the logarithmic scale is repeated twice and occupies in all only about one-third of the helix. The upper part of the helix carries a sine scale.
<>

<id>B241.82
<ma>Palatine Engineering Co. Ltd. Liverpool
<na>"Bryan's Patent Planimeter"
<sn>Planimeter
<#>1
<oc>Analog Calculator
<fa>Multiple Part
<ge>non-linear planimeter
<cp>
<fo>
<tc>
<yr>ca 1880
<co>England
<s#>
<si>70x105x405mm
<cr>
<mt>Brass
<cx>
<pt>Case, instrument, five cams, track made my Peter Delahar
<hw>Buy
<so>Peter Delahar
<$c>560 (82)
<$v>
<lo>D-Bells
<bl>
<>

<id>B242.82
<ma>Oliver
<na>"The Oliver Typewriter Model 9"
<sn>typewriter
<#>1
<oc>
<fa>
<ge>
<cp>
<fo>
<tc>
<yr>1916
<co>USA
<s#>
<si>405x370x250mm
<cr>khaki
<mt>metal
<cx>
<pt>
<hw>Buy
<so>
<$c>50 (82)
<$v>
<lo>D-Bells
<bl> The Oliver typewriter is the only successful down-strike-from-the-side class, was invented by Rev. Thomas Oliver in 1888 and patented in the USA in 1892 and Great Brtain in 18996. The Oliver Typewriting company was founded in 1895 with Model Number 1 (on view at the Science Museum). The models appearred in the following order No. 2 (1894), No. 3 (1898), No. 5 (1907), No. 7 (1915), No. 9 (1916) and the standard Model II 'Speedster' in 1922.

The 28 type-bars, each of which resembels an inverted U, are arranged in two banks to the right and left of the printing point, so providing complete visibility of the writing, the type striking on to the vertical centre line of the platen. Each bar carries three characters, the machine printing 84 characters by double shift. The use of a bar pivoted at each end is claimed to secure and preserve accurate alignment. The bars rest one within another and, as the length of the extremities vary, the shorter type-bars are provided with heavier type-heads with the object of

equalixing the impressions. The paper cylinder is fitted with three rollers, the pressure of which can be released for adjusting the paper. The register pawl can be lifted to free the roller when linving by pencil. Single or double spacing is actuated by a striking motion operated by the marginal stop.
<>

<id>B243.82
<ma>Ludwig Spitz & Co.
<na>"TIM Time is Money"
<sn>arithmometer
<#>1
<oc>Digital Calculator
<fa>3-4 register
<ge>stepped wheel
<cp>
<fo>
<tc>
<yr>ca 1880
<co>USA
<s#>
<si>420x200x160 mm
<cr>black
<mt>metal
<cx>eight digits, engraved The Oskar Muller Co. New York
<pt>
<hw>Buy
<so>Peter Delahar
<$c>220 (82)
<$v>
<lo>D-Bells
<bl>
<>

<id>B244.82
<ma>Dalton
<na>Adding and listing machine
<sn>
<#>1
<oc>Digital Calculator
<fa>1-2 register
<ge>Pascal key
<cp>
<fo>
<tc>
<yr>
<co>USA
<s#>
<si>
<cr>Black
<mt>Metal
<cx>
<pt>
<hw>Buy
<so>Amherst fleamarket
<$c>35 (82)
<$v>
<lo>D-Bells
<bl>
<>

<id>B245.82
<ma>Hitachi
<na>c-mos i c
<sn>
<#>1
<oc>
<fa>
<ge>
<cp>
<fo>tie clasp
<tc>
<yr>1982?
<co>Japan
<s#>
<si>
<cr>
<mt>
<cx>
<pt>
<hw>Buy
<so>
<$c>
<$v>
<lo>D-Bells
<bl>
<>

<id>B246.82
<ma>Hilliard, Gray, Little, and Wilkins
<na>"Elements of Technology" by Jacob Bigelow, M.D.
<sn>
<#>1
<oc>
<fa>
<ge>
<cp>
<fo>Book
<tc>
<yr>1829
<co>USA
<s#>
<si>
<cr>
<mt>
<cx>Original cloth-covered boards with original paper label, uncut. xii, 507 pp. With a large folding, engraved frontispiece + 10 engraved plates (6 foling) + 11 woodcut plates (1 folding) + many text figs. Spine womewhat worn and repaired, cloth partially faded and frayed at edges.
<pt>
<hw>Buy
<so>The Antiquarian Scientist
<$c>160(82)
<$v>
<lo>D-Bells
<bl>Jacob Bigelow (1786-1879) was appointed in 1816 to the chair which Count Rumford had endowed at Harvard for the instruction of the application of the sciences to the useful arts, a first attempt to create a meeting ground for self-made inventors and academic scientists. There being no good name for such a field, Bigelow coined for it the name 'technology', which has passed into common language.
<>

<id>B247.82
<ma>Macmillan and Co.
<na>"A treatise on the calculus of finite differences," George Boole.
<sn>
<#>1
<oc>
<fa>
<ge>
<cp>
<fo>Book
<tc>
<yr>1860
<co>England
<s#>First edition.
<si>
<cr>
<mt>Cloth cover.
<cx>
<pt>
<hw>Buy
<so>The Antiquarian Scientist
<$c>275(82)
<$v>
<lo>D-Bells
<bl>
<>

<id>B248.82
<ma>Patrick Adie, Optician, Mathematical & Scientific Instrument Maker, Broadway Works, Westminster, London.
<na>"Eidograph"
<sn>pantograph
<#>1
<oc>Analog calculator
<fa>Multiple part
<ge>Drawing instrument
<cp>
<fo>
<tc>Mechanical
<yr>c 1860
<co>England
<s#>
<si>33 3/4" long with two 29" long 1/2 inch square rods
<cr>
<mt>brass
<cx>
<pt>instrument and large hand-dovetailed case made form mahogany, trade label, instruction set, and original key
<hw>Buy
<so>The Antiquarian Scientist
<$c>975(82)
<$v>
<lo>D-Bells
<bl>Each of the rods, marked 'A' and 'B' slip into corresponding channels of the pulleys of the body. Here their lengths are varied and rad by verniers in the pulleys. The length of the main body rod which pivots on a central circular support, can be set and read by a vernier. The pulleys move in unison by virtue of the adjustable stell band with brass fittings coursing over them. One very large weight of brass and lead is used to balance the main rod and two smaller weights for the two side rods.

The eidograph is essentially a more preceise and versatile pantograph. Variable ratios can be set on the instrument for enlarging or reducing work. The eidograph was invented by William Wallace in 1801 based on the 17th century pantograph.
<>

<id>B249.82
<ma>
<na>protractor and T-square
<sn>
<#>1
<oc>analog calculator
<fa>2-3 part
<ge>drawing instruments
<cp>
<fo>
<tc>mechanical
<yr>c 1830
<co>USA
<s#>
<si>23 1/2" with 6" radius protractor scale
<cr>
<mt>brass
<cx>
<pt>
<hw>Buy
<so>The Antiquarian Scientist
<$c>225(82)
<$v>
<lo>D-Bells
<bl>A nicely made brass t-square with an adjusting arm which allows it to be set to a particular angle as read off the protractor scale.
<>
<id>B1.75
<ma>EGLI & CO.
<na>"MILLIONAIRE"
<sn>
<#>1
<oc>Digital Calcula
<fa>Four Register
<ge>Automatic Stepped Wheel
<fo>
<tc>Mechanical
<yr>1903
<co>Switzerland
<s#>539
<si>17x52x28 cm

<cr>
<mt>Brass
<cx>6 digit
<pt>
<hw>Buy
<so>Dr. Margaret Kennedy
<$c>500 (75)
<$v>
<lo>D-MR2
<bl>The Millionaire was invented in 1893 by Otto Steiger and was the first direct multiplying calculator to be commercially successful. Between 1894 and 1935, 4,655 millionaires were sold.
Use. One turn of the crank automatically multiplies the accumulator by a single digit specified by a pointer in the upper left hand corner of the machine. The pointer is reset for each digit in the multiplier until the computation is complete.
<>

<id>B2.76
<ma>Hutton, Charles
<na>"Table of the Products and Numbers"
<sn>
<#>1
<oc>Memory
<fa>Table
<ge>Fixed
<cp>
<fo>
<tc>Craft
<yr>1781
<co>England
<s#>
<si>28x42x1 cm
<cr>
<mt>paper
<cx>
<pt>
<hw>Buy
<so>Historical Technology Inc.
<$c>68 (76)
<$v>
<lo>D-MR2
<bl>Compiled in 1781 by Charles Hutton, this is an early book of mathematical tables containing the products of the numbers 1 through 1000 by the numbers 1 through 100. It also contains squares and cubes of numbers and conversion tables for units of measurement.

One of the main problems with handcrafted books is the number of errors. On one page alone, every figures is off by one thousand. With handcrafted calculating and typesetting such problems are unavoidable. Later books of talbes were done by the Difference Machine and proved more reliable.
<>

<id>XB3.76
<ma>Chevalier Charles Savier Thomas
<na>"Arithmometer"
<sn>
<#>1
<oc>Digital Calcula
<fa>Three Register
<ge>Stepped Wheel
<cp>
<fo>
<tc>Mechanical
<yr>1850c
<co>England
<s#>1583
<cr>
<mt>Brass
<cx>
<pt>Wooden case
<si>10x18x58 cm
<hw>Buy
<so>Peter Delahar Antiques
<$c>376 (76)
<$v>2200 (82)
<lo>D-MR2
<bl>In 1820, Chevalier Charles X Thomas of Colmar designed and introduced the first multiplication machine made commercially available for general sale. Although it was not patented until 1851, the main features of the 1820 design remained unaltered.

The mechanism has three parts, concerned with setting, counting, and recording respectively. Any number up to 999,999 may be set by moving the pointers to the numbers 0 to 9 engraved next to the six slots on the fixed cover plate. The movement of any of these pointers slides a small pionion with ten teeth along a square axle, underneath and to the left of which is a Leibniz stepped wheel.

The Leibniz wheel, a cylinder having nine teeth of increasing length, is driven from the main shaft by means of a bevel wheel, and the small pinion is thus rotated by as many teeth as the cylinder bears in the plane corresponding to the digit set. This amount of rotation is transferred through one of a pair of bevel wheels, carried on a sleeve on the same axis, to the 'results' figure wheel on the back row on the hinged plate. This plate also carried the figure wheel recording the number of turns of the driving crank for each position of the hinged plate. The pair of bevel wheels is placed in proper gear by setting a lever at the top left-hand cover to either "Addition and Multiplication" or "Subtraction and Division." The "results" figure wheel is thereby rotated anti-clockwise or clockwise respectively.

Use. Multiplying 2432 by 598 may be performed as follows: Lift the hinged plate, turn and release the two milled knobs to bring all the figure wheels to show zero; lower the hinged plate in its position to the extreme left; set the number 2432 on the four slots on the fixed plate; set the lever on the left to "multiplication" and turn the handle eight times; lift the hinged plate, slide it one step to the right, and lower it into position; turn the handle nine times; step the plate one point to the right again and the turn the handle five times. The product 1,454,336 will then appear on the top row, and the multiplier 598 on the next row of figures.

<>

<id>B4.76
<ma>?
<na>Gunter Rule
<sn>
<#>1
<oc>Analog Calcula
<fa>2-3 Part
<ge>Gunter Rule
<cp>
<fo>
<tc>Craft
<yr>1800c
<co>England
<s#>
<cr>
<mt>wood
<cx>
<pt>
<si>5x60x.5 cm
<hw>Buy
<so>Peter Delahar Antiques
<$c>61 (76)
<$v>
<lo>D-MR2
<bl>About 1607 Edmund Gunter devised a scale that was to be the predecessor of the modern slide rule. In 1623 he published a description of this scale that is composed of two scales of the logarithms from 1 to 10 placed end to end. Although Napier conceived of the logarithm allowing multiplication or division to be accomplished by addition or subtraction, Napier relied on look up tables.

<u>Use.</u> Multiplication is carried out by using a pair of dividers to measure a distance, the multiplier, along the rule and add it to another distance, the multiplicand, forming the combined distance, the product, on the rule. The accuracy of an answer is limited by the length of the rule and the user's ability to resolve a number.
<>

<id>XB5.76
<ma>Stanley
<na>"Fuller's Spiral Slide Rule"
<sn>Spiral
<#>1
<oc>Analog Calcula
<fa>2-3 part
<ge>Slide Rule
<cp>
<fo>
<tc>Craft
<yr>1902
<co>England
<s#>
<si>9x9x33 cm
<cr>
<mt>Cardboard, Mahongany, Brass
<cx>
<pt>Screw on handle, case
<hw>Buy
<so>Historical Technology Inc
<$c>138 (76)
<$v>250 (82)
<lo>D-MR2
<bl>Designed in 1878 by Professor George Fuller, the logarithmic line is arranged spirally on the surface of a cylinder. The logarthmic line is in 50 turns, giving a working length of 41 feet 8 inches. All numbers of four figures either have a mark upon the scale or are midway between two marks, so that results accurate to four figures are easily obtained.

Use. By means of movable cylinders any length of spiral line may be at once transferred to any other part of the scale, and multiplications and divisions containing a series of factors can be worked with facility. Logarithms of numbers are given by means of a scale on the longer index arm together with a circular scale on the first cylinder, so that powers and roots are obtainable. The surface of the middle cylinder bears printed tables of decimal equivalents, natural sines, etc.
<>

<id>B6.76
<ma>J. Sang
<na>"Platometer"
<sn>Planimeter
<#>1
<oc>Analog Calcula
<fa>Multiple part
<ge>Areal Measure
<cp>
<fo>
<tc>Mechanical
<yr>1860c
<co>England
<s#>
<si>9x15x37 cm
<cr>
<mt>Brass
<cx>
<pt>Wooden case, magnifying glass
<hw>Buy
<so>Peter Delahar Antiques
<$c>355 (76)
<$v>
<lo>D-MR2
<bl>This instrument for directly measuring an area bounded by an irregular curve is based on an idea developed by the Bavarian engineer J M Hermann in 1814. The first commercially successful devices were made by Ernst of Paris. In 1851, John Sang of Kirkcaldy invented and made a "platometer" resembling the planimeter of Ernst.

Use. Operation is based on continuous integration. A curve is traced using the pointer, with the area read off on the dial after the complete perimeter has been traversed. As the pointer is moved the rollers that measure distance on the conical shaft calculate the product of the vertical distance times the horizontal distance. As a curve is traversed in a clockwise direction, the top area is integrated in a positive direction. On the return trip the integration is negative and the net value is provided.
<>

<id>B7.76
<ma>Burroughs
<na>"Burroughs Model 5"
<sn>
<#>1
<oc>Digital Calcula
<fa>Two Register
<ge>Keyed Wheel
<cp>
<fo>
<tc>Mechanical
<yr>
<co>USA
<s#>5-146-1088
<si>28x25x12 cm
<cr>Black
<mt>Metal
<cx>
<pt>
<hw>Buy
<so>City Office Equipment
<$c>10 (76)
<$v>
<lo>?
<bl>
<>

<id>XB8.76
<ma>Burroughs
<na>"Burroughs"
<sn>
<#>1
<oc>Digital Calcula
<fa>Single Register
<ge>Keyed Wheel
<cp>
<fo>
<tc>Mechanical
<yr>
<co>USA
<s#>A342273
<si>18x25x27 cm
<hw>Buy
<so>City Office Equipment
<$c>10 (76)
<$v>75 (82)
<lo>D-MR2
<bl>
<>

<id>B9.76
<ma>Felt & Tarrant Manufacturing Co.
<na>"Comptometer"
<sn>
<#>1
<oc>Digital Calcula
<fa>Single Register
<ge>Keyed Wheel
<cp>
<fo>
<tc>Mechanical
<yr>1914
<co>USA
<s#>
<si>37x28x15 cm
<cr>Green
<mt>Metal
<cx>
<pt>
<hw>Buy
<so>City Office Equipment Co
<$c>10 (76)
<$v>
<lo>D-MR2
<bl> The Comptometer was invented in 1887 by Dorr E Felt of Chicago and claims to be the first successful key-driven adding and calculating machine.

Use. For each digit a push button from 1 to 9 is selected which rotates a Pascal-type wheel with the corresponding number of increments. Numbers are subtracted by adding the complement (shown in smaller numbers). The carrying of tens is accomplished by power generated by the action of the keys and stored in a helical spring, which is automatically released at the proper instant to perform the carry.

Through effective marketting and training of skilled operators versed in complement arithmetic at Comptometer Schools, these machines became the workhorse of the accounting profession in the first part of the century. They never successfully advanced into the electro-mechanical era, but remained purely mechanical, two-function adding and subtracting machines.

<>

<id>B10.76
<ma>Monroe Calculating Machine Co.
<na>"Monroe Electric Calculator No. 1"
<sn>
<#>1
<oc>Digital Calcula
<fa>Three Register
<ge>Keyed Rotary
<cp>
<fo>
<tc>Electro-Mechanical
<yr>
<co>USA
<s#>336948
<si>38x31x24 cm
<cr>
<mt>
<cx>
<pt>
<hw>Buy
<so>City Office Equipment
<$c>10 (76)
<$v>
<lo>W-Bells
<bl>
<>

<id>B11.76
<ma>Monroe Calculating Machine Co.
<na>"Monroematic"
<sn>
<#>1
<oc>Digital Calculator
<fa>Four Register
<ge>Automatic Keyed Rotary
<cp>
<fo>
<tc>Electro-Mechanical
<yr>
<co>USA
<s#>506781
<si>18x23x34 cm
<cr>Gray
<mt>Metal
<cx>
<pt>
<hw>Buy
<so>City Office Equipment
<$c>10 (76)
<$v>
<lo>D-MR2
<bl>
<>

<id>B12.76
<ma>Friden
<na>"Friden Calculator Model D-8"
<sn>
<#>1
<oc>Digital Calcula
<fa>Four Register
<ge>Automatic Keyed Rotary
<cp>
<fo>
<tc>Electro-Mechanical
<yr>
<co>USA
<s#>202762
<si>38x26x20 cm
<cr>
<mt>
<cx>
<pt>
<hw>Buy
<so>City Office equipment
<$c>10 (76)
<$v>
<lo>W-Bells
<bl>
<>

<id>B13.76
<ma>Monroe
<na>"High Speed Adding Calculator"
<sn>
<#>1
<oc>Digital Calculator
<fa>Three Register
<ge>Keyed Rotary
<cp>
<fo>
<tc>Electro-Mechanical
<yr>
<co>USA
<s#>
<si>15x25x24 cm
<cr>Black
<mt>
<cx>
<pt>
<hw>Buy
<so>City Office Equipment
<$c>10 (76)
<$v>
<lo>D-ML12-1
<bl>
<>

<id>B14.76
<ma>Burroughs
<na>"Burroughs Adding Machine Model A"
<sn>
<#>1
<oc>Digital Calcula
<fa>Two Register
<ge>Keyed Wheel
<cp>
<fo>
<tc>Mechanical
<yr>
<co>USA
<s#>A605824
<si>22x15x12 cm
<cr>Black
<mt>Metal
<cx>5 Digit
<pt>
<hw>Buy
<so>City Office Equipment
<$c>10 (76)
<$v>
<lo>D-MR2
<bl>
<>

<id>B15.76
<ma>Underwood
<na>"Standard Typewriter No. 5"
<sn>Typewriter
<#>1
<oc>Transduction
<fa>
<ge>
<cp>
<fo>
<tc>Mechanical
<yr>
<co>USA
<s#>
<si>22x30x30 cm
<cr>
<mt>
<cx>
<pt>
<hw>Buy
<so>City Office Equipment
<$c>10 (76)
<$v>
<lo>D-ML12-1
<bl>
<>

<id>D16.76
<ma>IBM
<na>"IBM"
<sn>Typewriter
<#>1
<oc>Transduction
<fa>
<ge>
<cp>
<fo>
<tc>Electro-Mechanical
<yr>
<co>USA
<s#>112-42085
<si>26x44x40 cm
<cr>Gray
<mt>
<cx>Justowriter Corp On Motor Housing
<pt>
<hw>Buy
<so>City Office Equipment
<$c>10 (76)
<$v>
<lo>D-ML12-1
<bl>
<>

<id>B17.78
<ma>EGLI & CO.
<na>"Millionaire"
<sn>
<#>1
<oc>Digital Calcula
<fa>Four REGISTER
<ge>Automatic Stepped Wheel
<cp>
<fo>
<tc>Mechanical
<yr>1910 c
<co>Switzerland
<s#>1523
<si>18x29x76 cm
<cr>
<mt>Brass
<cx>10 Digit
<pt>
<hw>Buy
<so>George Nelson
<$c>275 (78)
<$v>
<lo>W-ML12-1
<bl>See B1.75
<>

<id>B18.78
<ma>Stone, Edmund
<na>"The Construction and Principal Uses Of Mathematical Instruments"
<sn>
<#>1
<oc>Analog Calcula
<fa>Multiple part
<ge>
<cp>
<fo>Book
<tc>Craft
<yr>1758
<co>England
<s#>
<si>34x23x4 cm
<cr>
<mt>Paper
<cx>1972 reprint Edition of 500
<pt>
<hw>Buy
<so>Historical Technology Inc
<$c>42 (78)
<$v>
<lo>D-Gordon's office
<bl> THE CONSTRUCTION AND PRINCIPAL USES OF MATHEMATICAL INSTRUMENTS. Translated from the French of M. Bion. To which are added, the construction and uses of such instruments as are omitted by M. Bion, particularly of those invented or improved by the English. 1972 reprint of the 2nd Edition of 1758 that includes a supplement containing a further account of some of the most useful mathematical instruments. A folio size book with 325 numbered pages and 30 full page plates. "This is the best English edition, of the best early 18th century book ever published on the design and use of scientific instruments." S. Moskowitz (catalog 117, fall 1978).
<>

<id>B19.78
<ma>?
<na>Drawing Instruments
<sn>
<#>1
<oc>Analog Calcula
<fa>Fixed
<ge>Rule, Parallel rule, Compass
<cp>
<fo>
<tc>Craft
<yr>
<co>England
<s#>
<si>20x11x4 cm
<cr>
<mt>Steel & Brass
<cx>
<pt>Fitted velvet & leather Case
<hw>Buy
<so>Historical Technology Inc.
<$c>80 (78)
<$v>
<lo>D-Gordon's Office
<bl>Cased English drawing instruments made in the second half othe 19th century. Brass and steel instruments, ruling pen with ivory handle; 13 separate items in lift-out tray. Small boxwood rule in space below. Rosewood veneered case and instruments in fine condition except that the large compass is missing its pivot locking nut and the brass has become a bit dull.
<>

<id>B20.78
<ma>W.H. Harling
<na>Rolling Parallel Rule
<sn>Parallel
<#>1
<oc>Analog Calcula
<fa>Fixed
<ge>Rule
<cp>
<fo>
<tc>Craft
<yr>1890 c
<co>England
<s#>
<si>4x33x8 cm
<cr>
<mt>Steel
<cx>
<pt>Walnut Case
<hw>Buy
<so>Historical Technology Inc.
<$c>75 (78)
<$v>
<lo>D-Gordon's Office
<bl>Cased presentation of an English rolling parallel rule. Pasted to the inside cover is the presentation certificate, "Bradford Technical College Prize Awarded to Fred Inman at the Annual Examination, 1893, by order of the Lords of the Committee of Her Majesty's most honourable privy council on education."
<>

<id>B21.78
<ma>?
<na>Navigator's Sector
<sn>
<#>1
<oc>Analog Calcula
<fa>2-3 Part
<ge>Sector
<cp>
<fo>
<tc>Craft
<yr>
<co>England
<s#>
<si>33x6x1 cm
<cr>
<mt>Boxwood With Brass Hinge
<cx>21 Scales On both Sides and Outside Edges
<pt>
<hw>Buy
<so>Historical Technology Inc.
<$c>465 (78)
<$v>
<lo>D-MR2
<bl>The sector is used to solve problems of proportion and works on the principle of similar triangles. Sectors were made with a variety of scales for use in calculation by navigators, surveyors, gunners, and draughtsmen. At first sight they look like a jointed rule usually made of ivory, brass, wood, or sometimes silver. First described by both Galileo in Italy and Thomas Hood in England , the sector was in use by 1600.

Use. A pair of dividers is necessary to read the relationships on all sectors. This instrument is marked: "Chords, Sec, Lines, Tangents, tan, Ver Sine, Sines, & Num." The scale layout permits this sector to be used as a Gunter rule as well, although it is not laid out to follow any of the five editions of Gunter, but is close to the example in Stone (B18.78).
<>

<id>B22.78
<ma>Burroughs Adding Machine Company
<na>"Burroughs"
<sn>
<#>1
<oc>Digital Calcula
<fa>Single Register
<ge>Keyed Wheel
<cp>
<fo>
<tc>Mechanical
<yr>1920 c
<co>USA
<s#>A335701
<si>15x30x25 cm
<cr>Black
<mt>Metal
<cx>Complement Arithmetic Nine Digits
<pt>
<hw>Buy
<so>City Office Equipment
<$c>10 (78)
<$v>
<lo>D-Bells
<bl>
<>

<id>B23.78
<ma>Friden
<na>"Friden Model 132"
<sn>
<#>1
<oc>Digital Calcula
<fa>Four Register
<ge>Automatic Keyed Rotary
<cp>
<fo>
<tc>Transistor
<yr>
<co>USA
<s#>3235
<si>26x45x54 cm
<cr>
<mt>
<cx>
<pt>
<hw>
<so>
<$c>
<$v>
<lo>D-ML12-1
<bl>
<>

<id>B24.78
<ma>?
<na>Parallel Rule
<sn>Parallel
<#>1
<oc>Analog Calcula
<fa>Fixed
<ge>Rule
<cp>
<fo>
<tc>Craft
<yr>1870 c
<co>
<s#>
<si>45x6x1 cm
<cr>
<mt>Rosewood and Brass
<cx>
<pt>
<hw>Buy
<so>
<$c>45 (78)
<$v>
<lo>D-Bells
<bl>
<>

<id>B25.78
<ma>DG Marketing Ltd
<na>"International Metric Converter"
<sn>
<#>1
<oc>Memory
<fa>Table
<ge>Manipulable
<cp>
<fo>
<tc>Craft
<yr>1978
<co>Hong Kong
<s#>
<si>10x8x6 cm
<cr>Black
<mt>Plastic
<cx>
<pt>
<hw>Buy
<so>
<$c>5 (78)
<$v>
<lo>D-Bells
<bl>
<>

<id>XB26.79
<ma>?
<na>Soroban
<sn>Soroban
<#>1
<oc>Digital Calcula
<fa>Single Register
<ge>Bead
<cp>
<fo>
<tc>Manual
<yr>
<co>
<s#>
<si>4x11x29 cm
<cr>
<mt>
<cx>
<pt>
<hw>
<so>
<$c>
<$v>25 (82)
<lo>D-MR2
<bl>
<>

<id>B27.79
<ma>?
<na>Napier's Bones
<sn>
<#>1
<oc>Memory
<fa>Table
<ge>Manipulable
<cp>
<fo>
<tc>Craft
<yr>1700c
<co>England
<s#>
<si>8x6x2 cm
<cr>
<mt>Wood
<cx>
<pt>Bones and Box
<hw>Buy
<so>Historical Technology Inc.
<$c>1732 (79)
<$v>
<lo>D-MR2
<bl>These small instruments for facilitating the multiplication and division of large numbers were invented by John Napier, laird of Merchiston in Scotland, and are described in his RABDOLOGIAE, published in 1617. He wrote that the multiplication and division of great numbers is troublesome, involving tedious expdendenditure of time, and subject to "slippery errors." His tables reduced these difficulties to simple addition and subtraction, and won immediate recognition. A set of Napier's bones are usually made of boxwood or ivory and often contained in a box or case that would fit in a pocket. A set usually contains 10 rods, plus extras representing squares and cubes.

Use. Addition is accomplished by reading the appropriate bones along the diagonal. To obtain a product of 224 x 44, the rods 2, 2, and 4 are put alongside each other, and the result is read off by combining the numbers in the fourth row -- 0/8, 0/8, 1/6 -- for the correct answer 896. This is repeated and the two products added together to give

9856. The bones are sometimes associated with an abacus to provide a store in the multiplication process.
<>

<id>XB28.79
<ma>Chemical Rubber Publishing Co.
<na>"Handbook of Chemistry and Physics, 31ST Ed"
<#>1
<oc>Memory
<fa>Fixed
<ge>Table
<ty>
<fo>
<tc>Mechanical
<yr>1949
<co>USA
<s#>
<si>19x13x8 cm
<cr>
<mt>
<cx>
<pt>
<hw>
<so>
<$c>
<$v>
<lo>D-MR2
<bl>
<>

<id>B29.77
<ma>KEUFFEL & ESSER
<na>"Thatcher's Calculating Instrument 4012"
<sn>Spiral
<#>1
<oc>Analog Calcula
<fa>2-3 Part
<ge>Slide Rule
<cp>
<fo>
<tc>Craft
<yr>1920c
<co>USA
<s#>5106
<si>13x13x63 cm
<cr>
<mt>Wood, Varnished Paper, and Brass
<cx>
<pt>Instrument and Wood Case
<hw>Buy
<so>Historical Technology Inc
<$c>510 (77)
<$v>
<lo>W-Bells
<bl>Patented in 1881 by Edwin Thatcher, an 1884 instruction book notes, "The originary rule in use is 12 inches long, with radii of 11 and 5 1/2 inches, the divisions of which are cut by hand, copying from a machine divided plate. In the present instrument the radii are 60 and 30 feet, the divisions of which are printed directly from machine divided plates. Those plates contain over 33,000 divisions, calculated to seven places of decimals from Babbage's tables by using a common multiplier, every line being subjected to correction for error of screw and temperature variations, so that possibly every line center is within .0001 inch of its true place."

The instrument consists of a cylindrical slide, which admits of both rotary and longitudinal movement within an open metallic framework of 20 equidistant triangular bars. The bars are connected to rings at their ends which admit rotation within standards attached to the base. Upon the slide are wrapped two complete logarithmic scales, each of which is divided into 40 parts of length equal to half that of the slide. The parts follow each other in regular order around the cylinder, and the figures and divisions which constitute any part of the right are repeated on the left, one line in advance.

Use. By the rotary and longitudinal movement of the slide any of its divisions may be brought opposite to or in contact with any division on the fixed scales. The divisions on the upper lines are transferred to the slide by means of a pointer fitting over the bars, which is also convenient for retaining the position of any division on either line while the slide is being revolved into the required position. Near the commencement of each scale on the slide is a heavy black mark designed to catch the eye readily during the rapid movement of the parts.

<>

<id>XB30.77
<ma>L.&I.D.
<na>Timber Calculating Slide Rule
<sn>Linear
<#>1
<oc>Analog Calcula
<fa>2-3 Part
<ge>Slide Rule
<cp>
<fo>
<tc>Craft
<yr>1800 c
<co>England
<s#>
<si>60x5x1 cm
<cr>
<mt>Boxwood
<cx>
<pt>
<hw>Buy
<so>Historical Technology Inc.
<$c>120 (77)
<$v>200 (82)
<lo>D-MR2
<bl>Use. On one side, the A line on the rule and the B and C lines on the slider are each numbered twice from 1-10, reading from left to right. The fourth line E is inverted, and is so arranged that 144 is opposite 1 and 10 on the A line. So that if length in feet on E be set opposite thickness in inches on C, the volume in cubic feet is read off on B opposite width in inches on A. The B line is subdivided into tenths, while the A, C, and E lines are subdivided into fourths. On the other side of the rule are A, B and C lines with the girt line (marked D) numbered from 4-40 and bearing various gauge points. The A and D lines are subdivided into fourths. The two edges of the rule bear scales of inches divided into quarter-inches.
<>

<id>B31.79
<ma>Selective Educational Equipment Corp
<na>"SEE CALCULATOR"
<sn>
<#>1
<oc>Digital Calcula
<fa>Single Register
<ge>Pascal Wheel
<cp>
<fo>
<tc>Mechanical
<yr>1968
<co>USA
<s#>
<si>18x4x1 cm
<cr>
<mt>
<cx>
<pt>
<hw>Buy
<so>Selective Educational Equipment Corp
<$c>3 (79)
<$v>
<lo>D-MR2
<bl>A small replica of the Pascal-type adder made to illustrate the mechanism. For a descriptionn of the original Pascal machine see B150.80.
<>

<id>B32.52
<ma>KEUFFEL & ESSER
<na>"Slide Rule 689"
<sn>Linear
<#>1
<oc>Analog Calcula
<fa>2-3 part
<ge>Slide Rule
<cp>
<fo>
<tc>Craft
<yr>1950c
<co>USA
<s#>848689
<si>32x6x1 cm
<cr>
<mt>
<cx>
<pt>Rule and Leather Case
<hw>Buy
<so>
<$c>
<$v>
<lo>D-MR2
<bl>
<>

<id>XB33.
<ma>Casio
<na>"Casio Mini Card Calculator"
<sn>Pocket Calculator
<#>1
<oc>Digital Calcula
<fa>Five or More Registers
<cp>Computer-controlled
<fo>
<tc>IC
<yr>
<co>Japan
<s#>
<si>5x8 cm
<cr>
<mt>
<cx>
<pt>Calculator and Case
<hw>Buy
<so>
<$c>
<$v>
<lo>D-MR2
<bl>
<>

<id>XB34.79
<ma>Hewlett Packard
<na>"HP-35"
<sn>Pocket Calculator
<#>1
<oc>Digital Calcula
<fa>Five or More Registers
<ge>Computer-controlled
<cp>
<fo>
<tc>IC
<yr>
<co>USA
<s#>
<si>3x8x16 cm
<cr>
<mt>
<cx>
<pt>
<hw>Buy
<so>
<$c>
<$v>
<lo>D-MR2
<bl>The HP-35 was the first hand-held scientific calculator small enough to fit in a pocket. It is something of a miniaturized version of earlier desk top scientific calculators such as the Friden. A microprocessor is programmed to carry out the calculator's functions.

Use. Functions include logarithms, exponentials, trigonometric, decimals, scientific notation, and degrees and radians are used. Reverse Polish notation replaces conventional parenthesis.
<>

<id>B35.79
<ma>Aluminum Housewares Co. Inc.
<na>"Fairgrove Adder"
<sn>
<#>1
<oc>Digital Calcula
<fa>Single Register
<ge>Pascal wheel
<cp>
<fo>
<tc>Mechanical
<yr>1975
<co>Hong Kong
<s#>
<si>2x5x10 cm
<cr>
<mt>Plastic
<cx>
<pt>
<hw>Buy
<so>
<$c>2 (79)
<$v>
<lo>D-Gordon's Office
<bl>
<>

<id>XB36.79
<ma>?
<na>"EXACTUS"
<sn>
<#>1
<oc>Digital Calcula
<fa>Single Register
<ge>Pascal Strip
<cp>
<fo>
<tc>Mechanical
<yr>1950 c
<co>England
<s#>
<si>7x11x.5 cm
<cr>
<mt>
<cx>
<pt>
<hw>
<so>
<$c>
<$v>25 (82)
<lo>D-MR2
<bl>A linear form of the simple Pascal two function calculating device that uses complement arithmetic. See also B150.80.

Use. Addition or subtraction is carried out by dialing the numbers starting with the least significant. A carry is performed by moving the final digit around the corner to the next linear register.
<>

<id>B37.79
<ma>Foto-mem Inc.
<na>Slide Rule
<sn>Linear
<#>1
<oc>Analog Calcula
<fa>2-3 part
<ge>Slide Rule
<cp>
<fo>
<tc>Craft
<yr>
<co>Japan
<s#>
<si>2x14x.5 cm
<cr>
<mt>
<cx>
<pt>
<hw>
<so>
<$c>
<$v>
<lo>D-Gordon's Office
<bl>
<>

<id>B38.79
<ma>Precision Adding Machine Co. Inc.
<na>"Quixsum Adding Machine Model C"
<sn>
<#>1
<oc>Digital Calcula
<fa>Single Register
<ge>Pascal Wheel
<cp>
<fo>
<tc>Mechanical
<yr>1930 c
<co>USA
<s#>2643
<si>7x18x48 cm
<cr>
<mt>
<cx>
<pt>Quixsum, Case, And Stylus
<hw>Buy
<so>
<$c>
<$v>
<lo>D-MR2
<bl>The Quixsum is a good example of how the stepped wheel principle of Pascal can be used to operate any special measures, not necessarily base ten. In this case it adds English units of feet and inches. See also l50.80.

Use. To add a number to the register, the appropriate digit is dialed. The result is displayed in a notch at the top of each wheel.
<>

<id>B39.79
<ma>Yanasa, Tokei, Keiki Co. Ltd.
<na>"Geigy Pedometer"
<sn>
<#>1
<oc>Digital Calcula
<fa>Single register
<ge>Escapement ratchet
<cp>
<fo>
<tc>Mechanical
<yr>
<co>Japan
<s#>
<si>3d x1 cm
<cr>
<mt>
<cx>
<pt>
<hw>
<so>
<$c>
<$v>
<lo>D-Gordon's Office
<bl>
<>

<id>B40.79
<ma>Monroe Calculating Machine Co.
<na>"Monroe" Calculator
<sn>
<#>1
<oc>Digital Calcula
<fa>Four Register
<cp>Automatic Keyed Rotary
<fo>
<tc>Electro-mechanical
<yr>
<co>USA
<s#>J421231
<si>15x30x26 cm
<cr>Gray
<mt>
<cx>8 Digit
<pt>
<hw>Buy
<so>
<$c>10 (79)
<$v>
<lo>D-Bells
<bl>
<>

<id>XB41.79
<ma>?
<na>Gunter Rule
<sn>
<#>1
<oc>Analog Calcula
<fa>2-3 Part
<ge>Gunter Rule
<cp>
<fo>
<tc>Craft
<yr>
<co>
<s#>
<si>15x3x.5 cm
<cr>
<mt>Boxwood
<cx>
<pt>
<hw>Buy
<so>
<$c>22 (79)
<$v>185 (82)
<lo>D-MR2
<bl> See B4.76
<>

<id>B42.80
<ma>Burroughs
<na>"Burroughs"
<sn>Printing Adding Machine
<#>1
<oc>Digital Calcula
<fa>Two Register
<ge>Keyed Wheel
<cp>
<fo>
<tc>Mechanical
<yr>
<co>USA
<s#>9A431239
<si>28x38x40 cm
<cr>
<mt>
<cx>
<pt>
<hw>Buy
<so>
<$c>20 (80)
<$v>
<lo>D-MR2
<bl>William S Burroughs introduced the keyboard type of adding and listing machine about 1880. It was designed to type a column of figures and then almost automatically type the sum total.

Use. (see British Science Museum exhibit and description)
<>

<id>B43.80
<ma>Bing
<na>"Bing No.2"
<sn>Typewriter
<#>1
<oc>Transduction
<fa>
<ge>
<cp>
<fo>
<tc>Mechanical
<yr>1930 c
<co>Germany
<s#>
<si>15x28x38 cm
<cr>
<mt>
<cx>1926 patent pending
<pt>Case and Typewriter
<hw>Buy
<so>
<$c>25 (80)
<$v>
<lo>W-Bells
<bl>
<>

<id>B44.79
<ma>Burrington, Richard Stevens
<na>"Handbook of Mathematical Tables and Formulas"
<sn>
<#>1
<oc>Memory
<fa>Fixed
<ge>Table
<cp>
<fo>
<tc>Mechanical
<yr>1950
<co>USA
<s#>
<si>20x13x2 cm
<cr>
<mt>
<cx>
<pt>
<hw>
<so>William B Lehmann
<$c>
<$v>
<lo>D-MR2
<bl>
<>

<id>XB45.79.Sue delete and put info on X list from Kenichi
<ma>Sharp Corporation
<na>"Elsi MATE El-8048"
<sn>Electronic Calculator Soroban
<#>1
<oc>Digital Calcula
<fa>Five or More Registers
<ge>Computer-controlled
<cp>
<fo>
<tc>IC
<yr>1979
<co>Japan
<s#>921
<si>30x9x2 cm
<cr>
<mt>Plastic
<cx>
<pt>
<hw>Buy
<so>
<$c>
<$v>
<lo>D-MR2
<bl>
<>

<id>B46.79
<ma>Royal London Co Ltd
<na>"Executive Thought Organizer"
<sn>
<#>1
<oc>
<fa>
<ge>
<cp>
<fo>Toy
<tc>Transistor
<yr>
<co>Japan
<s#>
<si>11d x10 cm
<cr>
<mt>Plastic
<cx>
<pt>
<hw>
<so>
<$c>
<$v>
<lo>D-Gordon's Office
<bl>
<>

<id>B47.79
<ma>Hoare, Charles
<na>"The Slide Rule and How to Use It"
<sn>
<#>1
<oc>Analog Calcula
<fa>2-3 part
<ge>Slide Rule
<cp>
<fo>Book
<tc>Craft
<yr>1896
<co>England
<s#>
<si>18x11x1 cm
<cr>
<mt>
<cx>7th Edition
<pt>
<hw>Buy
<so>Historical Technology Inc
<$c>30 (79)
<$v>
<lo>D-MR2
<bl>
<>

<id>B48.79
<ma>Rowning, J.
<na>"Directions for Making a Machine to Solve Equations"
<sn>
<#>1
<oc>Analog Calcula
<fa>Multiple part
<ge>
<cp>
<fo>Book
<tc>Mechanical
<yr>1768
<co>England
<s#>
<si>22x18x2 cm
<cr>
<mt>
<cx>
<pt>
<hw>Buy
<so>Historical Technology Inc.
<$c>95 (79)
<$v>
<lo>D-Gordon's Office
<bl>This work describes the first analog computer designed to solve algebraic equations of the n'th degree expessed in the form y = a + bx + cx2 + dx3 + . . . + qxn . It was completed in 1768 by Rowning based upon the graphical method invented by A. deSegner in 1751. In 1770 an actual machine mechanized to the second degree was presented to the Royal Society, but apparently no longer exists. Rowning's instrument consists of a number of adjustable straight bars, or "rulers," centred and combined together in such a way as to occupy progressively the various positions in accordance with deSegner's graphical construction. Movement in two directions at right angles to one another is secured by means of two pairs of racks and pinions. The curve is drawn by a pencil on the underside of a piece of pasteboard supported by two adjustable bars.

Use. Segner's method consisted in finding, by graphical construction, the values of y for various assumed values of x, plotting the curve, and reading off the values

of x at the points where the curve intersected the axis of x, thus obtaining the real roots of the equation. The impossible or imaginary roots were indicated by the points where the curve approached and receded from the axis of x, without reaching it.
<>

<id>B49.79
<ma>The A. Leitz Co.
<na>Planimeter
<sn>Variable Ratio Polar Planimeter
<#>1
<oc>Analog Calcula
<fa>Multiple part
<ge>Planimeter
<cp>
<fo>
<tc>Mechanical
<yr>1900 c
<co>Switzerland
<s#>64567
<si>2x4x28 cm
<cr>
<mt>German Silver and Steel
<cx>
<pt>Instrument and Fitted Cloth Covered Case
<hw>Buy
<so>Historical Technology Inc
<$c>75 (79)
<$v>
<lo>D-Gordon's Office
<bl>This instrument for measuring the area of any plane figure was invented by Professor Jacob Amsler in 1856. It is a proportional instrument in that the unit can be changed by altering the radius of the tracing arm.
<u>Use.</u> The weighted point is fixed and the tracing pointer guided exactly once round the outline of the figure whose area is to be measured. The difference of the readings on the graduated roller before and after this operation gives the area of the figure in units dependent on the setting of the tracing arm.
<>

<id>B50.79
<ma>J.S.M.
<na>Navigator's Gunter Rule
<sn>Navigator's
<#>1
<oc>Analog Calcula
<fa>2-3 Part
<ge>Gunter Rule
<cp>
<fo>
<tc>Craft
<yr>1800 c
<co>England
<s#>
<si>60x5x.5 cm
<cr>
<mt>
<cx>
<pt>
<hw>Buy
<so>Historical Technology Inc.
<$c>-95 (79)
<$v>
<lo>?
<bl>
<>

<id>B51.79
<ma>Stanley
<na>"Fuller's Spiral Slide Rule"
<sn>Spiral
<#>1
<oc>Analog Calcula
<fa>2-3 Part
<ge>Slide Rule
<fo>
<tc>Craft
<yr>1880c
<co>England
<s#>
<si>33x10x10 cm
<cr>

<mt>paper, wood, metal
<cx>
<pt>cylindrical case and rule
<hw>Buy
<so>Historical Technology Inc.
<$c>220 (79)
<$v>
<lo>D-Gordon's office
<bl> See B5.76
<>

<id>B52.79
<ma>Manlove, Alliott, Fryer & Co.
<na>"Boucher's calculating circle"
<sn>Circular
<#>1
<oc>Analog Calcula
<fa>2-3 Part
<ge>Slide Rule
<cp>
<fo>
<tc>Craft
<yr>
<co>France
<s#>
<si>
<cr>
<mt>
<cx>
<pt>
<hw>BUY
<so>
<$c>-275 (79)
<$v>
<lo>?
<bl>
<>

<id>B53.80
<ma>Lowry Mfg. Co.
<na>"Lowry-bowyer Telemeter"
<sn>
<#>1
<oc>Analog Calcula
<fa>Multiple Part
<ge>
<cp>
<fo>
<tc>Mechanical
<yr>1900 c
<co>USA
<s#>
<si>15x78x7 cm
<cr>
<mt>Aluminum and Wood
<cx>
<pt>Instrument, Mahongany Base, Cover
<hw>Buy
<so>Historical Technology, Inc.
<$c>195 (80)
<$v>
<lo>D-Gordon's Office
<bl>A version of the classical trigonometer signed and dated "THE LOWRY MFG. CO./BOSTON, U.S.A./PAT. 1887, '92, '96". It has two four and a half inch compass bearing dials, one fixed at the end of the twenty-six inch long graduate slotted base plate, the other sliding, and each with graduated pivoted arms of 18 3/8" radius. It was intended for the analog solution of the plane triangle knowing two angles and included side, two sides and the included angle, or three sides. Thus it was useful for problems both of navigation and gunnery.
<>

<id>B54.80
<ma>?
<na>Navigator's Gunter Rule
<sn>
<#>1
<oc>Analog Calcula
<fa>2-3 Part
<ge>Gunter Rule
<cp>
<tc>Craft
<yr>1800 c
<co>England
<s#>
<si>5x60x.5 cm
<cr>
<mt>Darkened Boxwood
<cx>Minor Warping And Edge Chipping
<pt>
<hw>Buy
<so>Historical Technology Inc.
<$c>155 (80)
<$v>
<lo>D-MR2
<bl>See B4.76
<>

<id>B55.80
<ma>Dring & Fage
<na>Inland Revenue Slide Rule
<sn>Four-sided
<#>1
<oc>Analog Calcula
<fa>2-3 part
<ge>Slide Rule
<cp>
<fo>
<tc>Craft
<yr>1825
<co>England
<s#>
<si>60x5x1 cm
<cr>
<mt>Boxwood
<cx>One ink Stain
<pt>
<hw>Buy
<so>Historical Technology Inc.
<$c>215 (80)
<$v>
<lo>D-MR2
<bl>The rule is specially arranged for the use of excise officers and maltsters in gauging computations. Slide rules for this purpose were first devised by Thomas Everard in 1683, and modified by Vero, Leadbetter and others. In this example, four scales appear on one side and the other side is blank.
<>

<id>B56.80
<ma>KEUFFEL & ESSER
<na>"Thatcher's Calculating Instrument"
<sn>Spiral
<#>1
<oc>Analog Calcula
<fa>2-3 Part
<ge>Slide Rule
<cp>
<fo>
<tc>Craft
<yr>1925
<co>USA
<s#>5870
<si>16d x58 cm
<cr>
<mt>Wood, Brass, And Varnished Cardboard
<cx>
<pt>Calculator, Case, And Magnifying Glass
<hw>Buy
<so>Historical Technology Inc.
<$c>625 (80)
<$v>
<lo>D-MR2
<bl>See B29.77
<>

<id>B57.80
<ma>Felt & Tarrant Mfg Co.
<na>"Comptometer"
<sn>
<#>1
<oc>Digital Calcula
<fa>Single Register
<ge>Keyed Wheel
<cp>
<fo>
<tc>Mechanical
<yr>1920 c
<co>USA
<s#>J341613
<si>36x22x15 cm
<cr>Bronze
<mt>Metal
<cx>
<pt>
<hw>Buy
<so>
<$c>75 (80)
<$v>
<lo>D-MR2
<bl>See B9.76
<>

<id>B58.80
<ma>
<na>"RAILROAD TELEGRAPHER MAGAZINE"
<SN>
<#>2
<OC>
<FA>
<GE>
<CP>
<YR>
<CO>
<S#>
<SI>
<HW>
<SO>
<$C>
<$V>
<LO>?
<BL>
<>

<id>B59.80
<ma>Fowler & Co.
<na>"Fowler's Calculator"
<sn>Circular
<#>1
<oc>Analog Calcula
<fa>2-3 Part
<ge>Slide Rule
<cp>
<fo>
<tc>Mechanical
<yr>
<co>
<s#>5660
<si>6d x1 cm
<cr>
<mt>
<cx>
<pt>
<hw>Buy
<so>Ampersand, NY
<$c>184 (80)
<$v>
<lo>D-Bells
<bl>
<>

<id>B60.80
<ma>
<na>"WESTERN UNION RULES AND INSTRUCTIONS"
<sn>
<#>
<oc>
<fa>
<ge>
<cp>
<tc>
<yr>
<co>
<s#>
<si>
<cr>
<mt>
<cx>
<pt>
<hw>
<so>
<$c>
<$v>
<lo>
<bl>
<>

<id>B61.80
<ma>J.R. Bunnell
<na>Telegraph Key And Receiver
<sn>
<#>1
<oc>Transmission
<fa>
<ge>
<cp>
<fo>
<tc>Electro-mechanical
<yr>1900 c
<co>USA
<s#>
<si>10x10x20 cm
<cr>
<mt>
<cx>
<pt>Key and Receiver
<hw>Buy
<so>Victor, Co.
<$c>45 (80)
<$v>
<lo>W-MR2
<bl>
<>

<id>B62.80
<ma>Marchant
<na>"Marchant"
<sn>
<#>1
<oc>Digital Calcula
<fa>Four Register
<ge>Automatic Keyed Rotary
<cp>
<fo>
<tc>Electro-mechanical
<yr>1950 c
<co>USA
<s#>B-M-112311
<si>40x25x31 cm
<cr>
<mt>Metal
<cx>
<pt>
<hw>Buy
<so>
<$c>35 (80)
<$v>
<lo>D-MR-2
<bl>
<>

<id>B63.80
<ma>Corona
<na>"Corona No. 3"
<sn> Portable Typewriter
<#>1
<oc>Transduction
<fa>
<ge>
<cp>
<fo>
<tc>Mechanical
<yr>1920 c
<co>USA
<s#>480206
<si>23x25x12 cm
<cr>Black
<mt>Metal
<cx>Carraige folds up over Keyboard
<pt>
<hw>Buy
<so>
<$c>15 (80)
<$v>
<lo>D-Gordon's Office
<bl>
<>

<id>B64.80
<ma>Burroughs
<na>"Burroughs"
<sn>Visible Printing Adding Machine
<#>1
<oc>Digital Calcula
<fa>Two Register
<ge>Keyed wheel
<cp>
<fo>
<tc>Mechanical
<yr>1910 c
<co>USA
<s#>1-43288
<si>
<cr>Black
<mt>Metal, Bevelled Glass, AND Plexi
<cx>
<pt>Removable Printer
<hw>Buy
<so>Victor, Co
<$c>250 (80)
<$v>
<lo>D-MR2
<bl>See B42.80
<>

<id>B65.80
<ma>Molle Typewriter Co.
<na>"Molle No. 3"
<sn>Typewriter
<#>1
<oc>Transduction
<fa>
<ge>
<cp>
<fo>
<tc>Mechanical
<yr>
<co>USA
<s#>6824
<si>25x28x33 cm
<cr>Black
<mt>Metal
<cx>
<pt>Case and Typewriter
<hw>Buy
<so>
<$c>35 (80)
<$v>
<lo>W-ML12-1
<bl>
<>

<id>B66.80
<ma>Swift & Anderson Inc.
<na>Gunnery Level
<sn>
<#>1
<oc>Analog Calcula
<fa>2-3 part
<ge>Sight and Level
<cp>
<fo>
<tc>Mechanical
<yr>1910 c
<co>
<s#>
<si>
<cr>
<mt>Lead, Brass and Glass
<cx>
<pt>
<hw>Buy
<so>Ron Hoffmann, NY
<$c>15 (80)
<$v>
<lo>D-Bells
<bl>
<>

<id>B67.80
<ma>Adler
<na>"Favorit 2"
<sn>Portable Typewriter
<#>1
<oc>Transduction
<fa>
<ge>
<cp>
<fo>
<tc>Mechanical
<yr>1940 c
<co>Germany
<s#>2103
<si>36x28x11 cm
<cr>Black
<mt>
<cx>German Keyboard
<pt>Case and Typewriter
<hw>Gift
<so>Burt Still
<$c>
<$v>
<lo>W-ML12-1
<bl>
<>

<id>B68.80
<ma>W & E Co.
<na>Telegraph Receiver and Relay
<sn>
<#>1
<oc>Transmission
<fa>
<ge>
<cp>
<fo>
<tc>Electro-mechanical
<yr>1890 c
<co>USA
<s#>
<si>10x20x12 cm
<cr>
<mt>
<cx>
<pt>Receiver and Relay
<hw>Buy
<so>Victor, Co.
<$c>50 (80)
<$v>
<lo>D-Gordon's Office
<bl>
<>

<id>B69.80
<ma>Heath and Co. Ltd.
<na>Sextant
<sn>Sextant
<#>1
<oc>Analog Calcula
<fa>2-3 Part
<ge>Location-finder
<cp>
<fo>
<tc>Mechanical
<yr>1920 c
<co>England
<s#>W450
<si>35x25x17 cm
<cr>
<mt>
<cx>Certified at The National Physics Laboratory
<pt>Case and Sextant
<hw>Buy
<so>Joe Stamps, NY
<$c>600 (80)
<$v>
<lo>W-Bells
<bl>
<>

<id>B70.67
<ma>Digital Equipment Corp.
<na>PDP-6 Signed Photo
<sn>
<#>1
<oc>Computer
<fa>
<ge>
<cp>
<fo>Photo
<tc>Transistor
<yr>1967
<co>USA
<s#>
<si>
<cr>
<mt>
<cx>
<pt>
<hw>Gift
<so>PDP-6 Engineers
<$c>
<$v>
<lo>W-MR2
<bl>
<>

<id>B71.74
<ma>Digital Equipment Corp.
<na>PDP-8 Flip-flop R201
<sn>
<#>1
<oc>Computer
<fa>
<ge>
<cp>Logic Module
<fo>
<tc>Transistor
<yr>1966
<co>USA
<s#>
<si>1x15x7 cm
<cr>
<mt>
<cx>
<pt>
<hw>
<so>
<$c>
<$v>
<lo>D-Bells
<bl>
<>

<id>B72.74
<ma>?
<na>Vacuum Tube Logic Module M.D.Type 8
<sn>
<#>1
<oc>Computer
<fa>
<ge>
<cp>Logic Module
<fo>
<tc>Electronic
<yr>1950
<co>USA
<s#>108
<si>10x30x35 cm
<cr>
<mt>
<cx>
<pt>
<hw>
<so>
<$c>
<$v>
<lo>D-Bells
<bl>
<>

<id>B73.80
<ma>?
<na>Field Microscope
<sn>
<#>1
<oc>
<fa>
<ge>
<cp>
<fo>
<tc>Mechanical
<yr>
<co>France
<s#>
<si>5x5x15 cm
<cr>
<mt>Brass, Glass, Wood
<cx>
<pt>Wooden Box and Microscope
<hw>Buy
<so>Ron HOffman, Ny
<$c>12 (80)
<$v>
<lo>D-Bells
<bl>
<>

<id>B74.77
<ma>Cohen, Harold
<na>"Amsterdam Suite"
<sn>
<#>4
<oc>Computer
<fa>
<ge>
<cp>
<fo>Artwork
<tc>
<yr>1977
<co>
<s#>
<si>
<cr>3 Line Drawings, 1 Colored
<mt>Framed Lithographs
<cx>
<pt>
<hw>Gift
<so>Harold Cohen
<$c>
<$v>
<lo>D-Spitbrook
<bl>
<>

<id>B75.80
<ma>MARX
<na>"Dial Typewriter"
<sn>
<#>1
<oc>Transduction
<fa>
<ge>
<cp>
<fo>Toy
<tc>Mechanical
<yr>1950 c
<co>USA
<s#>
<si>15x15x30 cm
<cr>
<mt>
<cx>
<pt>
<hw>Buy
<so>J Stamps, NY
<$c>30 (80)
<$v>
<lo>D-Gordon's Office
<bl>
<>

<id>B76.80
<ma>
<na>"BABY CALCULATOR"
<sn>
<#>1
<oc>Digital Calculator
<fa>Single Register
<ge>Pascal Strip
<cp>
<fo>
<tc>Mechanical
<yr>ca 1950
<co>USA
<s#>
<si>1x8x6 cm

<cr>
<mt>Tin
<cx>
<pt>
<hw>Buy
<so>J. Stamps, NY; Oregon
<$c>24 (80) 8 (81)
<$v>
<lo>D
<bl>See B36.79
<>

<id>B77.72
<ma>Digital Equipment Corp.
<na>PDP-11/20 Module Artwork
<sn>
<#>1
<oc>Computer
<fa>
<ge>
<cp>
<fo>Artwork
<tc>Transistor
<yr>1969
<co>USA
<s#>
<si>100x94 cm
<cr>
<mt>Mylar in Plexi
<cx>
<pt>
<hw>Gift
<so>J O'Loughlin
<$c>
<$v>
<lo>D-Museum 5/6
<bl>
<>

<id>B78.80
<ma>A.B. Dick
<na>"The Edison Mimeograph No. 1"

<sn>
<#>1
<oc>Transduction
<fa>
<ge>
<cp>
<fo>
<tc>Mechanical
<yr>1900 c
<co>USA
<s#>
<si>13x33x43 cm
<cr>
<mt>Wood Case and Frames
<cx>
<pt>Complete Cased Set with Roller Etc
<hw>Buy
<so>
<$c>75 (80)
<$v>
<lo>
<bl>
<>

<id>B79.80
<ma>JJ&EF Johnson Co.
<na>Telegraph Key J-44
<sn>
<#>1
<oc>Transmission
<fa>
<ge>
<cp>
<fo>
<tc>Electro-mechanical
<yr>
<co>USA
<s#>
<si>12x8x4 cm
<cr>
<mt>
<cx>

<pt>
<hw>Gift
<so>Clyde Still
<$c>
<$v>
<lo>
<bl>
<>

<id>B80.80
<ma>Trinks-brunsviga
<na>"Trinks-brunsviga"
<sn>Brunsviga
<#>1
<oc>Digital Calcula
<fa>Three Register
<ge>Rotary
<cp>
<fo>
<tc>Mechanical
<yr>1940 c
<co>
<s#>39329
<si>15x12x36 cm
<hw>Gift
<so>Declan and Margrit Kennedy
<$c>
<$v>
<lo>D
<bl>The German patent of W T Odhner, 1891, was acquired by Messrs Grimme, Natalis & Co, and was embodied in a machine known as the "Brunsviga." This example is a further adaptation and sits on a wood board that was part of a disappearring desk top.

Use. Although the machine performs multiplication by repeated addition as in the Thomas type, the use of the Odhner wheel instead of the Leibniz toothed wheel led to a more compact design. The Odhner wheels fit very close together on the axle on the back. A setting lever, the end of which projects through a slot in the cylindrical portion of the cover plate, forms part of each wheel. If a lever is set against any figure (1 to 9) of its slot, a corresponding

number of pins are made to project from its wheel. When the operating handle is turned, these pins gear with small toothed wheels of the product register, which in turn gear with the number wheels in front. The product register is mounted on a longitudinally movable carriage arranged in front of the machine, which carries a second counter for registering the multiplier or the quotient. The handle is turned in a clockwise direction for addition and multiplication, and counter-clockwise for subtraction and division.
<>

<id>XB81.80
<ma>Bell Punch Co. Ltd.
<na>"Plus"
<oc>Digital Calculator
<fa>Single Register
<ge>Keyed Wheel
<cp>
<fo>
<tc>Mechanical
<yr>
<co>England
<s#>A7-1783
<si>15x30x40 cm
<cr>Green
<mt>Metal
<cx>Model #909/C/V/504.929/A
<pt>
<hw>Buy
<so>
<$c>25 (80)
<$v>75 (82)
<lo>D-MR2
<bl>An electrified modification of the Comptometer. See B9.76
<>

<id>B82.80
<ma>C & E Layton
<na>"Tates Arithmometer"
<sn>

<#>1
<oc>Digital Calculator
<fa>Three Register
<ge>Stepped Wheel
<cp>
<fo>
<tc>Mechanical
<yr>
<co>England
<s#>1184
<si>10x17x58 cm
<cr>
<mt>Brass and Wood
<cx>
<pt>Wood Case and Brass Machine with Removable Handle
<hw>Buy
<so>Peter Delahar Antique
<$c>1276 (80)
<$v>
<lo>
<bl>This machine, which is of the Thomas type, embodies the modifications patented in 1884 and 1903 by S Tate, who in 1883 was the first in England to manufacture this type of calculating machine. His patents were later taken over by C and E Layton.
<>

<id>B83.80
<ma>Metallograph Corp.
<na>"Musketry Rule of 1918"
<sn>Linear
<#>1
<oc>Analog Calcula
<fa>2-3 Part
<ge>Slide Rule
<cp>
<fo>
<tc>Craft
<yr>1918 c
<co>USA
<s#>
<si>3x13 cm

<cr>Black
<mt>Metal
<cx>
<pt>Neck String and Rule
<hw>Buy
<so>Ron Hoffman, NY
<$c>12 (80)
<$v>
<lo>D Museum
<bl>
<>

<id>XB84.79
<ma>Thales
<na>"Thales Patent Calculator"
<sn>
<#>1
<oc>Digital Calculator
<fa>Four Register
<cp>Automatic Rotary
<fo>
<tc>Mechanical
<yr>
<co>Germany
<s#>S 153248
<si>15x30x20 cm
<cr>Gray
<mt>Metal
<cx>
<pt>
<hw>Buy
<so>
<$c>50 (79)
<$v>100 (82)
<lo>D-MR2
<bl>A "Brunsviga" type machine made in Germany. See B80.80.
<>

<id>XB85.78
<ma>Reliable Typewriter & Adding Machine Corp.
<na>"Addometer"
<sn>

<#>1
<oc>Digital Calculator
<fa>Single Register
<ge>Pascal Wheel
<cp>
<fo>
<tc>Mechanical
<yr>
<co>USA
<s#>
<si>1x5x30 cm
<cr>Black
<mt>Metal
<cx>
<pt>Case, Calculator And Instruction Booklet
<hw>Buy
<so>Historical Technology Inc.
<$c> 30(79)
<$v>50 (82)
<lo>D
<bl>See Bl50.80
<>

<id>B86.79
<ma>Olivetti
<na>"Olivetti"
<sn>
<#>1
<oc>Digital Calcula
<fa>Two Register
<ge>Keyed Wheel
<cp>
<fo>
<tc>Electro-mechanical
<yr>
<co>Argentina
<s#>Summa quanta 20
<si>15x15x30 cm
<cr>
<mt>Plexi-glass, Metal, Paper Tape
<cx>
<pt>

<hw>Buy
<so>City Office Equipment
<$c>50 (79)
<$v>
<lo>D-MR2
<bl>
<>

<id>B87.79
<ma>Contina Ag Mauren
<na>"Curta"
<sn>
<#>1
<oc>Digital Calcula
<fa>Three Register
<ge>Rotary
<cp>
<fo>
<tc>Mechanical
<yr>
<co>Liechtenstein
<s#>70588
<si>10d x12 cm
<cr>Black
<mt>Metal
<cx>
<pt>
<hw>Gift
<so>Brian Randall
<$c>
<$v>
<lo>D-MR2
<bl>The Curta is the ultimate example of the rotary mechanical calculator. Its small size requires better manufacturing technology than any other mechanical calulator. Model I had an 8 digit input setting, 6 digit counter, and 11 digit accumulator. Model II had an 11 digit setting, 8 digit counter, and 15 digit accumlator. Prior to the electronic calculator, the Curta was the only four-digit portable calculator and as such was expecially popular for use at car rallies.
<>

<id>B88.80
<ma>Wales the Adder Machine Co.
<na>"Wales Visible Adding Machine"
<sn>
<#>1
<oc>Digital Calcula
<fa>Two Register
<ge>Keyed Wheel
<cp>
<fo>
<tc>Mechanical
<yr>
<co>USA
<s#>
<si>20x24x38 cm
<cr>
<mt>Metal and Plexi Replacements for Glass
<cx>
<pt>Removable Printer
<hw>Buy
<so>City Office Equipment
<$c>175 (80)
<$v>
<lo>D-MR2
<bl>A copy of the Burroughs printing-adding machine. See B42.
<>

<id>B89.80
<ma>Allen-wales Adding Machine Corp
<na>"Allen-wales Printing Adding Machine"
<sn>
<#>1
<oc>Digital Calcula
<fa>Two Register
<ge>Keyed Wheel
<cp>
<fo>
<tc>Mechanical
<yr>
<co>USA

<s#>77-26208
<si>20x20x40 cm
<cr>Black
<mt>Metal
<cx>
<pt>
<hw>Buy
<so>
<$c>35 (80)
<$v>
<lo>D-MR2
<bl>See B42.
<>

<id>B90.79
<ma>Monroe Calculating Machine Co.
<na>"Monroe No. 1"
<sn>
<#>1
<oc>Digital Calcula
<fa>Three Register
<ge>Keyed Rotary
<cp>
<fo>
<tc>Electro-mechanical
<yr>
<co>USA
<s#>
<si>20x25x30 cm
<cr>
<mt>Metal
<cx>
<pt>
<hw>Buy
<so>City Office Equipment
<$c>10 (76)
<$v>
<lo>D-MR2
<bl>
<>

<id>XB91.76

<ma>Hans W. Egli
<na>"Millionaire"
<sn>
<#>1
<oc>Digital Calcula
<fa>Four Register
<ge>Automatic Stepped Wheel
<cp>
<fo>
<tc>Mechanical
<yr>
<co>Switzerland
<s#>1073
<si>18x29x76 cm
<cr>
<mt>Brass
<cx>8 Digit
<pt>Calculator with Stand
<hw>Buy
<so>
<$c>1000 (79)
<$v>1500 (82)
<lo>D-MR2
<bl>See Bl.75.
<>

<id>B92.80
<ma>?
<na>Drafting Set
<sn>
<#>1
<oc>Analog Calcula
<fa>Fixed
<ge>Parallel Rule, Scale, Compass
<cp>
<fo>
<tc>Craft
<yr>1800 c
<co>England
<s#>
<si>15x17x30 cm
<cr>

<mt>Brass, Wood, Marble
<cx>Cornelius Conklin (owner)
<pt>Boxed with Box of Tools, Pens, Etc.
<hw>Buy
<so>
<$c>261 (80)
<$v>
<lo>W-Bells
<bl>
<>

<id>XB93.80
<ma>?
<na>Abacus
<sn>
<#>1
<oc>Digital Calcula
<fa>Single Register
<ge>Bead
<cp>
<fo>
<tc>Manual
<yr>
<co>China
<s#>
<si>22x16x3 cm
<cr>
<mt>Wood
<cx>9 Digit
<pt>Removable Wooden Backboard
<hw>Buy
<so>
<$c>50 (80)
<$v>75 (82)
<lo>D-MR2
<bl>The abacus is the earliest known computing device and the first hand-held calculator. It postdated the invention of the decimal system by the Egyptians circa 3000 BC. The Greeks and Romans built and used the abacus based on Hindu-Arabic numerals.
Unlike earlier notations and devices using stones and marks, the abacus utilizes positional notation, including the

representation of zeros, differences, with capabilities for multiplication and division. The Chinese abacus has beads in groups of 5 and 2, representing decimal digits. The Japanese first modified this to 5 and 1 and then 4 and 1.
<>

<id>B94.80
<ma>?
<na>Soroban
<sn>Soroban
<#>1
<oc>Digital Calcula
<fa>Single Register
<ge>Bead
<cp>
<fo>
<tc>Manual
<yr>
<co>
<s#>
<si>10x2x40 cm
<cr>
<mt>Wood and Bamboo
<cx>21 Digits
<pt>
<hw>Buy
<so>
<$c>22 (80)
<$v>
<lo>D-Bells
<bl>
<>

<id>B95.80
<ma>
<na>Abacus
<sn>
<#>1
<oc>Digital Calculator
<fa>Single Register
<ge>Bead
<cp>

<fo>
<tc>Manual
<yr>
<co>Taiwan
<s#>
<si>2x4x6 cm
<cr>Green
<mt>Marble and Brass
<cx>9 Digit
<pt>Abacus on Marble with Instruction Booklet
<hw>Buy
<so>
<$c>7 (80)
<$v>
<lo>D
<bl>
<>

<id>B96.80
<ma>Reliable Typewriter and Adding Machine Corp.
<na>"Addometer"
<sn>
<#>1
<oc>Digital Calculator
<fa>Single Register
<ge>Pascal Wheel
<cp>
<fo>
<tc>Mechanical
<yr>
<co>USA
<s#>
<si>1x5x30 cm
<cr>Dark Gray
<mt>Metal and Fiber
<cx>
<pt>Fiber Case and Instruction Booklet
<hw>Buy
<so>
<$c>14 (80)
<$v>
<lo>D-Bells

<bl>See Bl50.80.
<>

<id>B97.80
<ma>KEUFFEL AND ESSER
<na>"E.A. Sperry's Calculator"
<sn>Circular
<#>1
<oc>Analog Calcula
<fa>2-3 part
<ge>Slide Rule
<cp>
<fo>
<tc>Craft
<yr>
<co>USA
<s#>S650
<si>6d x2 cm
<cr>
<mt>
<cx>Pocket Watch Style
<pt>
<hw>Buy
<so>
<$c>42 (80)
<$v>
<lo>D-Bells
<bl>
<>

<id>B98.80
<ma>
<na>Navigator's Gunter Rule
<sn>
<#>1
<oc>Analog Calculator
<fa>2-3 part
<ge>Gunter Rule
<cp>
<fo>
<tc>Craft
<yr>

<co>
<s#>
<si>2x15 cm
<cr>Cream
<mt>Ivory
<cx>
<pt>
<hw>Buy
<so>
<$c>60 (80)
<$v>
<lo>D-Bells
<bl>See B4.76
<>

<id>B99.80
<ma>Stanley Rule & Level Co.
<na>Timber Slide Rule
<sn>Linear
<#>2
<oc>Analog Calculator
<fa>2-3 Part
<ge>Slide Rule
<cp>
<fo>
<tc>Craft
<yr>
<co>USA
<s#>
<si>4x30 cm
<cr>
<mt>Brass and Warranted Box Wood
<cx>
<pt>
<hw>Buy
<so>
<$c>38(80) 21(80)
<$v>
<lo>
<bl>One given away to the Museum
<>

<id>XB100.87
<ma>J. B. Carroll Co.
<na>Computer Altitude Correction Type AN-5837-I
<sn>Circular Slide Rule
<#>2
<oc>Analog Calculator
<fa>2-3 Part
<ge>Circular Slide Rule
<cp>
<fo>
<tc>Craft
<yr>ca 1960
<co>USA
<s#>
<si>
<cr>Black and yellow
<mt>Metal and plastic
<cx>
<pt>Paper box and instrument
<hw>Buy
<so>NE Trade Fair
<$c>10 (87)
<$v>
<lo>D-Bells
<bl>"This computer gives true altitutde above a plateau from indicated values."
<>
<id>B101.80
<ma>MARX
<na>"Junior Typewriter"
<sn>
<#>1
<oc>Transduction
<fa>
<ge>
<cp>
<fo>Toy
<tc>Mechanical
<yr>
<co>USA
<s#>
<si>28x13x18 cm

<cr>Gray and Blue
<mt>Tin
<cx>Bent & Rusty
<pt>
<hw>Buy
<so>
<$c>12 (80)
<$v>
<lo>D-Gordon's office
<bl>
<>

<id>B102.80
<ma>?
<na>Navigator's Sector
<sn>
<#>1
<oc>Analog Calcula
<fa>2-3 Part
<ge>Sector
<cp>
<fo>
<tc>Craft
<yr>
<co>
<s#>
<si>4x16 cm
<cr>Cream
<mt>Ivory and Brass
<cx>Chipped
<pt>
<hw>Buy
<so>
<$c>89 (80)
<$v>
<lo>D-Bells
<bl>See B21.78
<>

<id>B103.80
<ma>Welch
<na>Teaching Slide Rule
<sn>Linear
<#>1
<oc>Analog Calcula
<fa>2-3 Part
<ge>Slide Rule
<cp>
<fo>Display
<tc>Craft
<yr>
<co>USA
<s#>
<si>2x23x125 cm
<cr>Black
<mt>Masonite
<cx>With Hangers
<pt>
<hw>Buy
<so>
<$c>30 (80)
<$v>
<lo>W-Bells
<bl>
<>

<id>B104.80
<ma>T.S. & J.D. Negus
<na>Parallel Rule
<sn>Parallel
<#>1
<oc>Analog Calcula
<fa>Fixed
<ge>Rule
<cp>
<fo>
<tc>Craft
<yr>
<co>
<s#>
<si>8x45 cm
<cr>
<mt>Brass
<cx>Inscribed with Degrees
<pt>
<hw>Buy
<so>The Packet Boat, Boston
<$c>40 (80)
<$v>
<lo>D-MR2
<bl>
<>

<id>105.80
<ma>
<na>Rolling Parallel Rule
<sn>Parallel
<#>1
<oc>Analog Calcula
<fa>Fixed
<ge>Rule
<cp>
<fo>
<tc>Mechanical
<yr>
<co>
<s#>
<si>6x46x2.5 cm
<cr>
<mt>Brass
<cx>Patt. No. 160100
<pt>Wooden Case and Instrument
<hw>Buy
<so>The Packet Boat, Boston
<$c>90 (80)
<$v>
<lo>W-Bells
<>

<id>B106.80
<ma>
<na>Drawing Instruments
<sn>
<#>1
<oc>Analog Calcula
<fa>Fixed
<ge>Compass, Parallel Rule, Scale
<cp>
<fo>
<tc>Craft
<yr>1850c
<co>England
<s#>
<si>16x7x2.5 cm
<cr>Green
<mt>Shagreen Case, Brass, Steel, Ivory, Silver & Ebony
<cx>
<pt>Fitted Case, 8 Instruments, Rule, Sector & Parallel Rule
<hw>Buy
<so>Arthur Middleton, London
<$c>648 (80)
<$v>
<lo>D-MR2
<bl>
<>

<id>XB107.80
<ma>J Thomlinson Ltd Glasgow
<na>"Thomlinson's Equivalent Paper Slide Scale"
<sn>Linear
<#>1
<oc>Analog Calcula
<fa>2-3 Part
<ge>Slide Rule
<cp>
<fo>
<tc>Craft
<yr>1940c
<co>Scotland
<s#>
<si>8x58x1.5 cm
<cr>Brown
<mt>Wood
<cx>One Sided with Two Moving Rules
<pt>
<hw>Buy
<so>Peter Delahar
<$c>43 (80)
<$v>195 (82)
<lo>D-MR2
<bl> This specialized rule was designed for the paper and printing industry. The A scale indicated length, B scale the breadth, and area in square inches was read off the C scale.
The D scale was used to read off translations of inches to centimeters, kilos to pounds, 480 and 500 sheet reams, and various weights of different standard paper cuts.
<>

<id>B108.80
<ma>Dring and Fage
<na>"Leadbetter Slide Rule"
<sn>Linear
<#>1
<oc>Analog Calcula
<fa>2-3 Part
<ge>Slide Rule
<cp>
<fo>
<tc>Craft
<yr>1800c
<co>England
<s#>
<si>31x3x2 cm
<cr>Brown
<mt>Boxwood
<cx>Four Sided Slide Rule with Slides on each Side
<pt>
<hw>Buy
<so>Peter Delahar
<$c>84
<$v>
<lo>D-MR2
<>

<id>B109.80
<ma>?
<na>Slide Rule
<sn>Coggeshall
<#>1
<oc>Analog Calcula
<fa>2-3 Part
<ge>Slide Rule
<cp>
<fo>
<tc>Craft
<yr>1800c
<co>England
<s#>
<si>4x33x.5 cm
<cr>
<mt>Boxwood and Brass
<cx>Hinged with Two Slides
<pt>
<hw>Buy
<so>Peter Delahar
<$c>75 (80)
<$v>
<lo>D-MR2
<bl> A modified Coggeshal type slide rule with one brass and one wood slide. Navigational scales including meridian, chords, latitudes, and hours are inscribed. Freeth and Co. Brimingham is overstamped.
<>

<id>XB110.80
<ma>J.F. Fuller
<na>"Palmer's Improved By Fuller Computing Scale"
<sn>Circular
<#>1
<oc>Analog Calcula
<fa>2-3 Part
<ge>Slide Rule
<cp>
<fo>
<tc>Craft
<yr>1847
<co>USA
<s#>
<si>28x28x.5 cm
<cr>Cream and Black
<mt>Cardboard
<cx>"Fuller's Time Telegraph" is on the Reverse
<pt>
<hw>Buy
<so>Peter Delahar
<$c>216 (80)
<$v>250 (82)
<lo>D-MR2
<bl>"Palmer's Computing Scale" patented in 1843 by Aaron Palmer was improved and produced by J.E. Fuller in 1847. This model is printed from the original Palmer plate with Fuller's name and own patent added to the engraving, done by George C. Smith, 186 Washington St., Boston. The reverse side, "Fuller's Time Telegraph" was patented by him in 1845.

Use. "Palmer's Computing Scale" was used to calculate square measures, cubic measures, timber measures, grain measures, liquid measures and interest rates from 3 percent to 10 percent on a daily and monthly basis. "Fuller's Time Telegraph" (on the reverse) was used to calculate time lapse in days or weeks between any two given dates. In concert these two measures would be useful to dealers in grain, alcohol and other commodity trading.
<>

<id>XB112.80
<ma>Fowler & Co
<na>"Fowler's Textile Calculator"
<sn>Circular
<#>1
<oc>Analog Calcula
<fa>2-3 Part
<ge>Slide Rule
<cp>
<fo>
<tc>Craft
<yr>1900c
<co>England
<s#>14398
<si>6.5d x.7 cm
<cr>
<mt>Chrome, Glass, Paper
<cx>Two-sided Circular Rule
<pt>
<hw>Buy
<so>Maitland Antiques, Portobello Rd.
<$c>60 (80)
<$v>100 (82)
<lo>D-MR2
<bl> Short scale type of "Fowler's Textile Calculator" with two scales on one side. The other side holds a table equivalency for weft, looms, and reeds.
<>

<id>B113.80
<ma>Lewis & Tylor, Limited
<na>"Hydralculator"
<sn>Linear
<#>1
<oc>Analog Calcula
<fa>2-3 Part
<ge>Slide Rule
<cp>
<fo>
<tc>Craft
<yr>1940c
<co>England
<s#>
<si>7x19x.5 cm
<cr>Cream
<mt>Cardboard
<cx>One Rule on one Side
<pt>Case and Rule
<hw>Buy
<so>Portobello Rd.
<$c>9 (80)
<$v>
<lo>D-MR2
<bl>"Hydralculator", patent number 396,533, published by Lewis & Tylor Ltd., Gripoly Mills, Cardiff, the manufacturers of "underwriter" super fire fighting hose, for the use of their "Friends in the Fire Service."

Use. To find the quantity of water discharged for any given nozzle and a known pressure, place press on scale "b" opposite nozzle on scale "a', and read discharge through window in slide. To find height of jet for given pressure and nozzle diameter, proceed as above and read opposite arrow in center of slide, the height given on scale "d" for the appropriate nozzle.
<>

<id>XB114.80
<ma>?
<na>"Circular Concise Slide Rule"
<sn>Circular
<#>1
<oc>Analog Calcula
<fa>2-3 Part
<ge>Slide Rule
<cp>
<fo>
<tc>Craft
<yr>1960c
<co>Japan
<s#>
<si>8d cm
<cr>White
<mt>Plastic
<cx>No. 28; Reverse has Standard Equivalency Tables
<pt>
<hw>Buy
<so>Portobello Rd.
<$c>5 (80)
<$v>25 (82)
<lo>D-MR2
<>

<id>B115.80
<ma>?
<na>Music Box
<sn>
<#>1
<oc>
<fa>
<ge>
<cp>
<fo>
<tc>Mechanical
<yr>1980
<co>Switzerland
<s#>
<si>6.5dx5 cm
<cr>
<mt>Plastic and Aluminum
<cx>Plays Jingle Bells
<pt>
<hw>Buy
<so>
<$c>6 (80)
<$v>
<lo>D-Gordon's Office
<bl>
<>

<id>B116.80
<ma>Blickensderfer
<na>"Featherweight Blickensderfer"
<sn>
<#>1
<oc>Transduction
<fa>
<ge>
<cp>
<fo>
<tc>Mechanical
<yr>1900c
<co>USA
<s#>153497
<si>25x30x13 cm
<cr>
<mt>Aluminium
<cx>501 Special Stamped on Base
<pt>
<hw>Buy
<so>Portobello Road
<$c>120 (80)
<$v>
<lo>D-Gordon's Office
<bl>The "Blick" was the first typewriter intended to be readily portable. It was designed by Georges Blickensderfer and patented in 1890 and first sold in 1893.

Use. Each key had three positions, upper and lower case and a figure that positioned three levels of the printing wheel.
<>

<id>B117.80
<ma>?
<na>Jacquard Loom Mechanism
<sn>
<#>1
<oc>Digital Programma
<fa>Card-controlled
<ge>Loom
<cp>
<fo>Model
<tc>Mechanical
<yr>1805c
<co>France
<s#>
<si>16x36x40 cm
<cr>
<mt>Wood, Brass, and Steel
<cx>Paper Cards Added by Peter Delahar
<pt>
<hw>Buy
<so>Peter Delahar
<$c>2040 (80)
<$v>
<lo>D-Gordon's Office
<>

<id>B118.80
<ma>L.M. Ericsson & Co.
<na>Printing Telegraph Receiver
<sn>
<#>1
<oc>Transmission
<fa>
<ge>
<cp>
<fo>
<tc>Electro-mechanical
<yr>1890c
<co>Sweden
<s#>7640
<si>36x42x17 cm
<cr>
<mt>Brass, Wood, Bevelled Glass
<cx>
<pt>Key, Brass Spool, Paper Tape, and Receiver
<hw>Buy
<so>Arthur Middleton
<$c>626 (80)
<$v>
<lo>D-Gordon's Office
<>

<id>B119.80
<ma>
<na>Navigator's Sector
<sn>
<#>1
<oc>Analog Calcula
<fa>2-3 Part
<ge>Sector
<cp>
<fo>
<tc>Craft
<yr>1800c
<co>England
<s#>
<si>16x3.5x.3 cm
<cr>
<mt>Ivory
<cx>Lee & Son, Portsea Engraved
<pt>
<hw>Buy
<so>Portobello Rd
<$c>60 (80)
<$v>
<lo>D-Bells
<bl>See B21.78
<>

<id>B120.80
<ma>C.W. Dizey, New Bond St London
<na>Proportional Rule and Protractor
<sn>
<#>1
<oc>Analog Calcula
<fa>Fixed
<ge>Rule, Protractor
<cp>
<fo>
<tc>Craft
<yr>1890c
<co>England
<s#>
<si>4.3x15.2x.2 cm
<cr>
<mt>Ivory
<cx>
<pt>
<hw>Buy
<so>Bermondsey Market
<$c>24 (80)
<$v>
<lo>D-Bells
<bl>A protractor and architect's proportions are inscribed on one side; engineer's scale and vernier on the other.
<>

<id>B121.80
<ma>United Chemical Engraving Co. Ltd.
<na>Proportional Rule and Protractor
<sn>
<#>1
<oc>Analog Calcula
<fa>Fixed
<ge>Rule
<cp>
<fo>
<tc>Craft
<yr>1932
<co>England
<s#>5917
<si>15x5x.2 cm
<cr>Cream
<mt>Plastic
<cx>Inscribed D.A.E. Carter
<pt>
<hw>Buy
<so>
<$c>5 (80)
<$v>
<lo>D-Bells
<bl>Protractor and table with set scales at l/20,000, 100,000, and 250,000 inscribed on one side. The other side has scales of one half inch and one inch to the mile, a scale of 1/20,000 in meters and listing of metric equivalents.
<>

<id>B122.80
<ma>
<na>Parallel Rule
<sn>Parallel
<#>1
<oc>Analog Calcula
<fa>Fixed
<ge>Rule
<cp>
<fo>
<tc>Craft
<yr>1890c
<co>England
<s#>
<si>3.5x15x.2 cm
<cr>
<mt>Ebony and Brass
<cx>
<pt>
<hw>Buy
<so>Maitland Antiques
<$c>10 (80)
<$v>
<lo>D-MR2
<>

<id>B123.80
<ma>R. Waddington, Coventry
<na>Lord's Calculator
<sn>Circular
<#>1
<oc>Analog Calcula
<fa>2-3 Part
<ge>Slide Rule
<cp>
<fo>
<tc>Craft
<yr>
<co>England
<s#>
<si>7d x1.5 cm
<cr>
<mt>Chrome and Glass
<cx>
<pt>
<hw>Buy
<so>Maitland Antiques
<$c>48 (80)
<$v>
<lo>D-Bells
<>

<id>B124.80
<ma>Fowler's (calculators) Ltd Sale
<na>"Fowler's Calculator"
<sn>Circular
<#>1
<oc>Analog Calcula
<fa>2-3 Part
<ge>Slide Rule
<cp>
<fo>
<tc>Craft
<yr>1920c
<co>England
<s#>
<si>6d x1 cm
<cr>
<mt>Chrome, Glass and Paper
<cx>Long Scale Calculator
<pt>
<hw>Buy
<so>Maitland Antiques
<$c>60 (80)
<$v>
<lo>D-Bells
<bl>
<>

<id>B125.80
<ma>The Cleveland Twist Drill Co.
<na>Circular Slide Rule
<sn>Circular
<#>1
<oc>Analog Calcula
<fa>2-3 Part
<ge>Slide Rule
<cp>
<fo>
<tc>Craft
<yr>1920c
<co>USA
<s#>
<si>8d x.3 cm
<cr>Cream
<mt>Plastic
<cx>Printing worn off
<pt>
<hw>Buy
<so>Portobello Rd
<$c>2 (80)
<$v>
<lo>D-Bells
<bl>This specialized rule is copyright 1911, The Cleveland Twist Drill Company.

Use. The rule indicated drill speeds for wrought iron, machinery steel and soft tool steel. One side shows revolutions per minute for diameters ranging from one-sixteenth to three inches for both high speed and carbon steel drills. The other side shows tap and drill sizes and the decimal equivalent for inch divisions.
<>
<id>B
<ma>
<na>
<sn>
<#>1
<oc>
<fa>
<ge>
<cp>

<fo>
<tc>MECHANICAL
<yr>
<co>USA
<s#>
<si>
<cr>
<mt>
<cx>
<pt>
<hw>BUY
<so>
<$c>
<$v>
<lo>D-BELLS
<bl>
<>

<id>B126.80
<ma>Johnson
<na>"Johnson Artifical Light Exposure Calculator"
<sn>Circular
<#>1
<oc>Analog Calculator
<fa>2-3 Part
<ge>Slide Rule
<cp>
<fo>
<tc>Mechanical
<yr>
<co>England
<s#>
<si>6.5d x.2 cm
<cr>Cream
<mt>Plastic
<cx>
<pt>
<hw>Buy
<so>Portobello Rd
<$c>2 (80)
<$v>
<lo>D-Bells
<bl>Use. 1. Set at start. 2. Select wattage notch and dial clockwise to "stop"; 3. Repeat for distance of lamp from the subject; 4. Turn over and repeat for angel of light film speed and subject; 5. Read exposure against F/Ratio.
<>

<id>B127.80
<ma>Thorens
<na>Musical Disk
<sn>
<#>1
<oc>Digital Programma
<fa>
<ge>
<cp>
<fo>
<tc>Mechanical
<yr>1980
<co>Switzerland
<s#>
<si>11d x.1 cm
<cr>Black and Yellow
<mt>Tin
<cx>
<pt>
<hw>Buy
<so>
<$c>1 (80)
<$v>
<lo>D-Gordon's Office
<bl>
<>

<id>B128.80
<ma>Morris
<na>"Morris's Measuring Instrument"
<sn>
<#>1
<oc>Analog Calcula
<fa>2-3 Part
<ge>Linear Measure
<cp>
<fo>
<tc>Mechanical
<yr>
<co>England
<s#>
<si>5.5d x1 cm
<cr>
<mt>Metal, Paper, Cloth, Glass
<cx>
<pt>Case and Instrument
<hw>Buy
<so>Maitland Antiques
<$c>60 (80)
<$v>
<lo>D-Bells
<bl>
<>

<id>B129.80
<ma>Tacro Inc.
<na>Map Measure and Compass
<sn>
<#>1
<oc>Analog Calcula
<fa>2-3 Part
<ge>Linear Measure
<cp>
<fo>
<tc>Mechanical
<yr>
<co>Germany
<s#>
<si>7x3.5x.5 cm
<cr>
<mt>Chrome, Paper, Glass
<cx>
<pt>
<hw>
<so>
<$c>
<$v>
<lo>D-Bells
<bl>
<>

<id>B130.80
<ma>
<na>Drawing Instruments
<sn>
<#>1
<oc>Analog Calcula
<fa>Fixed
<ge>Drawing Instruments
<cp>
<fo>
<tc>Craft
<yr>1900c
<co>England
<s#>
<si>6x16x2.5 cm
<cr>Black Case
<mt>Brass, Steel, Wood, Cardboard
<cx>
<pt>7 Instruments and Case
<hw>Buy
<so>Bermondsey Market
<$c>72 (80)
<$v>
<lo>D-Bells
<>

<id>B131.80
<ma>ADDI-COSMOS
<na>"B.U.G Calculator"
<sn>
<#>1
<oc>Digital Calcula
<fa>Single Register
<ge>Pascal Strip
<cp>
<fo>
<tc>Mechanical
<yr>
<co>
<s#>5223
<si>4.5x20.5x4 cm
<cr>
<mt>Brass, Steel, Wood, fabric
<cx>
<pt>Instrument and Case
<hw>Buy
<so>Portobello Rd
<$c>$288 (80)
<$v>
<lo>D-MR2
<>

<id>132.80
<ma>
<na>Drawing Instruments
<sn>
<#>1
<oc>Analog Calcula
<fa>Fixed
<ge>Drawing Instruments
<cp>
<fo>
<tc>Craft
<yr>
<co>England
<s#>
<si>7x15x2 cm case
<cr>
<mt>Wood, Fabric, Brass, Steel
<cx>
<pt>4 Instruments and Wood Case
<hw>Buy
<so>
<$c>34 (80)
<$v>
<lo>W-Bells
<>

<id>B133.80
<ma>
<na>Drawing Instruments
<sn>
<#>1
<oc>Analog Calcula
<fa>Fixed
<ge>Drawing Instruments
<cp>
<fo>
<tc>Craft
<yr>
<co>England
<s#>
<si>10x19x4 cm box
<cr>
<mt>Wood, Brass, Velvet
<cx>
<pt>10 Instruments and Case
<hw>Buy
<so>
<$c>140 (80)
<$v>
<lo>W-Bells
<>

<id>B134.80
<ma>
<na>Pantograph
<sn>
<#>1
<oc>Analog Calcula
<fa>Multiple part
<ge>Proportional Recorder
<cp>
<fo>
<tc>Mechanical
<yr>1850c
<co>England
<s#>
<si>85x15x8 cm Case
<cr>
<mt>Brass and Wood
<cx>Engraved, J. Davis Cheltenham
<pt>Instrument and Case
<hw>Buy
<so>Arthur Middleton
<$c>275 (80)
<$v>
<lo>W-Bells
<>

<id>B135.80
<ma>Odhner
<na>"Original Odhner"
<sn>Odhner
<#>1
<oc>Digital Calcula
<fa>Three Register
<ge>Rotary
<cp>
<fo>
<tc>Mechanical
<yr>1920c
<co>England
<s#>239-868452
<si>
<cr>Grey
<mt>Metal
<cx>
<pt>
<hw>Buy
<so>Bermondsey Market
<$c>50 (80)
<$v>
<lo>D-Bells
<bl>
<>

<id>B136.81
<ma>W. Egli
<na>"Millionaire"
<sn>
<#>1
<oc>Digital Calcula
<fa>Four Register
<ge>Automatic Stepped Wheel
<cp>
<fo>
<tc>Mechanical
<yr>1920c
<co>Switzerland
<s#>4493
<si>
<cr>
<mt>Brass
<cx>Electrified Eight-digit Model
<pt>Stand, Motor, and Calculator
<hw>Buy
<so>Historical Technology
<$c>840 (81)
<$v>
<lo>D-MR2
<bl>See B1.75
<>

<id>B137.81
<ma>American Can Company
<na>"American Adding Machine"
<sn>
<#>2
<oc>Digital Calculator
<fa>Two Register
<ge>
<cp>
<fo>
<tc>Mechanical
<yr>ca 1920
<co>USA
<s#>31850
<si>

<cr>Black
<mt>Metal
<cx>Digits worn
<pt>
<hw>Buy
<so>D. Stillings/BRIEUX; Stamps
<$C>125 (81) 50 (81)
<$v>
<lo>
<bl> Essentially a Pascal-like single register machine, only the digits are grooved and stay in place showing the entry (a second register) until they are cleared. Interesting directions regarding complementary numbers and the use of the simple machine for multiplication.
<>

<id>B138.81
<ma>
<na>Scale and Ruled Compass
<sn>Drawing Instrument
<#>1
<oc>Analog Calcula
<fa>Fixed
<ge>Scale and Compass
<cp>
<fo>
<tc>Craft
<yr>
<co>USA
<s#>
<si>3x12 cm
<cr>
<mt>Metal
<cx>"W.B.Pierce Co. Civil Engineers"
<pt>
<hw>Buy
<so>
<$c>10 (81)
<$v>
<lo>D-Bells
<bl>
<>

<id>B139.80
<ma>W. Mount and T. Page, at the Postern on Tower-hill
<na>J. Good, "Measuring Made Easy: Or the Description and Use of Coggeshall's Sliding Rule, much Enlarg'd by J. Atkinson, Sen. London."
<sn>Coggeshall
<#>1
<oc>Analog Calcula
<fa>2-3 Part
<ge>Slide Rule
<cp>
<fo>Book
<tc>Craft
<yr>1744
<co>England
<s#>
<si>10x16x1 cm
<cr>
<mt>Paper and Leather
<cx>96 Pages with 2 folding Engraved Plates. Portion of Spine lacking but still tight, without fly leaves.
<pt>
<hw>Buy
<so>The Antiquarian Scientist
<$c>121 (80)
<$v>
<lo>D-Bells
<bl>Taylor (1966) lists John Good (1706-33) as a mathematical teacher and notes a 1751 edition of this work edited by Atkinson, A maker of slide rules. The first plate illustrates Coggeshall's Sliding rule.
<>

<id>B140.80
<ma>Depose H.C.
<na>Map Mileage Reader
<sn>
<#>1
<oc>Analog Calcula
<fa>2-3 Part
<ge>Linear Measure
<cp>
<fo>
<tc>Mechanical
<yr>
<co>USA
<s#>
<si>12x3.5dx.5 cm
<cr>
<mt>Metal, Paper and Glass
<cx>
<pt>
<hw>Buy
<so>
<$c>35 (81)
<$v>
<lo>D-Bells
<bl>
<>

<id>B141.80
<ma>
<na>Counting Beads
<sn>
<#>1
<oc>Digital Calcula
<fa>Single Register
<ge>Bead
<cp>
<fo>
<tc>Manual
<yr>
<co>USA
<s#>
<si>27x19.5x1 cm
<cr>Red, Black, and Green Beads
<mt>Wood and Metal
<cx>Paint worn off beads, beads missing on top
<pt>
<hw>Buy
<so>
<$c>9 (81)
<$v>
<lo>D-Bells
<bl>
<>

<id>B142.81
<ma>Bennett
<na>Typewriter
<sn>
<#>1
<oc>Transduction
<fa>
<ge>
<cp>
<fo>
<tc>Mechanical
<yr>
<co>USA
<s#>
<si>27x12x4 cm
<cr>Black with Yellow Letters
<mt>Metal
<cx>
<pt>Case and Typewriter
<hw>Buy
<so>
<$c>40 (81)
<$v>
<lo>D-Bells
<bl>Very compact with three positions for the keys and a wheel device. Small sized ribbon and removable carraige.
<>

<id>B143.81
<ma>Bunzel Mfg, Vienna
<na>Thomas Arithmometer
<sn>
<#>1
<oc>Digital Calcula
<fa>Three Register
<ge>Stepped Wheel
<cp>
<fo>
<tc>Mechanical
<yr>1910 c
<co>Austria, distributed by Dietzgen, USA
<s#>
<si>
<cr>
<mt>Wood, Metal
<cx>
<pt>Case, Arithmometer, Digits
<hw>Buy
<so>Historical Technology
<$c>840 (81)
<$v>
<lo>D-Bells
<bl>See B3.76.
<>

<id>B144.81
<ma>EUGENE DIETZGEN CO.
<na>"DIETZGEN MULTIPHASE STYLE-M IMPROVED DECIMAL TRIG TYPE LOG LOG RULE"
<sn>Linear
<#>1
<oc>Analog Calculator
<fa>2-3 Part
<ge>Slide Rule
<cp>
<fo>
<tc>Craft
<yr>1954
<co>USA
<s#>Cat. No. 1738

<si>5x32x.4 cm
<cr>
<mt>Aluminum and Plexi
<cx>
<pt>
<hw>Buy
<so>Lincoln City, Ore
<$c>8 (81)
<$v>
<lo>D-Bells
<bl>
<>

<id>B145.81
<ma>Dietzgen
<na>Slide Rule
<sn>Linear
<#>1
<oc>Analog Calculator
<fa>2-3 Part
<ge>Slide Rule
<cp>
<fo>
<tc>Craft
<yr>
<co>USA
<s#>
<si>26x3x1 cm
<cr>
<mt>Wood and Paper
<cx>
<pt>
<hw>Buy
<so>
<$c>2 (81)
<$v>
<lo>D-Bells
<bl>
<>

<id>B146.81
<ma>Stanley Rule and Level Co., New Britain, Conn

<na>Coggeshall Rule
<sn>Coggeshall
<#>1
<oc>Analog Calculator
<fa>2-3 Part
<ge>Slide Rule
<cp>
<fo>
<tc>Craft
<yr>
<co>USA
<s#>
<si>32x4x.4 cm
<cr>
<mt>Wood and Brass
<cx>
<pt>
<hw>Buy
<so>Brimfield
<$c>70 (81); 30(82)
<$v>
<lo>D-Bells
<bl>
<>

<id>B147.81
<ma>Richardson and Co., Middleton, Co.
<na>Coggeshall Timber Slide Rule
<sn>Coggeshall
<#>1
<oc>Analog Calculator
<fa>2-3 Part
<ge>Slide Rule
<cp>
<fo>
<tc>Craft
<yr>
<co>USA
<s#>
<si>4x31.5x.3 cm
<cr>
<mt>Boxwood, Brass, and Steel

<cx>
<pt>
<hw>Buy
<so>NE Trade Fair
<$c>20 (81)
<$v>
<lo>D-Bells
<bl>
<>

<id>B148.81
<ma>
<na>Spelling and Counting Board
<sn>
<#>1
<oc>Digital Calcula
<fa>Single Register
<ge>Bead
<cp>
<fo>Toy
<tc>Craft
<yr>1950 c
<co>USA
<s#>
<si>23d x 2 cm
<cr>red
<mt>Plastic and Wood
<cx>
<pt>
<hw>Buy
<so>Lincoln City, Ore.
<$c>2 (81)
<$v>
<lo>D-Bells
<bl>
<>

<id>B149.87
<ma>
<na>"Every Man's Own Interest Calculator"
<sn>Table
<#>1

<oc>Memory
<fa>
<ge>Table lookup
<cp>
<fo>
<tc>
<yr>1862
<co>USA
<s#>
<si>
<cr>Black
<mt>Lithograph in a hard cover
<cx>
<pt>
<hw>Buy
<so>Antiquarian Scientist
<$c>75 (87)
<$v>
<lo>D-Bells
<bl>Interest found on any sum from one cent to $5000 entered according to Act of Congress in the Year 1862 by John Hilberly in the Clerks Office of the District Court of the US for the Eastern District of Pennsylvania.
<>

<id>B150.81
<ma>Roberto Guatelli
<na>Pascal Adder
<#>1
<oc>Digital Calcula
<fa>Single Register
<ge>Pascal Wheel
<fo>Replica
<tc>Mechanical
<yr>1645
<co>France
<s#>
<si>
<cr>Bronze
<mt>
<cx>
<pt>

<hw>Buy
<so>R. Guatelli
<$c>3500 (81)
<$v>
<lo>D-MR2
<bl>The first mechanical adding machine built by the French phsycist and matehmatician, Blaise Pascal.
Use. The dials show the French monetary unit, the livre, which
was divided into 12 deniers, each subdivided into 20 sols. The essential part of the machine was its decimal carry; each toothed wheel moved forward one unit (one-tenth of a revolution on each wheel except those of deniers and sols) when the previous wheel had completed one revoltuion. Subtraction was based on complementary numbers that could be revealed by moving the strip at the top of the calculator.
<>
<id>B151.81
<ma>Electric Specialty Mfg Co., Cedar Rapids, Ia.
<na>Telegraph Key
<sn>
<#>1
<oc>Links & Switches
<fa>
<ge>
<cp>
<fo>
<tc>Electro-mechanical
<yr>ca 1900
<co>USA
<s#>
<si>7x8x18.5 cm
<cr>black
<mt>metal
<cx>
<pt>
<hw>Buy
<so>
<$c>$15 (81)
<$v>
<lo>D-Bells
<bl>

<>

<id>B152.81
<ma>SELSI
<na>Map mileage reader and compass
<sn>
<#>1
<oc>Analog Calcula
<fa>2-3 part
<ge>Integrator
<cp>
<fo>
<tc>Mechanical
<yr>ca 1930
<co>Germany
<s#>
<si>11x3.5x.5 cm
<cr>
<mt>
<cx>The handle also serves as a pencil.
<pt>
<hw>Buy
<so>
<$c>$7 (81)
<$v>
<lo>D-Bells
<bl>
<>

<id>B153.81
<ma>A & W Smith
<na>Pantograph
<sn>
<#>1
<oc>Analog Calcula
<fa>Multiple part
<ge>Drawing instruments
<cp>
<fo>
<tc>Mechanical
<yr>ca 1820
<co>England
<s#>
<si>59x7x5.5 mahoganny case
<cr>
<mt>Brass
<cx>
<pt>3 brass scales, ivory and brass roller, and pins
<hw>Buy
<so>Peter Delahar
<$c>$465 (81)
<$v>
<lo>D-Bells
<bl>"A rare type of brass pantograph," P. Delahar.
<>

<id>B154.81
<ma>Corona Typewriter Co., Inc. Groton, N.Y.
<na>"CORONA FOUR"
<sn>Typewriter
<#>1
<oc>Transduction
<fa>
<ge>Typewriter
<cp>
<fo>
<tc>Mechanical
<yr>ca 1920
<co>USA
<s#>H201124
<si>26x31x11 cm
<cr>Black
<mt>
<cx>
<pt>case and ribbons missing
<hw>Buy
<so>Oregon
<$c>$8 (81)
<$v>
<lo>D-Bells
<bl>
<>

<id>B155.81
<ma>Burroughs
<na>"Burroughs Calculator"
<sn>Adding machine
<#>1
<oc>Digital Calcula
<fa>Single Register
<ge>Keyed Wheel
<cp>
<fo>
<tc>Mechanical
<yr>ca 1910
<co>USA
<s#>5-607901
<si>18x23x30 cm
<cr>Black and green
<mt>Metal
<cx>Stands on legs at a tilt for ease of operation.
<pt>
<hw>Buy
<so>Rte 20 antique store in Wayland
<$c>$5 (81)
<$v>
<lo>D-Bells
<bl>
<>

<id>B156.80
<ma>Burroughs
<na>"The Burroughs Adding and Listing Machine"
<sn>Adding Machine
<#>1
<oc>Digital Calcula
<fa>Two Register
<ge>Key Punch
<cp>
<fo>
<tc>Mechanical
<yr>ca 1900
<co>USA
<s#>
<si>
<cr>Black
<mt>Metal with beveled glass sides
<cx>
<pt>
<hw>Buy
<so>Victor, Co.
<$c>$225 (80)
<$v>
<lo>D-MR-2
<bl>
<>

<id>B157.81
<ma>Burroughs
<na>"The Burroughs Adding and Listing Machine"
<sn>Adding Machine
<#>1
<oc>Digital Calcula
<fa>Two Register
<ge>Keyed Wheel
<cp>Stand and motor
<fo>
<tc>Mechanical
<yr>ca 1910
<co>USA
<s#>
<si>
<cr>Black
<mt>Metal with beveled glass
<cx>Adapted for motorized operation
<pt>Stand, motor, calculator, printer
<hw>Buy
<so>Oregon
<$c>$75 (81)
<$v>
<lo>D-MR-2
<bl>
<>

<id>B158.81
<ma>J. Halden & Co., Ltd.
<na>"HALDEN CALCULEX"
<sn>Circular Slide Rule
<#>1
<oc>Analog Calcula
<fa>2-3 part
<ge>Slide rule
<cp>
<fo>
<tc>Craft
<yr>ca 1910
<co>England
<s#>
<si>6 cm diameter
<cr>
<mt>Metal ring with glass discs covering paper scales
<cx>
<pt>Aluminum case with velvet interior and leather covered 95 page manual only measuring 5.5 cm square, plus instrument
<hw>Buy
<so>The Antiquarian Scientist
<$c>$90 (81)
<$v>
<lo>D-Bells
<bl>Cajori in his "history of the Logarithmic Slide Rule" (1909) lists this unique instrument as No. 211 and notes the manual.
<>

<id>B159.81
<ma>Henry Carey Baird, Industrial Publisher, Philadelphia
<na>"A Treatise on a Box of Instruments and the Slide Rule for the Use of Guagers, Engineers, Seaman, and Students," by Thomas Kentish
<sn>
<#>1
<oc>Analog Calcula
<fa>2-3 part
<ge>
<cp>
<fo>Book
<tc>Craft
<yr>1864
<co>USA
<s#>
<si>12x18x2 cm
<cr>
<mt>
<cx>Original cloth cover, 228 pages with a folding plate
<pt>
<hw>Buy
<so>The Antiquarian Scientist
<$c>$50 (81)
<$v>
<lo>D-Bells
<bl> The use of 2-3 part analog calculators for practical geometry, trigonometry, and logarthms are explained. Special sections deal with circles and navigational calculations.
<>

<id>B160.81
<ma>R. & L.W. Leybourn
<na>"TRIGONOMETRIA"
<sn>Book
<#>1
<oc>Writable or Readable Memory
<fa>Paper
<ge>Random
<cp>
<fo>
<tc>Craft
<yr>1657
<co>England
<s#>
<si>14x18x3.5 cm
<cr>
<mt>Original leather binding
<cx>
<pt>
<hw>Buy
<so>The Antiquarian Scientist
<$c>650 (81)
<$v>
<lo>D-MR-2
<bl>The original set of logarthmic tables and their explanation as made by William Oughtred, who made significant improvements on the slide rule.
<>

<id>B161.81
<ma>HANS W. EGLI CO.
<na>"MILLIONAIRE"
<sn>Calculator
<#>1
<oc>Digital Calcula
<fa>Four Function
<ge>Stepped Wheel
<cp>
<fo>
<tc>Mechanical
<yr>ca 1900
<co>Switzerland
<s#>272
<si>
<cr>18x29x76 cm
<mt>wooden case, brass calculator
<cx>8 digit
<pt>wooden stand, case, and calculator
<hw>Buy
<so>Antiquarian Scientist
<$c>920 (81)
<$v>
<lo>D-Bells
<bl>See B1.75
<>

<id>B162.81
<ma>Ticknor and Fields, Boston
<na>"History, Theory, and Practice of the Electric Telegraph" by George B. Prescott
<sn>
<#>1
<oc>Links & Switches
<fa>Telegraph
<ge>
<cp>
<fo>Book
<tc>Electro-mechanical
<yr>1864
<co>USA
<s#>
<si>14x4x20cm
<cr>
<mt>
<cx>well-illustrated, good condition
<pt>
<hw>Buy
<so>The Antiquarian Scientist
<$c>$40 (81)
<$v>
<lo>D-Bells
<bl>Contents: 1. Electrical Manifestations; 2. Propagation of Electricity; 3. Magnetism; 4. General Principles of the Electric Telegraph. 5. The Morse System. 6. The Needle System; 7. House's Printing Telegraph; 8. Bain's Electro-chemical Telegraph; 9. The Hughes System; 10. The American Printing Telegraph; 11. Horne's Electro-thermal Telegraph; 12. The Dial Telegraphs; 13. Subterranean and Submarine Lines; 14. The Atlantic Cable; 15. Progress of the Electric Telegraph; 16. Various Applications of the Electric Telegraph; 17. Construction of Telegraph Lines; 18. Atmospheric Electricity; 19. Terrestrial Magnetism; 20. Miscellaneous Matters; 21. Early Discoveries in Electro-dynamics; 22. Galvanism. Index.
<>

<id>B163.81
<ma>H. Dessain, Imprimeur-Libraire, Liege
<na>"Recherches sur La Telegraphie Electrique" par Michel Gloesener
<sn>
<#>1
<oc>Links & Switches
<fa>
<ge>
<cp>
<fo>Book
<tc>Electro-mechanical
<yr>1853
<co>Belgium
<s#>
<si>16x23.5x1.5cm
<cr>
<mt>paper back
<cx>
<pt>
<hw>Buy
<so>The Antiquarian Scientist
<$c>110 (81)
<$v>
<lo>D-Bells
<bl>Beautiful fold-out plates of the needle telegraph.
<>

<id>XB164.81
<ma>Signal Electric Mfg. Co.
<na>"Signal Telegraph Instrument"
<sn>Telegraph Keys and Sounders
<#>2
<oc>Links & Switches
<fa>
<ge>
<cp>
<fo>
<tc>Electro-mechanical
<yr>ca 1920
<co>USA
<s#>
<si>11x10x16 cm
<cr>
<mt>Wooden base, brass, and other metals
<cx>
<pt>
<hw>Buy
<so>Westford
<$c>20 (each)
<$v>30 (each)
<lo>D-MR2
<bl>
<>

<id>B165.81
<ma>Simplex Typewriter Company
<na>"The New Simplex Typewriter No. 1"
<sn>Typewriter
<#>1
<oc>Typewriter
<fa>
<ge>
<cp>
<fo>
<tc>Mechanical
<yr>ca 1920
<co>USA
<s#>
<si>22x12x6 cm
<cr>red, yellow, and black
<mt>wooden base with metal
<cx>
<pt>cardboard case and typewriter
<hw>BUY
<so>Knotty Pine Antique Market, West Swanzey, NH
<$c>15 (81)
<$v>
<lo>D-Gordon's Office
<bl> The simplex is a small, inexpensive, home typewriter that only holds paper less than seven inches wide. U.S. patent numers 1138427, 1204912, 1521408, 1865288, 1869426, and 1957373.

Use: From the Directions for Operating in the case: "First: Hold the machine with rack side toward you. Push carriage to the left to starting point. When doing this see that dog does not catch in rack. Insert paper between rollers from the front. Put finger on key of letter desired and swing it into notch in rim of typecase near the dog: <u>Press downward to print.</u> To make a space without prining, press down on any key near to but not in the notch. To ink apply only a drop of ink to each pad with the end of a matchstick or toothpick. Be careful not to bend the pads down so far as to prevent them from springing back into position. Use only Simplex Ink which will be supplied at 10 cents per tube, cheap ink destroys the face of the type. Do not oil. If keyplate sticks take a rag moistened with vaseline and hold against underside of keys at the notch and twirl type plate around a few times. If the carriage does not move forward freely, apply a little vaseline to the carriageway where it rubs. Caution! Keep oil or vaseline away from rubber type and ink pads. Oil will swell and destroy the letters."

<>

<id>B166.81
<ma>Simlex Typewriter Co., Inc.
<na>"Simplex Portable Typewriter Special Demonstrated Model S"
<sn>Typewriter
<#>1
<oc>Typewriter
<fa>
<ge>
<cp>
<fo>
<tc>Mechanical
<yr>ca 1930
<co>USA
<s#>
<si>24x8x16 cm
<cr>Green and red
<mt>Metal
<cx>
<pt>
<hw>Buy
<so>Knotty Pine Antique Market, West Swanzey
<$c>7 (81)
<$v>
<lo>D-Bells
<bl>See B165.81.
<>

<id>XB167.81
<ma>Wolverine Supply and Manufacturing Co.,
<na>"Adding Machine"
<sn>
<#>1
<oc>Digital Calcula
<fa>Single Register
<ge>Pascal Strip
<cp>
<fo>
<tc>Mechanical
<yr>ca 1950
<co>USA
<s#>
<si>10x15x23 cm
<cr>Red, blue, and cream
<mt>Tin
<cx>
<pt>
<hw>Buy
<so>Knotty Pine Antique Market
<$c>10 (81)
<$v>25 (82)
<lo>D-MR2
<bl>
<>

<id>B168.81
<ma>
<na>Navigator's Sector
<sn>
<#>1
<oc>Analog Calcula
<fa>2-3 Part
<ge>Sector
<cp>
<fo>
<tc>Craft
<yr>ca 1880
<co>USA
<s#>
<si>3.5x16x.3 cm
<cr>
<mt>wood
<cx>
<pt>
<hw>BUY
<so>Knotty Pine Antique Market, W. Swanzey
<$c>10 (81)
<$v>
<lo>D-Bells
<bl>
<>

<id>B169.81
<ma>
<na>Navigator's Sector
<sn>
<#>1
<oc>Analog Calcula
<fa>2-3 Part
<ge>Sector
<cp>
<fo>
<tc>Craft
<yr>ca 1880
<co>USA
<s#>
<si>3.5x16x.3 cm
<cr>
<mt>Wood
<cx>
<pt>
<hw>Buy
<so>Amherst Outdoor Antique Market
<$c>18 (81)
<$v>
<lo>D-Bells
<bl>
<>

<id>B170.81
<ma>
<na>Coggeshall Slide Rule
<sn>
<#>1
<oc>Analog Calcula
<fa>2-3 Part
<ge>Slide Rule
<cp>
<fo>
<tc>Craft
<yr>ca 1850
<co>USA
<s#>
<si>4x33x.5 cm
<cr>
<mt>Wood and Brass
<cx>No makers name, wood cracked, shows signs of real wear
<pt>
<hw>Buy
<so>Knotty Pine Antique Market, West Swanzey, NH
<$c>15 (81)
<$v>
<lo>D-Bells
<bl>
<>

<id>B172.81
<ma>Pickett & Eckel, Inc.
<na>Slide Rule
<sn>
<#>1
<oc>Analog Calcula
<fa>2-3 Part
<ge>Log-log
<cp>
<fo>
<tc>Craft
<yr>1960
<co>USA
<s#>405171
<si>31x6x3 cm
<cr>Yellow
<mt>Aluminum and Plexi
<cx>
<pt>Box, Case, instruction pamphlet, and guarantee
<hw>Buy
<so>Westford flea market
<$c>6 (81)
<$v>
<lo>D-Bells
<bl>
<>

<id>B173.81
<ma>Burroughs
<na>"Burroughs"
<sn>Adding Machine
<#>1
<oc>Digital Calcula
<fa>Two Register
<ge>Keyed Wheel
<cp>
<fo>
<tc>Mechanical
<yr>ca 1950
<co>USA
<s#>8A193393
<si>22x37x20 cm
<cr>Green and Black
<mt>Metal
<cx>8 digits with paper tape printing
<pt>
<hw>Buy
<so>
<$c>19 (81)
<$v>
<lo>D-Bells
<bl>
<>

<id>B174.81
<ma>Felt & Tarrant Mfg Co.,
<na>"Comptometer"
<sn>
<#>1
<oc>Digital Calcula
<fa>Single Register
<ge>Keyed Wheel
<cp>
<fo>
<tc>Mechanical
<yr>ca 1895
<co>USA
<s#>505
<si>
<cr>
<mt>Walnut, Brass & Other Metals
<cx>
<pt>
<hw>Buy
<so>Peter Delahar
<$c>400 (81)
<$v>
<lo>D-MR2
<bl> An early Comptometer with the springs showing on the upper keys. The keys are molded differently on alternative rows to give the operator a "feeling" of relative location. The walnut cabinetry and tooling was clearly a hand-made.
<>

<id>B175.80
<ma>Siemens Brothers & Co., London
<na>Printing Telegraph
<sn>
<#>1
<oc>Links and Switches
<fa>
<ge>
<cp>
<fo>
<tc>Electro-mechanical
<yr>ca 1900
<co>England
<s#>12145
<si>
<cr>
<mt>Wood and brass
<cx>Does not work
<pt>
<hw>Buy
<so>Portobello Rd., London
<$c>510 (80)
<$v>
<lo>D-Gordon's Office
<bl>
<>

<id>B176.80
<ma>
<na>Sector
<sn>
<#>1
<oc>Analog Calcula
<fa>2-3 Part
<ge>Sector
<cp>
<fo>
<tc>Craft
<yr>ca 1623
<co>England
<s#>
<si>9 inch; 240x50x5 mm
<cr>
<mt>Brass
<cx>
<pt>
<hw>Buy
<so>Peter Delahar
<$c>2400 (1981)
<$v>
<lo>D-Bells
<bl>Nine inch brass sector as described by Edmund Gunter (1581-1626) in 1623. Unsigned by probably made by Elias Allen in 1623.
<>

<id>B177.81
<ma>Thomas Graham
<na>"The Oriental Calculator or Tables for the Calculation of Interest, Exchange & Commission" by Dorabjee Hormusjee
<sn>Book of tables
<#>1
<oc>Writable or Readable Memory
<fa>Paper
<ge>Random
<cp>
<fo>
<tc>Craft
<yr>1860
<co>India
<s#>
<si>15x23x4 cm
<cr>Green
<mt>Paper
<cx>Third Edition, Good condition
<pt>
<hw>Buy
<so>Editions
<$c>45 (81)
<$v>
<lo>D-Bells
<bl>Part I contains Interest Tables in Rupees, Dollars, and Sterling from one-half to 12 per cent per annum. Part Ii contains tables for the conversion of rupees, into sterling and dollars; and sterling into dollars. Part III contains commission or Inland Exchange Tables; Key showing indirect exchange between England, India and China; Tables shoing the comparative rates of exchange for sight bills, and tables showing the estimated value of one pound of cotton with all charges and varying exchange rates.

In the preface to the third edition the author states, "The rapid sale of the previous Editions of the "Oriental Calculator" and the pressing demand for it, are evident proofs of the utility of this work in mercantile circles; and the production of the Third Edition is the result of the liberal patronage and support the author has been favored with."
<>

<id>B178.81
<ma>
<na>Counting Beads
<sn>
<#>1
<oc>Digital Calcula
<fa>Single Register
<ge>Bead
<cp>
<fo>
<tc>Manual
<yr>
<co>
<s#>
<si>37x2x44 cm
<cr>red and black beads
<mt>wood and metal
<cx>9 rows by 10 digits
<pt>
<hw>Buy
<so>Joe Stamps, NY
<$c>50 (81)
<$v>
<lo>D-Bells
<bl>
<>

<id>XB179.81
<ma>Reliable Typewriter & Adding Machine Co.,
<na>"Addometer"
<sn>
<#>1
<oc>Digital Calcula
<fa>Single Register
<ge>Pascal Wheel
<cp>
<fo>
<tc>Mechanical
<yr>
<co>USA
<s#>
<si>1x5x30 cm
<cr>Brown with red and white dials and yellow numbers
<mt>Metal
<cx>
<pt>Case, Instructions, Stylus, and Calculator
<hw>Buy
<so>Joe Stamps, NY
<$c>28 (81)
<$v>125 (82)
<lo>D-Bells
<bl>See B150.80
<>

<id>B180.87
<ma>Morin, H. de
<na>Les Appareils De'Integration: Paris, Gauthier-villars, Imprimeur-Libraire du bureau des Longitudes, de L'Ecole Plytechnique, Quai des Grands-Augustins, 55, Paris
<sn>
<#>1
<oc>Analog Calculator
<fa>3 or more parts
<ge> planimetres; integrometres; integraphes et courbes integrales; analyse harmonique et analyseurs
<cp>
<fo>Book
<tc>Mechanical
<yr>1913

<co>France
<s#>
<si>208 pp; 123 figures
<cr>
<mt>
<cx>
<pt>
<hw>Buy
<so>Antiquarian Scientist
<$c>150 (87)
<$v>
<lo>D-Bells
<bl>See B137.81
<>

<id>B181.81
<ma>
<na>Abacus
<sn>
<#>1
<oc>Digital Calcula
<fa>Single Register
<ge>Bead
<cp>
<fo>
<tc>Manual
<yr>
<co>
<s#>
<si>29x14x2.5 cm
<cr>
<mt>Wood
<cx>13 digit
<pt>
<hw>Buy
<so>Amherst outdoor antique market
<$c>10 (81)
<$v>
<lo>D-Bells
<bl>
<>

<id>B182.81
<ma>Burroughs
<na>"Burroughs Calculator"
<sn>
<#>1
<oc>Digital Calcula
<fa>Single Register
<ge>Keyed Wheel
<cp>
<fo>
<tc>Mechanical
<yr>ca 1910
<co>USA
<s#>#204128
<si>230x100x360 mm
<cr>Black
<mt>Metal
<cx>
<pt>
<hw>Buy
<so>Reading flea market
<$c>3 (81)
<$v>50 (81)
<lo>D-Bells
<bl>Replica of an early Comptometer. See B9.76.
<>

<id>B183.81
<ma>SELSI
<na>Map mileage reader and compass
<sn>
<#>1
<oc>Analog Calcula
<fa>2-3 part
<ge>Integrator
<cp>
<fo>
<tc>Mechanical
<yr>ca 1930
<co>Germany
<s#>
<si>110x35x5 mm

<cr>
<mt>
<cx>The handle also serves as a pencil.
<pt>
<hw>Buy
<so>Reading flea market
<$c>4 (81)
<$v>8 (81)
<lo>D-Bells
<bl>
<>

<id>B184.81
<ma>Digital Equipment Corporation
<na>2 PM Flip Flop
<sn>
<#>1
<oc>
<fa>
<ge>
<cp>
<fo>
<tc>Transistor
<yr>1966
<co>USA
<s#>R20YC
<si>
<cr>
<mt>
<cx>
<pt>
<hw>
<so>
<$c>
<$v>
<lo>D-Bells
<bl>
<>

<id>B185.81
<ma>Data Products
<na>Core Memory

<sn>
<#>1
<oc>
<fa>
<ge>
<cp>
<fo>
<tc>
<yr>
<co>
<s#>
<si>
<cr>
<mt>
<cx>
<pt>
<hw>
<so>
<$c>
<$v>
<lo>
<bl>8 K by 19 bit 3W-3D 18 mil planar memory.
<>

<id>B186.81
<ma>Cal Research Computer
<na>Tube and circuit
<sn>
<#>1
<oc>
<fa>
<ge>Philips tube
<cp>
<fo>
<tc>
<yr>
<co>
<s#>00667001, TC3-C5
<si>
<cr>
<mt>
<cx>

<pt>
<hw>
<so>
<$c>
<$v>
<lo>D-Bells
<bl>
<>

<id>B187.81
<ma>Abdank-Abakanowicz
<na>Les Integraphes La Courbe integrale et ses application; Etude sur un nouveau systeme d'integrateurs mecaniques, Paris, Gauthier-Villars, Imprimeur-Libraire du Bureau des Longitudes, de L'ecole Polytechnique, Successeur de Mallet-Bachelier, Quai des Augustins, 55
<sn>
<#>1
<oc>Analog Calculators
<fa>
<ge>Integrators
<cp>
<fo>Book
<tc>Mechanical
<yr>1886
<co>France
<s#>
<si>
<cr>
<mt>Paper bound, torn pages, 156 pp, 90 figures
<cx>
<pt>
<Hw>Buy
<so>Antiquarian Scientist
<$c>150 (87)
<$v>
<lo>D-Bells
<bl>
<>

<id>B188.81
<ma>

<na>"Precise"
<sn>Adding Machine
<#>1
<oc>Digital Calcula
<fa>Single Register
<ge>Pascal Strip
<cp>
<fo>
<tc>Mechanical
<yr>ca 1910
<co>USA
<s#>
<si>105x120x175 mm
<cr>Silver and Bronze
<mt>Metal
<cx>
<pt>Stylus and calculator
<hw>Buy
<so>
<$c>25 (81)
<$v>
<lo>D-Bells
<bl>
<>

<id>B189.81
<ma>A W Faber
<na>Slide Rule
<sn>
<#>2
<oc>Analog Calculator
<fa>2-3 Part
<ge>Slide Rule
<cp>
<fo>
<tc>Craft
<yr>ca 1935
<co>Germany
<s#>98350;371190
<si>33x9x270 mm
<cr>Ivory
<mt>Ivory bonded to wood

<cx>Inch and centimeter scales are on opposite sides
<pt>Leather case and rule
<hw>Buy
<so>
<$c>10(84)
<$v>
<lo>D-Bells
<bl>
<>

<id>B190.81
<ma>Ideas Unlimited
<na>"Horse-meter"
<sn>
<#>1
<oc>Analog Calcula
<fa>2-3 Part
<ge>Circular Slide Rule
<cp>
<fo>
<tc>Craft
<yr>1951
<co>USA
<s#>
<si>135 mm diamter
<cr>Orange, gray and yellow
<mt>Paper
<cx>
<pt>
<hw>Buy
<so>Colorado Springs
<$c>1 (81)
<$v>
<lo>D-Bells
<bl>"Directions for use: (1) Consult daily Racing Form for speed ratings, weights and class; (2) Figure rating for each horse in race as follows: (a) turn red dial to best speed rating in past 30 days; (b) turn blue dial to class in key race; (c) Turn yellow dial to weight difference of (a) race and today's race; (c) Add (or subtract) figures (a) (b) (c). This is horses rating. (3) Horse with at least 2 points aove rest is the choice in this race; (4) Play only if final odds are 2/1 or better; (5) Best results will be had by avoiding 2 year old, maiden, fillies and mares, stakes, hurdle, turf and steeple races and races over 1 1/8 miles."
<>

<id>B191.81
<ma>E. & F. N. Spon, 125, Strand. London
<na>"Pocket-book of Useful Formulae & memoranda for Civil and Mechanical Engineers," by Sir Guilford L. Molesworth
<sn>Book
<#>1
<oc>Readable or Writable Memory
<fa>Paper
<ge>Random
<cp>
<fo>
<tc>Craft
<yr>1888
<co>England
<s#>
<si>77x30x120 mm
<cr>Black with gold leaf edges
<mt>Paper
<cx>
<pt>
<hw>Buy
<so>
<$c>3 (81)
<$v>ca 50
<lo>D-Bells
<bl>Originally compiled in 1862, this is the 22nd edition of a truly pocket-sized book of formula. Although there is no table of contents, a very thorough index is provided for the 732 pages of tables.
<>

<id>B192.81
<ma>
<na>Section of the first Atlantic Telephone Cable
<sn>
<#>1
<oc>Transduction
<fa>
<ge>
<cp>
<fo>
<tc>Electro-mechanical
<yr>1858
<co>US
<s#>
<si>95x18 mm diameter
<cr>
<mt>
<cx>
<pt>
<hw>Buy
<so>
<$c>200 (81)
<$v>
<lo>D-Bells
<bl>Cyrus West Field (1819-1892) American merchant, promotor of the first Atlantic cable was botn in Stockbridge, massachusetts. In 1854, he conceivec the idea of the calbe and secured a charter to organize the England and American companies. The British and American naval ships, HMS Agamemnon and the USS Niagara were secured to lay the cable. Five attempts were made between 1857 and 58. The first message transmitted, August 16, 1858, read, "England and America are united by telegraph. Golory to God in the highest and on earth peace and good will towards men." The Queen and the President of the United States exchanged congratulations, but the cable ceased working three weeks later. It was necessary for Field to raise new funds and make new arrangements. The great Eastern succeeded in laying a calbe in 1866.
<>

<id>B193.81
<ma>A. Massim, Paris
<na>Music Box
<sn>
<#>1
<oc>Readable or Writable Memory
<fa>Mechanically stable
<ge>Cyclic
<cp>
<fo>
<tc>Mechanical
<yr>1840
<co>France
<s#>30981
<si>343x160x120 mm
<cr>Black
<mt>Wood and brass fittings
<cx>
<pt>
<hw>Buy
<so>
<$c>400 (81)
<$v>
<lo>D-Bells
<bl>The music box plays six tunes; Robin Adair, the Blue Bells of Scotland, The Campbells are coming, Auld Lang Syne, Coming Through the Rye, and Bonnie Sweet Home.
<>

<id>B194.81
<ma>Aaron Palmer, Boston
<na>"Palmer's Pocket Scale"
<sn>Circular slide rule
<#>1
<oc>Analog Calculator
<fa>2-3 part
<ge>Circular slide rule
<cp>
<fo>
<tc>Craft
<yr>1845
<co>USA
<s#>
<si>7x95x150 mm
<cr>
<mt>Paper
<cx>
<pt>
<hw>Buy
<so>Moskowitz
<$c>ca 185(81)
<$v>
<lo>D-MR2
<bl>Palmer's Pocket Scale with rules for its use in solving Arithmetical and Geometrical Problems preceded the large sized Fuller's scale. See B110.80.
<>

<id>B195.81
<ma>
<na>Excise slide rule
<sn>
<#>1
<oc>
<fa>
<ge>
<cp>
<fo>
<tc>
<yr>
<co>
<s#>
<si>
<cr>
<mt>
<cx>
<pt>
<hw>
<so>Moskowitz
<$c>375(81)
<$v>
<lo>
<bl>complete on getting catalog
<>

<id>B196.81
<ma>A.W. Faber, "Castell" Pencil Works, Ltd.
<na>"Instruction for the use of A.W. Faber "Castell" Precision Calculating Rules," by Henry O. Cooper
<sn>Book
<#>1
<oc>Analog Calculators
<fa>2-3 part
<ge>Slide rule
<cp>
<fo>Book
<tc>Craft
<yr>ca 1935
<co>Germany
<s#>
<si>155x228x8 mm
<cr>Grey and red cover
<mt>Paper
<cx>
<pt>
<hw>Buy
<so>Moskowitz
<$c>15(81)
<$v>
<lo>D-Bells
<bl>
<>

<id>B197.81
<ma>
<na>"Enigma"
<sn>
<#>1
<oc>Transducer
<fa>
<ge>
<cp>
<fo>
<tc>
<yr>
<co>
<s#>
<si>
<cr>
<mt>
<cx>
<pt>
<hw>
<so>
<$c>
<$v>
<lo>D-MR2
<bl>
<>

<id>B198.81
<ma>
<na>"Enigma"
<sn>
<#>1
<oc>
<fa>
<ge>
<cp>
<fo>
<tc>
<yr>
<co>
<s#>
<si>
<cr>
<mt>
<cx>
<pt>
<hw>
<so>
<$c>
<$v>
<lo>D-MR2
<bl>
<>

<id>B199.82
<ma>
<na>"Everard" slide rule
<sn>slide rule
<#>1
<oc>Analog Calculator
<fa>2-3 part
<ge>Slide rule
<cp>
<fo>
<tc>Craft
<yr>ca 1720
<co>England
<s#>
<si>303x17x25 mm
<cr>
<mt>Boxwood
<cx>The early form of Everard slide rule with two slides.
<pt>
<hw>Buy
<so>Delahar
<$c>222 (82)
<$v>
<lo>D-Bells
<bl>
<>

<id>B
<ma>
<na>
<sn>
<#>1
<oc>
<fa>
<ge>
<cp>
<fo>
<tc>
<yr>
<co>
<s#>
<si>
<cr>
<mt>
<cx>
<pt>
<hw>
<so>
<$c>
<$v>
<lo>
<bl>
<>

<id>B250.82
<ma>
<na>Trigonometer
<sn>
<#>1
<oc>Analog Calculator
<fa>Multiple Part
<ge>
<cp>
<fo>
<tc>Mechanical
<yr>c 1840
<co>USA
<s#>
<si>12"x6"
<cr>
<mt>brass
<cx>
<pt>
<hw>Buy
<so>The Antiquarian Scientist
<$c>1,875(82)
<$v>
<lo>D-Bells
<bl>The instrument is constructed so that a swinging arm carrying two sight vanes piots away from a stationary arm, also with two sight vanes, over an attached 90' scale with an intricate grid for reading the sine of the subtended angle by vernier directly to three places. A bubble level on the stationary arm allows horizontal or vertical reading. A ratcheted chain counter is also fixed to the stationary arm. A removable box compass can be fitted onto either arm by a neatly devised, quick action device.

The instrument was once the equipment of a Virginia surveyor and retains a fine hand-worked character with great attention to detail, such as fine knurling of the many thumb screws. Smart illustrates a similar instrument by Francis Whiteley of Standardsville, Virginia on p. 165. Both examples are elaborations of Whiteley's patent of 1836, but with the additions of the sine grid. The patent model and its type were made first, then the design with the sine grid, and finally the most advanced type with serial numbers and an

added verneir on the swinging arm for reading the protractor scale as illustrated in Smart.
<>

<id>B251.82
<ma>Troughton, London
<na>proportional compass
<sn>
<#>1
<oc>Analog Calculator
<fa>2-3 parts
<ge>drawing instruments
<cp>
<fo>
<tc>Mechanical
<yr>c 1800
<co>England
<s#>
<si>6 1/4inch long
<cr>
<mt>Brass with steel points
<cx>hand-engraved
<pt>shaped sharkskin case and instrument
<hw>Buy
<so>The Antiquarian Scientist
<$c>500(82)
<$v>
<lo>D-Bells
<bl>Edward Troughton (1753-1836), the 'celebrated' English instrument maker, is well known for his very fine astrnomical and navigational instruments. In 1826, Troughton took in William Simms, and the firm flourished as Troughton 7 Simms, even after Troughton's death.
   The instrument is used for enlarging or reducing a drawing with ratios marked along the slot, set by moving the screw pivot in it.
<>

<id>B252.82
<ma>
<na>planimeter
<sn>

<#>1
<oc>Analog Calculator
<fa>multiple parts
<ge>
<cp>
<fo>
<tc>Mechanical
<yr>
<co>
<s#>
<si>
<cr>
<mt>
<cx>
<pt>planimeter and case
<hw>Buy
<so>Margaret Weiner Kennedy
<$c>75(82)
<$v>
<lo>D-Bells
<bl>
<>

<id>B253.82
<ma>
<na>Computing Mechanisms and Linkages by Antonin Svoboda, edited by Hubert M. James, New York, Dover Publications 1965, unabridged republication of the work first published by McGraw-Hill Book Company, Inc. 1948.
<sn>
<#>1
<oc>
<fa>
<ge>
<cp>
<fo>
<tc>
<yr>1948
<co>USA
<s#>
<si>
<cr>

<mt>
<cx>
<pt>
<hw>Buy
<so>D. Rubinstein
<$c>5(82)
<$v>
<lo>D-Bells
<bl>
<>

<id>B254.82
<ma>
<na>Logic Machines and Diagrams by Martin Gardner, McGraw Hill Book Company, Inc. New York, 1958
<sn>
<#>1
<oc>
<fa>
<ge>
<cp>
<fo>
<tc>
<yr>1958
<co>USA
<s#>
<si>
<cr>
<mt>
<cx>
<pt>
<hw>Buy
<so>D. Rubinstein
<$c>5(82)
<$v>
<lo>D-Bells
<bl>Contents include: The Ars Magna of Ramon Lull, Logic Diagrams, A Network Diagram for Propositional Calculus, The Stanhope Demonstrator, Jevons Logic Machine, Marquand's Machine, Window Cards, Electrical Lobic Machines, The Future of Logic Machines.
<>

<id>B255.82
<ma>
<na>The Trachtenberg Speed Ssytem of Basic Mathematics translated and adapted by Ann Cutler and Rudoph McShane, Doubleday & Co., Garden City, N.Y., 1960
<sn>
<#>1
<oc>
<fa>
<ge>
<cp>
<fo>
<tc>
<yr>
<co>
<s#>
<si>
<cr>
<mt>
<cx>
<pt>
<hw>Buy
<so>
<$c>5(82)
<$v>
<lo>D-Bells
<bl>
<>

<id>B256.82
<ma>
<na>the Japanese Abacus, its use and Theory by Takashi Kojima, Charles E. Tuttle Co., Publishers, Vermont and Japan
<sn>
<#>1
<oc>
<fa>
<ge>abacus
<cp>
<fo>book
<tc>

<yr>
<co>
<s#>
<si>
<cr>
<mt>
<cx>
<pt>
<hw>Buy
<so>
<$c>
<$v>
<lo>D-Bells
<bl>
<>

<id>B257.82
<ma>
<na>Faster than Thought, edited by B. V. Bowden. Sir Isaac Pitman & Sons, Ltd., London, 1953
<sn>
<#>1
<oc>
<fa>
<ge>
<cp>
<fo>
<tc>
<yr>
<co>
<s#>
<si>
<cr>
<mt>
<cx>
<pt>
<hw>Buy
<so>
<$c>
<$v>
<lo>D-Bells
<bl>

<>

<id>B258.82
<ma>
<na>Blaise Pascal "auvergnat" la famillle a l'oeuvre, Musee D'art de Clermont-Ferrant, 6 octobre - 8 novembre 1981
<sn>
<#>1
<oc>
<fa>
<ge>
<cp>
<fo>
<tc>
<yr>
<co>
<s#>
<si>
<cr>
<mt>
<cx>
<pt>
<hw>Buy
<so>A Brieux
<$c>10(82)
<$v>
<lo>D-Bells
<bl>
<>

<id>B259.83
<ma>J. Archbutt & Sons, 20 Bridge Road, Lambeth
<na>parallel rule, compass and rule
<sn>
<#>1
<oc>analog calculator
<fa>2-3 part
<ge>parallel rule
<cp>
<fo>
<tc>craft
<yr>ca 1850

<co>England
<s#>
<si>44x150x2 mm
<cr>
<mt>ivory
<cx>
<pt>
<hw>Buy
<so>Woburn antiques show
<$c>135(83)
<$v>
<lo>D-Bells
<bl>
<>

<id>B260.83
<ma>The Lightning Adding Machine Co. Inc., Los Angeles
<na>"The Lightning Adder"
<sn>Pascal wheel
<#>1
<oc>Digital Calculator
<fa>Single Register
<ge>Pascal Wheel
<cp>
<fo>
<tc>Mechanical
<yr>ca1950
<co>USA
<s#>
<si>350x90x45 mm
<cr>green and brown
<mt>plastic holder and metal adder
<cx>
<pt>holder, mechanism, stylus
<hw>Buy
<so>Colorado Springs
<$c>10(83)
<$v>
<lo>D-Bells
<bl>See 150.80 and 96.80.
<>

<id>B261.83
<ma>The University of Illinois Press
<na>"Calculating Instruments and Machines" by Douglas R. Hartree, Plummer Professor of Mathematical Physics, University of Cambridge
<sn>Book
<#>1
<oc>
<fa>
<ge>
<cp>
<fo>
<tc>
<yr>1949
<co>USA
<s#>
<si>174x260x17 mm
<cr>
<mt>cloth cover
<cx>138 pp., 68 illustrations, index
<pt>
<hw>Buy
<so>D. Rubinstein
<$c>60 (83)
<$v>
<lo>D-Bells
<bl>The first chapters are devoted to differential analyzers which were still being used and developed for computational needs. The last chapters discuss digital calculators starting with Babbage's analytical engine and including extensive discussions of ENIAC and the Harvard Mark I.
<>

<id>B262.83
<ma>Addiator
<na>"Arithma"
<sn>
<#>2
<oc>Digital Calculator
<fa>Single Register
<ge>Pascal Strip
<cp>

<fo>
<tc>Mechanical
<yr>ca 1935
<co>Germany
<s#>
<si>155x40x3 mm
<cr>Black and red
<mt>aluminum
<cx>
<pt>case, stylus, instructions, and instrument
<hw>Buy
<so>Colorado Springs; NE Trade Center
<$c>6(83) 10(87)
<$v>
<lo>D-Bells
<bl>See description Winter 1987 Museum Report.
<>

<id>B263.83
<ma>Globe Ticket Company, 4201 Brighton Blvd, Denver, Co.
<na>
<sn>punch card
<#>3
<oc>
<fa>
<ge>
<cp>
<fo>advertisement on a calendar blotter
<tc>
<yr>March 1960, November 1961, January 1962
<co>USA
<s#>
<si>98x230 mm
<cr>
<mt>blotting paper
<cx>
<pt>
<hw>Buy
<so>Colorado Springs
<$c>3(83) each
<$v>
<lo>D-Bells

<bl>
<>

<id>B264.83
<ma>Charles Knight, Pall Mall East, London
<na>"On the Economy of Machinery and Manufactures" by Charles Babbage, Esqre A.M.
<sn>
<#>1
<oc>
<fa>
<ge>
<cp>
<fo>Book
<tc>
<yr>1831
<co>England
<s#>
<si>48x208x23 mm
<cr>Red leather binding
<mt>
<cx>With Edward Ryan's bookplate and inscribed by the author, "To Sir Edward Ryan from his friend, the Author"
<pt>
<hw>Buy
<so>The Antiquarian Scientist
<$c>750(83)
<$v>
<lo>D-Bells
<bl>
<>

<id>B265.83
<ma>
<na>Planimeter
<sn>
<#>1
<oc>Analog Calculator
<fa>two-three part
<ge>Planimeter
<cp>
<fo>
<tc>Mechanical
<yr>
<co>
<s#>
<si>290x110x20 mm
<cr>
<mt>nickel
<cx>
<pt>instrument and case
<hw>Buy
<so>Tesseract
<$c>135(83)
<$v>
<lo>D-Bells
<bl>
<>

<id>B266.83
<ma>Automatic Adding Machine Co., New York
<na>"Golden Gem Adding Machine"
<sn>Pascal strip
<#>2
<oc>Digital Calculator
<fa>Single Register
<ge>Pascal Strip
<cp>
<fo>
<tc>Mechanical
<yr>1906
<co>USA
<s#>
<si>103x80x20 mm
<cr>red and green
<mt>metal
<cx>
<pt>case and instrument
<hw>Buy
<so>NE Trade Show; Colorado Springs
<$c>15(83) 20(81)
<$v>
<lo>D-Bells
<bl>Interesting directions regarding complementary numbers and the use of the simple machine for multiplication.
<>

<id>B267.83
<ma>The Adding Pencil Co., St. Louis
<na>The Adding Pencil, Model B
<sn>
<#>1
<oc>Digital Calculator
<fa>Single Register
<ge>Pascal Wheel
<cp>
<fo>
<tc>Mechanical
<yr>ca 1930
<co>USA
<s#>

<si>10dx155 mm
<cr>Orange
<mt>Metal
<cx>
<pt>Paper instruction case and pencil
<hw>Buy
<so>Colorado Springs
<$c>19(83)
<$v>
<lo>D-Bells
<bl>
<>

<id>B268.83
<ma>Eugene Dietzgen Co.
<na>Catalogue and Price List of Eugene Dietzgen Co.
<sn>book
<#>1
<oc>
<fa>
<ge>
<cp>
<fo>
<tc>
<yr>1912
<co>USA
<s#>Ninth Edition
<si>110x158x23 mm
<cr>green
<mt>paper
<cx>555 pages, well-illustrated, index
<pt>
<hw>Buy
<so>Tesseract
<$c>39(83)
<$v>
<lo>D-Bells
<bl>Excellent section on slide rules and calulators, pp 216-236, and on planimeters, integrators and integraphs, pp 500-507.
<>

<id>B269.83
<ma>Keuffel & Esser Co.
<na>Catalogue of Keuffel & Esser Co.
<sn>book
<#>1
<oc>
<fa>
<ge>
<cp>
<fo>
<tc>
<yr>1921
<co>USA
<s#>36th edition
<si>150x227x30mm
<cr>Red
<mt>Hard bound, paper
<cx>482 pages, index, well-illustrated
<pt>
<hw>Buy
<so>Tesseract
<$c>34
<$v>
<lo>D-Bells
<bl>From 229-264, calcuators, slide rules, planimeters, pantographs, and integraphs are illustrated and explained.
<>

<id>B270.83
<ma>S.A. Main BSc
<na>Ballistic Coefficient Slide Rule
<sn>slide rule
<#>1
<oc>Analog Calculator
<fa>2-3 parts
<ge>linear slide rule
<cp>
<fo>
<tc>
<yr>ca 1910
<co>USA
<s#>

<si>470x78x20 mm
<cr>yellow
<mt>Wood, paper, ivory and brass slide
<cx>hand lettered in red and black
<pt>
<hw>Buy
<so>
<$c>145
<$v>
<lo>D-Bells
<bl>Top scale is the ballistic coefficient; bottom is coefficient of form; center sliding scale has weight in pounds nad diameter in includes. Instructions: with Slide set the Diameter to the Coeff of Form; with Cursor set the value of Theta to the Weight; Read off Ballistic Coeff against Value of T. Reservse side has two sliders. Top stationery rule is ballistic coefficient. Slider has range-yards; time of flight-seconds; height of vertex - fee; angle of elevation or descent. Stationery rule has velocity reduced time in seconds. Slider has velocity and reduced elevation and reduced angle of descent. Bottom stationery rule has velocity. "Designed by S.A. Main, B.Sc.
<>

<id>B271.83
<ma>DeMarre
<na>Ballistic Slide Rule
<sn>Slide Rule
<#>1
<oc>Analog Calculator
<fa>2-3 parts
<ge>Linear Slide Rule
<cp>
<fo>
<tc>
<yr>ca 1910
<co>USA
<s#>
<si>420x70x15 mm
<cr>yellow
<mt>Wood, paper, brass
<cx>Hand written lettering

<pt>
<hw>Buy
<so>
<$c>145
<$v>
<lo>D-Bells
<bl>Designed for solving DeMarre's Formula:

$$T^{7} = \frac{W^{.5}\,V}{D^{.75}} \times \frac{1}{\log^{-1}\ 3.00945}$$

Top scale has plate thickness; slider has striking velocity in foot/seconds and diameter of shot in inchdes; bottom scale has weight of shot in pounds. Sliding cursor has two more scales that are not identified.
<>

<id>B272.83
<ma>A Toyes, Chex Sainton, Pere et Fils, Imprimeurs du Departement
<na>Tables de Comparaison entre les Mesures Anciennes usitees dan le Departement de L'Aube, et celles qui les remplacent dans le
nouveau System metrique, avec des observations sur les Mesures locales et l'explication a l'usage des Tables. Suivies du vocabulaire des nouvelles Mesures, de Notions elementaires sur le nouveau systeme.
<sn>book
<#>1
<oc>
<fa>
<ge>
<cp>
<fo>
<tc>
<yr>1800
<co>France
<s#>
<si>125x200x10 mm
<cr>
<mt>paper

<cx>120 pp. sheep-backed boards
<pt>
<hw>Buy
<so>Jonathan Hill
<$c>100
<$v>
<lo>D-Bells
<bl>May be a first edition. A rare explication of the new metric system.
<>

<id>B274.83
<ma>William Jones
<na>(Edmund Gunter), The Description and Use of the Sector. The Crosse-staffe and other instruments. For such as are studious of Mathematicall practise. and Canon Triangulorum or tables of Artificiall Sines and Tangents to a Radius of 10000,0000 parts, and each minute of the Quadrant.
<sn>Book
<#>1
<oc>
<fa>
<ge>
<cp>
<fo>
<tc>
<yr>1624
<co>England
<s#>
<si>135x177x40 mm
<cr>
<mt>Leather and paper
<cx>First edition, 2 parts with the engraved title depicting the use of the istruments. Engraved plate of rules after the title, woodcuts in the text, signature A misbound after B, lower fore-edge corners of first few leaves worn, wormhole through some 40 leaves.
<pt>
<hw>Buy
<so>Harriet Wynter Ltd
<$c>400
<$v>

<lo>D-Bells
<bl>
<>

<id>B275.83
<ma>Nystrom, J.W.
<na>A Treatise on Screw Propellers and their Steam Engines, also A full Description of a Calculating Machine
<sn>
<#>1
<oc>Analog Calculator
<fa>2-3 parts
<ge>Circular slide rule
<cp>
<fo>Book
<tc>
<yr>1852
<co>USA
<s#>
<si>
<cr>
<mt>
<cx>
<pt>
<hw>Buy
<so>Jeremy Norman
<$c>350
<$v>
<lo>D-Bells
<bl>Plate XXXII has a drawing of Nystrom's calculating machine that he said was exhibited at the Franklin Institute Exhibition in 1849. Pages 179-229 give a complete description of the calculator.
<>

<id>B276.83
<ma>Saxton, E.
<na>Saxton's Logs for Four-place Work. Table and Text
<sn>Book
<#>1
<oc>
<fa>

<ge>
<cp>
<fo>
<tc>
<yr>1908
<co>USA
<s#>
<si>100x290x10 mm
<cr>
<mt>paper
<cx>
<pt>Case and book
<hw>Buy
<so>JOe Stamps
<$c>36
<$v>
<lo>D-Bells
<bl>
<>

<id>B277.82
<ma>Briggs, Henry
<na>Arthmetica Logarithimica
<sn>book
<#>1
<oc>
<fa>
<ge>
<cp>
<fo>
<tc>
<yr>1624
<co>England
<s#>
<si>
<cr>
<mt>
<cx>1st edition
<pt>
<hw>Buy
<so>Antiquarian Scientist
<$c>1300

<$v>
<lo>D-Bells
<bl>
<>

<id>B273.82
<ma>Newton, John
<na>Trigonometria Britanica and A Table of Logarithms to 100,000 with Artifical Sinces and Tangents
<sn>Book
<#>1
<oc>
<fa>
<ge>
<cp>
<fo>
<tc>
<yr>1658
<co>
<s#>
<si>
<cr>
<mt>
<cx>
<pt>
<hw>Buy
<so>Antiquarian Scientist
<$c>675
<$v>
<lo>D-Bells
<bl>
<>

<id>B279.83
<ma>Vlacq
<na>Trigonometria artificialis
<sn>Book
<#>1
<oc>
<fa>
<ge>
<cp>

<fo>
<tc>
<yr>1633
<co>England
<s#>
<si>
<cr>
<mt>
<cx>
<pt>
<hw>Buy
<so>Antiquarian Scientist
<$c>600
<$v>
<lo>D-Bells
<bl>Vlacq (1600-1667) of Gouda, the illustrious successor of Napier, lived in London and then in Paris as a bookseller and publisher, but was driven out and returned to Holland. This work contains his treatise of 52 pages on plane and spherical triangles and his table on trigonometry as well as the table of logarithms of numbers.
<>

<id>B280.83
<ma>Good, J.
<na>Measuring made Easy: or the Description and Use of Coggeshall's Sliding Rule
<sn>
<#>1
<oc>Analog Calculator
<fa>2-3 part
<ge>Coggeshall Slide Rule
<cp>
<fo>Book
<tc>Craft
<yr>1744
<co>England
<s#>
<si>
<cr>
<mt>
<cx>96 pages, several fold outs

<pt>
<hw>Buy
<so>The Antiquarian Scientist
<$c>275
<$v>
<lo>D-Bells
<bl>
<>

<id>B283.78
<ma>Casio
<na>Mini Card fx-48 Scientific Calculator
<sn>
<#>1
<oc>Digital Calculator
<fa>
<ge>
<cp>
<fo>
<tc>
<yr>1978
<co>Japan
<s#>256023
<si>90x53x3 mm
<cr>
<mt>Metal
<cx>
<pt>Case, instruction book, unit conversion table, physical constants table, calculator
<hw>Buy
<so>
<$c>
<$v>
<lo>D-Bells
<bl>
<>

<id>B284.83
<ma>Commodore US*14
<na>Digital Calculator
<sn>
<#>1

<oc>Digital Calculator
<fa>
<ge>
<cp>
<fo>
<tc>
<yr>ca 1970
<co>USA
<s#>11619
<si>195x290x75 mm
<cr>Black and White
<mt>Plastic case, transistors
<cx>
<pt>Cord and calculator
<hw>Buy
<so>
<$c>3 (83)
<$v>
<lo>S-Under vestibule-Bells
<bl>
<>

<id>B285.83
<ma>HDC Industries
<na>"Human Digital Calculator: Add'em up Finger Machine"
<sn>
<#>1
<oc>
<fa>
<ge>
<cp>
<fo>
<tc>
<yr>ca 1980
<co>USA
<s#>
<si>140x88x2 mm
<cr>Red and White
<mt>Cardboard
<cx>
<pt>
<hw>Buy

<so>
<$c>
<$v>
<lo>D-Bells
<bl>
<>

<id>B286.70
<ma>M.V. Wilkes, D. J. Wheeler, and Stanley Gill
<na>Programs for and Electronic Digital Computer, Addison Wesley Publishing Company
<sn>
<#>1
<oc>
<fa>
<ge>
<cp>
<fo>
<tc>
<yr>1951
<co>USA
<s#>Second Edition, 1957
<si>160x233x19 mm
<cr>
<mt>Paper
<cx>238 pp
<pt>
<hw>Buy
<so>
<$c>
<$v>
<lo>D-Bells
<bl>
<>

<id>B287.55
<ma>Richard Stevens Burrington
<na>Handbook of Mathematical Tables and Formulas, Handbook Publishers, Inc. Sandusky, Ohio
<sn>Book
<#>1
<oc>Memory
<fa>
<ge>
<cp>
<fo>
<tc>
<yr>1933
<co>USA
<s#>Reprinted with corretions, 1953
<si>137x200x20 mm
<cr>Navy blue
<mt>Paper
<cx>296 pp. index
<pt>
<hw>Buy
<so>
<$c>
<$v>
<lo>D-Bells
<bl>
<>

<id>B288.83
<ma>Wolverine
<na>Adding Machine
<sn>Calculator
<#>1
<oc>Digital Calculator
<fa>Single register
<ge>Pascal strip
<cp>
<fo>
<tc>
<yr>ca 1935
<co>USA
<s#>
<si>135x225x105 mm
<cr>Red, Blue, Cream
<mt>Tin
<cx>
<pt>
<hw>Buy
<so>
<$c>
<$v>
<lo>D-Bells
<bl>Patent 2243884
<>

<id>B289.79
<ma>Designsense, Inc., Atlanta, Ga.
<na>"mileage minder"
<sn>circular slide rule
<#>1
<oc>Analog Calculator
<fa>2-3 parts
<ge>circular slide rule
<cp>
<fo>
<tc>
<yr>1979
<co>USA
<s#>
<si>195x108x2 mm
<cr>Black, red and white
<mt>Paper and aluminum
<cx>
<pt>Instructions and instrument
<hw>Buy
<so>Jordan Marsh
<$c>5 (79)
<$v>
<lo>D-Bells
<bl>The left rule with input of odometer start and odometer end shows miles driven. The right rul inputting midles driven and miles per gallon, shows gallons used.
<>

<id>B290.83
<ma>Simplex
<na>"Simplex Typewriter Model A"
<sn>Typewriter
<#>1
<oc>
<fa>
<ge>
<cp>
<fo>
<tc>
<yr>ca 1940
<co>USA
<s#>
<si>170x120x75 mm
<cr>Red, yellow and blue
<mt>Tin
<cx>
<pt>Box, instructions and typewriter
<hw>Buy
<so>
<$c>
<$v>
<lo>D-Bells
<bl>Model A prints 36 characters, on 6 inch paper and cost $1.00; Model C, 42 characters on 7 inch paper and cost $1.50; Model D prints 68 characters both capital and small on 7 inch paper and cost $3.00; and Model E prints 72 characters capitals and small letters on 8 inch paper and cost $4. Sold as "useful where speed of pen suffices and carbon capy is not needed. They fascinate and teach children. Their Elders find them useful."
<>

<id>B291.83
<ma>Barron's Educational Services, Inc., Woodbury, NY
<na>"Metric Converter"
<sn>Slide rule
<#>1
<oc>Analog Calculator
<fa>2-3 parts
<ge>slide rule
<cp>
<fo>
<tc>
<yr>1976
<co>USA
<s#>
<si>212x82x2 mm
<cr>red, orange, and yellow on white
<mt>cardboard
<cx>
<pt>
<hw>Buy
<so>
<$c>
<$v>
<lo>D-Bells
<bl>
<>

<id>B292.83
<ma>
<na>Typewriter
<sn>
<#>1
<oc>
<fa>
<ge>
<cp>
<fo>
<tc>
<yr>ca 1900
<co>
<s#>
<si>
<cr>
<mt>Wooden case and base, steel, tin, rubber
<cx>
<pt>case and machine
<hw>Buy
<so>Margaret Weiner Kennedy
<$c>150 (83)
<$v>
<lo>D-Bells
<bl>No maker yet this was manufactured.
<>

<id>B293.83
<ma>IBM
<na>plug board for 911
<sn>
<#>1
<oc>
<fa>
<ge>
<cp>
<fo>
<tc>
<yr>
<co>USA
<s#>Type 911, #121854
<si>290x170x30
<cr>
<mt>Stainless steel, plastic coated plugs
<cx>
<pt>Board and plugs
<hw>Buy
<so>Computer Museum
<$c>-
<$v>
<lo>D-Bells
<bl>
<>

<id>B294.83
<ma>DEC
<na>PDP-10 Cable connector
<sn>
<#>1
<oc>
<fa>
<ge>
<cp>
<fo>
<tc>
<yr>
<co>
<s#>
<si>
<cr>
<mt>
<cx>
<pt>
<hw>
<so>
<$c>
<$v>
<lo>D-Bells
<bl>
<>

<id>B295.83
<ma>DEC
<na>UART
<sn>
<#>1
<oc>
<fa>
<ge>
<cp>
<fo>
<tc>
<yr>1979
<co>
<s#>
<si>132x215x2 mm
<cr>green board
<mt>
<cx>
<pt>
<hw>
<so>
<$c>
<$v>
<lo>D-Bells
<bl>
<>

<id>B296.83
<ma>DEC
<na>Core plane
<sn>
<#>1
<oc>Memory
<fa>
<ge>
<cp>
<fo>
<tc>
<yr>1974
<co>
<s#>
<si>208x265x20
<cr>
<mt>
<cx>
<pt>
<hw>
<so>
<$c>
<$v>
<lo>D-Bells
<bl>Late PDP-11 core plane.
<>

<id>B297.83
<ma>DEC
<na>modules
<sn>
<#>3
<oc>
<fa>
<ge>
<cp>
<fo>
<tc>Transistor
<yr>1960
<co>USA
<s#>
<si>43x43x170 mm
<cr>
<mt>
<cx>
<pt>
<hw>
<so>
<$c>
<$v>
<lo>D-Bells
<bl>
<>

<id>B298.83
<ma>George Fisher
<na>Arithmetic in the Plainest and most Consise Methods Hitherto Extant, Peter Brynberg, London
<sn>book
<#>1
<oc>
<fa>
<ge>
<cp>
<fo>
<tc>
<yr>1800
<co>
<s#>
<si>160x96x30 mm
<cr>
<mt>leather binding
<cx>
<pt>
<hw>Buy
<so>
<$c>55 (83)
<$v>
<lo>D-Bells
<bl>
<>

<id>B299.80
<ma>Monroe
<na>"Monroe"
<sn>calculator
<#>1
<oc>Digital Calculator
<fa>3-4 registers
<ge>
<cp>
<fo>
<tc>
<yr>ca 1950
<co>USA
<s#>Model LA7-160; #J716387
<si>190x150x280 mm
<cr>grey
<mt>
<cx>
<pt>
<hw>Buy
<so>
<$c>25 (80)
<$v>
<lo>D-Bells
<bl>
<>
9:45 AM
July 14, 1978 - Arrived

Turned keys of el cheapo Avis Toyota over to faithful chauffeur, companion Kato (Brig) and he drove us like a mad man to Kuilima Hyatt Resort Hotel, Kahuku, Oahu, Hawaii 96731, through the pineapple fields. The time was 7 local and 1 AM (Boston). Had our fourth meal of the day and crumped out at 8. Rose at 6 (Brig at 7), had a camping breakfast, did the news, read the rest of Dan's work he sent, went swimming/snorkling (visibility poor, scenes dull), got set for visit to Kahuka Farms - a place I have some (ill-fated tax-deducted) $'s in which is supposed to raise oysters/clams, to form plankton they farm by the ton. Set for scuba this afternoon if we have the time.

Airplane ride ridded me of 1/2 the paper in my briefcase (gift to United) and obsolete book on Japan that Clayton loaned me, an outline of a paper about the future of computers (2, 5-10) in case I write it for Justice Department, and allowed reading 100+ pages of Reischauer - The Japanese. The later seem most fascinating. It was necessary to watch a movie (House Calls - Walter Mathau) to break the monotony of 11 hours of flying and now have only a little more industrial background information to read. (The Reischauer book is a "must read" for everyone whose life the Japanese impinge).

7:30 PM
We visited the Kahuka Farms Agriculture Farm where we saw plankton being harvested and many oysters growing in what used to be an airfield. The engineering problems of sea farming are enormous -- the old problem: everything corrodes. We were impressed at the progress, delighted to hear that the president now has a chief executive, who's a construction engineer, to run the place and worried about the same old issue. The dream expands faster than their ability to get the profit and make a go of it. I have no doubt that the scheme will work very well. It will, but the ability to manage the dream is the problem. I reviewed a consultant's report which was favorable; but even I, dumb engineer , could poke holes in the financial part (consistency, depreciation, maintenance). Somehow there needs to be more of a hard-ass financial person closer to this. The flaky tax situation of tax write offs for farms places an unrealistic magnet for capital -- this is wrong. It ultimately has to fly on its own. The government playing god moses again and makes for more unrealism.

The windmill I recommended he not get has run one year and fallen apart with corrosion. I recommended he not get a computer to control the water flow into the plankton. Somehow, there needs to be a first rate intellectual attached to the project who worries about the engineering (i.e., hours off (sun light)=plankton/liter, the diffusion equations for oysters, clams, prawns, etc. when fed this way.) I recommend that Rod Harrington at Purdue (the only Ag. Engineer I know) come get involved. It's a beautiful problem. (We topped morning off with two each, very fat oysters!) We ate buffet at lunch and fully stuffed ourselves after the spartan breakfast and oyster appetizers.

In the afternoon Brig and I went to another unspellable, unpronounceable, 20-minute away tour, rented scuba gear and drove back about 1/2 way and had a nice long dive. We got out of the water - he had 1200# left, I about 600. We were somewhat cold; I was tired since it was first dive in two years. The place was Bojacs in Haleiwa. It's an easy dive off the beach. No colored coral, some urchins, many of the fish of the caribbean, but lots of nice caves to swim in and out of. Took the equipment back, got our dive cards back, which they kept as equipment deposits, got an ice cream cone (reasonable quality - about Brigham's level) and then started back. Stopped at a local place (previously recommended) and had an earlier dinner -- which we shouldn't have. (We should have got our bodies to an 8+ (5 in Japan) dinner hour. We'll pay tomorrow! Shopped for fresh pineapple which we bought at slightly higher than mainland prices; got Brig some milk for breakfast. This time a pretty elegant one.

The main thing we can be thankful about is the lack of sunburn -- we got some fancy (expensive) filter water-insoluble cream. We were only in water/sun a couple of hours.

The hotel is the usual American obsenity (could be anywhere) -- a real energy pig. Lots of architecty incandesent lights, fully air conditioned even though its only 70-80, and lots of wind. (We've kept our room open) it overlooks a gorgeous cove and the noise is great as waves break on the beach.

October 23, 1979

Mr. Archie J. McGill
Vice President, Business Marketing
American Telephone and Telegraph Company
295 North Maple Avenue
Basking Ridge, New Jersey 07920

Dear Mr. McGill:

I'm sorry I wasn't able to meet you when you visited Digital several months ago in regard to ACS. However, I continue to be involved in the work here and am dedicated to making it a success. Having visited Bell Labs several times this last year, I feel a basic change in attitude toward making products available sooner. Your name continues to come up as being the driver of this change, and hence I am writing this letter about my view of Teleconferencing.

We used PMS to try it out and indeed it is useful and impressive, and the only drawback is the lack of its availability. Indeed the NET&T people asked for a quote from me to publish internally. I said:

> "We used PMS for an introductory technical conference with people we hadn't met beforehand and it worked fine. It saved a day of travel time for four people and our meeting lasted 2 1/2 hours--whereas, if it had been a trip, we'd feel obliged to have the perfunctory Parkinsonian one day meeting, dinner, etc., and would not have accomplished any more.
>
> It's unfortunate that it's so hard to get access to PMS because it is badly needed. There should be an instrument to perform all the picture and voice input-output which could be rented or purchased and easily installed in any reasonable room. AT&T could then provide the electrical path and we'd all be happy."

Here, the last paragraph is significant. Having stimulated the market through PMS, we postulated that links among our engineering sites (only 30-60 minutes away, plus one in Colorado Springs) would save us lots in terms of travel, people and lost opportunity costs. We then tried to get the service from NET&T and found what we expected, no links and no rooms...in short nothing. We are still going ahead with a microwave and satellite links, and are trying to get a local firm to engineer the video console. I still feel like this is AT&T's province/responsibility to supply the equipment and links.

Can I urge you to get several firms, say GE, RCA, Sony, Hitachi to build a standard instrument which is portable, has 3-5 cameras, accepts viewgraph and paper input, provides the voice mixing, provides the 2 screen with videotape and hard copy output and which anyone can rent or buy. I trust you would also make it available as a service like current telephones. In a similar way, the lines would be supplied either by you or by others. I think AT&T could really help us be more productive, while at the same time reducing oil imports. Any chance your organization will rise to the challenge, or will it just evolve in a totally bottom-up ad hoc fashion which will ultimately have to be standardized?

Sincerely,

Gordon Bell
Vice President of Engineering

GB:swh
GB0005/25

October 22, 1979

Mr. Archie J. McGill
Vice President, Business Marketing
American Telephone and Telegraph company
295 North Maple Avenue
Basking Ridge, New Jersey 07920

Dear Mr. McGill:

Gordon Bell, Digital Equipment Corporation, says:

"We used PMS for an introductory technical conference with people we hadn't met before hand and it worked fine. It saved a day of travel time for four people and our meeting lasted 2 1/2 hours--whereas, if it had been a trip, we'd feel obliged to have the perfunctory Parkinsonian one day meeting, dinner, etc., and would not have accomplished any more.

It's unfortunate that it's so hard to get access to PMS because it is badly needed. There should be an instrument to perform all the picture and voice input-output which could be rented or purchased and easily installed in any reasonable room. AT&T could then provide the electrical path and we'd all be happy."

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:swh
GB0005/23
Attachments

B1.75EGLI & CO., 1 "MILLIONAIRE" Four Register, Automatic Stepped Wheel, Mechanical, 1903, Switzerland, 539, 17x52x28 cm, Brass, 6 digit, Buy, Dr. Margaret Kennedy, 500 (75), D-MR2.

The Millionaire was invented in 1893 by Otto Steiger and was the first direct multiplying calculator to be commercially successful. Between 1894 and 1935, 4,655 millionaires were sold.

Use. One turn of the crank automatically multiplies the accumulator by a single digit specified by a pointer in the upper left hand corner of the machine. The pointer is reset for each digit in the multiplier until the computation is complete.

B2.76 Hutton, Charles, 1 "Table of the Products and Numbers", Table, Fixed, Craft, 1781, England, 28x42x1 cm, paper, Buy, Historical Technology Inc., 68 (76), D-MR2.

Compiled in 1781 by Charles Hutton, this is an early book of mathematical tables containing the products of the numbers 1 through 1000 by the numbers 1 through 100. It also contains squares and cubes of numbers and conversion tables for units of measurement.

One of the main problems with handcrafted books is the number of errors. On one page alone, every figures is off by one thousand. With handcrafted calculating and typesetting such problems are unavoidable. Later books of talbes were done by the Difference Machine and proved more reliable.

B3.76Chevalier Charles Savier Thomas, 1 "Arithmometer", Three Register, Stepped Wheel, Mechanical, ca 1850, England, 1583, 10x18x58 cm, Brass, Wooden case, Buy, Peter Delahar Antiques, 376 (76), D-MR2.

In 1820, Chevalier Charles X Thomas of Colmar designed and introduced the first multiplication machine made commercially available for general sale. Although it was not patented until 1851, the main features of the 1820 design remained unaltered.

The mechanism has three parts, concerned with setting, counting, and recording respectively. Any number up to 999,999 may be set by moving the pointers to the numbers 0 to 9 engraved next to the six slots on the fixed cover plate. The movement of any of these pointers slides a small pionion with ten teeth along a square axle, underneath and to the left of which is a Leibniz stepped wheel.

The Leibniz wheel, a cylinder having nine teeth of increasing length, is driven from the main shaft by means of a bevel wheel, and the small pinion is thus rotated by as many teeth as the cylinder bears in the plane corresponding to the digit set. This amount of rotation is transferred through one of a pair of bevel wheels, carried on a sleeve on the same axis, to the 'results' figure wheel on the back row on the hinged plate. This plate also carried the figure wheel recording the number of turns of the driving crank for each position of the hinged plate. The pair of bevel wheels is placed in proper gear by setting a lever at the top left-hand cover to either "Addition and Multiplication" or "Subtraction and Division." The "results" figure wheel is thereby rotated anti-clockwise or clockwise respectively.

<u>Use.</u> Multiplying 2432 by 598 may be performed as follows: Lift the hinged plate, turn and release the two milled knobs to bring all the figure wheels to show zero; lower the hinged plate in its position to the extreme left; set the number 2432 on the four slots on the fixed plate; set the lever on the left to "multiplication" and turn the handle eight times; lift the hinged plate, slide it one step to the right, and lower it into position; turn the handle nine times; step the plate one point to the right again and the turn the handle five times. The product 1,454,336 will then appear on the top row, and the multiplier 598 on the next row of figures.

B4.76?, 1 Gunter Rule, 2-3 Part, Gunter Rule, Craft, ca 1800 England, 5x60x.5 cm, wood, Buy, Peter Delahar Antiques, 61 (76), D-MR2.

About 1607 Edmund Gunter devised a scale that was to be the predecessor of the modern slide rule. In 1623 he published a description of this scale that is composed of two scales of the logarithms from 1 to 10 placed end to end. Although Napier conceived of the logarithm allowing multiplication or division to be accomplished by addition or subtraction, Napier relied on look up tables.

Use. Multiplication is carried out by using a pair of dividers
to measure a distance, the multiplier, along the rule and add it to another distance, the multiplicand, forming the combined distance, the product, on the rule. The accuracy of an answer is limited by the length of the rule and the user's ability to resolve a number.

B5.76Stanley, 1 "Fuller's Spiral Slide Rule", Spiral, 2-3 part, Slide Rule, Craft, 1902, England, 9x9x33 cm, Cardboard, Mahogany, Brass, Screw on handle, case, Buy, Historical Technology Inc, 138 (76), D-MR2.

Designed in 1878 by Professor George Fuller, the logarithmic line is arranged spirally on the surface of a cylinder. The logarthmic line is in 50 turns, giving a working length of 41 feet 8 inches. All numbers of four figures either have a mark upon the scale or are midway between two marks, so that results accurate to four figures are easily obtained.

Use. By means of movable cylinders any length of spiral line
may be at once transferred to any other part of the scale, and multiplications and divisions containing a series of factors can be worked with facility. Logarithms of numbers are given by means of a scale on the longer index arm together with a circular scale on the first cylinder, so that powers and roots are obtainable. The surface of the middle cylinder bears printed tables of decimal equivalents, natural sines, etc.

B6.76J. Sang, 1 "Platometer" Planimeter, Multiple part, Areal Measure, Mechanical, ca 1860, England, 9x15x37 cm, Brass, Wooden case, magnifying glass, Buy, Peter Delahar Antiques, 355 (76), D-MR2.

This instrument for directly measuring an area bounded by an irregular curve is based on an idea developed by the Bavarian engineer J M Hermann in 1814. The first commercially successful devices were made by Ernst of Paris. In 1851, John Sang of Kirkcaldy invented and made a "platometer" resembling the planimeter of

Ernst.

U<u>se.</u> Operation is based on continuous integration. A curve
is traced using the pointer, with the area read off on the dial after the complete perimeter has been traversed. As the pointer is moved the rollers that measure distance on the conical shaft calculate the product of the vertical distance times the horizontal distance. As a curve is traversed in a clockwise direction, the top area is integrated in a positive direction. On the return trip the integration is negative and the net value is provided.

B7.76Burroughs, 1 "Burroughs Model 5", Two Register, Keyed Wheel, Mechanical, USA, 5-146-1088, 28x25x12 cm, Black, Metal,, Buy, City Office Equipment, 10 (76), ?.

B8.76Burroughs, 1 "Burroughs" Single Register, Keyed Wheel, Mechanical, USA, A342273, 18x25x27 cm, , Buy, City Office Equipment, 10 (76), D-MR2.

B9.76Felt & Tarrant Manufacturing Co., 1 "Comptometer", Single Register, Keyed Wheel, Mechanical, 1914, USA, 37x28x15 cm, Green, Metal, Buy, City Office Equipment Co, 10 (76), D-MR2.

The Comptometer was invented in 1887 by Dorr E Felt of Chicago and claims to be the first successful key-driven adding and calculating machine.

<u>Use.</u> For each digit a push button from 1 to 9 is selected which rotates a Pascal-type wheel with the corresponding number of increments. Numbers are subtracted by adding the complement (shown in smaller numbers). The carrying of tens is accomplished by power generated by the action of the keys and stored in a helical spring, which is automatically released at the proper instant to perform the carry.

Through effective marketting and training of skilled operators
versed in complement arithmetic at Comptometer Schools, these machines became the workhorse of the accounting

profession in the first part of the century. They never successfully advanced into the electro-mechanical era, but remained purely mechanical, two-function adding and subtracting machines.

B10.76Monroe Calculating Machine Co., 1 "Monroe Electric Calculator No. 1", Three Register, Keyed Rotary, Electro-Mechanical, USA, 336948, 38x31x24 cm, Buy, City Office Equipment, 10 (76), W-Bells.

B11.76Monroe Calculating Machine Co., 1 "Monroematic" Four Register, Automatic Keyed Rotary, Electro-Mechanical, USA, 506781, 18x23x34 cm, Gray, Metal, Buy, City Office Equipment, 10 (76), D-MR2.

B12.76Friden, 1 "Friden Calculator Model D-8", Four Register, Automatic Keyed Rotary,, Electro-Mechanical, USA, 202762, 38x26x20 cm, Buy, City Office equipment, 10 (76), W-Bells.

B13.76Monroe, 1 "High Speed Adding Calculator", Three Register, Keyed Rotary, Electro-Mechanical, USA, 15x25x24 cm, Black, Buy, City Office Equipment, 10 (76), D-ML12-1.

B14.76Burroughs, 1 "Burroughs Adding Machine Model A", Two Register, Keyed Wheel, Mechanical, USA, A605824, 22x15x12 cm, Black, Metal, 5 Digit, Buy, City Office Equipment, 10 (76), D-MR2.

B15.76Underwood, 1 "Standard Typewriter No. 5" Typewriter, Mechanical, USA, 22x30x30 cm, Buy, City Office Equipment, 10 (76), D-ML12-1.

D16.76IBM, 1 "IBM" Typewriter, Electro-Mechanical, USA, 112-42085, 26x44x40 cm, Gray, Justowriter Corp On Motor Housing, Buy, City Office Equipment, 10 (76), D-ML12-1.

B17.78 EGLI & CO., 1 "Millionaire", Four Register, Automatic Stepped Wheel, Mechanical, ca 1910, Switzerland, 1523, 18x29x76 cm, Brass, 10 Digit, Buy, George Nelson, 275 (78), W-ML12-1.

See B1.75

B18.78Stone, Edmund, 1 "The Construction and Principal Uses Of Mathematical Instruments", Multiple part, Book, Craft, 1758, England, 34x23x4 cm, Paper, 1972 reprint Edition of 500, Buy, Historical Technology Inc, 42 (78), D-Gordon's office.

THE CONSTRUCTION AND PRINCIPAL USES OF MATHEMATICAL INSTRUMENTS. Translated from the French of M. Bion. To which are added, the construction and uses of such instruments as are omitted by M. Bion, particularly of those invented or improved by the English. 1972 reprint of the 2nd Edition of 1758 that includes a supplement containing a further account of some of the most useful mathematical instruments. A folio size book with 325 numbered pages and 30 full page plates. "This is the best English edition, of the best early 18th century book ever published on the design and use of scientific instruments." S. Moskowitz (catalog 117, fall 1978).

B19.78?, 1 Drawing Instruments, Fixed, Rule, Parallel rule, Compass, Craft, England, 20x11x4 cm, Steel & Brass, Fitted velvet & leather Case, Buy, Historical Technology Inc., 80 (78), D-Gordon's Office.

Cased English drawing instruments made in the second half of the 19th century. Brass and steel instruments, ruling pen with ivory handle; 13 separate items in lift-out tray. Small boxwood rule in space below. Rosewood veneered case and instruments in fine condition except that the large compass is missing its pivot locking nut and the brass has become a bit dull.

B20.78W.H. Harling, 1 Rolling Parallel Rule, Parallel Fixed, Rule, Craft, ca 1890, England, 4x33x8 cm, Steel, Walnut Case, Buy Historical Technology Inc., 75 (78), D-Gordon's Office.

Cased presentation of an English rolling parallel rule. Pasted to the inside cover is the presentation certificate, "Bradford Technical College Prize Awarded to Fred Inman at the Annual Examination, 1893, by order of the Lords of the Committee of Her Majesty's most honourable privy council on education."

B21.78?, 1 Navigator's Sector, 2-3 Part, Sector, Craft, England, 33x6x1 cm, Boxwood With Brass Hinge, 21 Scales On both Sides and Outside Edges, Buy, Historical Technology Inc., 465 (78), D-MR2.

The sector is used to solve problems of proportion and works on the principle of similar triangles. Sectors were made with a variety of scales for use in calculation by navigators, surveyors, gunners, and draughtsmen. At first sight they look like a jointed rule usually made of ivory, brass, wood, or sometimes silver. First described by both Galileo in Italy and Thomas Hood in England the sector was in use by 1600.

Use. A pair of dividers is necessary to read the relationships on all sectors. This instrument is marked: "Chords, Sec, Lines, Tangents, tan, Ver Sine, Sines, & Num." The scale layout permits this sector to be used as a Gunter rule as well, although it is not laid out to follow any of the five editions of Gunter, but is close to the example in Stone (B18.78).

B22.78Burroughs Adding Machine Company, 1 "Burroughs" Single Register, Keyed Wheel, Mechanical, ca 1920, USA, A335701, 15x30x25 cm, Black, Metal, Complement Arithmetic Nine Digits, Buy, City Office Equipment, 10 (78), D-Bells.

B23.78 Friden, 1 "Friden Model 132" Four Register, Automatic Keyed Rotary, Transistor, USA, 3235, 26x45x54 cm, D-ML12-1.

B24.78?, 1 Parallel Rule Parallel, Fixed, Rule, Craft, ca 1870, 45x6x1 cm, Rosewood and Brass, Buy, 45 (78), D-Bells.

B25.78 DG Marketing Ltd, 1 "International Metric Converter", Table, Manipulable, Craft, 1978, Hong Kong, 10x8x6 cm, Black, Plastic, Buy, 5 (78), D-Bells.

B26.79?, 1 Soroban, Single Register, Bead, Manual, 4x11x29 cm, D-MR2.

B27.79?, 1 Napier's Bones, Table, Manipulable, Craft, ca

1700, England, 8x6x2 cm, Wood, Bones and Box, Buy, Historical Technology Inc., 1732 (79), D-MR2.

These small instruments for facilitating the multiplication and division of large numbers were invented by John Napier, Laird of Merchiston in Scotland, and are described in his RABDOLOGIAE, published in 1617. He wrote that the multiplication and division of great numbers is troublesome, involving tedious expenditure of time, and subject to "slippery errors." His tables reduced these difficulties to simple addition and subtraction, and won immediate recognition. A set of Napier's bones are usually made of boxwood or ivory and often contained in a box or case that would fit in a pocket. A set usually contains 10 rods, plus extras representing squares and cubes.

Use. Addition is accomplished by reading the appropriate bones
along the diagonal. To obtain a product of 224 x 44, the rods 2, 2, and 4 are put alongside each other, and the result is read off by combining the numbers in the fourth row -- 0/8, 0/8, 1/6 -- for the correct answer 896. This is repeated and the two products added together to give 9856. The bones are sometimes associated with an abacus to provide a store in the multiplication process.

B28.79Chemical Rubber Publishing Co., 1 "Handbook of Chemistry and Physics, 31ST Ed", Fixed, Table, Mechanical, 1949, USA, 19x13x8 cm, D-MR2.

B29.77KEUFFEL & ESSER 1 "Thatcher's Calculating Instrument 4012", Spiral, 2-3 Part, Slide Rule, Craft, ca 1920, USA, 5106, 13x13x63 cm, Wood, Varnished Paper, and Brass, Instrument and Wood Case, Buy, Historical Technology Inc, 510 (77), W-Bells.

Patented in 1881 by Edwin Thatcher, an 1884 instruction book notes, "The originary rule in use is 12 inches long, with radii of 11 and 5 1/2 inches, the divisions of which are cut by hand, copying from a machine divided plate. In the present instrument the radii are 60 and 30 feet, the divisions of which are printed directly from machine divided plates. Those plates contain over

33,000 divisions, calculated to seven places of decimals from Babbage's tables by using a common multiplier, every line being subjected to correction for error of screw and temperature variations, so that possibly every line center is within .0001 inch of its true place."

The instrument consists of a cylindrical slide, which admits of both rotary and longitudinal movement within an open metallic framework of 20 equidistant triangular bars. The bars are connected to rings at their ends which admit rotation within standards attached to the base. Upon the slide are wrapped two complete logarithmic scales, each of which is divided into 40 parts of length equal to half that of the slide. The parts follow each other in regular order around the cylinder, and the figures and divisions which constitute any part of the right are repeated on the left, one line in advance.

Use. By the rotary and longitudinal movement of the slide any
of its divisions may be brought opposite to or in contact with any division on the fixed scales. The divisions on the upper lines are transferred to the slide by means of a pointer fitting over the bars, which is also convenient for retaining the position of any division on either line while the slide is being revolved into the required position. Near the commencement of each scale on the slide is a heavy black mark designed to catch the eye readily during the rapid movement of the parts.

B30.77L.&I.D., 1 Timber Calculating Slide RuleLinear, 2-3 Part, Slide Rule, Craft, ca 1800, England, 60x5x1 cm, Boxwood, Buy, Historical Technology Inc., 120 (77), D-MR2.

Use. On one side, the A line on the rule and the B and C lines on the slider are each numbered twice from 1-10, reading from left to right. The fourth line E is inverted, and is so arranged that 144 is opposite 1 and 10 on the A line. So that if length in feet on E be set opposite thickness in inches on C, the volume in cubic feet is read off on B opposite width in inches on A. The B line is subdivided into tenths, while the A, C, and E lines are subdivided into fourths. On the other side of the rule are A, B and C lines with the girt line (marked

D) numbered from 4-40 and bearing various gauge points. The A and D lines are subdivided into fourths. The two edges of the rule bear scales of inches divided into quarter-inches.

B31.79 Selective Educational Equipment Corp, 1 "SEE CALCULATOR", Single Register, Pascal Wheel, Mechanical, 1968, USA, 18x4x1 cm, , Buy, Selective Educational Equipment Corp, 3 (79), D-MR2.

A small replica of the Pascal-type adder made to illustrate the mechanism. For a descriptionn of the original Pascal machine see B150.80.

B32.52KEUFFEL & ESSER, 1 "Slide Rule 689", Linear, 2-3 part, Slide Rule, Craft, ca 1950, USA, 848689, 32x6x1 cm, Rule and Leather Case, Buy, D-MR2.

B33Casio, 1 "Casio Mini Card Calculator" Five or More Registers, Computer-controlled, IC, Japan, 5x8 cm, Calculator and Case, Buy, D-MR2.

B34.79Hewlett Packard, 1 "HP-35" Pocket Calculator, Five or More Registers, Computer-controlled, IC, USA, 3x8x16 cm, Buy, D-MR2.

The HP-35 was the first hand-held scientific calculator small enough to fit in a pocket. It is something of a miniaturized version of earlier desk top scientific calculators such as the Friden. A microprocessor is programmed to carry out the calculator's functions.

Use. Functions include logarithms, exponentials, trigonometric, decimals, scientific notation, and degrees and radians are used. Reverse Polish notation replaces conventional parenthesis.

B35.79Aluminum Housewares Co. Inc., 1 "Fairgrove Adder", Single Register, Pascal wheel, Mechanical, 1975, Hong Kong, 2x5x10 cm, Plastic, Buy, 2 (79), D-Gordon's Office.

B36.79?, 1 "EXACTUS", Single Register, Pascal Strip, Mechanical, ca 1950, England, 7x11x.5 cm, D-MR2.

A linear form of the simple Pascal two function calculating device that uses complement arithmetic. See also B150.80.

Use. Addition or subtraction is carried out by dialing the
numbers starting with the least significant. A carry is performed by moving the final digit around the corner to the next linear register.

B37.79Foto-mem Inc., 1 Slide RuleLinear, 2-3 part, Slide Rule, Craft, Japan, 2x14x.5 cm, D-Gordon's Office.

B38.79Precision Adding Machine Co. Inc., 1 "Quixsum Adding Machine Model C", Single Register, Pascal Wheel, Mechanical, ca 1930, USA, 2643, 7x18x48 cm, Quixsum, Case, And Stylus, Buy, D-MR2.

The Quixsum is a good example of how the stepped wheel principle of Pascal can be used to operate any special measures, not necessarily base ten. In this case it adds English units of feet and inches. See also l50.80.

Use. To add a number to the register, the appropriate digit
is dialed. The result is displayed in a notch at the top of each wheel.

B39.79Yanasa, Tokei, Keiki Co. Ltd., 1 "Geigy Pedometer", Single register, Escapement ratchet, Mechanical, Japan, 3d x1 cm, D-Gordon's Office.

B40.79 Monroe Calculating Machine Co., 1 "Monroe" Calculator, Four Register, Automatic Keyed Rotary, Electro-mechanical, USA, J421231, 15x30x26 cm, Gray, 8 Digit, Buy, 10 (79), D-Bells.

B41.79?, 1 Gunter Rule, 2-3 Part, Gunter Rule, Craft, 15x3x.5 cm, Boxwood, Buy, 22 (79), D-MR2.

See B4.76

B42.80Burroughs, 1 "Burroughs" Printing Adding Machine, Two Register, Keyed Wheel Mechanical, USA, 9A431239, 28x38x40 cm, Buy, 20 (80), D-MR2.

William S Burroughs introduced the keyboard type of adding and listing machine about 1880. It was designed to type a column of figures and then almost automatically type the sum total.

<u>Use.</u> (see British Science Museum exhibit and description)

B43.80Bing, 1 "Bing No.2" Typewriter, Mechanical, ca 1930, Germany, 15x28x38 cm, 1926 patent pending, Case and Typewriter, Buy, 25 (80), W-Bells.

B44.79 Burrington, Richard Stevens, 1 "Handbook of Mathematical Tables and Formulas", Fixed, Table, Mechanical, 1950, USA, 20x13x2 cm, William B Lehmann, D-MR2.

B45.79Sharp Corporation, 1 "Elsi MATE El-8048" Electronic Calculator Soroban, Five or More Registers, Computer-controlled, IC, 1979, Japan, 921, 30x9x2 cm, Plastic,, Buy, D-MR2.

B46.79   Royal London Co Ltd, 1 "Executive Thought Organizer", Toy, Transistor, Japan, 11d x10 cm, Plastic, D-Gordon's Office.

B47.79Hoare, Charles, 1 "The Slide Rule and How to Use It", 2-3 part, Slide Rule, Book, Craft, 1896, England, 18x11x1 cm, 7th Edition, Buy, Historical Technology Inc, 30 (79), D-MR2.

B48.79Rowning, J., 1 "Directions for Making a Machine to Solve Equations", Multiple part, Book, Mechanical, 1768, England, 22x18x2 cm, Buy, Historical Technology Inc., 95 (79), D-Gordon's Office.

This work describes the first analog computer designed to solve algebraic equations of the n'th degree expessed in the form y = a + bx + cx2 + dx3 + . . . + qxn . It was completed in 1768 by Rowning based upon the graphical method invented by A. deSegner in 1751. In 1770 an actual machine mechanized to the second degree was presented to the Royal Society, but apparently no longer exists. Rowning's instrument consists of a number of adjustable straight bars, or "rulers," centred and combined together in such a way as to occupy progressively the various positions in accordance with deSegner's graphical construction. Movement in two directions at right angles to one another is secured by means of two pairs of racks and pinions. The curve is drawn by a pencil on the underside of a piece of pasteboard supported by two adjustable bars.

Use. Segner's method consisted in finding, by graphical construction, the values of y for various assumed values of x, plotting the curve, and reading off the values of x at the points where the curve intersected the axis of x, thus obtaining the real roots of the equation. The impossible or imaginary roots were indicated by the points where the curve approached and receded from the axis of x, without reaching it.

B49.79The A. Leitz Co., 1 Planimeter Variable Ratio Polar Planimeter, Multiple part, Planimeter, Mechanical, 1900 c, Switzerland, 64567, 2x4x28 cm, German Silver and Steel, Instrument and Fitted Cloth Covered Case, Buy, Historical Technology Inc, 75 (79), D-Gordon's Office.

This instrument for measuring the area of any plane figure was invented by Professor Jacob Amsler in 1856. It is a proportional instrument in that the unit can be changed by altering the radius of the tracing arm.

Use. The weighted point is fixed and the tracing pointer guided exactly once round the outline of the figure whose area is to be measured. The difference of the readings on the graduated roller before and after this operation gives the area of the figure in units dependent on the setting of the tracing arm.

B50.79 J.S.M., 1 Navigator's Gunter Rule, 2-3 Part Gunter Rule, Craft, ca 1800, England, 60x5x.5 cm, Buy, Historical Technology Inc., -95 (79), ?.

B51.79Stanley, 1 "Fuller's Spiral Slide Rule" Spiral, 2-3

Part, Slide Rule, Craft, ca 1880, England, 33x10x10 cm, paper, wood, metal, cylindrical case and rule, Buy, Historical Technology Inc., 220 (79), D-Gordon's office.

See B5.76

B52.79 Manlove, Alliott, Fryer & Co., 1 "Boucher's calculating circle" Circular, 2-3 Part, Slide Rule, Craft, France, BUY, -275 (79), ?.

B53.80Lowry Mfg. Co., 1 "Lowry-bowyer Telemeter", Multiple Part, Mechanical, ca 1900, USA, 15x78x7 cm, Aluminum and Wood, Instrument, Mahongany Base, Cover Buy, Historical Technology, Inc., 195 (80), D-Gordon's Office.

A version of the classical trigonometer signed and dated "THE LOWRY MFG. CO./BOSTON, U.S.A./PAT. 1887, '92, '96". It has two four and a half inch compass bearing dials, one fixed at the end of the twenty-six inch long graduate slotted base plate, the other sliding, and each with graduated pivoted arms of l8 3/8" radius. It was intended for the analog solution of the plane triangle knowing two angles and included side, two sides and the included angle, or three sides. Thus it was useful for problems both of navigation and gunnery.

B54.80?, 1 Navigator's Gunter Rule, 2-3 Part, Gunter Rule, Craft, ca 1800, England, 5x60x.5 cm, Darkened Boxwood, Minor Warping And Edge Chipping, Buy, Historical Technology Inc., 155 (80), D-MR2.

See B4.76

B55.80Dring & Fage, 1 Inland Revenue Slide Rule, Four-sided, 2-3 part, Slide Rule, Craft, 1825, England, 60x5x1 cm, Boxwood, One ink Stain, Buy, Historical Technology Inc., 215 (80), D-MR2.

The rule is specially arranged for the use of excise officers and maltsters in gauging computations. Slide rules for this purpose were first devised by Thomas Everard in 1683, and modified by Vero, Leadbetter and others. In this example, four scales appear on one side and the other side is blank.

B56.80 KEUFFEL & ESSER, 1 "Thatcher's Calculating

Instrument", Spiral, 2-3 Part, Slide Rule, Craft, 1925, USA, 5870, 16d x58 cm, Wood, Brass, And Varnished Cardboard, Calculator, Case, And Magnifying Glass, Buy, Historical Technology Inc., 625 (80), D-MR2.
See B29.77

B57.80Felt & Tarrant Mfg Co., 1 "Comptometer", Single Register, Keyed Wheel, Mechanical, ca 1920, USA, J341613, 36x22x15 cm, Bronze, Metal, Buy, 75 (80), D-MR2.
See B9.76

B58.80 2 "RAILROAD TELEGRAPHER MAGAZINE",.

B59.80Fowler & Co., 1 "Fowler's Calculator" Circular, 2-3 Part, Slide Rule, Mechanical, 5660, 6d x1 cm, , Buy, Ampersand, NY, 184 (80), D-Bells.

B60.80 , "WESTERN UNION RULES AND INSTRUCTIONS" .

B61.80J.R. Bunnell, 1 Telegraph Key And Receiver, Electro-mechanical, ca 1900, USA, 10x10x20 cm, Key and Receiver, Buy, Victor, Co., 45 (80), W-MR2.

B62.80Marchant, 1 "Marchant" Four Register, Automatic Keyed Rotary, Electro-mechanical, ca 1950, USA, B-M-112311, 40x25x31 cm, Metal, Buy, 35 (80), D-MR-2.

B63.80Corona, 1 "Corona No. 3" Portable Typewriter, Mechanical, ca 1920, USA, 480206, 23x25x12 cm, Black, Metal, Carriage folds up over keyboard, Buy, 15 (80), D-Gordon's Office.

B64.80Burroughs, 1 "Burroughs" Visible Printing Adding Machine, Two Register, Keyed wheel, Mechanical, ca 1910, USA, 1-43288, Black, Metal, Bevelled Glass, and Plexi, Removable Printer, Buy Victor, Co, 250 (80), D-MR2.
See B42.80

B65.80Molle Typewriter Co., 1 "Molle No. 3" Typewriter, , Mechanical, USA, 6824, 25x28x33 cm, Black, Metal, Case and Typewriter, Buy, 35 (80), W-ML12-1.

B66.80Swift & Anderson Inc., 1 Gunnery Level, 2-3 part, Sight and Level, Mechanical, ca 1910, Lead, Brass and Glass, Buy, Ron Hoffmann, NY, 15 (80), D-Bells.

B67.80 Adler, 1 "Favorit 2" Portable Typewriter, Mechanical, ca 1940, Germany, 2103, 36x28x11 cm, Black, German Keyboard, Case and Typewriter, Gift, Burt Still, W-ML12-1.

B68.80W & E Co., 1 Telegraph Receiver and Relay, Electro-mechanical, ca 1890, USA, 10x20x12 cm, Receiver and Relay, Buy, Victor, Co., 50 (80), D-Gordon's Office.

B69.80Heath and Co. Ltd., 1 Sextant, 2-3 Part, Location-finder, Mechanical, ca 1920, England, W450, 35x25x17 cm, Certified at The National Physics Laboratory, Case and Sextant, Buy, Joe Stamps, NY, 600 (80), W-Bells.

B70.67Digital Equipment Corp., 1 PDP-6 Signed Photo, Photo, Transistor, 1967, USA, Gift PDP-6 Engineers, W-MR2.

B71.74Digital Equipment Corp., 1 PDP-8 Flip-flop R201, Logic Module, Transistor, 1966, USA, 1x15x7 cm, D-Bells.

B72.74?, 1 Vacuum Tube Logic Module M.D.Type 8, Logic Module, Electronic, 1950 USA, 108, 10x30x35 cm, D-Bells.

B73.80?, 1 Field Microscope, Mechanical, France, 5x5x15 cm, Brass, Glass, Wood, Wooden Box and Microscope, Buy, Ron HOffman, Ny, 12 (80), D-Bells.

B74.77Cohen, Harold, 4 "Amsterdam Suite", Artwork, 1977, 3 Line Drawings, 1 Colored, Framed Lithographs, Gift, Harold Cohen, D-Spitbrook.

B75.80MARX, 1 "Dial Typewriter", Toy, Mechanical, ca 1950, USA, 15x15x30 cm, Buy, J Stamps, NY, 30 (80), D-Gordon's Office.

B76.80?, 1 "BABY CALCULATOR", Single Register, Pascal Strip, Mechanical, ca 1950, USA, 1x8x6 cm, Tin, Buy, J. Stamps, NY, 24 (80), D-Gordon's Office.

See B36.79

B77.72Digital Equipment Corp., 1 PDP-11/20 Module Artwork, Artwork, Transistor, 1969, USA, 100x94 cm, Mylar in Plexi, Gift J O'Loughlin, D-MR2.

B78.80 A.B. Dick, 1 "The Edison Mimeograph No. 1", Mechanical, ca 1900, USA, 13x33x43 cm, Wood Case and Frames, Complete Cased Set with Roller Etc Buy, 75 (80), W-MR2.

B79.80JJ&EF Johnson Co., 1 Telegraph Key J-44, Electro-mechanical, USA, 12x8x4 cm, Gift, Clyde Still, D-Gordon's Office.

B80.80Trinks-brunsviga, 1 "Trinks-brunsviga" Brunsviga, Three Register, Rotary, Mechanical, ca 1940, 39329, 15x12x36 cm, Gift, Declan and Margrit Kennedy, D-Gordon's Office.

The German patent of W T Odhner, 1891, was acquired by Messrs Grimme, Natalis & Co, and was embodied in a machine known as the "Brunsviga." This example is a further adaptation and sits on a wood board that was part of a disappearring desk top.

Use. Although the machine performs multiplication by repeated
addition as in the Thomas type, the use of the Odhner wheel instead of the Leibniz toothed wheel led to a more compact design. The Odhner wheels fit very close together on the axle on the back. A setting lever, the end of which projects through a slot in the cylindrical portion of the cover plate, forms part of each wheel. If a lever is set against any figure (1 to 9) of its slot, a corresponding number of pins are made to project from its wheel. When the operating handle is turned, these pins gear with small toothed wheels of the product register, which in turn gear with the number wheels in front. The product register is mounted on a longitudinally movable carriage arranged in front of the machine, which carries a second counter for registering the multiplier or the quotient. The handle is turned in a clockwise direction

for addition and multiplication, and counter-clockwise for subtraction and division.

B81.80Bell Punch Co. Ltd., "Plus" Single Register, Keyed Wheel, Mechanical, England, A7-1783, 15x30x40 cm, Green, Metal, Model #909/C/V/504.929/A, Buy, 25 (80), D-MR2.

An electrified modification of the Comptometer. See B9.76

B82.80 C & E Layton, 1 "Tates Arithmometer", Three Register, Stepped Wheel, Mechanical, England, 1184, 10x17x58 cm, Brass and Wood, Wood Case and Brass Machine with Removable Handle, Buy, Peter Delahar Antique, 1276 (80), D-MR2.

This machine, which is of the Thomas type, embodies the modifications patented in 1884 and 1903 by S Tate, who in 1883 was the first in England to manufacture this type of calculating machine. His patents were later taken over by C and E Layton.

<u>Use.</u> See B3.76.

B83.80Metallograph Corp., 1 "Musketry Rule of 1918" Linear, 2-3 Part, Slide Rule, Craft, ca 1918, USA, 3x13 cm, Black, Metal, Neck String and Rule, Buy, Ron Hoffman, NY, 12 (80), D MR-2.

B84.79Thales, 1 "Thales Patent Calculator", Four Register, Automatic Rotary, Mechanical, Germany, S 153248, 15x30x20 cm, Gray, Metal, Buy, 50 (79), D-MR2.

A "Brunsviga" type machine made in Germany. See B80.80.

B85.78Reliable Typewriter & Adding Machine Corp., 1 "Addometer" Single Register, Pascal Wheel, Mechanical, USA, 1x5x30 cm, Black, Metal, Case, Calculator And Instruction Booklet, Buy, Historical Technology Inc., 30?(79), D-MR2.

See Bl50.80

B86.79Olivetti, 1 "Olivetti" Two Register, Keyed Wheel, Electro-mechanical, Argentina, Summa quanta 20, 15x15x30 cm, Plexi-glass, Metal, Paper Tape, Buy, City Office Equipment, 50 (79), D-MR2.

B87.79Contina Ag Mauren, 1 "Curta" Three Register, Rotary, Mechanical, Liechtenstein, 70588, 10d x12 cm, Black, Metal, Gift, Brian Randall, D-MR2.

The Curta is the ultimate example of the rotary mechanical calculator. Its small size requires better manufacturing technology than any other mechanical calulator. Model I had an 8 digit input setting, 6 digit counter, and ll digit accumulator. Model II had an 11 digit setting, 8 digit counter, and 15 digit accumlator. Prior to the electronic calculator, the Curta was the only four-digit portable calculator and as such was expecially popular for use at car rallies.

B88.80Wales the Adder Machine Co., 1 "Wales Visible Adding Machine", Two Register, Keyed Wheel, Mechanical, USA, 20x24x38 cm, Metal and Plexi Replacements for Glass, Removable Printer, Buy, City Office Equipment, 175 (80), D-MR2.

A copy of the Burroughs printing-adding machine. See B42.

B89.80Allen-wales Adding Machine Corp, 1 "Allen-wales Printing Adding Machine", Two Register, Keyed Wheel, Mechanical, USA, 77-26208, 20x20x40 cm, Black, Metal, Buy, 35 (80), D-MR2.

See B42.

B90.79Monroe Calculating Machine Co., 1 "Monroe No. 1" Three Register, Keyed Rotary, Electro-mechanical, USA, 20x25x30 cm, Metal, Buy, City Office Equipment, 10 (76), D-MR2.

B91.76Hans W. Egli, 1 "Millionaire", Four Register, Automatic Stepped Wheel, Mechanical, Switzerland, 1073, 18x29x76 cm, Brass, 8 Digit, Calculator with Stand, Buy, 1000 (79), D-MR2.

See Bl.75.

B92.80?, 1 Drafting Set, Fixed, Parallel Rule, Scale, Compass, Craft, ca 1800, England, 15x17x30 cm, Brass, Wood, Marble, Cornelius Conklin (owner), Boxed with Box of Tools, Pens, Etc., Buy, 261 (80), W-Bells.

B93.80?, 1 Abacus, Single Register, Bead, Manual, China, 22x16x3 cm, Wood, 9 Digit, Removable Wooden Backboard, Buy, 50 (80), D-MR2.

The abacus is the earliest known computing device and the first hand-held calculator. It postdated the invention of the decimal system by the Egyptians circa 3000 BC. The Greeks and Romans built and used the abacus based on Hindu-Arabic numerals.

Unlike earlier notations and devices using stones and marks,
the abacus utilizes positional notation, including the representation of zeros, differences, with capabilities for multiplication and division. The Chinese abacus has beads in groups of 5 and 2, representing decimal digits. The Japanese first modified this to 5 and 1 and then 4 and 1.

B94.80?, 1 Soroban, Single Register, Bead, Manual, 10x2x40 cm, Wood and Bamboo, 21 Digits, Buy, 22 (80), D-Bells.

B95.80?, 1 Abacus, Single Register, Bead, Manual, Taiwan, 2x4x6 cm, Green, Marble and Brass, 9 Digit, Abacus on Marble with Instruction Booklet, Buy, 7 (80), D-Gordon's Office.

B96.80Reliable Typewriter and Adding Machine Corp., 1 "Addometer" Single Register, Pascal Wheel, Mechanical, USA, 1x5x30 cm, Dark Gray, Metal and Fiber, Fiber Case and Instruction Booklet, Buy, 14 (80), D-Bells.

See Bl50.80.

B97.80 KEUFFEL AND ESSER, 1 "E.A. Sperry's Calculator"Circular, 2-3 part, Slide Rule, Craft, USA, S650, 6d x2 cm, Pocket Watch Style, Buy, 42 (80), D-Bells.

B98.80?, 1 Navigator's Gunter Rule, 2-3 part, Gunter Rule, Craft, 2x15 cm, Cream, Ivory, Buy, 60 (80), D-Bells.

See B4.76

B99.80Stanley Rule & Level Co., 1 Timber Slide RuleLinear, 2-3 Part, Slide Rule, Craft, USA, 4x30 cm, Brass and Warranted Box Wood, Buy, 38 (80), D-MR2.

See B30.77

B100.80 Stanley Rule & Level Co., 1 Timber Slide RuleLinear, 2-3 Part, Slide Rule, Craft, USA, 4x30 cm, Brass and Warranted Boxwood, Cracked, Warped and Stained, Buy, 21 (80), D-Bells.

See B30.77

B101.80MARX, 1 "Junior Typewriter", Toy, Mechanical, USA, 28x13x18 cm, Gray and Blue, Tin, Bent & Rusty, Buy, 12 (80), D-Gordon's office.

B102.80?, 1 Navigator's Sector, 2-3 Part, Sector, Craft, 4x16 cm, Cream, Ivory and Brass, Chipped, Buy, 89 (80), D-Bells.

See B21.78

B103.80Welch, 1 Teaching Slide RuleLinear, 2-3 Part, Slide Rule, Display, Craft, USA, 2x23x125 cm, Black, Masonite, With Hangers, Buy, 30 (80), W-Bells.

B104.80T.S. & J.D. Negus, 1 Parallel Rule, Fixed, Rule, Craft, 8x45 cm, Brass, Inscribed with Degrees Buy, The Packet Boat, Boston, 40 (80), D-MR2.

105.80, 1 Rolling Parallel Rule, Fixed, Rule, Mechanical, 6x46x2.5 cm, Brass, Patt. No. 160100, Wooden Case and Instrument, Buy, The Packet Boat, Boston, 90 (80), W-Bells.

B106.80, 1 Drawing Instruments, Fixed, Compass, Parallel Rule, Scale, Craft, ca 1850, England, 16x7x2.5 cm, Green, Shagreen Case, Brass, Steel, Ivory, Silver & Ebony, Fitted Case, 8 Instruments, Rule, Sector & Parallel Rule, Buy, Arthur Middleton, London, 648 (80), D-MR2.

B107.80 J Thomlinson Ltd Glasgow, 1 "Thomlinson's

Equivalent Paper Slide Scale" Linear, 2-3 Part, Slide Rule, Craft, ca 1940, Scotland, 8x58x1.5 cm, Brown, Wood, One Sided with Two Moving Rules, Buy, Peter Delahar, 43 (80), D-MR2.

This specialized rule was designed for the paper and printing industry. The A scale indicated length, B scale the breadth, and area in square inches was read off the C scale.

The D scale was used to read off translations of inches to centimeters, kilos to pounds, 480 and 500 sheet reams, and various weights of different standard paper cuts.

B108.80Dring and Fage, 1 "Leadbetter Slide Rule"Linear, 2-3 Part, Slide Rule, Craft, ca 1800, England, 31x3x2 cm, Brown, Boxwood, Four Sided Slide Rule with Slides on each Side, Buy, Peter Delahar, 84, D-MR2.

B109.80?, 1 Slide RuleCoggeshall, 2-3 Part, Slide Rule, Craft, ca 1800, England, 4x33x.5 cm, Boxwood and Brass, Hinged with Two Slides, Buy, Peter Delahar, 75 (80), D-MR2.

A modified Coggeshal type slide rule with one brass and one wood slide. Navigational scales including meridian, chords, latitudes, and hours are inscribed. Freeth and Co. Brimingham is overstamped.

B110.80 J.F. Fuller, 1 "Palmer's Improved By Fuller Computing Scale" Circular, 2-3 Part, Slide Rule, Craft, 1847, USA, 28x28x.5 cm, Cream and Black, Cardboard, "Fuller's Time Telegraph" is on the Reverse, Buy, Peter Delahar, 216 (80), D-MR2.

"Palmer's Computing Scale" patented in 1843 by Aaron Palmer was improved and produced by J.E. Fuller in 1847. This model is printed from the original Palmer plate with Fuller's name and own patent added to the engraving, done by George C. Smith, 186 Washington St., Boston. The reverse side, "Fuller's Time Telegraph" was patented by him in 1845.

Use. "Palmer's Computing Scale" was used to calculate square measures, cubic measures, timber measures, grain measures, liquid measures and interest rates from 3 percent to 10 percent on a daily and monthly basis. "Fuller's Time Telegraph" (on the reverse) was used to calculate time lapse in days or weeks between any two given dates. In concert these two measures would be useful to dealers in grain, alcohol and other commodity trading.

B112.80 Fowler & Co, 1 "Fowler's Textile Calculator"Circular, 2-3 Part, Slide Rule, Craft, ca 1900, England, 14398, 6.5d x.7 cm, Chrome, Glass, Paper, Two-sided Circular Rule, Buy, Maitland Antiques, Portobello Rd., 60 (80), D-MR2.

Short scale type of "Fowler's Textile Calculator" with two scales on one side. The other side holds a table equivalency for weft, looms, and reeds.

B113.80Lewis & Tylor, Limited, 1 "Hydralculator", Linear, 2-3 Part, Slide Rule, Craft, ca 1940, England, 7x19x.5 cm, Cream, Cardboard, One Rule on one Side, Case and Rule, Buy, Portobello Rd., 9 (80), D-MR2.

"Hydralculator", patent number 396,533, published by Lewis & Tylor Ltd., Gripoly Mills, Cardiff, the manufacturers of "underwriter" super fire fighting hose, for the use of their "Friends in the Fire Service."

Use. To find the quantity of water discharged for any given
nozzle and a known pressure, place press on scale "b" opposite nozzle on scale "a', and read discharge through window in slide. To find height of jet for given pressure and nozzle diameter, proceed as above and read opposite arrow in center of slide, the height given on scale "d" for the appropriate nozzle.

B114.80?, 1 "Circular Concise Slide Rule" Circular, 2-3 Part, Slide Rule, Craft, ca 1960, Japan, 8d cm, White, Plastic, No. 28; Reverse has Standard Equivalency Tables, Buy, Portobello Rd., 5 (80), D-MR2.

B115.80?, 1 Music Box, , Mechanical, 1980, Switzerland, 6.5dx5 cm, Plastic and Aluminum, Plays Jingle Bells, Buy, 6 (80), D-Gordon's Office.

B116.80Blickensderfer, 1 "Featherweight Blickensderfer", , Mechanical, ca 1900, USA, 153497, 25x30x13 cm, Aluminium, 501 Special Stamped on Base, Buy, Portobello Road, 120 (80), D-Gordon's Office.

The "Blick" was the first typewriter intended to be readily portable. It was designed by Georges Blickensderfer and patented in 1890 and first sold in 1893.

Use. Each key had three positions, upper and lower case and a
figure that positioned three levels of the printing wheel.

B117.80?, 1 Jacquard Loom Mechanism, Card-controlled, Loom, Model, Mechanical, ca 1805, France, 16x36x40 cm, Wood, Brass, and Steel, Paper Cards Added by Peter Delahar, Buy, Peter Delahar, 2040 (80), D-Gordon's Office.

B118.80L.M. Ericsson & Co., 1 Printing Telegraph Receiver, Electro-mechanical, ca 1890, Sweden, 7640, 36x42x17 cm, Brass, Wood, Bevelled Glass, Key, Brass Spool, Paper Tape, and Receiver, Buy, Arthur Middleton, 626 (80), D-Gordon's Office.

B119.80, 1 Navigator's Sector, 2-3 Part, Sector, Craft, ca 1800, England, 16x3.5x.3 cm, Ivory, Lee & Son, Portsea Engraved, Buy, Portobello Rd, 60 (80), D-Bells.

See B21.78

B120.80C.W. Dizey, New Bond St London, 1 Proportional Rule and Protractor, Fixed, Rule, Protractor, Craft, ca 1890, England, 4.3x15.2x.2 cm, Ivory, Buy, Bermondsey Market, 24 (80), D-Bells.

A protractor and architect's proportions are inscribed on one side; engineer's scale and vernier on the other.

B121.80United Chemical Engraving Co. Ltd., 1 Proportional Rule and Protractor, Fixed, Rule, Craft, 1932, England, 5917, 15x5x.2 cm, Cream, Plastic, Inscribed D.A.E. Carter, Buy, 5 (80), D-Bells.

Protractor and table with set scales at l/20,000, 100,000, and 250,000 inscribed on one side. The other side has scales of one half inch and one inch to the mile, a scale of 1/20,000 in meters and listing of metric equivalents.

B122.801 Parallel Rule, Fixed, Rule, Craft, ca 1890, England, 3.5x15x.2 cm, Ebony and Brass, Buy, Maitland Antiques, 10 (80), D-MR2.

B123.80 R. Waddington, Coventry, 1 Lord's CalculatorCircular, 2-3 Part, Slide Rule, Craft, England, 7d x1.5 cm, Chrome and Glass, Buy, Maitland Antiques, 48 (80), D-Bells.

B124.80Fowler's (calculators) Ltd Sale, 1 "Fowler's Calculator"Circular, 2-3 Part, Slide Rule, Craft, ca 1920, England, 6d x1 cm, Chrome, Glass and Paper, Long Scale Calculator, Buy, Maitland Antiques, 60 (80), D-Bells.

B125.80The Cleveland Twist Drill Co., 1 Circular Slide RuleCircular, 2-3 Part, Slide Rule, Craft, ca 1920, USA, 8d x.3 cm, Cream, Plastic, Printing worn off, Buy, Portobello Rd, 2 (80), D-Bells.

This specialized rule is copyright 1911, The Cleveland Twist Drill Company.

Use. The rule indicated drill speeds for wrought iron, machinery steel and soft tool steel. One side shows revolutions per minute for diameters ranging from one-sixteenth to three inches for both high speed and carbon steel drills. The other side shows tap and drill sizes and the decimal equivalent for inch divisions.

B126.80Johnson, 1 "Johnson Artifical Light Exposure Calculator", Circular, 2-3 Part, Slide Rule, Mechanical, England, 6.5d x.2 cm, Cream, Plastic, Buy, Portobello Rd, 2 (80), D-Bells.

Use. 1. Set at start. 2. Select wattage notch and dial clockwise to "stop"; 3. Repeat for distance of lamp from the subject; 4. Turn over and repeat for angel of light film speed and subject; 5. Read exposure against F/Ratio.

B127.80 Thorens, 1 Musical Disk, Mechanical, 1980, Switzerland, 11d x.1 cm, Black and Yellow, Tin, Buy, 1 (80), D-Gordon's Office.

B128.80Morris, 1 "Morris's Measuring Instrument", 2-3 Part, Linear Measure, Mechanical, England, 5.5d x1 cm, Metal, Paper, Cloth, Glass, Case and Instrument, Buy, Maitland Antiques, 60 (80), D-Bells.

B129.80Tacro Inc., 1 Map Measure and Compass, 2-3 Part, Linear Measure, Mechanical, Germany, 7x3.5x.5 cm, Chrome, Paper, Glass, D-Bells.

B130.801 Drawing Instruments, Fixed, Drawing Instruments, Craft, ca 1900, England, 6x16x2.5 cm, Black Case, Brass, Steel, Wood, Cardboard, 7 Instruments and Case, Buy, Bermondsey Market, 72 (80), D-Bells.

B131.80ADDI-COSMOS, 1 "B.U.G Calculator", Single Register, Pascal Strip, Mechanical, 5223, 4.5x20.5x4 cm, Brass, Steel, Wood, fabric, Instrument and Case, Buy, Portobello Rd, $288 (80), D-MR2.

132.801 Drawing Instruments, Fixed, Drawing Instruments, Craft, England, 7x15x2 cm case, Wood, Fabric, Brass, Steel, 4 Instruments and Wood Case, Buy, 34 (80), W-Bells.

B133.801 Drawing Instruments, Fixed, Drawing Instruments, Craft, England, 10x19x4 cm box, Wood, Brass, Velvet, 10 Instruments and Case, Buy, 140 (80), W-Bells.

B134.801 Pantograph, Multiple part, Proportional Recorder, Mechanical, ca 1850, England, 85x15x8 cm Case, Brass and Wood, Engraved, J. Davis Cheltenham, Instrument and Case, Buy, Arthur Middleton, 275 (80), W-Bells.

B135.80Odhner, 1 "Original Odhner"Odhner, Three Register, Rotary, Mechanical, ca 1920, England, 239-868452, Grey, Metal, Buy, Bermondsey Market, 50 (80), D-Bells.

B136.81W. Egli, 1 "Millionaire", Four Register, Automatic Stepped Wheel, Mechanical, ca 1920, Switzerland, 4493, Brass, Electrified Eight-digit Model, Stand, Motor, and Calculator, Buy, Historical Technology, 840 (81), D-MR2.
See B1.75

B137.81American Can Company, 1 "American Adding Machine", Two Register, Mechanical, ca 1920, USA, 31850, Black, Metal, Digits worn, Buy, D. Stillings/BRIEUX, 125 (81), D-MR2.

Essentially a Pascal-like single register machine, only the digits are grooved and stay in place showing the entry (a second register) until they are cleared.

B138.811 Scale and Ruled CompassDrawing Instrument, Fixed, Scale and Compass, Craft, USA, 3x12 cm, Metal, "W.B.Pierce Co. Civil Engineers", Buy, 10 (81), D-Bells.

B139.80W. Mount and T. Page, at the Postern on Tower-hill, I. J. Good, "Measuring Made Easy: Or the Description and Use of Coggeshall's Sliding Rule, much Enlarg'd by J. Atkinson, Sen. London."Coggeshall 2-3 Part, Slide Rule, Book, Craft, 1744, England, 10x16x1 cm, Paper and Leather, 96 Pages with 2 folding Engraved Plates. Portion of Spine lacking but still tight, without fly leaves., Buy, The Antiquarian Scientist, 121 (80), D-Bells.

Taylor (1966) lists John Good (1706-33) as a mathematical teacher and notes a 1751 edition of this work edited by Atkinson, A maker of slide rules. The first plate illustrates Coggeshall's Sliding rule.

B140.80Depose H.C., 1 Map Mileage Reader, 2-3 Part, Linear Measure, Mechanical, USA, 12x3.5dx.5 cm, Metal, Paper and Glass, Buy, 35 (81), D-Bells.

B141.801 Counting Beads, Single Register, Bead, Manual, USA, 27x19.5x1 cm, Red, Black, and Green Beads, Wood and Metal, Paint worn off beads, beads missing on top, Buy, 9 (81), D-Bells.

B142.81Bennett, 1 Typewriter, Mechanical, USA, 27x12x4 cm, Black with Yellow Letters, Metal, Case and Typewriter, Buy, 40 (81), D-Bells.

Very compact with three positions for the keys and a wheel device. Small sized ribbon and removable carraige.

B143.81Bunzel Mfg, Vienna, 1 Thomas Arithmometer, Three Register, Stepped Wheel, Mechanical, ca 1910, Austria, distributed by Dietzgen, USA, Wood, Metal, Case, Arithmometer, Digits, Buy, Historical Technology, 840 (81), D-Bells.

See B3.76.

B144.81EUGENE DIETZGEN CO., 1 "DIETZGEN MULTIPHASE STYLE-M IMPROVED DECIMAL TRIG TYPE LOG LOG RULE" Log-log, 2-3 Part, Slide Rule, Craft, 1954, USA, Cat. No. 1738, 5x32x.4 cm, Aluminum and Plexi, Buy, Lincoln City, Ore, 8 (81), D-Bells.

B145.81Dietzgen, 1 Slide Rule, Linear, 2-3 Part, Slide Rule, Craft, USA, 26x3x1 cm, Wood and Paper, Buy, l2 (81), D-Bells.

B146.81Stanley Rule and Level Co., New Britain, Conn, 1 Coggeshall Rule, 2-3 Part, Slide Rule, Craft, USA, 32x4x.4 cm, Wood and Brass, Buy, 70 (81), D-Bells.

B147.81Richardson and Co., Middleton, Co., 1 Coggeshall Timber Slide Rule, 2-3 Part, Slide Rule, Craft, USA, 4x31.5x.3 cm, Boxwood, Brass, and Steel, Buy, NE Trade Fair, 20 (81), D-Bells.

B148.811 Spelling and Counting Board, Single Register, Bead, Toy, Craft, ca 1950, USA, 23d x 2 cm, red, Plastic and Wood, Buy, Lincoln City, Ore., 2 (81), D-Bells.

B149.811 "BABY CALCULATOR", Single Register, Pascal Strip, Mechanical, USA, 14.5x7.5x.7 cm, Black, Gold and Red, Metal, Buy, Lincoln City, Ore, 8 (81), D-Bells.

See

B150.81Roberto Guatelli, 1 Pascal Adder, Single Register, Pascal Wheel, Replica, Mechanical, 1645, France, Bronze, Buy, R. Guatelli, 3500 (81), D-MR2.

The first mechanical adding machine built by the French physcist and matehmatician, Blaise Pascal.

Use. The dials show the French monetary unit, the livre, which was divided into 12 deniers, each subdivided into 20 sols. The essential part of the machine was its decimal carry; each toothed wheel moved forward one unit (one-tenth of a revolution on each wheel except those of deniers and sols) when the previous wheel had completed one revoltuion. Subtraction was based on complementary numbers that could be revealed by moving the strip at the top of the calculator.

B151.81Electric Specialty Mfg Co., Cedar Rapids, Ia., 1 Telegraph Key, Transduction, Electro-mechanical, ca 1900, USA, 7x8x18.5 cm, black, metal, Buy, $15 (81), D-Bells.

B152.81SELSI, 1 Map mileage reader and compass, Analog Calcula, 2-3 part, Linear measure, Mechanical, ca 1930, Germany, 11x3.5x.5 cm, The handle also serves as a pencil. Buy, 7 (81), D-Bells.

B153.81A & W Smith, 1 Pantograph, Analog Calcula, Multiple part, Proportional planar copier, Mechanical, ca 1820, England, 59x7x5.5 cm, mahoganny case, Brass, 3 brass scales, ivory and brass roller, and pins, Buy, Peter Delahar, 400 (81), D-Bells.

"A rare type of brass pantograph," P. Delahar.

B154.81Corona Typewriter Co., Inc. Groton, N.Y., 1 "CORONA FOUR" Typewriter, TRANSDUCTION, Typewriter, Mechanical, ca 1920, USA, H201124, 26x31x11 cm, Black, case and ribbons missing, Buy, Oregon, $8 (81), D-Bells.

B155.81Burroughs, 1 "Burroughs Calculator" Adding machine, Digital Calcula, Single Register, Keyed Wheel, Mechanical, ca 1910, USA, 5-607901, 18x23x30 cm, Black and green, Metal, Stands on legs at a tilt for ease of operation. Buy, Rte 20 antique store in Wayland, 5 (81), D-Bells.

B156.80Burroughs, 1 "The Burroughs Adding and Listing

Machine" Adding Machine, Digital Calcula, Two Register, Key Punch, Mechanical, ca 1900, USA, Black, Metal with beveled glass sides, Buy, Victor, Co., 225 (80), D-MR-2.

B157.81Burroughs, 1 "The Burroughs Adding and Listing Machine" Adding Machine, Digital Calcula, Two Register, Keyed Wheel, Stand and motor, Mechanical, ca 1910, USA, Black, Metal with beveled glass, Adapted for motorized operation, Stand, motor, calculator, printer, Buy, Oregon, 75 (81), D-MR-2.

B158.81 J. Halden & Co., Ltd., 1 "HALDEN CALCULEX" Circular Slide Rule, Analog Calcula, 2-3 part, Slide rule, Craft, ca 1910, England, 6 cm diameter, Metal ring with glass discs covering paper scales, Aluminum case with velvet interior and leather covered 95 page manual only measuring 5.5 cm square, plus instrument, Buy, The Antiquarian Scientist, 90 (81), D-Bells.

Cajori in his "history of the Logarithmic Slide Rule" (1909) lists this unique instrument as No. 211 and notes the manual.

B159.81 Henry Carey Baird, Industrial Publisher, Philadelphia, 1 "A Treatise on a Box of Instruments and the Slide Rule for the Use of Guagers, Engineers, Seaman, and Students," by Thomas Kentish, Analog Calcula, 2-3 part, Book, Craft, 1864, USA, 12x18x2 cm, Original cloth cover, 228 pages with a folding plate, Buy, The Antiquarian Scientist, 50 (81), D-Bells.

The use of 2-3 part analog calculators for practical geometry, trigonometry, and logarthms are explained. Special sections deal with circles and navigational calculations.

B160.81R. & L.W. Leybourn, 1 "TRIGONOMETRIA" Logarthmic Tables, Memory, Book, Craft, 1657, England, 14x18x3.5 cm, Original leather binding, Buy, The Antiquarian Scientist, $600 (81), D-MR-2.

The original set of logarthmic tables and their explanation as made by William Oughtred, who made significant improvements on the slide rule.

B161.81HANS W. EGLI CO., 1 "MILLIONAIRE" Calculator, Digital Calcula, Four Function, Stepped Wheel, Mechanical, ca 1900, Switzerland, 272, 18x29x76 cm, wooden case, brass calculator, 8 digit, wooden stand, case, and calculator, Buy, Antiquarian Scientist, 800 (81), D-Bells.

See B1.75

B162.81Ticknor and Fields, Boston, 1 "History, Theory, and Practice of the Electric Telegraph" by George B. Prescott, Transmission, Telegraph, Book, Electro-mechanical, 1864, USA, 14x4x20cm, well-illustrated, good condition, Buy, The Antiquarian Scientist, 40 (81), D-Bells.

Contents: 1. Electrical Manifestations; 2. Propagation of Electricity; 3. Magnetism; 4. General Principles of the Electric Telegraph. 5. The Morse System. 6. The Needle System; 7. House's Printing Telegraph; 8. Bain's Electro-chemical Telegraph; 9. The Hughes System; 10. The American Printing Telegraph; 11. Horne's Electro-thermal Telegraph; 12. The Dial Telegraphs; 13. Subterranean and Submarine Lines; 14. The Atlantic Cable; 15. Progress of the Electric Telegraph; 16. Various Applications of the Electric Telegraph; 17. Construction of Telegraph Lines; 18. Atmospheric Electricity; 19. Terrestrial Magnetism; 20. Miscellaneous Matters; 21. Early Discoveries in Electro-dynamics; 22. Galvanism. Index.

B163.81 H. Dessain, Imprimeur-Libraire, Liege, 1 "Recherches sur La Telegraphie Electrique" par Michel Gloesener, Transmission, Telegraphy, Book, Electro-mechanical, 1853, Belgium, 16x23.5x1.5cm, paper back, Buy, The Antiquarian Scientist, 50 (81), D-Bells.

Beautiful fold-out plates of the needle telegraph.

B164.81Signal Electric Mfg. Co., 2 "Signal Telegraph Instrument" Telegraph Keys and Sounders, Telegraphy, Electro-mechanical, ca 1920, USA, 11x10x16 cm, Wooden base, brass, and other metals, Buy, Westford, 20 (each), D-MR2.

B165.81Simplex Typewriter Company, 1 "The New Simplex Typewriter No. 1" Typewriter, Typewriter, Mechanical, ca

1920, USA, 22x12x6 cm, red, yellow, and black, wooden base with metal, cardboard case and typewriter, BUY, Knotty Pine Antique Market, West Swanzey, NH, 15 (81), D-Gordon's Office.

The simplex is a small, inexpensive, home typewriter that only holds paper less than seven inches wide. U.S. patent numers 1138427, 1204912, 1521408, 1865288, 1869426, and 1957373.

Use: From the Directions for Operating in the case: "First:
Hold the machine with rack side toward you. Push carriage to the left to starting point. When doing this see that dog does not catch in rack. Insert paper between rollers from the front. Put finger on key of letter desired and swing it into notch in rim of typecase near the dog: <u>Press downward to print.</u> To make a space without prining, press down on any key near to but not in the notch. To ink apply only a drop of ink to each pad with the end of a matchstick or toothpick. Be careful not to bend the pads down so far as to prevent them from springing back into position. Use only Simplex Ink which will be supplied at 10 cents per tube, cheap ink destroys the face of the type. Do not oil. If keyplate sticks take a rag moistened with vaseline and hold against underside of keys at the notch and twirl type plate around a few times. If the carriage does not move forward freely, apply a little vaseline to the carriageway where it rubs. Caution! Keep oil or vaseline away from rubber type and ink pads. Oil will swell and destroy the letters."

B166.81Simlex Typewriter Co., Inc., 1 "Simplex Portable Typewriter Special Demonstrated Model S" Typewriter, Mechanical, ca 1930, USA, 24x8x16 cm, Green and red, Metal, Buy, Knotty Pine Antique Market, West Swanzey, 7 (81), D-Bells.

See B165.81.

B167.81Wolverine Supply and Manufacturing Co., 1 "Adding Machine", Digital Calcula, Single Register, Pascal Strip, Mechanical, ca 1950, USA, 10x15x23 cm, Red, blue, and cream, Tin, Buy, Knotty Pine Antique Market, 10 (81), D-

MR2.

B168.811 Navigator's Sector, Analog Calcula, 2-3 Part, Sector, Craft, ca 1880, USA, 3.5x16x.3 cm, wood, BUY, Knotty Pine Antique Market, W. Swanzey, 10 (81), D-Bells.

B169.811 Navigator's Sector, Analog Calcula, 2-3 Part, Sector, Craft, ca 1880, USA, 3.5x16x.3 cm, Wood, Buy, Amherst Outdoor Antique Market, 18 (81), D-Bells.

B170.811 Coggeshall Slide Rule, Analog Calcula, 2-3 Part, Slide Rule, Craft, ca 1850, USA, 4x33x.5 cm, Wood and Brass, No makers name, wood cracked, shows signs of real wear, Buy, Knotty Pine Antique Market, West Swanzey, NH, 15 (81), D-Bells.

B171.81 Pickett & Eckel, Inc., 1 Slide Rule, Analog Calculator, 2-3 Part, Log-log, Craft, 1960, USA, 405171, 31x6x3 cm, Yellow, Aluminum and Plexi, Box, Case, instruction pamphlet, and guarantee, Buy, Westford flea market, 6 (81), D-Bells.

B172.811 Abacus, Digital Calculator, Single Register, Bead, Manual, 29x14x2.5 cm, Wood, 13 digit, Buy, Amherst outdoor antique market, 10 (81), D-Bells.

B173.81Burroughs, 1 "Burroughs" Adding Machine, Digital Calculator, Two Register, Keyed Wheel, Mechanical, ca 1950, USA, 8A193393, 22x37x20 cm, Green and Black, Metal, 8 digits with paper tape printing, Buy, 19 (81), D-Bells.

B174.81Felt & Tarrant Mfg Co., 1 "Comptometer", Digital Calculator, Single Register, Keyed Wheel, Mechanical, ca 1895, USA, 505, Walnut, Brass & Other Metals, Buy, Peter Delahar, 400 (81), D-MR2.

An early Comptometer with the springs showing on the upper keys. The keys are molded differently on alternative rows to give the operator a "feeling" of relative location. The walnut cabinetry and tooling was clearly a hand-made.

B175.80 Siemens Brothers & Co., London, 1 Printing

Telegraph, Links and Switches, Electro-mechanical, ca 1900, England, 12145, Wood and brass, Does not work, Buy, Portobello Rd., London, 510 (80), D-Gordon's Office.

B176.801 Sector, Analog Calcula, 2-3 Part, Sector, Craft, ca 1623, England, 9 inch; 240x50x5 mm, Brass, Buy, Peter Delahar, 2400 (1981), D-Bells.

Nine inch brass sector as described by Edmund Gunter (1581-1626) in 1623. Unsigned by probably made by Elias Allen in 1623.

B177.81Thomas Graham, 1 "The Oriental Calculator or Tables for the Calculation of Interest, Exchange & Commission" by Dorabjee Hormusjee, Book of tables, Writable or Readable Memory, Paper, Random, Craft, 1860, India, 15x23x4 cm, Green, Paper, Third Edition, Good condition, Buy, Editions, 45 (81), D-Bells.

Part I contains Interest Tables in Rupees, Dollars, and Sterling from one-half to 12 per cent per annum. Part Ii contains tables for the conversion of rupees, into sterling and dollars; and sterling into dollars. Part III contains commission or Inland Exchange Tables; Key showing indirect exchange between England, India and China; Tables shoing the comparative rates of exchange for sight bills, and tables showing the estimated value of one pound of cotton with all charges and varying exchange rates.

In the preface to the third edition the author states, "The rapid sale of the previous Editions of the "Oriental Calculator" and the pressing demand for it, are evident proofs of the utility of this work in mercantile circles; and the production of the Third Edition is the result of the liberal patronage and support the author has been favored with."

B178.811 Counting Beads, Digital Calculator, Single Register, Bead, Manual, 37x2x44 cm, red and black beads, wood and metal, 9 rows by 10 digits, Buy, Joe Stamps, NY, 50 (81), D-Bells.

XB179.81Reliable Typewriter & Adding Machine Co., 1 "Addometer", Digital Calcula, Single Register, Pascal

Wheel, Mechanical, USA, 1x5x30 cm, Brown with red and white dials and yellow numbers, Metal, Case, Instructions, Stylus, and Calculator, Buy, Joe Stamps, NY, 28 (81), D-Bells.

See B150.80

B180.81American Can Company, 1 "American Adding Machine", Digital Calcula, Two Register, Tab, Mechanical, ca 1920, USA, 22x22x19 cm, Black with green, Metal, Rusted and worn, Buy, J Stamps, NY, 50 (81), D-Bells.

See B137.81

B181.811 Abacus, Digital Calcula, Single Register, Bead, Manual, 29x14x2.5 cm, Wood, 13 digit, Buy, Amherst outdoor antique market, 10 (81), D-Bells.

B182.81Burroughs, 1 "Burroughs Calculator", Digital Calcula, Single Register, Keyed Wheel, Mechanical, ca 1910, USA, #204128, 230x100x360 mm, Black, Metal, Buy, Reading flea market, 3 (81), D-Bells.

Replica of an early Comptometer. See B9.76.

B183.81SELSI, 1 Map mileage reader and compass, Analog Calcula, 2-3 part, Integrator, Mechanical, ca 1930, Germany, 110x35x5 mm, The handle also serves as a pencil. Buy, Reading flea market, 4 (81), D-Bells.

B184.81Digital Equipment Corporation, 1 2 PM Flip Flop, Transistor, 1966, USA, R20YC, D-Bells.

B185.81 Data Products, 1 Core Memory,.

8 K by 19 bit 3W-3D 18 mil planar memory.

B186.81Cal Research Computer, 1 Tube and circuit, Philips tube, 00667001, TC3-C5, D-Bells.

B187.81Automatic Adding Machine Co., 1 "Golden Gem Adding Machine", Digital Calcula, Single Register, Linear Pascal, Mechanical, 1904, USA, 56950, 105x75x18 mm, Metal, Complementary numbers scratched in, Case, instructions, and calculator, Buy, Colorado Springs, 20 (81), D-Bells.

Interesting directions regarding complementary numbers and the use of the simple machine for multiplication.

B188.811 "Precise"Adding Machine, Digital Calcula, Single Register, Pascal Strip, Mechanical, ca 1910, USA, 105x120x175 mm, Silver and Bronze, Metal, Stylus and calculator, Buy, 25 (81), D-Bells.

B189.81A W Faber, 1 Slide Rule, Analog Calcula, 2-3 Part, Slide Rule, Craft, ca 1935, Germany, 98350, 33x9x270 mm, Ivory, Ivory bonded to wood, Inch and centimeter scales are on opposite sides, Leather case and rule, Buy, D-Bells.

B190.81Ideas Unlimited, 1 "Horse-meter", Analog Calcula, 2-3 Part, Circular Slide Rule, Craft, 1951, USA, 135 mm diamter, Orange, gray and yellow, Paper, Buy, Colorado Springs, 1 (81), D-Bells.

"Directions for use: (1) Consult daily Racing Form for speed ratings, weights and class; (2) Figure rating for each horse in race as follows: (a) turn red dial to best speed rating in past 30 days; (b) turn blue dial to class in key race; (c) Turn yellow dial to weight difference of (a) race and today's race; (c) Add (or subtract) figures (a) (b) (c). This is horses rating. (3) Horse with at least 2 points aove rest is the choice in this race; (4) Play only if final odds are 2/1 or better; (5) Best results will be had by avoiding 2 year old, maiden, fillies and mares, stakes, hurdle, turf and steeple races and races over 1 1/8 miles."

B191.81E. & F. N. Spon, 125, Strand. London, 1 "Pocket-book of Useful Formulae & memoranda for Civil and Mechanical Engineers," by Sir Guilford L. MolesworthBook, Readable or Writable Memory, Paper, Random, Craft, 1888, England, 77x30x120 mm, Black with gold leaf edges, Paper, Buy, 3 (81), D-Bells.

Originally compiled in 1862, this is the 22nd edition of a truly pocket-sized book of formula. Although there is no table of contents, a very thorough index is provided for the 732 pages of tables.

B192.811 Section of the first Atlantic Telephone Cable, Transduction, Electro-mechanical, 1858, US, 95x18 mm diameter, Buy, 200 (81), D-Bells.

Cyrus West Field (1819-1892) American merchant, promotor of the first Atlantic cable was botn in Stockbridge, massachusetts. In 1854, he conceivec the idea of the calbe and secured a charter to organize the England and American companies. The British and American naval ships, HMS Agamemnon and the USS Niagara were secured to lay the cable. Five attempts were made between 1857 and 58. The first message transmitted, August 16, 1858, read, "England and America are united by telegraph. Golory to God in the highest and on earth peace and good will towards men." The Queen and the President of the United States exchanged congratulations, but the cable ceased working three weeks later. It was necessary for Field to raise new funds and make new arrangements. The great Eastern succeeded in laying a calbe in 1866.

B193.81A. Massim, Paris, 1 Music Box, Readable or Writable Memory, Mechanically stable, Cyclic, Mechanical, 1840, France, 30981, 343x160x120 mm, Black, Wood and brass fittings, Buy, 400 (81), D-Bells.

The music box plays six tunes; Robin Adair, the Blue Bells of Scotland, The Campbells are coming, Auld Lang Syne, Coming Through the Rye, and Bonnie Sweet Home.

B194.81 Aaron Palmer, Boston, 1 "Palmer's Pocket Scale"Circular slide rule, Analog Calculator, 2-3 part, Circular slide rule, Craft, 1845, USA, 7x95x150 mm, Paper, Buy, Moskowitz, ca 185(81), D-MR2.

Palmer's Pocket Scale with rules for its use in solving Arithmetical and Geometrical Problems preceded the large sized Fuller's scale. See B110.80.

B195.81 1 Excise slide rule, Moskowitz, 375(81), .
complete on getting catalog

B196.81 A.W. Faber, "Castell" Pencil Works, Ltd., 1 "Instruction for the use of A.W. Faber "Castell" Precision

Calculating Rules," by Henry O. CooperBook, Analog Calculators, 2-3 part, Slide rule, Book, Craft, ca 1935, Germany, 155x228x8 mm, Grey and red cover, Paper, Buy, Moskowitz, 15(81), D-Bells.

B197.81 1 "Enigma", Transducer, D-MR2.

B198.81 1 "Enigma", D-MR2.

B199.821 "Everard" slide rule, Analog Calculator, 2-3 part, Slide rule, Craft, ca 1720, England, 303x17x25 mm, Boxwood, The early form of Everard slide rule with two slides., Buy, Delahar, 222 (82), D-Bells.

B1.75 EGLI & CO., 1 "MILLIONAIRE" Four Register, Automatic

Stepped Wheel, Mechanical, 1903, Switzerland, 539, 17x52x28 cm, Brass, 6 digit, Buy, Dr. Margaret Kennedy, 500 (75), D-MR2.

The Millionaire was invented in 1893 by Otto Steiger and

was the first direct multiplying calculator to be commercially successful. Between 1894 and 1935, 4,655 millionaires were sold.

Use. One turn of the crank automatically multiplies

the accumulator by a single digit specified by a pointer in the upper left hand corner of the machine. The pointer is reset for each digit in the multiplier until the computation is complete.

B2.76 Hutton, Charles, 1 "Table of the Products and Numbers",

Table, Fixed, Craft, 1781, England, 28x42x1 cm, paper, Buy, Historical Technology Inc., 68 (76), D-MR2.

Compiled in 1781 by Charles Hutton, this is an early book of mathematical tables containing the products of the numbers 1 through 1000 by the numbers 1 through 100. It also contains squares and cubes of numbers and conversion tables for units of measurement.

One of the main problems with handcrafted books is the

number of errors. On one page alone, every figures is off by one thousand. With handcrafted calculating and typesetting such problems are unavoidable. Later books of talbes were done by the Difference Machine and proved more reliable.

B3.76 Chevalier Charles Savier Thomas, 1 "Arithmometer", Three Register, Stepped Wheel, Mechanical, ca 1850, England, 1583, 10x18x58 cm, Brass, Wooden case, Buy, Peter Delahar Antiques, 376 (76), D-MR2.

In 1820, Chevalier Charles X Thomas of Colmar designed and introduced the first multiplication machine made commercially available for general sale. Although it was not patented until 1851, the main features of the 1820 design remained unaltered.

The mechanism has three parts, concerned with setting, counting, and recording respectively. Any number up to 999,999 may be set by moving the pointers to the numbers 0 to 9 engraved next to the six slots on the fixed cover plate. The movement of any of these pointers slides a small pionion with ten teeth along a square axle, underneath and to the left of which is a Leibniz stepped wheel.

The Leibniz wheel, a cylinder having nine teeth of increasing length, is driven from the main shaft by means of a bevel wheel, and the small pinion is thus rotated by as many teeth as the cylinder bears in the plane corresponding to the digit set. This amount of rotation is transferred through one of a pair of bevel wheels, carried on a sleeve on the same axis, to the 'results' figure wheel on the back row on the hinged plate. This plate also carried the figure wheel recording the number of turns of the driving crank for each position of the hinged plate. The pair of bevel wheels is placed in proper gear by setting a lever at the top left-hand cover to either "Addition and Multiplication" or "Subtraction and Division." The "results" figure wheel is thereby rotated anti-clockwise or clockwise respectively.

Use. Multiplying 2432 by 598 may be performed as follows: Lift the hinged plate, turn and release the two milled knobs to bring all the figure wheels to show zero; lower the hinged plate in its position to the extreme left; set the number 2432 on the four slots on the fixed plate; set the lever on the left to "multiplication" and turn the handle eight times; lift the hinged plate, slide it one step to the right, and lower it into position; turn the handle nine times; step the plate one point to the right again and the turn the handle five times. The product 1,454,336 will then appear on the top row, and the multiplier 598 on the next row of figures.

B4.76 ?, 1 Gunter Rule, 2-3 Part, Gunter Rule, Craft, ca 1800

England, 5x60x.5 cm, wood, Buy, Peter Delahar Antiques, 61 (76), D-MR2.

About 1607 Edmund Gunter devised a scale that was to be the predecessor of the modern slide rule. In 1623 he published a description of this scale that is composed of two scales of the logarithms from 1 to 10 placed end to end. Although Napier conceived of the logarithm allowing multiplication or division to be accomplished by addition or subtraction, Napier relied on look up tables.

Use. Multiplication is carried out by using a pair of dividers to measure a distance, the multiplier, along the rule and add it to another distance, the multiplicand, forming the combined distance, the product, on the rule. The accuracy of an answer is limited by the length of the rule and the user's ability to resolve a number.

B5.76 Stanley, 1 "Fuller's Spiral Slide Rule", Spiral, 2-3 part,

Slide Rule, Craft, 1902, England, 9x9x33 cm, Cardboard, Mahogany, Brass, Screw on handle, case, Buy, Historical Technology Inc, 138 (76), D-MR2.

Designed in 1878 by Professor George Fuller, the logarithmic line is arranged spirally on the surface of a cylinder. The logarthmic line is in 50 turns, giving a working length of 41 feet 8 inches. All numbers of four figures either have a mark upon the scale or are midway between two marks, so that results accurate to four figures are easily obtained.

Use. By means of movable cylinders any length of spiral

line may be at once transferred to any other part of the scale, and multiplications and divisions containing a series of factors can be worked with facility. Logarithms of numbers are given by means of a scale on the longer index arm together with a circular scale on the first cylinder, so that powers and roots are obtainable. The surface of the middle cylinder bears printed tables of decimal equivalents, natural sines, etc.

B6.76 J. Sang, 1 "Platometer" Planimeter, Multiple part, Areal

Measure, Mechanical, ca 1860, England, 9x15x37 cm, Brass, Wooden case, magnifying glass, Buy, Peter Delahar Antiques, 355 (76), D-MR2.

This instrument for directly measuring an area bounded by an irregular curve is based on an idea developed by the Bavarian engineer J M Hermann in 1814. The first commercially successful devices were made by Ernst of Paris. In 1851, John Sang of Kirkcaldy invented and made a "platometer" resembling the planimeter of Ernst.

Use. Operation is based on continuous integration.

A curve is traced using the pointer, with the area read off on the dial after the complete perimeter has been traversed. As the pointer is moved the rollers that measure distance on the conical shaft calculate the product of the vertical distance times the horizontal distance. As a curve is traversed in a clockwise direction, the top area is integrated in a positive direction. On the return trip the integration is negative and the net value is provided.

B7.76 Burroughs, 1 "Burroughs Model 5", Two Register, Keyed Wheel,

Mechanical, USA, 5-146-1088, 28x25x12 cm, Black, Metal,, Buy, City Office Equipment, 10 (76), ?.

B8.76 Burroughs, 1 "Burroughs" Single Register, Keyed Wheel,

Mechanical, USA, A342273, 18x25x27 cm, , Buy, City Office Equipment, 10 (76), D-MR2.

B9.76 Felt & Tarrant Manufacturing Co., 1 "Comptometer", Single Register, Keyed Wheel, Mechanical, 1914, USA, 37x28x15 cm, Green, Metal, Buy, City Office Equipment Co, 10 (76), D-MR2.

The Comptometer was invented in 1887 by Dorr E Felt of Chicago and claims to be the first successful key-driven adding and calculating machine.

Use. For each digit a push button from 1 to 9 is selected which rotates a Pascal-type wheel with the corresponding number of increments. Numbers are subtracted by adding the complement (shown in smaller numbers). The carrying of tens is accomplished by power generated by the action of the keys and stored in a helical spring, which is automatically released at the proper instant to perform the carry.

Through effective marketting and training of skilled operators versed in complement arithmetic at Comptometer Schools, these machines became the workhorse of the accounting profession in the first part of the century. They never successfully advanced into the electro-mechanical era, but remained purely mechanical, two-function adding and subtracting machines.

B10.76 Monroe Calculating Machine Co., 1

"Monroe Electric Calculator No. 1", Three Register, Keyed Rotary, Electro-Mechanical, USA, 336948, 38x31x24 cm, Buy, City Office Equipment, 10 (76), W-Bells.

B11.76 Monroe Calculating Machine Co., 1

"Monroematic" Four Register, Automatic Keyed Rotary, Electro-Mechanical, USA, 506781, 18x23x34 cm, Gray, Metal, Buy, City Office Equipment, 10 (76), D-MR2.

B12.76 Friden, 1 "Friden Calculator Model D-8",

Four Register, Automatic Keyed Rotary,, Electro-Mechanical, USA, 202762, 38x26x20 cm, Buy, City Office equipment, 10 (76), W-Bells.

B13.76 Monroe, 1 "High Speed Adding Calculator",

Three Register, Keyed Rotary, Electro-Mechanical, USA, 15x25x24 cm, Black, Buy, City Office Equipment, 10 (76), D-ML12-1.

B14.76 Burroughs, 1 "Burroughs Adding Machine Model A",

Two Register, Keyed Wheel, Mechanical, USA, A605824, 22x15x12 cm, Black, Metal, 5 Digit, Buy, City Office Equipment, 10 (76), D-MR2.

B15.76 Underwood, 1 "Standard Typewriter No. 5"

Typewriter, Mechanical, USA, 22x30x30 cm, Buy, City Office Equipment, 10 (76), D-ML12-1.

D16.76 IBM, 1 "IBM" Typewriter, Electro-Mechanical, USA,

112-42085, 26x44x40 cm, Gray, Justowriter Corp On Motor Housing, Buy, City Office Equipment, 10 (76), D-ML12-1.

B17.78 EGLI & CO., 1 "Millionaire",

Four Register, Automatic Stepped Wheel, Mechanical, ca 1910, Switzerland, 1523, 18x29x76 cm, Brass, 10 Digit, Buy, George Nelson, 275 (78), W-ML12-1.

See B1.75

B18.78 Stone, Edmund, 1 "The Construction and

Principal Uses Of Mathematical Instruments", Multiple part, Book, Craft, 1758, England, 34x23x4 cm, Paper, 1972 reprint Edition of 500, Buy, Historical Technology Inc, 42 (78), D-Gordon's office.

THE CONSTRUCTION AND PRINCIPAL USES OF MATHEMATICAL INSTRUMENTS. Translated from the French of M. Bion. To which are added, the construction and uses of such instruments as are omitted by M. Bion, particularly of those invented or improved by the English. 1972 reprint of the 2nd Edition of 1758 that includes a supplement containing a further account of some of the most useful mathematical instruments. A folio size book with 325 numbered pages and 30 full page plates. "This is the best English edition, of the best early l8th century book ever published on the design and use of scientific instruments." S. Moskowitz (catalog 117, fall 1978).

B19.78 ?, 1 Drawing Instruments, Fixed, Rule,

Parallel rule, Compass, Craft, England, 20x11x4 cm, Steel & Brass, Fitted velvet & leather Case, Buy, Historical Technology Inc., 80 (78), D-Gordon's Office.

Cased English drawing instruments made in the second half of the l9th century. Brass and steel instruments, ruling pen with ivory handle; l3 separate items in lift-out tray. Small boxwood rule in space below. Rosewood veneered case and instruments in fine condition except that the large compass is missing its pivot locking nut and the brass has become a bit dull.

B20.78 W.H. Harling, 1 Rolling Parallel Rule, Parallel Fixed, Rule, Craft, ca 1890, England, 4x33x8 cm, Steel, Walnut Case, Buy Historical Technology Inc., 75 (78), D-Gordon's Office.

Cased presentation of an English rolling parallel rule. Pasted to the inside cover is the presentation certificate, "Bradford Technical College Prize Awarded to Fred Inman at the Annual Examination, 1893, by order of the Lords of the Committee of Her Majesty's most honourable privy council on education."

B21.78 ?, 1 Navigator's Sector, 2-3 Part, Sector, Craft,

England, 33x6x1 cm, Boxwood With Brass Hinge, 21 Scales On both Sides and Outside Edges, Buy, Historical Technology Inc., 465 (78), D-MR2.

The sector is used to solve problems of proportion and works on the principle of similar triangles. Sectors were made with a variety of scales for use in calculation by navigators, surveyors, gunners, and draughtsmen. At first sight they look like a jointed rule usually made of ivory, brass, wood, or sometimes silver. First described by both Galileo in Italy and Thomas Hood in England the sector was in use by 1600.

Use. A pair of dividers is necessary to read the

relationships on all sectors. This instrument is marked: "Chords, Sec, Lines, Tangents, tan, Ver Sine, Sines, & Num." The scale layout permits this sector to be used as a Gunter rule as well, although it is not laid out to follow any of the five editions of Gunter, but is close to the example in Stone (B18.78).

B22.78 Burroughs Adding Machine Company, 1 "Burroughs"

Single Register, Keyed Wheel, Mechanical, ca 1920, USA, A335701, 15x30x25 cm, Black, Metal, Complement Arithmetic Nine Digits, Buy, City Office Equipment, 10 (78), D-Bells.

B23.78 Friden, 1 "Friden Model 132" Four Register,

Automatic Keyed Rotary, Transistor, USA, 3235, 26x45x54 cm, D-ML12-1.

B24.78 ?, 1 Parallel Rule Parallel, Fixed, Rule, Craft, ca 1870,

45x6x1 cm, Rosewood and Brass, Buy, 45 (78), D-Bells.

B25.78 DG Marketing Ltd, 1 "International Metric Converter", Table, Manipulable, Craft, 1978, Hong Kong, 10x8x6 cm, Black, Plastic, Buy, 5 (78), D-Bells.

B26.79 ?, 1 Soroban, Single Register, Bead, Manual, 4x11x29 cm, D-MR2.

B27.79 ?, 1 Napier's Bones, Table, Manipulable, Craft, ca 1700, England, 8x6x2 cm, Wood, Bones and Box, Buy, Historical Technology Inc., 1732 (79), D-MR2.

These small instruments for facilitating the multiplication and division of large numbers were invented by John Napier, Laird of Merchiston in Scotland, and are described in his RABDOLOGIAE, published in 1617. He wrote that the multiplication and division of great numbers is troublesome, involving tedious expenditure of time, and subject to "slippery errors." His tables reduced these difficulties to simple addition and subtraction, and won immediate recognition. A set of Napier's bones are usually made of boxwood or ivory and often contained in a box or case that would fit in a pocket. A set usually contains 10 rods, plus extras representing squares and cubes.

<u>Use.</u> Addition is accomplished by reading the appropriate bones along the diagonal. To obtain a product of 224 x 44, the rods 2, 2, and 4 are put alongside each other, and the result is read off by combining the numbers in the fourth row -- 0/8, 0/8, 1/6 -- for the correct answer 896. This is repeated and the two products added together to give 9856. The bones are sometimes associated with an abacus to provide a store in the multiplication process.

B28.79 Chemical Rubber Publishing Co., 1 "Handbook of Chemistry and Physics, 31ST Ed", Fixed, Table, Mechanical, 1949, USA, 19x13x8 cm, D-MR2.

B29.77 KEUFFEL & ESSER 1 "Thatcher's Calculating Instrument 4012", Spiral, 2-3 Part, Slide Rule, Craft, ca 1920, USA, 5106, 13x13x63 cm, Wood, Varnished Paper, and Brass, Instrument and Wood Case, Buy, Historical Technology Inc, 510 (77), W-Bells.

Patented in 1881 by Edwin Thatcher, an 1884 instruction book notes, "The originary rule in use is 12 inches long, with radii of 11 and 5 l/2 inches, the divisions of which are cut by hand, copying from a machine divided plate. In the present instrument the radii are 60 and 30 feet, the divisions of which are printed directly from machine divided plates. Those plates contain over 33,000 divisions, calculated to seven places of decimals from Babbage's tables by using a common multiplier, every line being subjected to correction for error of screw and temperature variations, so that possibly every line center is within .0001 inch of its true place."

The instrument consists of a cylindrical slide, which admits of both rotary and longitudinal movement within an open metallic framework of 20 equidistant triangular bars. The bars are connected to rings at their ends which admit rotation within standards attached to the base. Upon the slide are wrapped two complete logarithmic scales, each of which is divided into 40 parts of length equal to half that of the slide. The parts follow each other in regular order around the cylinder, and the figures and divisions which constitute any part of the right are repeated on the left, one line in advance.

<u>Use.</u> By the rotary and longitudinal movement of the slide any of its divisions may be brought opposite to or in contact with any division on the fixed scales. The divisions on the upper lines are transferred to the slide by means of a pointer fitting over the bars, which is also convenient for retaining the position of any division on either line while the slide is being revolved into the required position. Near the commencement of each scale on the slide is a heavy black mark designed to catch the eye readily during the rapid movement of the parts.

B30.77 L.&I.D., 1 Timber Calculating Slide RuleLinear, 2-3 Part, Slide Rule, Craft, ca 1800, England, 60x5x1 cm, Boxwood, Buy, Historical Technology Inc., 120 (77), D-MR2.

Use. On one side, the A line on the rule and the B and C lines on the slider are each numbered twice from 1-10, reading from left to right. The fourth line E is inverted, and is so arranged that 144 is opposite 1 and 10 on the A line. So that if length in feet on E be set opposite thickness in inches on C, the volume in cubic feet is read off on B opposite width in inches on A. The B line is subdivided into tenths, while the A, C, and E lines are subdivided into fourths. On the other side of the rule are A, B and C lines with the girt line (marked D) numbered from 4-40 and bearing various gauge points. The A and D lines are subdivided into fourths. The two edges of the rule bear scales of inches divided into quarter-inches.

B31.79 Selective Educational Equipment Corp, 1 "SEE CALCULATOR", Single Register, Pascal Wheel, Mechanical, 1968, USA, 18x4x1 cm, , Buy, Selective Educational Equipment Corp, 3 (79), D-MR2.

A small replica of the Pascal-type adder made to illustrate the mechanism. For a descriptionn of the original Pascal machine see B150.80.

B32.52 KEUFFEL & ESSER, 1 "Slide Rule 689", Linear, 2-3 part, Slide Rule, Craft, ca 1950, USA, 848689, 32x6x1 cm, Rule and Leather Case, Buy, D-MR2.

B33 Casio, 1 "Casio Mini Card Calculator" Five or More Registers, Computer-controlled, IC, Japan, 5x8 cm, Calculator and Case, Buy, D-MR2.

B34.79 Hewlett Packard, 1 "HP-35" Pocket Calculator, Five or More Registers, Computer-controlled, IC, USA, 3x8x16 cm, Buy, D-MR2.

The HP-35 was the first hand-held scientific calculator small enough to fit in a pocket. It is something of a miniaturized version of earlier desk top scientific calculators such as the Friden. A microprocessor is programmed to carry out the calculator's functions.

Use. Functions include logarithms, exponentials, trigonometric, decimals, scientific notation, and degrees and radians are used. Reverse Polish notation replaces conventional parenthesis.

B35.79 Aluminum Housewares Co. Inc., 1 "Fairgrove Adder", Single Register, Pascal wheel, Mechanical, 1975, Hong Kong, 2x5x10 cm, Plastic, Buy, 2 (79), D-Gordon's Office.

B36.79 ?, 1 "EXACTUS", Single Register, Pascal Strip, Mechanical, ca 1950, England, 7x11x.5 cm, D-MR2.

A linear form of the simple Pascal two function calculating device that uses complement arithmetic. See also B150.80.

Use. Addition or subtraction is carried out by dialing the numbers starting with the least significant. A carry is performed by moving the final digit around the corner to the next linear register.

B37.79 Foto-mem Inc., 1 Slide RuleLinear, 2-3 part, Slide Rule, Craft, Japan, 2x14x.5 cm, D-Gordon's Office.

B38.79 Precision Adding Machine Co. Inc., 1 "Quixsum Adding Machine Model C", Single Register, Pascal Wheel, Mechanical, ca 1930, USA, 2643, 7x18x48 cm, Quixsum, Case, And Stylus, Buy, D-MR2.

The Quixsum is a good example of how the stepped wheel principle of Pascal can be used to operate any special measures, not necessarily base ten. In this case it adds English units of feet and inches. See also l50.80.

Use. To add a number to the register, the appropriate digit is dialed. The result is displayed in a notch at the top of each wheel.

B39.79 Yanasa, Tokei, Keiki Co. Ltd., 1 "Geigy Pedometer", Single register, Escapement ratchet, Mechanical, Japan, 3d x1 cm, D-Gordon's Office.

B40.79 Monroe Calculating Machine Co., 1 "Monroe" Calculator, Four Register, Automatic Keyed Rotary, Electro-mechanical, USA, J421231, 15x30x26 cm, Gray, 8 Digit, Buy, 10 (79), D-Bells.

B41.79 ?, 1 Gunter Rule, 2-3 Part, Gunter Rule, Craft, 15x3x.5 cm, Boxwood, Buy, 22 (79), D-MR2.

See B4.76

B42.80 Burroughs, 1 "Burroughs" Printing Adding Machine, Two Register, Keyed Wheel Mechanical, USA, 9A431239, 28x38x40 cm, Buy, 20 (80), D-MR2.

William S Burroughs introduced the keyboard type of adding and listing machine about 1880. It was designed to type a column of figures and then almost automatically type the sum total.

Use. (see British Science Museum exhibit and description)

B43.80 Bing, 1 "Bing No.2" Typewriter, Mechanical, ca 1930, Germany, 15x28x38 cm, 1926 patent pending, Case and Typewriter, Buy, 25 (80), W-Bells.

B44.79 Burrington, Richard Stevens, 1 "Handbook of Mathematical Tables and Formulas", Fixed, Table, Mechanical, 1950, USA, 20x13x2 cm, William B Lehmann, D-MR2.

B45.79 Sharp Corporation, 1 "Elsi MATE El-8048" Electronic Calculator Soroban, Five or More Registers, Computer-controlled, IC, 1979, Japan, 921, 30x9x2 cm, Plastic,, Buy, D-MR2.

B46.79 Royal London Co Ltd, 1 "Executive Thought Organizer", Toy, Transistor, Japan, 11d x10 cm, Plastic, D-Gordon's Office.

B47.79 Hoare, Charles, 1 "The Slide Rule and How to Use It", 2-3 part, Slide Rule, Book, Craft, 1896, England, 18x11x1 cm, 7th Edition, Buy, Historical Technology Inc, 30 (79), D-MR2.

B48.79 Rowning, J., 1 "Directions for Making a Machine to Solve Equations", Multiple part, Book, Mechanical, 1768, England, 22x18x2 cm, Buy, Historical Technology Inc., 95 (79), D-Gordon's Office.

This work describes the first analog computer designed to solve algebraic equations of the n'th degree expessed in the form y = a + bx + cx2 + dx3 + . . . + qxn . It was completed in 1768 by Rowning based upon the graphical method invented by A. deSegner in 1751. In 1770 an actual machine mechanized to the second degree was presented to the Royal Society, but apparently no longer exists. Rowning's instrument consists of a number of adjustable straight bars, or "rulers," centred and combined together in such a way as to occupy progressively the various positions in accordance with deSegner's graphical construction. Movement in two directions at right angles to one another is secured by means of two pairs of racks and pinions. The curve is drawn by a pencil on the underside of a piece of pasteboard supported by two adjustable bars.

Use. Segner's method consisted in finding, by graphical construction, the values of y for various assumed values of x, plotting the curve, and reading off the values of x at the points where the curve intersected the axis of x, thus obtaining the real roots of the equation.   The impossible or imaginary roots were indicated by the points where the curve approached and receded from the axis of x, without reaching it.

B49.79 The A. Leitz Co., 1 Planimeter Variable Ratio Polar Planimeter, Multiple part, Planimeter, Mechanical, 1900 c, Switzerland, 64567, 2x4x28 cm, German Silver and Steel, Instrument and Fitted Cloth Covered Case, Buy, Historical Technology Inc, 75 (79), D-Gordon's Office.

This instrument for measuring the area of any plane figure was invented by Professor Jacob Amsler in 1856. It is a proportional instrument in that the unit can be changed by altering the radius of the tracing arm.

Use. The weighted point is fixed and the tracing pointer guided exactly once round the outline of the figure whose area is to be measured. The difference of the readings on the graduated roller before and after this operation gives the area of the figure in units dependent on the setting of the tracing arm.

B50.79 J.S.M., 1 Navigator's Gunter Rule, 2-3 Part Gunter Rule, Craft, ca 1800, England, 60x5x.5 cm, Buy, Historical Technology Inc., -95 (79), ?.

B51.79 Stanley, 1 "Fuller's Spiral Slide Rule" Spiral, 2-3 Part, Slide Rule, Craft, ca 1880, England, 33x10x10 cm, paper, wood, metal, cylindrical case and rule, Buy, Historical Technology Inc., 220 (79), D-Gordon's office.

See B5.76

B52.79 Manlove, Alliott, Fryer & Co., 1 "Boucher's calculating circle" Circular, 2-3 Part, Slide Rule, Craft, France, , BUY, -275 (79), ?.

B53.80 Lowry Mfg. Co., 1 "Lowry-bowyer Telemeter", Multiple Part, Mechanical, ca 1900, USA, 15x78x7 cm, Aluminum and Wood, Instrument, Mahongany Base, Cover Buy, Historical Technology, Inc., 195 (80), D-Gordon's Office.

A version of the classical trigonometer signed and dated "THE LOWRY MFG. CO./BOSTON, U.S.A./PAT. 1887, '92, '96". It has two four and a half inch compass bearing dials, one fixed at the end of the twenty-six inch long graduate slotted base plate, the other sliding, and each with graduated pivoted arms of l8 3/8" radius. It was intended for the analog solution of the plane triangle knowing two angles and included side, two sides and the included angle, or three sides. Thus it was useful for problems both of navigation and gunnery.

B54.80 ?, 1 Navigator's Gunter Rule, 2-3 Part, Gunter Rule, Craft, ca 1800, England, 5x60x.5 cm, Darkened Boxwood, Minor Warping And Edge Chipping, Buy, Historical Technology Inc., 155 (80), D-MR2.

See B4.76

B55.80 Dring & Fage, 1 Inland Revenue Slide Rule, Four-sided, 2-3 part, Slide Rule, Craft, 1825, England, 60x5x1 cm, Boxwood, One ink Stain, Buy, Historical Technology Inc., 215 (80), D-MR2.

The rule is specially arranged for the use of excise officers and maltsters in gauging computations. Slide rules for this purpose were first devised by Thomas Everard in 1683, and modified by Vero, Leadbetter and others. In this example, four scales appear on one side and the other side is blank.

B56.80 KEUFFEL & ESSER, 1 "Thatcher's Calculating Instrument", Spiral, 2-3 Part, Slide Rule, Craft, 1925, USA, 5870, 16d x58 cm, Wood, Brass, And Varnished Cardboard, Calculator, Case, And Magnifying Glass, Buy, Historical Technology Inc., 625 (80), D-MR2.

See B29.77

B57.80 Felt & Tarrant Mfg Co., 1 "Comptometer", Single Register, Keyed Wheel, Mechanical, ca 1920, USA, J341613, 36x22x15 cm, Bronze, Metal, Buy, 75 (80), D-MR2.

See B9.76

B58.80   2 "RAILROAD TELEGRAPHER MAGAZINE",.

B59.80 Fowler & Co., 1 "Fowler's Calculator" Circular, 2-3 Part, Slide Rule, Mechanical, 5660, 6d x1 cm, , Buy, Ampersand, NY, 184 (80), D-Bells.

B60.80 , "WESTERN UNION RULES AND INSTRUCTIONS" .

B61.80 J.R. Bunnell, 1 Telegraph Key And Receiver, Electro-mechanical, ca 1900, USA, 10x10x20 cm, Key and Receiver, Buy, Victor, Co., 45 (80), W-MR2.

B62.80 Marchant, 1 "Marchant" Four Register, Automatic Keyed Rotary, Electro-mechanical, ca 1950, USA, B-M-112311, 40x25x31 cm, Metal, Buy, 35 (80), D-MR-2.

B63.80 Corona, 1 "Corona No. 3" Portable Typewriter, Mechanical, ca 1920, USA, 480206, 23x25x12 cm, Black, Metal, Carriage folds up over keyboard, Buy, 15 (80), D-Gordon's Office.

B64.80 Burroughs, 1 "Burroughs" Visible Printing Adding Machine, Two Register, Keyed wheel, Mechanical, ca 1910, USA, 1-43288, Black, Metal, Bevelled Glass, and Plexi, Removable Printer, Buy Victor, Co, 250 (80), D-MR2.

See B42.80

B65.80 Molle Typewriter Co., 1 "Molle No. 3" Typewriter, , Mechanical, USA, 6824, 25x28x33 cm, Black, Metal, Case and Typewriter, Buy, 35 (80), W-ML12-1.

B66.80 Swift & Anderson Inc., 1 Gunnery Level, 2-3 part, Sight and Level, Mechanical, ca 1910, Lead, Brass and Glass, Buy, Ron Hoffmann, NY, 15 (80), D-Bells.

B67.80 Adler, 1 "Favorit 2" Portable Typewriter, Mechanical, ca 1940, Germany, 2103, 36x28x11 cm, Black, German Keyboard, Case and Typewriter, Gift, Burt Still, W-ML12-1.

B68.80 W & E Co., 1 Telegraph Receiver and Relay, Electro-mechanical, ca 1890, USA, 10x20x12 cm, Receiver and Relay, Buy, Victor, Co., 50 (80), D-Gordon's Office.

B69.80 Heath and Co. Ltd., 1 Sextant, 2-3 Part, Location-finder, Mechanical, ca 1920, England, W450, 35x25x17 cm, Certified at The National Physics Laboratory, Case and Sextant, Buy, Joe Stamps, NY, 600 (80), W-Bells.

B70.67 Digital Equipment Corp., 1 PDP-6 Signed Photo, Photo, Transistor, 1967, USA, Gift PDP-6 Engineers, W-MR2.

B71.74 Digital Equipment Corp., 1 PDP-8 Flip-flop R201, Logic Module, Transistor, 1966, USA, 1x15x7 cm, D-Bells.

B72.74 ?, 1 Vacuum Tube Logic Module M.D.Type 8, Logic Module, Electronic, 1950 USA, 108, 10x30x35 cm, D-Bells.

B73.80 ?, 1 Field Microscope, Mechanical, France, 5x5x15 cm, Brass, Glass, Wood, Wooden Box and Microscope, Buy, Ron HOffman, Ny, 12 (80), D-Bells.

B74.77 Cohen, Harold, 4 "Amsterdam Suite", Artwork, 1977, 3 Line Drawings, 1 Colored, Framed Lithographs, Gift, Harold Cohen, D-Spitbrook.

B75.80 MARX, 1 "Dial Typewriter", Toy, Mechanical, ca 1950, USA, 15x15x30 cm, Buy, J Stamps, NY, 30 (80), D-Gordon's Office.

B76.80 ?, 1 "BABY CALCULATOR", Single Register, Pascal Strip, Mechanical, ca 1950, USA, 1x8x6 cm, Tin, Buy, J. Stamps, NY, 24 (80), D-Gordon's Office.

See B36.79

B77.72 Digital Equipment Corp., 1 PDP-11/20 Module Artwork, Artwork, Transistor, 1969, USA, 100x94 cm, Mylar in Plexi, Gift J O'Loughlin, D-MR2.

B78.80 A.B. Dick, 1 "The Edison Mimeograph No. 1", Mechanical, ca 1900, USA, 13x33x43 cm, Wood Case and Frames, Complete Cased Set with Roller Etc Buy, 75 (80), W-MR2.

B79.80 JJ&EF Johnson Co., 1 Telegraph Key J-44, Electro-mechanical, USA, 12x8x4 cm, Gift, Clyde Still, D-Gordon's Office.

B80.80 Trinks-brunsviga, 1 "Trinks-brunsviga" Brunsviga, Three Register, Rotary, Mechanical, ca 1940, 39329, 15x12x36 cm, Gift, Declan and Margrit Kennedy, D-Gordon's Office.

The German patent of W T Odhner, 1891, was acquired by Messrs Grimme, Natalis & Co, and was embodied in a machine known as the "Brunsviga." This example is a further adaptation and sits on a wood board that was part of a disappearring desk top.

Use. Although the machine performs multiplication by repeated addition as in the Thomas type, the use of the Odhner wheel instead of the Leibniz toothed wheel led to a more compact design. The Odhner wheels fit very close together on the axle on the back. A setting lever, the end of which projects through a slot in the cylindrical portion of the cover plate, forms part of each wheel. If a lever is set against any figure (1 to 9) of its slot, a corresponding number of pins are made to project from its wheel. When the operating handle is turned, these pins gear with small toothed wheels of the product register, which in turn gear with the number wheels in front. The product register is mounted on a longitudinally movable carriage arranged in front of the machine, which carries a second counter for registering the multiplier or the quotient. The handle is turned in a clockwise direction for addition and multiplication, and counter-clockwise for subtraction and division.

B81.80 Bell Punch Co. Ltd., "Plus" Single Register, Keyed Wheel, Mechanical, England, A7-1783, 15x30x40 cm, Green, Metal, Model #909/C/V/504.929/A, Buy, 25 (80), D-MR2.

An electrified modification of the Comptometer. See B9.76

B82.80 C & E Layton, 1 "Tates Arithmometer", Three Register, Stepped Wheel, Mechanical, England, 1184, 10x17x58 cm, Brass and Wood, Wood Case and Brass Machine with Removable Handle, Buy, Peter Delahar Antique, 1276 (80), D-MR2.

This machine, which is of the Thomas type, embodies the modifications patented in 1884 and 1903 by S Tate, who in 1883 was the first in England to manufacture this type of calculating machine. His patents were later taken over by C and E Layton.

Use. See B3.76.

B83.80 Metallograph Corp., 1 "Musketry Rule of 1918" Linear, 2-3 Part, Slide Rule, Craft, ca 1918, USA, 3x13 cm, Black, Metal, Neck String and Rule, Buy, Ron Hoffman, NY, 12 (80), D MR-2.

B84.79 Thales, 1 "Thales Patent Calculator", Four Register, Automatic Rotary, Mechanical, Germany, S 153248, 15x30x20 cm, Gray, Metal, Buy, 50 (79), D-MR2.

A "Brunsviga" type machine made in Germany. See B80.80.

B85.78 Reliable Typewriter & Adding Machine Corp., 1 "Addometer" Single Register, Pascal Wheel, Mechanical, USA, 1x5x30 cm, Black, Metal, Case, Calculator And Instruction Booklet, Buy, Historical Technology Inc., 30?(79), D-MR2.

See Bl50.80

B86.79 Olivetti, 1 "Olivetti" Two Register, Keyed Wheel, Electro-mechanical, Argentina, Summa quanta 20, 15x15x30 cm, Plexi-glass, Metal, Paper Tape, Buy, City Office Equipment, 50 (79), D-MR2.

B87.79 Contina Ag Mauren, 1 "Curta" Three Register, Rotary, Mechanical, Liechtenstein, 70588, 10d x12 cm, Black, Metal, Gift, Brian Randall, D-MR2.

The Curta is the ultimate example of the rotary mechanical calculator. Its small size requires better manufacturing technology than any other mechanical calulator. Model I had an 8 digit input setting, 6 digit counter, and ll digit accumulator. Model II had an 11 digit setting, 8 digit counter, and 15 digit accumlator. Prior to the electronic calculator, the Curta was the only four-digit portable calculator and as such was expecially popular for use at car rallies.

B88.80 Wales the Adder Machine Co., 1 "Wales Visible Adding Machine", Two Register, Keyed Wheel, Mechanical, USA, 20x24x38 cm, Metal and Plexi Replacements for Glass, Removable Printer, Buy, City Office Equipment, 175 (80), D-MR2.

A copy of the Burroughs printing-adding machine. See B42.

B89.80 Allen-wales Adding Machine Corp, 1 "Allen-wales Printing Adding Machine", Two Register, Keyed Wheel, Mechanical, USA, 77-26208, 20x20x40 cm, Black, Metal, Buy, 35 (80), D-MR2.

See B42.

B90.79 Monroe Calculating Machine Co., 1 "Monroe No. 1" Three Register, Keyed Rotary, Electro-mechanical, USA, 20x25x30 cm, Metal, Buy, City Office Equipment, 10 (76), D-MR2.

B91.76 Hans W. Egli, 1 "Millionaire", Four Register, Automatic Stepped Wheel, Mechanical, Switzerland, 1073, 18x29x76 cm, Brass, 8 Digit, Calculator with Stand, Buy, 1000 (79), D-MR2.

See Bl.75.

B92.80 ?, 1 Drafting Set, Fixed, Parallel Rule, Scale, Compass, Craft, ca 1800, England, 15x17x30 cm, Brass, Wood, Marble, Cornelius Conklin (owner), Boxed with Box of Tools, Pens, Etc., Buy, 261 (80), W-Bells.

B93.80 ?, 1 Abacus, Single Register, Bead, Manual, China, 22x16x3 cm, Wood, 9 Digit, Removable Wooden Backboard, Buy, 50 (80), D-MR2.

The abacus is the earliest known computing device and the first hand-held calculator. It postdated the invention of the decimal system by the Egyptians circa 3000 BC. The Greeks and Romans built and used the abacus based on Hindu-Arabic numerals.

Unlike earlier notations and devices using stones and marks, the abacus utilizes positional notation, including the representation of zeros, differences, with capabilities for multiplication and division. The Chinese abacus has beads in groups of 5 and 2, representing decimal digits. The Japanese first modified this to 5 and 1 and then 4 and 1.

B94.80 ?, 1 Soroban, Single Register, Bead, Manual, 10x2x40 cm, Wood and Bamboo, 21 Digits, Buy, 22 (80), D-Bells.

B95.80 ?, 1 Abacus, Single Register, Bead, Manual, Taiwan, 2x4x6 cm, Green, Marble and Brass, 9 Digit, Abacus on Marble with Instruction Booklet, Buy, 7 (80), D-Gordon's Office.

B96.80 Reliable Typewriter and Adding Machine Corp., 1 "Addometer" Single Register, Pascal Wheel, Mechanical, USA, 1x5x30 cm, Dark Gray, Metal and Fiber, Fiber Case and Instruction Booklet, Buy, 14 (80), D-Bells.

See Bl50.80.

B97.80 KEUFFEL AND ESSER, 1 "E.A. Sperry's Calculator"Circular, 2-3 part, Slide Rule, Craft, USA, S650, 6d x2 cm, Pocket Watch Style, Buy, 42 (80), D-Bells.

B98.80 ?, 1 Navigator's Gunter Rule, 2-3 part, Gunter Rule, Craft, 2x15 cm, Cream, Ivory, Buy, 60 (80), D-Bells.

See B4.76

B99.80 Stanley Rule & Level Co., 1 Timber Slide RuleLinear, 2-3 Part, Slide Rule, Craft, USA, 4x30 cm, Brass and Warranted Box Wood, Buy, 38 (80), D-MR2.

See B30.77

B100.80Stanley Rule & Level Co., 1 Timber Slide RuleLinear, 2-3 Part, Slide Rule, Craft, USA, 4x30 cm, Brass and Warranted Boxwood, Cracked, Warped and Stained, Buy, 21 (80), D-Bells.

See B30.77

B101.80MARX, 1 "Junior Typewriter", Toy, Mechanical, USA, 28x13x18 cm, Gray and Blue, Tin, Bent & Rusty, Buy, 12 (80), D-Gordon's office.

B102.80?, 1 Navigator's Sector, 2-3 Part, Sector, Craft, 4x16 cm, Cream, Ivory and Brass, Chipped, Buy, 89 (80), D-Bells.

See B21.78

B103.80Welch, 1 Teaching Slide RuleLinear, 2-3 Part, Slide Rule, Display, Craft, USA, 2x23x125 cm, Black, Masonite, With Hangers, Buy, 30 (80), W-Bells.

B104.80T.S. & J.D. Negus, 1 Parallel Rule, Fixed, Rule, Craft, 8x45 cm, Brass, Inscribed with Degrees Buy, The Packet Boat, Boston, 40 (80), D-MR2.

105.80 , 1 Rolling Parallel Rule, Fixed, Rule, Mechanical, 6x46x2.5 cm, Brass, Patt. No. 160100, Wooden Case and Instrument, Buy, The Packet Boat, Boston, 90 (80), W-Bells.

B106.80, 1 Drawing Instruments, Fixed, Compass, Parallel Rule, Scale, Craft, ca 1850, England, 16x7x2.5 cm, Green, Shagreen Case, Brass, Steel, Ivory, Silver & Ebony, Fitted Case, 8 Instruments, Rule, Sector & Parallel Rule, Buy, Arthur Middleton, London, 648 (80), D-MR2.

B107.80J Thomlinson Ltd Glasgow, 1 "Thomlinson's Equivalent Paper Slide Scale" Linear, 2-3 Part, Slide Rule, Craft, ca 1940, Scotland, 8x58x1.5 cm, Brown, Wood, One Sided with Two Moving Rules, Buy, Peter Delahar, 43 (80), D-MR2.

This specialized rule was designed for the paper and printing industry. The A scale indicated length, B scale the breadth, and area in square inches was read off the C scale.

The D scale was used to read off translations of inches to centimeters, kilos to pounds, 480 and 500 sheet reams, and various weights of different standard paper cuts.

B108.80Dring and Fage, 1 "Leadbetter Slide Rule"Linear, 2-3 Part, Slide Rule, Craft, ca 1800, England, 31x3x2 cm, Brown, Boxwood, Four Sided Slide Rule with Slides on each Side, Buy, Peter Delahar, 84, D-MR2.

B109.80?, 1 Slide RuleCoggeshall, 2-3 Part, Slide Rule, Craft, ca 1800, England, 4x33x.5 cm, Boxwood and Brass, Hinged with Two Slides, Buy, Peter Delahar, 75 (80), D-MR2.

A modified Coggeshal type slide rule with one brass and one wood slide. Navigational scales including meridian, chords, latitudes, and hours are inscribed. Freeth and Co. Brimingham is overstamped.

B110.80J.F. Fuller, 1 "Palmer's Improved By Fuller Computing Scale" Circular, 2-3 Part, Slide Rule, Craft, 1847, USA, 28x28x.5 cm, Cream and Black, Cardboard, "Fuller's Time Telegraph" is on the Reverse, Buy, Peter Delahar, 216 (80), D-MR2.

"Palmer's Computing Scale" patented in 1843 by Aaron Palmer was improved and produced by J.E. Fuller in 1847. This model is printed from the original Palmer plate with Fuller's name and own patent added to the engraving, done by George C. Smith, 186 Washington St., Boston. The reverse side, "Fuller's Time Telegraph" was patented by him in 1845.

Use. "Palmer's Computing Scale" was used to calculate square measures, cubic measures, timber measures, grain measures, liquid measures and interest rates from 3 percent to 10 percent on a daily and monthly basis. "Fuller's Time Telegraph" (on the reverse) was used to calculate time lapse in days or weeks between any two given dates. In concert these two measures would be useful to dealers in grain, alcohol and other commodity trading.

B112.80Fowler & Co, 1 "Fowler's Textile Calculator"Circular, 2-3 Part, Slide Rule, Craft, ca 1900, England, 14398, 6.5d x.7 cm, Chrome, Glass, Paper, Two-sided Circular Rule, Buy, Maitland Antiques, Portobello Rd., 60 (80), D-MR2.

Short scale type of "Fowler's Textile Calculator" with two scales on one side. The other side holds a table equivalency for weft, looms, and reeds.

B113.80Lewis & Tylor, Limited, 1 "Hydralculator", Linear, 2-3 Part, Slide Rule, Craft, ca 1940, England, 7x19x.5 cm, Cream, Cardboard, One Rule on one Side, Case and Rule, Buy, Portobello Rd., 9 (80), D-MR2.

"Hydralculator", patent number 396,533, published by Lewis & Tylor Ltd., Gripoly Mills, Cardiff, the manufacturers of "underwriter" super fire fighting hose, for the use of their "Friends in the Fire Service."

Use. To find the quantity of water discharged for any given nozzle and a known pressure, place press on scale "b" opposite nozzle on scale "a', and read discharge through window in slide. To find height of jet for given pressure and nozzle diameter, proceed as above and read opposite arrow in center of slide, the height given on scale "d" for the appropriate nozzle.

B114.80?, 1 "Circular Concise Slide Rule" Circular, 2-3 Part, Slide Rule, Craft, ca 1960, Japan, 8d cm, White, Plastic, No. 28; Reverse has Standard Equivalency Tables, Buy, Portobello Rd., 5 (80), D-MR2.

B115.80?, 1 Music Box, , Mechanical, 1980, Switzerland, 6.5dx5 cm, Plastic and Aluminum, Plays Jingle Bells, Buy, 6 (80), D-Gordon's Office.

B116.80Blickensderfer, 1 "Featherweight Blickensderfer", , Mechanical, ca 1900, USA, 153497, 25x30x13 cm, Aluminium, 501 Special Stamped on Base, Buy, Portobello Road, 120 (80), D-Gordon's Office.

The "Blick" was the first typewriter intended to be readily portable. It was designed by Georges Blickensderfer and patented in 1890 and first sold in 1893.

Use. Each key had three positions, upper and lower case and a figure that positioned three levels of the printing wheel.

B117.80?, 1 Jacquard Loom Mechanism, Card-controlled, Loom, Model, Mechanical, ca 1805, France, 16x36x40 cm, Wood, Brass, and Steel, Paper Cards Added by Peter Delahar, Buy, Peter Delahar, 2040 (80), D-Gordon's Office.

B118.80L.M. Ericsson & Co., 1 Printing Telegraph Receiver, Electro-mechanical, ca 1890, Sweden, 7640, 36x42x17 cm, Brass, Wood, Bevelled Glass, Key, Brass Spool, Paper Tape, and Receiver, Buy, Arthur Middleton, 626 (80), D-Gordon's Office.

B119.80, 1 Navigator's Sector, 2-3 Part, Sector, Craft, ca 1800, England, 16x3.5x.3 cm, Ivory, Lee & Son, Portsea Engraved, Buy, Portobello Rd, 60 (80), D-Bells.

See B21.78

B120.80C.W. Dizey, New Bond St London, 1 Proportional Rule and Protractor, Fixed, Rule, Protractor, Craft, ca 1890, England, 4.3x15.2x.2 cm, Ivory, Buy, Bermondsey Market, 24 (80), D-Bells.

A protractor and architect's proportions are inscribed on one side; engineer's scale and vernier on the other.

B121.80United Chemical Engraving Co. Ltd., 1 Proportional Rule and Protractor, Fixed, Rule, Craft, 1932, England, 5917, 15x5x.2 cm, Cream, Plastic, Inscribed D.A.E. Carter, Buy, 5 (80), D-Bells.

Protractor and table with set scales at l/20,000, 100,000, and 250,000 inscribed on one side. The other side has scales of one half inch and one inch to the mile, a scale of 1/20,000 in meters and listing of metric equivalents.

B122.801 Parallel Rule, Fixed, Rule, Craft, ca 1890, England, 3.5x15x.2 cm, Ebony and Brass, Buy, Maitland Antiques, 10 (80), D-MR2.

B123.80R. Waddington, Coventry, 1 Lord's CalculatorCircular, 2-3 Part, Slide Rule, Craft, England, 7d x1.5 cm, Chrome and Glass, Buy, Maitland Antiques, 48 (80), D-Bells.

B124.80Fowler's (calculators) Ltd Sale, 1 "Fowler's Calculator"Circular, 2-3 Part, Slide Rule, Craft, ca 1920, England, 6d x1 cm, Chrome, Glass and Paper, Long Scale Calculator, Buy, Maitland Antiques, 60 (80), D-Bells.

B125.80The Cleveland Twist Drill Co., 1 Circular Slide RuleCircular, 2-3 Part, Slide Rule, Craft, ca 1920, USA, 8d x.3 cm, Cream, Plastic, Printing worn off, Buy, Portobello Rd, 2 (80), D-Bells.

This specialized rule is copyright 1911, The Cleveland Twist Drill Company.

Use. The rule indicated drill speeds for wrought iron, machinery steel and soft tool steel. One side shows revolutions per minute for diameters ranging from one-sixteenth to three inches for both high speed and carbon steel drills. The other side shows tap and drill sizes and the decimal equivalent for inch divisions.

B126.80Johnson, 1 "Johnson Artifical Light Exposure Calculator", Circular, 2-3 Part, Slide Rule, Mechanical, England, 6.5d x.2 cm, Cream, Plastic, Buy, Portobello Rd, 2 (80), D-Bells.

Use. 1. Set at start. 2. Select wattage notch and dial clockwise to "stop"; 3. Repeat for distance of lamp from the subject; 4. Turn over and repeat for angel of light film speed and subject; 5. Read exposure against F/Ratio.

B127.80Thorens, 1 Musical Disk, Mechanical, 1980, Switzerland, 11d x.1 cm, Black and Yellow, Tin, Buy, 1 (80), D-Gordon's Office.

B128.80Morris, 1 "Morris's Measuring Instrument", 2-3 Part, Linear Measure, Mechanical, England, 5.5d x1 cm, Metal, Paper, Cloth, Glass, Case and Instrument, Buy, Maitland Antiques, 60 (80), D-Bells.

B129.80Tacro Inc., 1 Map Measure and Compass, 2-3 Part, Linear Measure, Mechanical, Germany, 7x3.5x.5 cm, Chrome, Paper, Glass, D-Bells.

B130.801 Drawing Instruments, Fixed, Drawing Instruments, Craft, ca 1900, England, 6x16x2.5 cm, Black Case, Brass, Steel, Wood, Cardboard, 7 Instruments and Case, Buy, Bermondsey Market, 72 (80), D-Bells.

B131.80ADDI-COSMOS, 1 "B.U.G Calculator", Single Register, Pascal Strip, Mechanical, 5223, 4.5x20.5x4 cm, Brass, Steel, Wood, fabric, Instrument and Case, Buy, Portobello Rd, $288 (80), D-MR2.

132.80 1 Drawing Instruments, Fixed, Drawing Instruments, Craft, England, 7x15x2 cm case, Wood, Fabric, Brass, Steel, 4 Instruments and Wood Case, Buy, 34 (80), W-Bells.

B133.801 Drawing Instruments, Fixed, Drawing Instruments, Craft, England, 10x19x4 cm box, Wood, Brass, Velvet, 10 Instruments and Case, Buy, 140 (80), W-Bells.

B134.801 Pantograph, Multiple part, Proportional Recorder, Mechanical, ca 1850, England, 85x15x8 cm Case, Brass and Wood, Engraved, J. Davis Cheltenham, Instrument and Case, Buy, Arthur Middleton, 275 (80), W-Bells.

B135.80Odhner, 1 "Original Odhner"Odhner, Three Register, Rotary, Mechanical, ca 1920, England, 239-868452, Grey, Metal, Buy, Bermondsey Market, 50 (80), D-Bells.

B136.81W. Egli, 1 "Millionaire", Four Register, Automatic Stepped Wheel, Mechanical, ca 1920, Switzerland, 4493, Brass, Electrified Eight-digit Model, Stand, Motor, and Calculator, Buy, Historical Technology, 840 (81), D-MR2.

See B1.75

B137.81American Can Company, 1 "American Adding Machine", Two Register, Mechanical, ca 1920, USA, 31850, Black, Metal, Digits worn, Buy, D. Stillings/BRIEUX, 125 (81), D-MR2.

Essentially a Pascal-like single register machine, only the digits are grooved and stay in place showing the entry (a second register) until they are cleared.

B138.811 Scale and Ruled CompassDrawing Instrument, Fixed, Scale and Compass, Craft, USA, 3x12 cm, Metal, "W.B.Pierce Co. Civil Engineers", Buy, 10 (81), D-Bells.

B139.80W. Mount and T. Page, at the Postern on Tower-hill, I. J. Good, "Measuring Made Easy: Or the Description and Use of Coggeshall's Sliding Rule, much Enlarg'd by J. Atkinson, Sen. London."Coggeshall 2-3 Part, Slide Rule, Book, Craft, 1744, England, 10x16x1 cm, Paper and Leather, 96 Pages with 2 folding Engraved Plates. Portion of Spine lacking but still tight, without fly leaves., Buy, The Antiquarian Scientist, 121 (80), D-Bells.

Taylor (1966) lists John Good (1706-33) as a mathematical teacher and notes a 1751 edition of this work edited by Atkinson, A maker of slide rules. The first plate illustrates Coggeshall's Sliding rule.

B140.80Depose H.C., 1 Map Mileage Reader, 2-3 Part, Linear Measure, Mechanical, USA, 12x3.5dx.5 cm, Metal, Paper and Glass, Buy, 35 (81), D-Bells.

B141.801 Counting Beads, Single Register, Bead, Manual, USA, 27x19.5x1 cm, Red, Black, and Green Beads, Wood and Metal, Paint worn off beads, beads missing on top, Buy, 9 (81), D-Bells.

B142.81Bennett, 1 Typewriter, Mechanical, USA, 27x12x4 cm, Black with Yellow Letters, Metal, Case and Typewriter, Buy, 40 (81), D-Bells.

Very compact with three positions for the keys and a wheel device. Small sized ribbon and removable carraige.

B143.81Bunzel Mfg, Vienna, 1 Thomas Arithmometer, Three Register, Stepped Wheel, Mechanical, ca 1910, Austria, distributed by Dietzgen, USA, Wood, Metal, Case, Arithmometer, Digits, Buy, Historical Technology, 840 (81), D-Bells.

See B3.76.

B144.81EUGENE DIETZGEN CO., 1 "DIETZGEN MULTIPHASE STYLE-M IMPROVED DECIMAL TRIG TYPE LOG LOG RULE" Log-log, 2-3 Part, Slide Rule, Craft, 1954, USA, Cat. No. 1738, 5x32x.4 cm, Aluminum and Plexi, Buy, Lincoln City, Ore, 8 (81), D-Bells.

B145.81Dietzgen, 1 Slide Rule, Linear, 2-3 Part, Slide Rule, Craft, USA, 26x3x1 cm, Wood and Paper, Buy, l2 (81), D-Bells.

B146.81Stanley Rule and Level Co., New Britain, Conn, 1 Coggeshall Rule, 2-3 Part, Slide Rule, Craft, USA, 32x4x.4 cm, Wood and Brass, Buy, 70 (81), D-Bells.

B147.81Richardson and Co., Middleton, Co., 1 Coggeshall Timber Slide Rule, 2-3 Part, Slide Rule, Craft, USA, 4x31.5x.3 cm, Boxwood, Brass, and Steel, Buy, NE Trade Fair, 20 (81), D-Bells.

B148.811 Spelling and Counting Board, Single Register, Bead, Toy, Craft, ca 1950, USA, 23d x 2 cm, red, Plastic and Wood, Buy, Lincoln City, Ore., 2 (81), D-Bells.

B149.811 "BABY CALCULATOR", Single Register, Pascal Strip, Mechanical, USA, 14.5x7.5x.7 cm, Black, Gold and Red, Metal, Buy, Lincoln City, Ore, 8 (81), D-Bells.

See

B150.81Roberto Guatelli, 1 Pascal Adder, Single Register, Pascal Wheel, Replica, Mechanical, 1645, France, Bronze, Buy, R. Guatelli, 3500 (81), D-MR2.

The first mechanical adding machine built by the French physcist and matehmatician, Blaise Pascal.

Use. The dials show the French monetary unit, the livre, which was divided into 12 deniers, each subdivided into 20 sols. The essential part of the machine was its decimal carry; each toothed wheel moved forward one unit (one-tenth of a revolution on each wheel except those of deniers and sols) when the previous wheel had completed one revoltuion. Subtraction was based on complementary numbers that could be revealed by moving the strip at the top of the calculator.

B151.81Electric Specialty Mfg Co., Cedar Rapids, Ia., 1 Telegraph Key, Transduction, Electro-mechanical, ca 1900, USA, 7x8x18.5 cm, black, metal, Buy, $15 (81), D-Bells.

B152.81SELSI, 1 Map mileage reader and compass, Analog Calcula, 2-3 part, Linear measure, Mechanical, ca 1930, Germany, 11x3.5x.5 cm, The handle also serves as a pencil. Buy, 7 (81), D-Bells.

B153.81A & W Smith, 1 Pantograph, Analog Calcula, Multiple part, Proportional planar copier, Mechanical, ca 1820, England, 59x7x5.5 cm, mahoganny case, Brass, 3 brass scales, ivory and brass roller, and pins, Buy, Peter Delahar, 400 (81), D-Bells.

"A rare type of brass pantograph," P. Delahar.

B154.81Corona Typewriter Co., Inc. Groton, N.Y., 1 "CORONA FOUR" Typewriter, TRANSDUCTION, Typewriter, Mechanical, ca 1920, USA, H201124, 26x31x11 cm, Black, case and ribbons missing, Buy, Oregon, $8 (81), D-Bells.

B155.81Burroughs, 1 "Burroughs Calculator" Adding machine, Digital Calcula, Single Register, Keyed Wheel, Mechanical, ca 1910, USA, 5-607901, 18x23x30 cm, Black and green, Metal, Stands on legs at a tilt for ease of operation. Buy, Rte 20 antique store in Wayland, 5 (81), D-Bells.

B156.80Burroughs, 1 "The Burroughs Adding and Listing Machine" Adding Machine, Digital Calcula, Two Register, Key Punch, Mechanical, ca 1900, USA, Black, Metal with beveled glass sides, Buy, Victor, Co., 225 (80), D-MR-2.

B157.81Burroughs, 1 "The Burroughs Adding and Listing Machine" Adding Machine, Digital Calcula, Two Register, Keyed Wheel, Stand and motor, Mechanical, ca 1910, USA, Black, Metal with beveled glass, Adapted for motorized operation, Stand, motor, calculator, printer, Buy, Oregon, 75 (81), D-MR-2.

B158.81 J. Halden & Co., Ltd., 1 "HALDEN CALCULEX" Circular Slide Rule, Analog Calcula, 2-3 part, Slide rule, Craft, ca 1910, England, 6 cm diameter, Metal ring with glass discs covering paper scales, Aluminum case with velvet interior and leather covered 95 page manual only measuring 5.5 cm square, plus instrument, Buy, The Antiquarian Scientist, 90 (81), D-Bells.

Cajori in his "history of the Logarithmic Slide Rule" (1909) lists this unique instrument as No. 211 and notes the manual.

B159.81Henry Carey Baird, Industrial Publisher, Philadelphia, 1 "A Treatise on a Box of Instruments and the Slide Rule for the Use of Guagers, Engineers, Seaman, and Students," by Thomas Kentish, Analog Calcula, 2-3 part, Book, Craft, 1864, USA, 12x18x2 cm, Original cloth cover, 228 pages with a folding plate, Buy, The Antiquarian Scientist, 50 (81), D-Bells.

The use of 2-3 part analog calculators for practical geometry, trigonometry, and logarthms are explained. Special sections deal with circles and navigational calculations.

B160.81R. & L.W. Leybourn, 1 "TRIGONOMETRIA" Logarthmic Tables, Memory, Book, Craft, 1657, England, 14x18x3.5 cm, Original leather binding, Buy, The Antiquarian Scientist, $600 (81), D-MR-2.

The original set of logarthmic tables and their explanation as made by William Oughtred, who made significant improvements on the slide rule.

B161.81HANS W. EGLI CO., 1 "MILLIONAIRE" Calculator, Digital Calcula, Four Function, Stepped Wheel, Mechanical, ca 1900, Switzerland, 272, 18x29x76 cm, wooden case, brass calculator, 8 digit, wooden stand, case, and calculator, Buy, Antiquarian Scientist, 800 (81), D-Bells.

See B1.75

B162.81Ticknor and Fields, Boston, 1 "History, Theory, and Practice of the Electric Telegraph" by George B. Prescott, Transmission, Telegraph, Book, Electro-mechanical, 1864, USA, 14x4x20cm, well-illustrated, good condition, Buy, The Antiquarian Scientist, 40 (81), D-Bells.

Contents: 1. Electrical Manifestations; 2. Propagation of Electricity; 3. Magnetism; 4. General Principles of the Electric Telegraph. 5. The Morse System. 6. The Needle System; 7. House's Printing Telegraph; 8. Bain's Electro-chemical Telegraph; 9. The Hughes System; 10. The American Printing Telegraph; 11. Horne's Electro-thermal Telegraph; 12. The Dial Telegraphs; 13. Subterranean and Submarine Lines; 14. The Atlantic Cable; 15. Progress of the Electric Telegraph; 16. Various Applications of the Electric Telegraph; 17. Construction of Telegraph Lines; 18. Atmospheric Electricity; 19. Terrestrial Magnetism; 20. Miscellaneous Matters; 21. Early Discoveries in Electro-dynamics; 22. Galvanism. Index.

B163.81 H. Dessain, Imprimeur-Libraire, Liege, 1 "Recherches sur La Telegraphie Electrique" par Michel Gloesener, Transmission, Telegraphy, Book, Electro-mechanical, 1853, Belgium, 16x23.5x1.5cm, paper back, Buy, The Antiquarian Scientist, 50 (81), D-Bells.

Beautiful fold-out plates of the needle telegraph.

B164.81 Signal Electric Mfg. Co., 2 "Signal Telegraph Instrument" Telegraph Keys and Sounders, Telegraphy, Electro-mechanical, ca 1920, USA, 11x10x16 cm, Wooden base, brass, and other metals, Buy, Westford, 20 (each), D-MR2.

B165.81Simplex Typewriter Company, 1 "The New Simplex Typewriter No. 1" Typewriter, Typewriter, Mechanical, ca 1920, USA, 22x12x6 cm, red, yellow, and black, wooden base with metal, cardboard case and typewriter, BUY, Knotty Pine Antique Market, West Swanzey, NH, 15 (81), D-Gordon's Office.

The simplex is a small, inexpensive, home typewriter that only holds paper less than seven inches wide. U.S. patent numers 1138427, 1204912, 1521408, 1865288, 1869426, and 1957373.

Use: From the Directions for Operating in the case: "First: Hold the machine with rack side toward you. Push carriage to the left to starting point. When doing this see that dog does not catch in rack. Insert paper between rollers from the front. Put finger on key of letter desired and swing it into notch in rim of typecase near the dog: <u>Press downward to print.</u> To make a space without prining, press down on any key near to but not in the notch. To ink apply only a drop of ink to each pad with the end of a matchstick or toothpick. Be careful not to bend the pads down so far as to prevent them from springing back into position. Use only Simplex Ink which will be supplied at 10 cents per tube, cheap ink destroys the face of the type. Do not oil. If keyplate sticks take a rag moistened with vaseline and hold against underside of keys at the notch and twirl type plate around a few times. If the carriage does not move forward freely, apply a little vaseline to the carriageway where it rubs. Caution! Keep oil or vaseline away from rubber type and ink pads. Oil will swell and destroy the letters."

B166.81Simlex Typewriter Co., Inc., 1 "Simplex Portable Typewriter Special Demonstrated Model S" Typewriter, Mechanical, ca 1930, USA, 24x8x16 cm, Green and red, Metal, Buy, Knotty Pine Antique Market, West Swanzey, 7 (81), D-Bells.

See B165.81.

B167.81Wolverine Supply and Manufacturing Co., 1 "Adding Machine", Digital Calcula, Single Register, Pascal Strip, Mechanical, ca 1950, USA, 10x15x23 cm, Red, blue, and cream, Tin, Buy, Knotty Pine Antique Market, 10 (81), D-MR2.

B168.811 Navigator's Sector, Analog Calcula, 2-3 Part, Sector, Craft, ca 1880, USA, 3.5x16x.3 cm, wood, BUY, Knotty Pine Antique Market, W. Swanzey, 10 (81), D-Bells.

B169.811 Navigator's Sector, Analog Calcula, 2-3 Part, Sector, Craft, ca 1880, USA, 3.5x16x.3 cm, Wood, Buy, Amherst Outdoor Antique Market, 18 (81), D-Bells.

B170.811 Coggeshall Slide Rule, Analog Calcula, 2-3 Part, Slide Rule, Craft, ca 1850, USA, 4x33x.5 cm, Wood and Brass, No makers name, wood cracked, shows signs of real wear, Buy, Knotty Pine Antique Market, West Swanzey, NH, 15 (81), D-Bells.

B171.81Pickett & Eckel, Inc., 1 Slide Rule, Analog Calculator, 2-3 Part, Log-log, Craft, 1960, USA, 405171, 31x6x3 cm, Yellow, Aluminum and Plexi, Box, Case, instruction pamphlet, and guarantee, Buy, Westford flea market, 6 (81), D-Bells.

B172.811 Abacus, Digital Calculator, Single Register, Bead, Manual, 29x14x2.5 cm, Wood, 13 digit, Buy, Amherst outdoor antique market, 10 (81), D-Bells.

B173.81Burroughs, 1 "Burroughs" Adding Machine, Digital Calculator, Two Register, Keyed Wheel, Mechanical, ca 1950, USA, 8A193393, 22x37x20 cm, Green and Black, Metal, 8 digits with paper tape printing, Buy, 19 (81), D-Bells.

B174.81Felt & Tarrant Mfg Co., 1 "Comptometer", Digital Calculatpr, Single Register, Keyed Wheel, Mechanical, ca 1895, USA, 505, Walnut, Brass & Other Metals, Buy, Peter Delahar, 400 (81), D-MR2.

An early Comptometer with the springs showing on the upper keys. The keys are molded differently on alternative rows to give the operator a "feeling" of relative location. The walnut cabinetry and tooling was clearly a hand-made.

B175.80Siemens Brothers & Co., London, 1 Printing Telegraph, Links and Switches, Electro-mechanical, ca 1900, England, 12145, Wood and brass, Does not work, Buy, Portobello Rd., London, 510 (80), D-Gordon's Office.

B176.801 Sector, Analog Calcula, 2-3 Part, Sector, Craft, ca 1623, England, 9 inch; 240x50x5 mm, Brass, Buy, Peter Delahar, 2400 (1981), D-Bells.

Nine inch brass sector as described by Edmund Gunter (1581-1626) in 1623. Unsigned by probably made by Elias Allen in 1623.

B177.81Thomas Graham, 1 "The Oriental Calculator or Tables for the Calculation of Interest, Exchange & Commission" by Dorabjee Hormusjee, Book of tables, Writable or Readable Memory, Paper, Random, Craft, 1860, India, 15x23x4 cm, Green, Paper, Third Edition, Good condition, Buy, Editions, 45 (81), D-Bells.

Part I contains Interest Tables in Rupees, Dollars, and Sterling from one-half to 12 per cent per annum. Part Ii contains tables for the conversion of rupees, into sterling and dollars; and sterling into dollars. Part III contains commission or Inland Exchange Tables; Key showing indirect exchange between England, India and China; Tables shoing the comparative rates of exchange for sight bills, and tables showing the estimated value of one pound of cotton with all charges and varying exchange rates.

In the preface to the third edition the author states, "The rapid sale of the previous Editions of the "Oriental Calculator" and the pressing demand for it, are evident proofs of the utility of this work in mercantile circles; and the production of the Third Edition is the result of the liberal patronage and support the author has been favored with."

B178.811 Counting Beads, Digital Calculator, Single Register, Bead, Manual, 37x2x44 cm, red and black beads, wood and metal, 9 rows by 10 digits, Buy, Joe Stamps, NY, 50 (81), D-Bells.

XB179.81Reliable Typewriter & Adding Machine Co., 1 "Addometer", Digital Calcula, Single Register, Pascal Wheel, Mechanical, USA, 1x5x30 cm, Brown with red and white dials and yellow numbers, Metal, Case, Instructions, Stylus, and Calculator, Buy, Joe Stamps, NY, 28 (81), D-Bells.

See B150.80

B180.81American Can Company, 1 "American Adding Machine", Digital Calcula, Two Register, Tab, Mechanical, ca 1920, USA, 22x22x19 cm, Black with green, Metal, Rusted and worn, Buy, J Stamps, NY, 50 (81), D-Bells.

See B137.81

B181.811 Abacus, Digital Calcula, Single Register, Bead, Manual, 29x14x2.5 cm, Wood, 13 digit, Buy, Amherst outdoor antique market, 10 (81), D-Bells.

B182.81Burroughs, 1 "Burroughs Calculator", Digital Calcula, Single Register, Keyed Wheel, Mechanical, ca 1910, USA, #204128, 230x100x360 mm, Black, Metal, Buy, Reading flea market, 3 (81), D-Bells.

Replica of an early Comptometer. See B9.76.

B183.81SELSI, 1 Map mileage reader and compass, Analog Calcula, 2-3 part, Integrator, Mechanical, ca 1930, Germany, 110x35x5 mm, The handle also serves as a pencil. Buy, Reading flea market, 4 (81), D-Bells.

B184.81 Digital Equipment Corporation, 1 2 PM Flip Flop, Transistor, 1966, USA, R20YC, D-Bells.

B185.81 Data Products, 1 Core Memory,.

8 K by 19 bit 3W-3D 18 mil planar memory.

B186.81 Cal Research Computer, 1 Tube and circuit, Philips tube, 00667001, TC3-C5, D-Bells.

B187.81Automatic Adding Machine Co., 1 "Golden Gem Adding Machine", Digital Calcula, Single Register, Linear Pascal, Mechanical, 1904, USA, 56950, 105x75x18 mm, Metal, Complementary numbers scratched in, Case, instructions, and calculator, Buy, Colorado Springs, 20 (81), D-Bells.

Interesting directions regarding complementary numbers and the use of the simple machine for multiplication.

B188.811 "Precise"Adding Machine, Digital Calcula, Single Register, Pascal Strip, Mechanical, ca 1910, USA, 105x120x175 mm, Silver and Bronze, Metal, Stylus and calculator, Buy, 25 (81), D-Bells.

B189.81A W Faber, 1 Slide Rule, Analog Calcula, 2-3 Part, Slide Rule, Craft, ca 1935, Germany, 98350, 33x9x270 mm, Ivory, Ivory bonded to wood, Inch and centimeter scales are on opposite sides, Leather case and rule, Buy, D-Bells.

B190.81Ideas Unlimited, 1 "Horse-meter", Analog Calcula, 2-3 Part, Circular Slide Rule, Craft, 1951, USA, 135 mm diamter, Orange, gray and yellow, Paper, Buy, Colorado Springs, 1 (81), D-Bells.

"Directions for use: (1) Consult daily Racing Form for speed ratings, weights and class; (2) Figure rating for each horse in race as follows: (a) turn red dial to best speed rating in past 30 days; (b) turn blue dial to class in key race; (c) Turn yellow dial to weight difference of (a) race and today's race; (c) Add (or subtract) figures (a) (b) (c). This is horses rating. (3) Horse with at least 2 points aove rest is the choice in this race; (4) Play only if final odds are 2/1 or better; (5) Best results will be had by avoiding 2 year old, maiden, fillies and mares, stakes, hurdle, turf and steeple races and races over 1 1/8 miles."

B191.81E. & F. N. Spon, 125, Strand. London, 1 "Pocket-book of Useful Formulae & memoranda for Civil and Mechanical Engineers," by Sir Guilford L. MolesworthBook, Readable or Writable Memory, Paper, Random, Craft, 1888, England, 77x30x120 mm, Black with gold leaf edges, Paper, Buy, 3 (81), D-Bells.

Originally compiled in 1862, this is the 22nd edition of a truly pocket-sized book of formula. Although there is no table of contents, a very thorough index is provided for the 732 pages of tables.

B192.811 Section of the first Atlantic Telephone Cable, Transduction, Electro-mechanical, 1858, US, 95x18 mm diameter, Buy, 200 (81), D-Bells.

Cyrus West Field (1819-1892) American merchant, promotor of the first Atlantic cable was botn in Stockbridge, massachusetts. In 1854, he conceivec the idea of the calbe and secured a charter to organize the England and American companies. The British and American naval ships, HMS Agamemnon and the USS Niagara were secured to lay the cable. Five attempts were made between 1857 and 58. The first message transmitted, August 16, 1858, read, "England and America are united by telegraph. Golory to God in the highest and on earth peace and good will towards men." The Queen and the President of the United States exchanged congratulations, but the cable ceased working three weeks later. It was necessary for Field to raise new funds and make new arrangements. The great Eastern succeeded in laying a calbe in 1866.

B193.81A. Massim, Paris, 1 Music Box, Readable or Writable Memory, Mechanically stable, Cyclic, Mechanical, 1840, France, 30981, 343x160x120 mm, Black, Wood and brass fittings, Buy, 400 (81), D-Bells.

The music box plays six tunes; Robin Adair, the Blue Bells of Scotland, The Campbells are coming, Auld Lang Syne, Coming Through the Rye, and Bonnie Sweet Home.

B194.81Aaron Palmer, Boston, 1 "Palmer's Pocket Scale"Circular slide rule, Analog Calculator, 2-3 part, Circular slide rule, Craft, 1845, USA, 7x95x150 mm, Paper, Buy, Moskowitz, ca 185(81), D-MR2.

Palmer's Pocket Scale with rules for its use in solving Arithmetical and Geometrical Problems preceded the large sized Fuller's scale. See B110.80.

B195.81 1 Excise slide rule, Moskowitz, 375(81), complete on getting catalog

B196.81 A.W. Faber, "Castell" Pencil Works, Ltd., 1

"Instruction for the use of A.W. Faber "Castell" Precision Calculating Rules," by Henry O. CooperBook, Analog Calculators, 2-3 part, Slide rule, Book, Craft, ca 1935, Germany, 155x228x8 mm, Grey and red cover, Paper, Buy, Moskowitz, 15(81), D-Bells.

B197.81 1 "Enigma", Transducer, D-MR2.

B198.81 1 "Enigma", D-MR2.

B199.821 "Everard" slide rule, Analog Calculator, 2-3 part, Slide rule, Craft, ca 1720, England, 303x17x25 mm, Boxwood, The early form of Everard slide rule with two slides., Buy, Delahar, 222 (82), D-Bells.

<u>July</u> <u>16</u>th - Arrive Tokyo

My seat mate from Honolulu, Anthony Geber, Director of Economic Policy, Bureau of East Asian Affairs (State Dept., 202-632-9690) illicited some argument from me. (He opened.) We exchanged business cards (I'm practicing for Japan) as it's the only time I've carried cards. (This, according to Reischauer, is the thing to do.) At any rate, his concern is simply that Americans are too lazy to compete. Also it's too hard for us to go after their small markets. Mine is more fundamental -- Japan's growth versus return on investment; the availability of capital; Japan's trade barriers and language/cultural barriers; and the way the Japanese focus on winning in trade -- all serve to scare the hell out of me. Throw in our waste, vis a vis energy, too. I also attribute our regard for science over engineering and engineering over manufacturing as key. The fact that we no longer build, but use tape recorders (especially videotape), radios, TV, high quality cameras (we only built a few - Kodak 35), small cars, is cause for concern.

<u>July</u> <u>17</u>th - DEC Office + Keio University

Here we lie, watching the news (in English) after a day of running around like mad. Our host, Yu Hata, picked us up at 9:00 AM, took us to the DEC office, gave us a one hour briefing on computers in Japan (a brief history), and then I gave a two hour seminar on DEC products and engineering organization. There was an hour of questions on everything from 50 hertz 100 volt power to multiprocessors. It's clear we have inadequate planning of products for this market. Engineering makes its plans clear. Who's got the responsibility? (GIA-Janzen, CSS-Holman/Martin/Watanabe, the VT100 product here - Halio, or DEC Japan or some P/L for character sets?) This is a mess! For starters, I say GIA had better drive this issue!

We went to a nearby hotel and had to have an international style lunch (versus Japanese) because the Japanese part was full. I intend to assimilate everything -- just like the Japanese, so the food is paramount.

We left at 1:00 PM for a ride to Keio University (CMU affiliate) where I gave a talk on minicomputer architecture, which prompted lots of questions. We left at 5:00 after interaction and a view of their predominantly batch 11/06. Professor Toroko is an assistant professor in hardware. We were shown around by Professor Nori Doi. They would very much like to visit DEC. There was interest in architecture, as they wanted to build a large multiprocessor. Funding is tight as they're a private university with no NSF, ARPA or real industrial support. The main professor wasn't there.

Toroko gave me some papers which I'm sending internally, and Doi gave me a paper on the Fortran they built for the 11/08 patterned after Waterloo's WATFIV. On the return, Hata finished his lesson on the Japanese computer industry vis a vis the 3rd pair of groups (Fujitsu - Hitachi, who make 370 compatible), (NEC - Toshika, who're looking for a mini in Honeywell and used to be with GE) and (Mitsubishi - Oki). Univac (Nippon) is a dominant supplier somehow, based on Mitsui's earlier impetus! (Sept. 76 Datamation explains this quicker and better. The article is attached.)

We were dropped off at the Okura Hotel, I wandered around checking out the baths, water, etc. and finally settled on a swim indoors with a sauna. This let me shed a kilogram quick plus earn dinner. We went to a nearby restaurant Hata recommended and got a reasonable meal for only $30 each. It was quite good, not great, but we muddled through as I almost drank the tempura sauce versus wait for food to dip it in. We returned at about 8:30 and I called Don Frost about our visit tomorrow to NEC. I'm set to see the Director plus the technical management. Since I have a strategy to get a large share of the market, I wanted to check it out. Don said I, objective technocrat, should try it out with them! Basically the theme is: Buy any or all of DEC hardware/software; use it as a standard (just as Fujitsu-Hitachi do with the 370); sell in any/all Japanese/world markets and build a huge 11-based computer business! The Ministry of Trade/Industry (MITI), who controls all, should absolutely love it. The only trick is to get them to invent the idea!

July 18th - NEC

We had enjoyable talks/visits with NEC. The main purpose was to assure them we'd support them in their effort with the distributed system for the IRS (NTAA) using our machines (DECnet, 11/70, IAS). This was needed because they may view us as a source of technology (DECnet, minicomputers, interactive systems). Actually, technologically they're quite advanced, but probably in the wrong direction as their machines are ECL-based. The high ends are a takeoff of the Honeywell ceramic modules. They've been affiliated with Honeywell for 10 years, and next year the affiliation will be reviewed again. (Honeywell doesn't offer them anything.) The high-end is 635 based; the mid is on some earlier (2000?); and the low is on their earlier machines. Their office machines (100-series) are based on their version of the 8080 -- note it's an upward-compatible (one-way) version!

Their factories (computer and TV) were immaculate. People seem to move around faster than in ours, with more to do. The designs and quality of workmanship were quite beautiful. They commented on our reputation for quality and reliability -- which I think we have ... but we have to get these better. It's the one sure way to **sell** in Japan. They like quality/reliability (probably our other customers do too).

I had visited a TV factory; it's like I expected. They make 1,500/day - 300K/year. They have to make subassemblies because of U.S. import quotas. Their 5 Japanese competitors for U.S. market now have U.S. factories, which means the issue of Japanese products (TV) is solely a capital, manufacturing and design issue -- not high labor, for example. Again, I remember buying and giving away a large Zenith portable color and replacing it with a Sony color! (The Zenith replaced an old GE B/W which was never particularly good.) So in essence, I believe our ability to compete with the Japanese is:

1. A product design: quality/functionality (they adore knobby gadgets just like we do)/reliability.

2. Ability to manufacture it cheaply (and in volume).

As long as we don't forget this, we have a market. When we do forget, we'll be a distributor, just like GE and Zenith! (Incidentally, I recall that as engineers we felt sorry for the 100 TV engineers on Zenith's research group...why didn't they design better products? Why not a tape recorder? No American company produces a VTR (yet it was a U.S. invention). This gets back to emphasis of research (science) vs engineering vs manufacturing. I hope we're doing the right thing by pushing more on engineering and manufacturing (to a lesser degree) versus research at DEC.

In the afternoon I met with a number of their people from

Central Research. They're largely American trained, where the cost is lower and training is supported by U.S. government. One was trained on MIT Multics. We had no trouble in communicating! My earlier frustration that they wouldn't talk wasn't true. I did have to control the flow, otherwise they'd clean me out of information! The affiliation with CMU turns out to be good, because I can merely quote work there and stay out of DEC's work. The central (non-product specific) R&D is 100 people versus 50 for us...or they have 4 x the R&D per NOR since they have roughly 750M in sales!

They're building a very high speed COBOL engine, multiprocessor (just as we're fascinated by them for production reasons), and doing a mass store subsystem. It's hard to compare us because they're more into batch. They build bigger machines, but they'll soon learn as they build Honeywell's Level 6 mini under license. I sense they have a fairly muddy strategy, building product-by-product as ideas seem to be good. (With our high end VAX/10/20 machine, I think will be a long way to having a <u>clearer</u> product strategy -- although we'll have more products!) A person from R&D was amazed at VAX, and what it had, what it cost...he said all those ideas came from large machines. Surprise! I said this in a paper in 1971 on minis!

Speaking of ideas. The Japanese (and we) have about the same regard for ideas...they're useless until applied. Once applied, fair game to be modified, taken, etc., within the limits of the law and morality (e.g. patents). I think we need to state as a policy that we do want patent protection on ideas whenever possible, and that we'll take ideas from any source subject to moral/legal constraints! Here's what struck me:

1. The semi-automatic wiring machine that Stocky designed wasn't patented. We gave it away to be manufactured locally. It was manufactured here as a <u>copy</u> by a Japanese firm. (I suspect they've improved it and maybe we should look into purchasing them here.)

2. Their low cost Teleprinter was adapted from Extel.

3. Their high speed laser

printer was mainly IBM based using some Honeywell ideas.

4. The CML logic on ceramic modules came from Honeywell - although they made them manufacturable.

5. They use Gardner-Denver wirewrap machines and Universal inserters.

6. Manufacturing tools seem to be adapted from Macrodata, Universal, Teradyne (the wirewrap/backplane tester).

7. Their printer came from Versetec, though in a different package!

8. Their Fax machines probably have similar origins!

9. Their new Spinwriter is an adaptation of Interdata's carousel - I have some printout samples. The quality may not be high enough for word processing use. They're stressing reliability, speed (to c/s) and quality!

10. Cables/connectors come from the U.S. (maybe under license).

11. There are copies of the Tektronix scopes.

On the other hand, aside from our development and dedication to interactive and real time computing, many ideas of our products came from someplace outside (e.g., DECtape, 3M tape, cassette tape, the RK05, the DECwriters, the CRT's, the cache) various CPU implementation organizations, APL, BASIC, COBOL, FORTRAN, wirewrap, various LSI and manufacturing tools). We did contribute to computer structures more. In many ways we resemble them.

In the evening we had dinner at a posh, continental style restaurant with Dr. Ishii and Mr. Kitamura of NEC. I reaffirmed our support to them to make the NTAA (IRS) project a success...without this MITI will clobber us and our name will be mud. This is merely a reaffirmation of the Operations Committee decision requested by Marcus, GIA, and DEC-Japan.

Ishii was relatively speechless when I laid out the proposition that they standardize on 11's and drop the manufacture of the Honeywell Level 6. This gets them a mini right now, without continued investment, and they can backward integrate as they see fit. This theme for the GIA nationalistic companies is the right way to approach the marketplace. Somehow, we have to convince them that we're sincere and believe it to be the way to get into computers. This "sales approach" isn't widely understood/used. We need to formalize it. Japan would be the ideal place to start.

In the afternoon we went to the NEC computer factory and I talked with a number of very bright people from their central research lab. Fortunately they don't understand minis .... or they put on a good act (they had xerox copies of our VAX documents). Research has 100 people for a company half our size (4 x the effort). We saw a TV factory complete with multi-height rack burn-in (which we should use for disks).

<u>July 19</u>th - Fujitsu

We visited the central lab of Fujitsu at Kawosaki (Mr. Kurosaki and Mr. Sato), and then went to Numazau near Mt. Fuji where the computers were built. Fujitsu is the most computer oriented of all the companies because their founder, who died a few years ago, built one of the first relay computers. They ran the relay machine for me at Numazau while it calculated several common functions. They're not especially profitable, but they make beautiful computers and have the necessary technology. We saw their newly announced M200 (1.3 - 1.5 x 3033) multiprocessor using a dual cross-point for reliability. It appears superior to both Amdahl V7 and IBM (neither of which believe in multiprocessors (on M200).

Yu Hata and I could have easily had an argument on the relationship between Amdahl and Fujitsu. My view is simple: at IBM, Amdahl had developed a significant set of ideas on how to build 360's/370's. He left there and further enhanced the ideas in the circuits, design aids, packaging, small components assembly and testing areas. He got into financing trouble and Fujitsu bought a significant amount in return for the technology. Fujitsu put up the capital for the factory and made the assembly line work - no trivial feat because there's so much small assembly work. Fujitsu's first machine was not better than Amdahl's, but they took a longer term view (they are not that profit oriented) and produced better design aids and semiconductors, etc., so that their circuit M200 will probably beat Amdahl's V7.

The workmanship and detailed engineering is really fantastic. They have a very good master-slice (gate arrays) and fast (8 nsec) RAMs. In the terminal work, they have an anechoic chamber to get noise level down. They have some color CRT's and a floppy based intelligent terminal and are working on high level forms languages to make them easier to use. Of course, their disks are reverse engineered copies of IBM's.

Overall, Fujitsu seems the most frightening because of their dedication to quality, and winning. They have the strongest engineering and so far haven't been interested in mini's (PANA FACOM is their brand - a joint venture of PANASONIC (Mitsubishi) and Fujitsu). Also, given their disinterest in profit, they'll be doubly hard to beat.

Probably more important, Amdahl understands IBM mentality and how they strategize. This clearly influences Fujitsu and MITI. In fact, I believe Amdahl influenced MITI, at least indirectly, to build the plug compatible systems!

In visiting the Fujitsu factory, we saw one of the floors of the factory was devoted to programming. They had set up something that was very much like an assembly line for programmers. I would love to have our programmers look at this kind of environment because, in effect, there was really a sea of programmers. Probably the most impressive part was that they had a great number of line printers all backed up to a conveyor; and as each line printer finished its output, it was cut and stacked. It was cut into the appropriate pile; the pile was put on the conveyor; and the conveyor ran it off. The whole thing appeared on a carousel so that in fact all the programming listings were delivered stacked automatically. Of course, there were no individual offices for the programmers, only a sea of desks.

I guess the other thing that was impressive about the Fujitsu factory was the very clean atmosphere. The custom of removing shoes is very helpful; this is done on entry to computer rooms, temples and tea rooms. It was the cleanest of all the computer companies that we saw. This really pays off when dealing with the large number of contacts, the small coaxial cable, and the way the multi-terminal integrated circuits are sorted at that point under the board.

The Fujitsu M190 and M200 computers also used color CRT's for controlling the computers. KIVIAT graphs are displayed on the consoles so that one can get an idea of what's happening to the various resources. They are used in real time display in the Fujitsu computers.

July 20th - Electro Technical Lab and University of Tokyo

We visited Dr. Nishino and Dr. Mori of the Electro Technical Lab, which is run by MITI. This is a Central Research group responsible for computer research (the nearest equivalent of ARPA). The lab in a sense looked like many government labs - a series of dusty old equipment with experiments, which can be put into service for visiting dignitaries; some good and some bad work; and a bunch of reasonably intense Ph.D's. I gave a talk on the VAX design and it illicited a number of interesting questions. They're doing a large number of computer structures related work, several projects on multiprocessors and on microprogramming, and various things on language translation. On Dr. Nishino's desk was a well worn copy of the Quantam Sciences forecast on office automation. I asked to see stuff on Word Processing but the stuff I saw was not particularly useful or impressive.

The ETL does have one interesting virtue in that it does very little hardware building. In fact, its main function is to fund various industry groups to do design for a lot of the Japanese minicomputers. Anyway the one that is the equivalent to the DG mini looked exactly like the DG framework, except the workmanship on the console was much better than Data General's.

We went to the Tokyo Hilton and fortunately had Tempura, which is sort of batter fried fish, shrimp, and vegetables (probably the easiest thing for Westerners to accept and digest). It was about our second Japanese meal, because all the other meals were given to us assuming that we could not eat Japansese food. We had sandwiches (with bread crusts removed, delicately made and presented) at the various companies and had continental food when we went out (especially the elegant NEC meal which was heavily influenced by French cooking).

In the afternoon we went over to the University of Tokyo where I gave a lecture on minicomputer architecture in a very formally decorated room (held about thirty). They apologized for the small crowd because it was vacation. I was with Professor Ashida and Professor Inose, both of whom had spent a great deal of time at BTL. Inose is the father of the time sort algorithms for ESS No. 4 time division multiplex switching, which he did about twenty years ago. The talk was supposed to take one and a half hours with a half hour of questions, but ended up taking about one hour with roughly forty-five minutes of questions. We went to Professor Inose's office, were formally received, and discussed various types of things. The two professors had to leave because they had a dinner meeting of some sort.

We were then shown around the large Hitachi machines by one of the students. It was the Hitachi 8800 and he lamented the fact that Hitachi now was making IBM compatible computers, which he considered inferior to the ones they had currently made. Their other line is almost IBM compatible, derived from the Spectre 70 unit, but has special supervisory call instructions which makes them incompatible. We looked around the computer, which is really a monstrous machine because it was made out of MECL 10K, I believe; but the machine was water cooled.

There was a four processor system, three fast processors and a slower processor. The load was not very heavy. We went over to look at the system resources and I ran a BASIC and FORTRAN program. The BASIC null program really bombed out so I have a feeling the null program took a good deal of time showing that they had some kind of interpretive compiler. The FORTRAN produced good quality code and ran very rapidly.

We left there about 6:00 PM for dinner with Yu Hata, his wife and Don Frost at Yu Hata's son's apartment. We spent a thoroughly enjoyable evening looking at his airplanes. Because he is an avid photographer, he got into building model airplanes for aerial reconnaissance photos. He also built some helicopters. All of this was indeed incredibly impressive. The airplanes are very detailed and take something in the area of six months to one year to build.

<u>July</u> <u>21</u>st - Sony

We were picked up early at the hotel, checked out, and went to the Sony Corporation Central Research Lab where we were given a brief introduction to what Sony is working on. Other than that I was able to get no information from the Central Research Lab group. I asked about what was going on in the Systems Research Group, but the only thing we saw was a Sony TV tube (used for Graphics) for which I have the specifications.

They also demonstrated with characters but the interlace problem created incredible flickers. I asked about buying monitors but they said I would have to see Mr. Iwama. Having gotten no information from the Central Research Lab, we then went to Sony's Atsugi plant, where we saw the video tape recorder being made. In contrast to the NEC TV plant, the Sony plant did not do any burn in of parts but in fact used testing to ensure that the product worked when they were all put together.

A large number of the parts were done outside this plant and subassemblies were brought back for fabrication. In all the plants that we saw only about half of the work is done inside. The rest is done by subassembly or contract labor. In the factory only 40% of the 1,100 people were workers. Of course, this was reasonably high considering that in that factory about 250 out of the 1,100 were in the engineering group. This is where they made so many semis.

The semiconductor part used three micron channel width for NMOS.

They were the first in Japan to use the Bell Lab license of the transistor, and Mr. Iwama, the President and technical person at the top, insisted that a large number of engineers be hired to do semiconductors and, in fact, he backed Dr. Esaki.

Sony has an electron beam mask maker, which they got from Japan Electric Corporation, which is a copy of the American electron beam mask maker. We saw one of the AM 2900 ion implanters. It was just the fourth or fifth installed there. They pride themselves in owning a great number of the key semiconductor patents and, in fact, have a 10,000 volt transistor patent which is very key to making all solid state TV sets.

We left the factory in time to have lunch with Mr. Iwama, who of course took us to a hotel where we had a western meal; but before this, we looked at three very interesting video recorder projects all of which we have become interested in.

The MAVICARD recorder, which I have brief information on and a carousel version that allows up to five other cards to be loaded automatically, is a scanned device and the card holds up to one hundred images. There was a small video disk which held ten seconds of video on a frame by frame basis, and could be used in freeze frame applications. That system will be introduced this year for sports teaching. I am asking Yu Hata to go ahead and get information on these products. The third device was a small tape recorder, a tiny video disk about three inches in diameter that can store only a few frames of video.

All these products I find extremely intriguing, and all we have to do is figure out how to couple them to DIGITAL recording. Iwama talked about the various forms of pulse code formulation for audio and video (they have got to get into it). We would automatically end up with tape and disks that will allow us to use the video technology in computers.

They make it a point in their advertising of trying to stay away from anything that other people are doing. One can see by their various products and images, just what their approach to life is. Their motto is, "research makes the day".

After lunch with Mr. Iwama, we drove to the train station where we got on the bullet train for Kyoto arriving in Osaka at about 7:15 PM. We were met by the software specialist and were taken to the Osaka Hotel where DEC Japan, Osaka Branch, were having their end-of-the-year party. There were about 75 people there. Don Frost gave a good speech calling for plenty of openness and then I followed up by saying how glad I was to be in Japan, about how impressed I was with the Japanese, and our need for quality.

We finally got back to Kyoto and the Tawaraya, an old-style Japanese Inn, at 11:00 or so. I was glad to lay on a mattress that was flat on the floor and very comfortable, after having lay too soft in Tokyo.

<u>July 22nd and 23rd</u> - Sightseeing at Kyoto and Nara

We had breakfast, Japanese style, in our room at about 8:30 AM and then Gen Narui and Miss Tomioka came for us to go sight-seeing. In Tokyo we had home-made coffee and fruit in the room to gain time, decrease interaction, write, and it's awfully cheap.

In the morning we went to the summer detached palace of the Emperor Shugakuin outside of Kyoto, which included many temples, houses and rice paddies in an extremely beautiful setting. We were very fortunate to get there, and because I was a visiting "dignitary", we were allowed to go. I was glad that neither Yu Hata nor Gen Narui had seen the palace so it was a treat for all of us. Miss Tomioko was in a traditional, elaborate, beautiful Kimono and kept being stopped by U.S. photographers at each site.

We took off on a tour, which was about a two mile walk in reasonably warm climate, up and down the hill in an almost Greek-like setting. Then we left for Arashi-Tei, a restaurant I think attached to a hotel that overlooked the Hozu River. We had a typical Japanese, probably nine course, luncheon starting off with beer because we were so thirsty after the walk. After lunch we went up the Hozu River and rode the boat down for about 10 miles back to the landing of the restaurant.

Off we went to visit the Nijo-Jo castle in the center of Kyoto.

This was a castle of the Shogun, built to impress the Emperor to put him in business. However, neither of them spent that much time in Kyoto because they both lived in Tokyo. The castle was, of course, extremely impressive with moats all made of wood and bamboo.

We came back to the Tawaraya, cleaned up a bit, and went out to dinner at a very nice restaurant. It is hard to remember which is the most memorable part of it, given that there were so many courses. After dinner we went down the main street of Kyoto looking for various souvenirs.

I spent most of my time looking for a knife, having been intrigued with the possibility of slicing vegetables very thin which is one of the specialties of the Japanese salads. I found one, got a few other odds and ends as presents, some more ideas for presents, and returned to the Hotel about 9:00 or so, quite ready to konk out so I could go the next day.

On Sunday morning we were trying to sleep late, given that we were going to take off at 9:30, but our maid/attendant unfortunately decided that we should get up about the same time as the day before and we were out by about 8:30. We met Gen and Miss Tomioka at the railway station and caught the 10:00 o'clock express train to Nara. The train is run by a private company and was extremely comfortable and cool, as are all the Japanese trains. We all got to the Todaiji Temple at about 10:30.

We went on to visit the Taishi Shrine at the same location, walked around, and had a fairly heavy nine-course lunch at an old inn called Tonochaya. We were off by 2:00 and went to visit both the Toshodaiji Temple and the Yakushaji Temple. These were high points of our trip. We were met by a lady who is on the staff there. Miss Tomioka knows her very well and we had an incredible walk through the various temples. The latter temple was probably most impressive because a fire had destroyed the west temple and they are building a new one. We were able to talk to the engineer who is in charge of the new construction. He showed us around and we ended up going into the construction of the temple. It is made of wood with no metal and is about 30 - 40 meters tall. We also went to the site where the wood was being prefabricated. This is being done by a bunch of scholars and an old carpenter. The whole temple is, of course, designed to last 1,000 years and, with the care they are taking, should easily accomplish this. There are about twenty carpenters working on the building. It is thought it will take about three years, or about sixty man years of work, to complete this temple.

The superstructure of the building is built around a wood pole and the temporary structure is made of steel and is quite permanent. After we got through climbing around, we were taken up in another temple that houses some of the Buddhas. All these temples, of course, house Buddhas of various sizes and shapes. The first one houses the world's largest Buddha made of 12th century bronze.

We were presented with various photographs, gifts, good luck charms, and goods to help us on our way. We had tea and cakes with one of the monks at the temple before we left at about 5:15. We got the 5:30 from the station near the temple, transferred to the express at Nara, were back to Kyoto by six, and had dinner at seven.

The five of us had dinner at the Tawaraya -- eleven courses. It was a magnificent dinner starting with raw fish, vegetables, and soup. Along about the eighth course we were served with a very heavy tempura as batter-fried shrimp, vegetables, potatoes, and fish. I was hoping things would be over, but in came the next course, which featured the hibachi. Everybody had steak and various vegetables. Somehow I managed to get through that course, but skipped the next two because it is probably thought bad luck to have an even number of courses. We were all presented with small hibachis. We finished dinner at about quarter of nine which is not necessarily typical, because for some reason, even though food is very lovely and things are in small servings, the Japanese eat very fast. While I am here I am trying to eat slower than normal, otherwise we would finish the meal in probably an hour. I do enjoy the food and the time spent very sociably.

<u>July</u> <u>24</u>th - Talks at Kyoto, Osaka, and Kyoto Sanyo University

I gave lectures at Kyoto and Osaka Universities and had dinner with people from Kyoto Sanyo University. (The tape is apparently lost in the Sydney secretarial pools).

July 25th - NEC

We visited NEC in Kyushu, which is on the island of Okinawa, a place where NEC makes almost 80% of its semiconductors. It is there because of the labor force and because of the supply of water. They make about 5 million pieces a month, 60 million per year (at 80%, this would give the total NEC IC's at 75 million per year). If each is selling for maybe $3.00, because they have a large amount of LSI, NEC's total sales would be at about a quarter billion dollars (which is what we think they are).

Mr. Iwao, Chief Engineer, took us around. He is actually the operator of the plant and is interested in high volume manufacturing. The brochure I took back has all of this annotated. They started there in September 1969, with only 400 million yen capital, or at today's prices, about $2,000,000. They employ about 1,750 people there -- 1,250 are direct laborers. They operate two shifts -- 5:30 AM to 1:45 PM, and then the second up to 10:30.

Their history there is one of starting out to do semiconductors for NEC's NTT telephone business, so they have a fundamental interest in quality. Subsequently when they got into the NMOS PMOS calculator, cash register, and computer business, they changed the emphasis to volume, which they have now. In doing this, they never left their concern for quality.

All products are burned in. The NTT products are sometimes burned in for as much as a week, and some products are only burned in half a day. Eight percent of NEC's total sales go outside. It is building as much as 15 to 20% of these sales for export. Probably a larger amount is to the United States, although we don't know. They are making all PMOS 4 calculators and cash registers, and NMOS computer memories, including the 4K plus 16K RAM. They are doing a lot of CMOS for watches, calculators and radio equipment. In addition this NEC plant makes the BIPOLAR CML logic for the high speed computers based on the Honeywell CML logic.

We initially had concern whether we could visit there and they reluctantly agreed to let us. The person who took us around was not that keen on having us, but was certainly cordial after we arrived. They try to keep their labor force flat. They have taken all of their plating and marking equipment for the two in-line packs to local shops outside. They start with silicon wafers, go through test, then ship. They have a very nice process chart. In fact, virtually like every Japanese company, we were handed a brochure that clearly described their whole process. In this case there are 15 steps. The 16th is shipment, which is by air in specialized containers. From a semiconductor standpoint, they used the 4" wafer on one line in a large two-story building (240 x 40 meters) -- they have about 4 lines and at the one end is the new 4 inch line.

In a small building they have the bipolar line which is low volume for all of the processing areas. The second floor is the pellitization through testing processes, exlcuding the part that is done outside.

Mr. Iwao wanted to know how this compared to TI and to INTEL. I could not tell him (probably because I don't understand semiconductors that well). Frankly I was quite impressed simply because of the incredible cleanliness and the well designed layout they have.

Again, the pressure of the Japanese custom of taking shoes off (leaving them at the door) to enter a building is really helpful to a semiconductor processor, because it means that you don't carry a lot of dirt around. All of the areas that were part of the factory were marked in terms of class. The workers and the back of the equipment was class F and then everything else was in class C. They had class B and class A rooms. They end up with a failure rate of 1% at burn in, so that they have a very high overall volume rate at customer acceptance.

They own mask making equipment in Tokyo, which is an EB machine. All of the work done by the design and manufacturing production equipment design is done in Tokyo.

NEC has processed SOS wafers, but is not interested in it because of the low volume, low yield, high cost nature of it. They are also looking at and made (it is not clear how) JIL parts apparently for the NTT. (NTT wants it.) Unlike many of the other semiconductor companies, especially Sony, NEC believes that it must bring all of the manufacturing equipment along. It has formed a wholly owned subsidiary tester company called ANDO. Of course, being very patriotic to Japan and themselves, they use the NEC M4 minicomputer, which is a conversion of the Varian machines. The manufacturing complaint, about the difficulty of maintenance of the tester, is traditional with every manufacturing group I have heard.

The 4 inch line is one area that we weren't allowed to see. In fact, he studiously avoided us looking at their wafer lines although there were windows into all of the other lines. In the case of the new 4NC wafer line, there were no windows and no hint as to what was inside. He did say, however, they use automatic aligners, and that through the process up to diffusion, everything was handled as a continuous process. I would guess they have as highly an automated function as TI's we saw several years ago. Diffusion, and some of the other processes, are batch in production. He longs to have the whole thing be a continuous process.

I was incredibly impressed with the fact that there were graphs of everything everywhere and I suspect even some graphs on semi-log paper somewhere. The graphs were used to plot everything against everything else, so that they really knew what their process was doing and the output. In the case of the secret process I asked about, he said that it had considerable computer control and the main reason for doing this was to know what the various steps of the process were doing and what the productivity was. As a manager, since he is not given that much control over his own destiny, he is very concerned about productivity. He does move some of the simple parts outside, but also is concerned with automating as much as possible, and keeping the cost of all the labor force flat while maintaining the various steep increases in volume. He did not say when the 65K/RAM would be built but they are being produced now in Tokyo.
<n>ABSTRACT: NEXT COMPUTER GEN: REQUREMENTS&CHALLANGE/GB4.S2.35

2/25/83 2/25/83 16:40 1 1 <>

<n>AMDAHL:EMS/3-9/EMC,PEG,RAD,TMC,ENGR.USERS/GB4.S3.13
3/9/83 3/9/83 11:06 2 4 <>

<n>AO: MCC TECHNICAL MEETING/EMS/1-9/GANNON/GB4.S2.13
2/18/83 2/22/83 15:16 3 3 <>

<n>ATANASOFF PREFACE/GB4.S2.31
2/21/83 4/26/83 0:01 5 3 <>

<n>ATANASOFF - THANK YOU FOR YOUR PAPER /GB4.S2.33
2/21/83 4/26/83 0:01 3 4 <>

<n>ATANASOFF - YES, PUBLISH THE PAPER/ BURKS/GB4.S2.32
2/21/83 4/26/83 0:02 6 8 <>

<n>AUSTRALIAN: VAX-VMS/DECNET INPUT-EMS-1/3-GB4.S1.5
1/3/83 2/18/83 15:47 5 5 <>

<n>AUSTRALIA:THANKS/EMS-FRANK WROE-1/3-GB4.S1.6.6
1/3/83 2/18/83 15:47 7 5 <>

<n>BOOK: OUTLINE II/ EMS-1/7-STRECKER,FULLER/GB4.S1.13
1/7/83 2/18/83 15:50 4 6 <>

<n>BUS:BUILD,USE,SELL/EMS/1-17/OC,PEG,MFG,PLM/GB4.S1.20
1/17/83 3/8/83 16:11 10 17 <>

<n>BUS: DISCUSSION OF POLICY/EMS/1-25/OC/GB4.S2.23
2/18/83 2/22/83 15:29 8 2 <>

<n>CFM: COST PERFORMANCE/EMS/2-15/OC/GB4.S1.24
2/15/83 4/26/83 0:08 12 11 <>

<n>CHIPS: 100K TRANSISTOR/SEG MGRS-GB4.S1.9
1/3/83 2/18/83 15:45 5 5 <>

<n>CLUSTERS:CLARIFYING & CLAIMING/EMS/2-6/OC/GB4.S3.6
3/4/83 3/4/83 10:46 10 1 <>

<n>CLUSTER: VMS, NAMING/EMS/HUSTVEDT/2-5/GB4.S3.4
3/4/83 3/4/83 10:36 4 1 <>

<n>COMPRESSION LABS:LTR TO JOHN TYSON/2-16/GB4.S1.39

2/16/83 2/16/83 9:47 3 1 <>

<n>COMPRESSION:LABS,INC.OPPORTUNITIES/EMS/CRAWFORD/2-15/GB4.S1.37
2/15/83 2/16/83 8:49 6 4 <>

<n>COMPUTERS: COMPARISON-INEXPENSIVE PC'S/EMS/1-2/OLSEN/GB4.S2.6
2/18/83 3/8/83 14:22 5 3 <>

<n>CRAY, SEYMOUR NAE FOUNDERS AWARD/LTR/ABRAMSON/1-26/GB4.S1.18
1/26/83 1/26/83 11:39 2 4 <>

<n>CSIRO:100K GATE CHIP/MARCUS PALTRIDGE/2-1/GB4.S1.27
2/1/83 2/15/83 9:40 2 3 <>

<n>DATAFLOW MACHINE:J.DENNIS/EMS/GANNON/3-1/GB4.S3.2
3/4/83 3/25/83 10:53 3 2 <>

<n>DECMAIL:EMS/1-3/DOCKSER,ANCONA,MARCUS/GB4.S1.10
1/3/83 1/3/83 15:12 4 3 <>

<n>DECMAIL: WHY BOTH WITH/EMS/1-3/ANCONA/GB4.S2.11
2/18/83 2/22/83 15:13 4 3 <>

<n>DECMATE II:CONGRATULATIONS/EMS/2-20/AVERY/GB4.S3.9
3/4/83 3/4/83 10:51 5 1 <>

<n>DEC 10/20: QUESTIONS/EMS/1-2/KNOWLES/GB4.S2.8
2/18/83 2/22/83 15:09 8 4 <>

<n>DESIGN:QUALITY METHODOLOGY/EMS/1-4/AVERY/GB4.S1.12
1/4/83 2/18/83 15:39 18 3 <>

<n>ENGINEERING: TOP 10 ISSUES FOR '83/EMS/1-21/PEG/GB4.S2.22
2/18/83 3/15/83 10:03 11 4 <>

<n>ENGINEER MODULES: RETHINK OF HOW WE DO IT/DEMMER/GB4.S2.18
2/18/83 4/26/83 0:08 4 4 <>

<n>FACTORY: PROPOSAL, LABORATORY HDWE./EMS/GB4.S1.22
1/20/83 2/18/83 16:02 4 7 <>

<n>FUJITSU: OPPORTUNITY/EMS/1-21/WIN HINDLE/GB4.S2.21
2/18/83 2/22/83 15:26 8 2 <>

<n>HISTORY:LEARNING FROM CDC-CRAY/EMS/2-14/PEG,TMC,OC/GB4.S1.31

2/14/83 2/15/83 10:51 10 8 <>

<n>HISTORY: IBM,AMDAHL ET AL /KNOWLES/GB4.S2.7
2/18/83 3/1/83 9:01 17 3 <>

<n>INDUSTRIAL TERMINALS:EMS/1-3/KO,HINDLE,MARCUS/GB4.S1.8
1/3/83 2/22/83 13:55 5 8 <>

<n>INTERVIEW - GB BIOGRAPHY /GB4.S1.2
1/3/83 2/24/83 11:58 152 24 <>

<n>INTERVIEW - VERSION 2 GB BIOGRAPHY/GB4.S2.2
2/10/83 3/30/83 13:31 <>

<n>INVITATION-NO-IEEE MEETING:/DAVID ZEIN/1-3/GB4.S1.4
1/3/83 1/11/83 9:15 2 4 <>

<n>JAPANESE:5G EFFORT,IBM/EMS/1-9/FOREST BASKETT/GB4.S2.14
2/18/83 2/22/83 15:17 4 2 <>

<n>LA12: LET'S DESIGN & BUILD IN AUSTRALIA/EMS/1-3/GB4.S2.10
2/18/83 2/22/83 15:11 6 4 <>

<n>LLL, DEAL WITH GEORGE MICHAELS/GANNON ET AL/GB4.S1.11
1/6/83 4/26/83 0:14 2 7 <>

<n>LLL:JOINT WORK ON CFM/782/EMS/1-6/FULLER/GB4.S2.12
2/18/83 2/22/83 15:15 5 3 <>

<n>MANAGEMENT PROBS 0 & 1/EMS/2-14/PEG,TMC,OC/GB4.S1.32
2/14/83 2/15/83 10:38 8 4 <>

<n>MCC SITE: COLOCATION W/HPP CENTER/BOB INMAN/2-15/GB4.S1.36
2/15/83 4/26/83 0:02 3 3 <>

<n>MEETINGS:INSPECTING&DIRECTING THE TECH SIDE/BORNSTEIN/GB4.S2.19
2/18/83 4/26/83 0:06 4 4 <>

<n>MicroVAX PC: PROBLEMS WITH BUSINESS/EMS/3-9/GB4.S3.12
3/8/83 3/9/83 14:56 9 5 <>

<n>MICROVAX:68,000 LANDSLIDE/EMS/2-14/OLSEN/GB4.S.30
2/14/83 2/15/83 11:00 6 4 <>

<n>MICRO 11:FEASIBILITY OF SMALL/EMS/2-23/HUGHES/GB4.S3.10

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                          3/4/83  3/4/83 11:57  14   1     <>

<n>MUDGE:100K TRANSISTOR CHIP/LTR/GB4.S1.16
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<n>NYU PROPOSAL/GB4.S1.17
                          1/10/83 1/10/83 11:40 4    3     <>

<n>OPERATING SYSTEM ADDICTION:EMS/2-18/OC/GB4.S3.8
                          3/4/83  3/4/83 10:50  11   2     <>

<n>PC MICROVAX: EMS-2-17-OLSEN,SHIELDS,HINDLE-GB4.S1.42
                          2/17/83 2/18/83 13:22 6    4     <>

<n>PC'S:HOW DO WE GET SOME/EMS/2-6/FOLSOM/GB4.S3.7
                          3/4/83  3/4/83 10:47  10   1     <>

<n>PDP 11: TASK FORCE/EMS/ANDY KNOWLES/2-1/GB4.S3.3
                          3/4/83  4/4/83 10:17  6    2     <>

<n>PDP-11:ETHERNET11 CLUSTERS/EMS/1-2/GUTMAN/GB4.S2.5
                          2/18/83 2/22/83 15:06 11   3     <>

<n>PDP-11: IMAGE & MARKETING/EMS/1-3/GB4.S2.9
                          2/18/83 2/22/83 15:10 3    2     <>

<n>PDP-11: TASK FORCE, INPUT/EMS/1-2/W.DAVIDSON/GB4.S2.3
                          2/18/83 2/22/83 12:08 11   2     <>

<n>PDP-11: TASK FORCE/EMS/1-30/GUTMAN/GB4.S2.28
                          2/18/83 2/22/83 15:35 7    3     <>

<n>PPA: ATTENTION IT REQUIRES/EMS/2-5/STRECKER/GB4.S3.5
                          3/4/83  3/21/83 9:48  4    2     <>

<n>PRINT SERVER: EMS-RON CRISS-REPLY BY GORDON-2/16-GB4.S1.38
                          2/16/83 2/18/83 9:35  5    7     <>

<n>PRODUCT PLAN:ENGR/CSS JOINT/EMS/2-22/AVERY/GB4.S2.34
                          2/22/83 3/11/83 10:04 6    4     <>

<n>PRODUCT STRATEGY--WE'RE REALLY MAKING IT/GB4.S2.36
                          2/28/83 3/1/83 10:23  179  5     <>

<n>QBUS:BASED CRT/EMS/1-27/C.LEAROYD/GB4.S2.24
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2/18/83 2/22/83 15:29 5 2 <>

<n>RAINBOW: DECISION TO SUPPORT/EMS/2-21/FOLSOM/GB4.S2.30
2/21/83 2/22/83 15:04 7 4 <>

<n>REFERENCE MUDGE:PROMO TO RSCH.SCIENTIST/PHILIP/GB4.S1.15
1/10/83 1/10/83 11:34 5 5 <>

<n>REFERENCE SIEWIOREK:TERMAN AWARD/DIRECTOR/GB4.S1.14
1/10/83 1/10/83 8:41 3 2 <>

<n>RETRAINING: FOLLOW UP-NAE SPEECH/EMS/1-11/OLSEN/GB4.S2.16
2/18/83 2/22/83 15:21 5 2 <>

<n>R&D TAX:COST-SHARING-REGS/EMS/CHAMBERLAIN/1-25/GB4.S1.21
1/25/83 2/18/83 16:17 11 8 <>

<n>SCHLUMBERGER:EMS-SKIP GARVIN-2/14-GB4.S1.40
2/17/83 2/17/83 10:48 12 3 <>

<n>SCORPIO ORGANIZATION REVIEW/GB4.S1.26
1/28/83 1/28/83 16:28 10 2 <>

<n>SDF - SYSTEM DEV. FOUNDATION:MTG. 3-13/KEN/1-27/GB4.1.25
1/27/83 1/27/83 14:29 2 3 <>

<n>SOFTWARE:PROPRIETARY OR NOT-PC'S/EMS/KC,CUDMORE/3-9/GB4.S3.11
3/8/83 3/9/83 10:48 7 3 <>

<n>SOFTWARE:PROPRIETARY VS INDUSTRY STD./EMS/3-9/OC/GB4.S3.14
3/9/83 3/9/83 14:45 8 4 <>

<n>TEKNOWLEDGE:TECHNOLOGY BOARD/EMS/2-14/PATEL,ABEL/GB4.S1.33
2/14/83 2/15/83 13:34 6 3 <>

<n>THANK YOU FOR DINNER, STANFORD: BOB WHITE/2-15/GB4.S1.34
2/15/83 4/26/83 0:04 2 4 <>

<n>THANK YOU FOR LECTURE, LINCOLN, NEIL /GB4.S1.35
2/15/83 4/26/83 0:03 3 5 <>

<n>U OF PITTSBURGH, DISTRIBUTED COMPUTING:BARDSLEY /GB4.S1.3
1/3/83 2/14/83 9:15 2 10 <>

<n>U.S.EXPORT LAWS:APPLICATION/EMS/ENGR USERS/1-25/GB4.S1.23

1/25/83 2/18/83 16:19 21 8 <>

<n>VIDEODISK: OR DIGITAL AUDIO/EMS/1-27/D.BROWN/GB4.S2.25
2/18/83 2/22/83 15:30 5 2 <>

<n>VT PROBLEMS FROM GERLAD DAVIS /AVERY/GB4.S2.15
2/18/83 3/1/83 11:23 4 4 <>

<n>WANG: LOCAL AREA NETS/EMS/1-3/LACROUTE,OC/GB4.S1.7
1/3/83 2/18/83 15:42 5 7 <>

<n>WORKSTATION: GETTING A FIRST RATE/EMS/1-29/CROXON/GB4.S2.27
2/18/83 2/22/83 15:31 5 2 <>

<n>WORLD BUS:SPECING IT-YOUR AGREEMENT/EMS/1-28/GAUBATZ/GB4.S2.26
2/18/83 2/22/83 15:31 5 3 <>

<n>WORLD BUS:SPECING/EMS/1-30/GAUBATZ/GB4.S2.29
2/18/83 2/22/83 15:35 7 2 <>

<n>WORLD BUS: EMS/1-20/GAUBATZ/GB4.S2.20
2/18/83 2/22/83 15:24 4 3 <>

<n>WPS STANDALONE: COMPARISON/EMS/1-2/BOB HUGHES/GB4.S2.4
2/18/83 2/22/83 12:52 10 3 <>

May 3, 1982

Susan Wood
Better Business Bureau, Inc.
150 Tremont Street
Boston, MA 02111

Dear Susan:

In answer to your letter of April 15, the $721.93 was the cost to repair the body damage when the car was broken into and to replace the radio. Pass & Weiss was unwilling to bear this expense. Since they agreed to take responsibility for the car overnight and did not put the car in a protected lot, I feel they must pay the $721.93.

Please help me get the $721.93 from them because it is their fault for not taking proper care of it, while at the same time agreeing to hold it.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

cc: Mr. Pass, Pass & Weiss
F. W. Doerr

GB:mal
GB3.S4.12
IDEALOGY
0. Overall, the ONLY way to work is under the pressure of conflict versus teamwork. DEC is simply not a fun place to work as a result. Virtually ALL focus is on INTERNAL, NOT EXTERNAL competition.

1. Short term versus Quality. Invariably responding to revenue problems with poor products cause more poor products wchich get there too late to solve the revenue problems, and get us (especially software) that has to be maintained forever. (eg. various collage of crappy, incompatible, unextendable, commercial products. They're too late when they get there to compete with the ibm and japanese pc world. They could either/both be on vax and rainbow... but not our past. Sell what we got.

2. Quality overall! VERSUS QUANTITY!
The issue is knowing when to stop the software and finally the hardware development and finally the marketing on a product family. The 8, 11 and Pro all are clearly dead from software viewpoint, but should be developed carefully in hardware. With the operation of the software on the Rainbow for WPS, the 8 hardware can be put to bed, if we go balls out with the software! Can we decide?

A careful review would have let us NOT sell the PRO, and probably we would have stopped it before announcement. (Now, we have to sell it and get out of it.)

We do n (=3) poor products versus 1 good one ala IBM. Nearly all the projects violate my heuristics based on history and common sense. We now have 3 barefoot, children to feed and not enough food for them. Only one is worth feeding anyway.

3. On how to compete and how to have impact. They go together. For example, our semiconductor design performance doesn't face a competitive market. I don't believe they'll ever make it without this external focus. IF not, then WHY BOTHER TO HAVE A SEMICONDUCTOR ENGINEERING GROUP? The same is true with disks, I believe. Software too. Namely, we should do NO commercial applications because it can be bought and will be better. Clearly the 11 is irrelevant in terms of being either adequate for modern software (especially business) versus the 8086 etc. family.

Impact (and profit) usually comes with market share. I see no way to do anything but to milk VAX and 11 out of the market, but we shouldn't be investing much there if we're going to do buyout machines (68K and 286) and compete with the workstations folks and PC folks.

4. Importance of Toem/coem reseller channels. These are essential as IBM learned from us and have to be nurtured. Why we ever thought otherwise in light of the data is inexcusable!

STYLES

0. We aren't able to focus on critical problems because the problems are defined, but instead everyone is building defenses. For example, the PRO defense against Ken's attack mask the critical issues. We did not look into this, and as a result, we still have no product. Legions are devoted solely to interpretation and defense management.

1. Focus is always on trying to build multiple, internally competitive teams. This requires cunning, devisiveness, and

is ultimately fairly destructive. For the extreme, read Soul of a New Machine for an account of our trainees. Yes, we have to have competitive projects. We needn't market them all. We needn't allocate the same. We need to be explicit and open.

2. Listening. The 11 is insignificant now, it could/should have occupied the space that the 8086 now occupies. History is about to repeat for VAX and MicroVAX. I happen to believe this is going to go down in the annals as another mismanagement. We're stuck with a flat growth, when it should be exponential and we should be setting the standards for the next generation of computing.

3. Mentoring/teaching is non-existent. Demise is almost certain depending on the inverse of the distance. The emphasis is never on how much a group or manager has learned, but on how poor they are, and how to construct something that will operate around them. Usually, this is another group. Instead of fixing (teaching) a group or manager, their IQ is measured, they're declared dumb. A new group is espablished that usually just makes another set of mistakes. The new commercial group and computer may be a case in point. The things that need doing have NEVER been written down per se so we can see which ones should be fixed across ALL groups. My general impression is that the commercial computer is a great idea: namely it's just a good computer that we ALL want and should have. Why not train the groups who are supposed to do their jobs? By having twice as many computers, we have a lot fewer good ones. We simply don't have the engineering resources to do twice the products at half the quality.

4. General problem solving is devisive, not mentoring and teaching. On simple problems, like having a different monitor, these should be done in exactly the same way as present. Make a breadboard and show it's the right way. On breadboard is more powerful than a 1000 people or 1000 pages of business plan, proposals, etc.

On problems like the low end interconnect which are beyond a few breadboards the entire organization should be off solving the problem as rapidly as possible. Note that there's no way to plug in the new terminals to the computers because this was worked only with the terminals people. This is simple, management etiquette. For example, collect ALL the memos and data on the subject, formulate the issues as well as possible, get the RESPONSIBLE managers together (in this one, me too) and get the problem(s) defined before we start building very much other than random breadboards. Assign the work and get all the good people behind it rather than protecting themselves and trying to prove it wrong.

BOTH Scorpio/BI and the low end swithing should be done this way. They are too important to simply operate in a teasing mode. This is devisive in Scorpio, and will cause us to do something done if TWO schemes are needed... and I expect they are.

PERSONAL
0. Feel the issue is personal competition, and showing my errors rather than help. Eg. Ethernet.

1. HAD NO SUPPORT OR NECESSARY REVIEW OF THE PRODUCT STRATEGY. Admittedly this was beyond the scope of oprational times, but it should be the most important thing to review and help on.

The strategy (DEC E Environment) can virtually not be mismanaged now, unless enough critical resources leave. Clusters, NI (and Omninet gateways I hope), the Seahorses and Workstations are virtually there. I don't think they could have been if Ken had been involved the way he is in the low end.

The Servers strategy is outlined and can be done. The PC Workstations are all set. We do have the talent, and the only issue is to apply it.

2. Role model has been negative. Everytime I use the style, I lose. The large number of losses we've incurred at the Operations Committee of people who should have been good for something, versus good for nothing is really troublesome.

3. I FEEL tolerated and expendable, NOT critical except to be

useful in the short run stock price and to organize a current critical project. Based on the history of others, I'm concerned about getting into a mode where I'm part of the tortured people who should have been fired (out of kindness) and ultimately leave in a coffin attached to a gold colored, plastic parachute.

4. The last change to diminish my role has meant that I don't have access to make the critical changes. The falling between the cracks of the PRO occurred because Avram thought he was safe from MY review, and Ken never did the review or took the responsiblity that I thought he was taking with Avram. We wouldn't have done the bus, and my plan to get the software on the Qbus (note the original Qbus controller for the CRT) wasn't followed as we got swept up in new boxes and connectors. This allowed Avram to build the largest empire.

There are critical changes required in Commercial (wasn't part of the recent product woods review, nor did I give an opinion). My opinion now, after meeting with the groups is pretty bad. Julie, as a marketing folk in engineer's clothing will put ALL possible half-assed products out. Furthermore, we should be marketing the DDP stuff!

5. Engineering badly needs leadership beyond the box level. I simply don't feel good about my support to get things done and what's expected of me.

6. When the public denigtration is made: "When Gordon's good he's very, very good and ... " it gives no basis, to work or lead from. In general, I have been rendered pretty impotent.

POWER PARADOX

The administrative management has been off loaded with Jack, but with it the technical leadership goes too because the critical information needed in leading the products comes with the administration and review of projects. Administration means following up to see that the critical projects are going. The technical folks STILL hold me responsible for leadership of products, and I'm having a difficult time in making this happen because Jack and I haven't yet been able to work out a formula to share the work.

BOTTOM LINE

I feel that Ken wants to lead engineering, have Jack manage the details, and me help when I can be useful or align with the instantaneous direction. I too have a very strong vision of what the products should be building based on the future of the industry and what the "E" should look and feel like. Mostly, I'm having trouble getting this done because Jack has two bosses.

I don't have the physical constitution, to argue (fight) on the basis of power versus knowledge, nor have Ken and I figured out a way to share the leadership. Therefore, Flight is the only way out unless I can tolerate the above leadership and seeing the product vision be eroded and destroyed.

IMPRESSIONS ON HOW WE AND THE JAPANESE ARE CONVERTING U.S. INDUSTRY INTO DISTRIBUTORS

Gordon Bell, Vice President of Engineering
Digital Equipment Corporation, Maynard, Mass.; and
Professor of Computer Science and Electrical Engineering (on leave)
Carnegie-Mellon University; Pittsburgh, Pa.

The island of Japan, with few natural resources and over 100 million people, virtually dominates world production of manufactured goods, including the components and processes to make these goods. Every Japanese knows that exports are vital to survival. Also ingrained is the understanding that savings and living within one's own means support the ability to manufacture and export. In contrast, the notion of balanced budgets, savings and manufacturing have gradually disappeared from U. S. culture.

For example, the United States still holds a dominant position in the production of computers and semiconductors, but the Japanese plan to dominate these industries. Unwittingly, U.S. industry, government and society continue to aid the Japanese. Forty odd reasons are given to support this conjecture, each one providing a lesson.

The Japanese have progressed from domination of low-technology simple commodities to complex manufactured goods. The progression has been from textiles, steel, radios, sewing machines, typewriters, quality cameras/optics, watches, small cars, television sets, tape recorders, video tape recorders, calculators and on to state-of-the-art semiconductors and computers. Their current position in semiconductors and semiconductor-making equipment indicates they are well on their plan to dominate this manufacturing as a base for the continued and future market domination of electronics and computers. High-technology industry is increasingly being concentrated in Japan while the Japanese-owned low skill textile and television factories are being located in the U.S.

Dataquest describes how the Japanese go about systematically to dominate a market. Appendix 1 describes the four, detailed phases: initial development of a domestic industry, establishment of an export base, significant market penetration in foreign markets and final market exploitation.

BASIC STRATEGY, AND TACTICS FOR DOMINATION

Japanese industry and government operate as a team reinforcing strategy and tactics with appropriate levels of competition. Unlike many companies and countries that have tried and failed, they successfully planned and built a mainframe computer industry.

The Ministry of International Trade and Industry (MITI), with autocratic power, helps to amalgamate strategies within industry groups creating an organization commonly referred to as "Japan Inc." Because there is no direct control, I prefer not to use the term "Japan Inc." but to name the phenomena "The Japan Club" since there's a structure for the essential competition at the market level. For example, MITI identified and encouraged early importing of minicomputers, including those from Digital Equipment Corporation, as a competitive "straw horse" to build their own industry. One of DEC's interactive data base systems, MUMPS, was sold in Japan for end-user applications. On seeing several lost sales, MITI funded the development of MUMPS on a Japanese minicomputer. In mid 1978, a Japanese researcher asked me, through an academic channel, for the internal architecture of MUMPS in order to study its structure from a so-called computer science viewpoint. We expect to catch MUMPS from Japan soon.

The U.S. has no equivalent of MITI to protect major corporations as national resources. In contrast, U.S. corporations are looked on as adversaries to the national interest. IBM, already under attack from Japanese competition, is also under the gun from most U.S. government departments. Together they seem intent on destroying IBM, leaving it and others as distributors for Japanese products.

The strategy of MITI and the Japanese companies to win dominance of the computer industry is clearly evidenced, but it is not understood by U.S. government and industry. In keeping with the priority, MITI is both very strong and attracts competent people. The Japanese companies, while maintaining competition in limited domains, both plan and talk with one another. For example, Fujitsu and Hitachi have developed IBM plug-compatible machines. Coupling individual, competing companies for technological acculturation in this fashion is an important management technique to assimilate technology quickly.

The U.S. Department of Commerce and the U.S. Labor Department, in contrast to MITI, have neither a plan nor the personnel to help maintain U.S. dominance in high-technology fields important to the future of the country's economy and security. Furthermore, these two adversary departments are adversary to U.S. business. Trade trips to Japan by Secretary Kreps only emphasize our lack of understanding of the Japanese capability to use trade to introduce technology into their society. Our trade deficits cannot be turned around by hand-shaking missions, but demand a strategic and tactical plan based on understanding. Our political system is devoid of planning and accountability of government departments; even if the Secretary of Commerce could plan, her short tenure is inadequate to solve this problem. Once a new administration appears, any policies, plans and commitments are reset to zero!

Japanese tactics focus on the centrality of work and loyality to a company. A company screens each new employee carefully because when it hires an individual it takes on a lifetime commitment. The security promotes risk-taking, a phenomena generally unknown in large U.S. corporations. The team spirit is engendered as the various members learn how to get along with each other.

Quality control is in the hands of the workers. Although data is kept centrally, the analysis, corrective action and responsibility for manufacturing and quality rests with the employees concerned. Quality control is generally centralized and the organization of work often does not lead to self-esteem in the U.S. organization. Such participative management provides a key to the devotion to the workplace and sense of value achieved through work. The incompetent workers become the wards of the organization rather than wards of the state. Pride, family tradition, and because everyone is working, nonwork is socially unacceptable, embedding the importance of work into the fabric of society. A similar effect is observed in the U.S. during periods of high unemployment. At this time non-work is approved since others are unemployed.

In the U.S., the freedom of the individual has superseded work as a goal. The employee mobility is high and as a result companies screen very little as the short tenure is assumed. One recent semiconductor company ad claimed that no interviews were required at all. Turn-over and unemployment here are high with levels of consumption also rising so that some Japanese observers have concluded that the Japanese live to work and the Americans need to work to live. The measurable results are simply that the relative per capita productivity in manufacturing industries of Japan is now almost twice that of the U.S! Also, the sales per employee of a Japanese electronics corporation is about $100K, versus $45K for the U.S.

The Japanese government has been able to nurture both large and small companies while the U.S. government agencies seem to alienate the large and aren't effective at supporting the small ones. Much work in Japan is done in small subassembly operations. Competitive small shops keep the cost down by removing it from the large, hard to manage hierarchical organizations.

USING ACCULTURATED DESIGN AS THE BASIS TO DOMINATE

For centuries Japan has acculturated customs, but mostly it adopts and adapts technology. In the 16th century, for example they began manufacturing gunpowder a scant 18 months after the Portuguese brought it to Japan. Shortly thereafter they were banned. Any idea or product has always been fair game for adoption and improvement. Product and process evolution are merged in a long term view of achieving market domination. They orient the processes competitively considering quality, volume for growth, and flexibility to allow for the fast turn-around needed to maintain full-production capacity in a shifting market.

All the Japanese computer manufactuers have acquired their technology within the past ten years by dealing with U.S. manufacturers either as a joint venture or under license, including: Fujitsu (Amdahl/Siemens) and Hitachi (RCA); NEC (Honeywell, GE, Varian) and Toshiba (Honeywell, GE, Interdata); Mitsubishi (Xerox) and Oki (with Univac joint venture); Yokogawa (HP); and Nippon Minicomputer (DG). In all cases, the Japanese have improved the technology in terms of perceived quality, performance and manufacturability.

The agreement between Fujitsu and Amdahl Corporation, though still at an early stage, provides a good example of the classic Japanese computer acculturation process. In the late 1960's, Gene Amdahl, then head of IBM's San Jose Advanced System Development Laboratory, explored the basic technology for high-performance IBM computers. When he failed to interest IBM in building high performance machines, he formed Amdahl Corporation to develop the technology. When he needed more capital Fujitsu bought an interest and acquired the manufacturing rights to, and became the manufacturer for the Amdahl line. Fujitsu was also able to use the same technology to design and manufacture computers for the Japanese market. In only one computer generation, at the beginning of 1978, both Amdahl and Fujitsu announced their latest computers based on the Fujitsu-Amdahl circuits and packaging. Now, Fujitsu appears to have a machine with higher performance and reliability (the M200) than either Amdahl or IBM have so far announced. Fujitsu has produced a machine based on multiprocessing which provides users with new capabilities; furthermore they can buy more processors rather than trade-in when increased computation is needed.

In addition, Japanese computer manufacturers have a complete line of peripherals and test and manufacturing equipment that is based on counter-parts invented in the U.S. The designs range from "reverse engineered", to look-alike copies, to radically improved products based on Japanese inventions. With "reverse engineering" a product is dissected with micrometers, special gauges, etc. and made compatible in nearly every respect. The Japanese make only products for export to the U.S. market that do not violate patents. Tektronix look-alike scopes and reverse engineered IBM disks are common. In 15 months, Nippon Peripherals Limited produced a disk that was mechanically identical to the IBM 3340. From comparing the two drives, one might conclude that they were made from the same drawings.

PRODUCT DESIGN BASED ON NEED, QUALITY AND THE LONG-TERM

Traditional top-down marketing is characterized by expensive, thick market surveys that extrapolate history in a self-perpetuating fashion. Here, the goal is to fill various revenue gaps that develop. Using a market survey approach the U.S. continues to build heavy, gas-consuming cars, because the marketing managers can only think in terms of what has sold in the past. Freed from this approach, the Japanese have been able to look at the real needs, and they have appropriately adapted existing ideas. High-level corporate marketing does not design the products; engineers design according to needs using a bottom-up approach and based on technology.

Japanese companies, with long-term goals and commitments, similarly are not forced to depend on a short-term marketing approach. NEC, Fujitsu and Hitachi, unlike Xerox, GE, Westinghouse, and RCA, have all persisted with computer manufacturing and after years of investment have established successful products. Their long-range thinking from the outset allowed them to invest in long lasting quality.

Japanese companies focus on highly sophisticated quality products rather than ultra-high quantity, low-quality throw-away merchandise. The differences are characterized by comparing Seiko versus Timex watches and comparing Minolta or Nikon versus Kodak or Polaroid cameras. Japanese styling is often technical and gadget oriented, typified by multi-knob hi-fi sets and complex watches. It may be impossible for them to design a product like the Polaroid One-Step Camera because of the differences in picture quality. The emphasis is on an educated consumer who will value his purchase.

Concern for quality and long-term values leads the Japanese to build products that have a long lifecycle. Even their auto industry constrained by Detroit's yearly new model concept is now getting very high ratings for durability and serviceability. Accounting models lead to emphasizing production of long lived versus throw-away goods.

PRODUCTS RESULT FROM UNDERSTANDING AND MANAGING A COMPLETE PROCESS

The successful production of competitive performance products in high technology industries depends on understanding a complete process that includes basic research, going through applied research and advanced development, to product development. In addition, a parallel and equally complex process is required to design and build the process that manufactures such products. After a new product is introduced, it may then be necessary to modify and enhance it to adapt it to the real or changing market, and finally to eliminate it when it is no longer effective.

The Japanese need invest little in basic and applied research because they are effectively coupling the U.S. laboratories into their advanced development. In contrast, aside from the direct hiring of students and researchers, there is very little flow of ideas from our public laboratories into our own industry. As Carver Mead of Cal Tech points out, "I like the Japanese. They listen. Also unlike American industry, they're willing to build from our ideas." The university laboratories at Stanford, MIT, Carnegie-Mellon, the University of Illinois, receiving significant ($20-30M/year) Advanced Research Projects Agency (ARPA) funding for Computer Science, have post-doctoral Japanese visitors. The university and industrial laboratories of Japan are headed and staffed by researchers who've spent their research years in key American laboratories (e.g., MIT Multics). In contrast there is no Japanese training of U.S. engineers and scientists; furthermore, the flow of ideas is minimal.

Most recently, Japan has offered to spend one billion dollars in the U.S. for research, predominately for energy conversion. By accepting these funds, the Japanese can be even more effectively coupled to U.S. research and can "learn" to research, just as they've learned manufacturing, design and advanced development. The scientific community is anxious for more funds, independent of where they come from or what the consequences are. Of the large companies with research laboratories, the Japanese emphasis is on advanced development where the output is a testable prototype, often of a potential product. In contrast, U.S. corporate laboratories hide behind the veil of science where the output is vague and untestable. The quality of these laboratories is high versus many comparable large U.S. companies where research is to ease the corporate conscience instead of providing new development. Although such corporate research laboratories (e.g., GE, Motorola, RCA, Westinghouse and Zenith) were significant in the early development of television, the U.S. television industry has declined with few recent local advances.

MITI funds and manages other laboratories and corporations to carry out research that is oriented toward getting experience that will eventually produce products. Funding specific, as opposed to having a captive laboratory, not only provides a system of checks and balances, but also provides an incentive. Many of our government laboratories were initially set up for specific missions, and although the missions were completed, the laboratories continue to exist. Since they no longer have a real goal, or mission, negligible new work is done. The dust is blown off the equipment for visitors and the same demonstration is run year after year. A buyer-seller relationship, in which an independent organization, such as a university, manages the lab and takes responsibility for results can minimize this "dusty lab" syndrome. Moreover, funding for specific projects can bring together diverse groups and promote technical interchange.

The Japanese orientation is toward engineering for trade rather than being strongly science-based. Since the rest of the world provides research, why should they bother? This comes about because of their need to manufacture products and their total dependence on the export of manufactured goods. Since our basic federal research funding for computing comes through the NSF, ARPA, and the armed services, the emphasis is on science and research. Their funding comes through MITI and from various corporations, and hence the orientation is on international trade.

The trade drive causes a strong emphasis on manufacturing, not just product design. In addition to the product engineering process there is a comparable and equally important process responsible for the development and operation of manufacturing. This discipline has been nearly eliminated from U.S. universities as it has moved from the engineering to the management school. There is a decided emphasis on manufacturing processes in Japan as people are rotated among the various processes and disciplines, making it equally desirable to be in all functions.

Everyone associated with science, engineering and manufacturing understands basic learning and demand curves and they are quantity (and growth) oriented, subject to the quality-first constraint. Knowledge of the learning curves (i.e., increases in the combined number of units produced cause a reduction in manufacturing cost) is everywhere. Fred Bucy comments on Japanese competition in TI's 1978 Annual Report: "...the big difference is that TI is the first major non-Japanese company they have run into that understands and uses the learning curve". The Japanese are willing to sell outside Japan at a lower exported price (dump) and lose money often by selling below cost for the short term (see also Appendix 1) in order to buy market share. This practice is illegal for both U.S. and Japanese companies. Although the Japanese pretend that their products are not competitive because the yen is so strong, they are consciously ignoring our dependency as a distributor now in many industries.

As a corollary to learning curves and market domination, it's necessary and they are willing to give up profit for growth. For example, RCA is now a rug maker (or distributor), car rentor, publisher, television component distributor; it hardly resembles the electronics company that pioneered television. It's difficult to put the whole blame on RCA management because they are constrained by the economic and business temperament of the U.S. environment. Whereas there is extreme pressure on our business for profit and return on investment, these factors are less important to the Japanese companies. Sony is only moderately profitable, Fujitsu does relatively poorly financially and NEC or Hitachi computer divisions may even lose money. None of these companies would compete for capital in the U.S. stock market where return-on-investment is the key criterion. Japanese companies are buying market share and this is clearly more acceptable to the U.S. investors than for GE, Xerox and RCA who left the computer business. They can buy the business through "dumping" and why not if there is long term reward?

JAPANESE DOMINATION IS PREDICATED ON OUR GREED AND VALUES`

As we watched the first few industries of textiles and steel become dominated by the Japanese, we unsympathetically stated that these industries were tired, the workforce was lazy, and the management was incompetent, unimaginative and unaggressive about getting capital. Certainly, there is no fondness for the automotive and petroleum industries and it seems fitting to import our cars as a lesson to our own U.S.

manufacturers. Now, however, the domination of <u>all</u> manufacturing is becoming so clear that we must look deeper at the causes.

The domination can only happen with consenting buyers in the U.S. It is these buyers, called distributors, including tired, old, former manufacturers that are to blame, not the Japanese. Our values appear to be too short term and too basic. We really must understand that the following, simple, long-term consequence is <u>complete</u> economic domination.

<u>The (Unstable) Three Island System - Or How and Why We Will Be Dominated</u>

Since it's not clear that continued consumption, with no corresponding export means, let's look at what is the ultimate, singularly stable point simply. A system of three inhabited islands, all of which have adequate food, water, shelter and land, points out the dilemma:

#1.supplies energy; consumes negligible manufactured goods;

#2. supplies manufactured goods (is supplied raw materials from several small islands it owns, and from discarded goods of island 3); and consumes energy;

#3.consumes energy and manufactured goods; supplies information.

Given that information is generally treated as a waste commodity of zero value, there is no stable state for the system <u>until</u> islands 1 and 2 absorb island 3. Or conversely using any monetary system, island 3's paper or tokens will always be worthless. That is, islands 1 and 2 currency values will be out of balance with island 3, until 1 and 2 "own" island 3.

Through greed and short-term values, <u>the Japanese and</u> their counterpart <u>American</u> <u>buyers have systematically transformed American business from inventor-manufacturer-distributor to</u> simply <u>distributorships</u>. This transformation is in complete keeping with the goals of American business as reported in business magazines and the teachings of modern business schools. The goal and reward of American industry are clear: return on investment and profit. Secondary measures, such as market share, are occasionally used. Only a few corporations consider no lay-offs and full-employment to be important; as such, a clear, adversely separation has formed between management and labor. Following only the profit-based goals, subject to no other constraints, leads U.S. industry directly to distributorships for Japanese products. This strategy requires no investment, no planning, and no risk. All a company has to do to be successful is to buy the right product from Japan and then resell it.

This merely confirms the classic definition of a capitalist as someone who'll make and sell the rope to hang himself. However, in this case the capitalist is reselling someone else's rope because he is too lazy to design and make his own rope.

The essence of distributorships is completely counter to the principles that made American industry initially great. The new principle is simply that with no work and no capital, anyone (everyone) can do nothing and succeed. All that's important is to find a supplier who'll put up the capital, design, and manufacture products that we can distribute. In computing, the trend has also started: Itel is buying Japanese-manufactured IBM 370-compatible computers. Thus we expect Itel to have good financial metrics and be a good investment. It will also cause a high net flow of dollars from the U.S. as it becomes more successful.

American business, of course, is only slightly at fault because the U.S. non-business communities (politicians in government, consumers, and academics) have introduced and strongly support heavy borrowing, beyond income. These thwart an environment conducive to manufacturing. Both the per capita rate and amount of savings for both individuals and corporations in Japan is twice that of their U. S. counterparts! For example, the retirement system in Japan is actuarially sound. Of course, the Japanese government operates a balanced budget and taxation supports savings. Furthermore, as a society, they understand themselves simply as an island that must have a favorable balance of trade.

There's no way a manufacturer can re-enter a lost business once he has becomes a distributor. The spirit, and capability to catch-up and manufacture are gone. Society and the investment structure are all aimed at continuing a status quo. Radio, television, hi-fi, and video recorder products are all built using key U.S. developed ideas and patents, yet are no longer built by U.S. manufacturers. Again, we can blame the Japanese, but someone in the distributors had to choose to buy the products rather than design and build competitive products. In the case of Motorola, the television division was purchased by Matsushita in 1974 and included both manufacturing and distribution. By 1976, the U.S. plant was reduced by 2/3, but the distribution network was left intact.

We (U.S.) have a higher regard for business training versus engineering and technical training. In the U.S. many engineers regard the MBA degree as necessary for a career in industry. The Japanese do not yet have many business schools; therefore, instead of MBAs, engineering master's degrees are sought. This makes the Japanese better engineers for the same educational investment. Also, the management of manufacturing organizations are the better equipped to understand technology and products.

By having more people just concerned with distribution, we are becoming a nation of shopkeepers. The emphasis is simply to keep stores open longer and to find new ways to distribute Japanese manufactured goods. Not only does this further stimulate consumption, but it takes people from the primary production work force and makes us merely an island of consumers with no material means of support.

THE JAPANESE HAVE PRIORITIES AND SUPPORT FOR TRADE

At a government/society level the Japanese appear to have their act together. The Japanese seem to have a clear, crisp ranking of goals and priorities. For starters, the Japanese know their goals and priorities, whereas nearly all our goals that begin simple become entangled as special interest groups enter the fray. Some issues that compete for priority include: human rights versus equal rights; full employment versus inflation and balance of payments; environment versus region versus country; capital versus labor; and consumer protection versus business protection.

Because of the need to manufacture and export, <u>the Japanese educational system supports engineering and technology</u>, <u>while we support lawyers and</u> other <u>semantic accountants</u>. There are fewer lawyers per person by a factor of two than in the U.S. The Japanese emphasis (priority) is on physical output. The increasingly large number of U.S. lawyers: consumes productive and creative output of workers; creates a self-perpetuating, non-productive body; detracts from persons who would otherwise enter productive occupations; and tends to build an even larger governing body. With an increased emphasis on legal training, our output is measured by intergroup contracts, policies, laws, rules, regulations and other forms of bickering among semantic accountants.

As a simple explanation, <u>more money is available in Japan for investment to enable them to manufacture (for their island) because of lower taxes</u>. This clearly affects their ability to invest in industry.

<u>Their government spending for military is nearly nonexistent</u>. Although there are prototypes from our military spending, they seem small and are by-products. In the case of research for semiconductors and computers the benefit though impressive might have been as great, given a different goal (e.g., energy self-sufficiency).

<u>The Japanese don't have the federal research over-expenditures, epitomized by NASA and NIH</u>. In the event of results, the Japanese will capitalize on our research for their manufacture and export. The NASA goals, for example, appear to be vague now that they've stopped providing the world with exciting space shots and television pictures from the moon, and the immediate needs for this research is unclear to most of us.

National health research seems equally vague. This research appears to increase health care costs, through a number of secondary effects. By contrast the Japanese spend one-half of what we do per capita for health care and medical research. They can capitalize on our research, but since they have a longer lifespan, it is not clear what we gain with the extra expenditures. In effect, Japan's lack of spending in medicine goes to investments which result in full, lifetime employment which is probably the best solution to personal health.

<u>The Japanese believe computers are fundamental for the long term</u> and they are prepared to invest in them and wait for return. Non only are machines used in all products they build for export, but they save labor too. Labor is both precious and expensive in Japan: there are only about one hundred

million people and two percent unemployment. They're considering raising retirement from 60 to 65 to get the extra productivity. They must have computers to raise productivity; computers are vital to their continued domination of manufacturing. As a separate research area, robots are an important component of manufacturing domination. While much of the pioneering work was done in the U.S., the continued work to make robotics practical takes place in Japan. By contrast, in Australia where there is increasing unemployment, there's a belief that computers must be eliminated. Australia buys nearly all Japanese products, produces less and less, and the small Australian automotive industry of GM- and Ford-based large cars is rapidly declining under the stress of small, mass-produced Japanese cars.

THE JAPANESE SOLUTION TO OUR BALANCE OF PAYMENTS PROBLEM: SELL (IN JAPAN)

Can we solve our balance of payments problem by selling to Japan? Selling to Japan is the answer our government and industry want and willingly, but foolishly, look to. However, the Japanese rhetoric is only for our gullible government and academic communities and the naive business people. Furthermore the trade missions are only stocked with powerless, non-responsible, short-lived politicians whose main purposes include visiting Japan and being able to say something to the folks back home. For example, when state trade envoys visit Japan with the expectation of selling high technology goods, they succeed in selling only a few prototypes. The real sales will come in 5-10 years when these products are resold in volume to the U.S!

There has not been, nor will there be any serious trading of American products with Japan. The distributor/trading network entirely thwarts such an effort! The results are clear and we must face them.

<u>Japan is a closed society and market</u>. As the most powerful, homogeneous culture in the world it has a long history of being closed. There is no counter-evidence that an open market exists. The <u>language is a code to</u> further <u>segment</u>. Although business people do learn the language in crash courses, the language is relatively useless without the societal understanding. We only teach Japanese minimally on the West Coast of the U.S. On the other hand the technically trained Japanese have several years of English language training.

Even though there are major cultural differences among Japan and other far eastern countries (e.g., China, Taiwan, Korea) there is closer proximity among them than with western countries. This closeness is especially advantageous in finding additional sources of especially low cost labor.

The <u>tariffs support the establishment of any industries</u> they target. Although the semiconductor and computer import duties have been "advertised" to be on a parity with the U.S. they aren't there yet, but this matters little since their industry is strong enough to withstand imports. Still prices of U.S. produced computing machines are cheaper. In semiconductors the rationale for high tariffs has been protection of infant industries, yet outside of Texas Instruments and Western Electric, Japanese companies have been manufacturing longer than all other U. S. corporations. As evidenced in other industries, this is a come-on to further strengthen the Japanese manufacturers for export competition by having them compete in a token way with the few imports and thereby gain ideas to sharpen their exports.

For example, in the early seventies the Japanese encouraged U.S. minicomputer imports, although there were high tariffs. These occurred and now there is a significant Japanese minicomputer industry. For example, the basic structure of Fujitsu's minicomputer is quite similar to the DEC PDP-11.

Because of the closed nature of society and the emphasis on personal relationships, it is difficult, perhaps impossible to have significant Japanese sales. There are no significant examples to the contrary. "Doing business" together appears to be done over a long time period and is almost ritualistic. This means that it's essentially impossible to have an effective international company as we know it. A foreign manager is clearly tabu and sales are limited to one-shot deals with trading companies. There is no trading except as joint ventures. A foreign-owned company with controlling equity is so rare that it is an effective unwritten law.

JAPANESE HIGH LABOR COST, LIMITED POPULATION, FULL EMPLOYMENT AND FEW NATURAL RESOURCES, CREATES IMPORTANT BY-PRODUCTS TO FURTHER HELP TRADE

Japanese transportation and meetings run on time and at full capacity. Roughly twice as much as in the U.S. can be accomplished per day in Japan, especially those requiring meetings. The cordial, formal protocols help meetings proceed rapidly.

There's measurement of and pressure for efficiency. That is, the work-out/work-in ratio is high. For example, taxis have a driver-operated back door opener so that passengers can load/unload faster. The notion of efficiency seems to be taught to all and factories measure, graph and display key results. Concepts like fuel efficiency versus speed, weight and pollution are difficult concepts for Americans to understand, yet the Japanese "feel" them.

Given a notion of efficiency, there's real concern for saving physical resources too. At the computation center, printing isn't automatic; it's queued and must be requested separately. Lights, always florescent for high efficiency, are off when not in use. Of course small cars, taxis, a good train/subway are other indicators. The cars have mandatory bells that ring when the car is going over 100 Kmh! None of these artifacts for efficiency exist in the U.S.

Contrary to our "feelings", they are working the environment issue by less consumption, for example. This will indirectly make more money and resources available for production at lower costs. For example, cars don't pollute. U.S. environmental people at conferences in Japan are politely ignored while taking their basically boondoggle-oriented conference registration fees paid for by the U.S. government research establishment.

There is a range of basically human and personal concerns which encourage and support productivity. The result is a longer life span in the face of stress on productivity. While the subways and high density trains jostle people pretty badly, and there's no segmented smoker areas (and many smoke), there's great concern for the feelings, privacy and treatment of individuals. On arrival and departure at every organization, one is given moist cloths and refreshments. Taxis and buildings are air-conditioned. The hotels, though very expensive, provide privacy, ambiance and excellent food and service. For example, one expects a cloth cover over the telephone to enable it to fit the room decor. There are Japanese baths, and these are great too!

They are compulsively clean. In an indirect way, this really helps the manufacturing of small, precise goods including cameras, semiconductors, high-speed computers and disk memories.

There's orderly queueing at each server. The Japanese appear to be the world's best self-queuers. Queued systems of this type have higher through-put and make the best use of resources. One might suspect there is lower general hostility arising from competing for a finite resource when queueing.

Inventions are to labor-saving devices. There are countless gadgets to save scarce labor. Computation center line printers have paper cutters and conveyors in order to bring printing back to a single station. There are no computer operators and people to serve the users! This direct use of facilities not only costs less, but provides better service and throughput.

Conclusions

We must be impressed with the intense drive coupled with the technical, manufacturing and marketing acumen of the Japanese. This drive and ability, coupled with many factors of our society, has enabled the Japanese to systematically plan and dominate every U.S. market that they've attempted. Although there's been a "feeling" that the market domination is limited to low technology, there is evidence that nothing is immune.

However, despite a desire to blame the Japanese for dominating our manufacturing, it comes about because there are U.S. buyers and distributors for their goods. Distributors come about because of the intense emphasis we have on profit and return-on-investment. By only distributing and not designing and manufacturing the investment is negligible, giving a high return-on-investment.

The intent of the paper is to describe variously "how" this market/product domination is carried out. Like any good Japanese product, the ideas within the paper have been taken liberally from many sources -- mostly without credit. It should be self evident that, we (the U.S.) have a problem. Each of us, whether we be part of industry, government, or academia, can now address the issues we're responsible for. There's no real need for another fact-finding trip to Japan to further define the problem. Japan is clearly not a place to search for the solution.

Many solutions are required. Freezing the current level of government size spending and non-productive people (e.g., lawyers) would be fine first starts. Living within our collective energy budget is also needed. Rather than engaging in a trade war the following mechanism could simply address the trade deficit:

> No company can import and distribute a foreign product without arranging an equal export credit. That is, a company; such as Itel who buys and resells Japanese computers can get agricultural products to sell or it could export its own services in an equal amount. The trade balance has to be the distributor's problem -- not that of the President, or the Secretary of Commerce or Congress.

Appendix 1. A Chronology of Systematic Domination*

I. "Development of a domestic Japanese industry. The Japanese industry is developed and grows rapidly. The major aspects that mark this development include:

(a) Market control. Imports limited essentially to zero. Only a few major manufacturers are permitted. Prices remain significantly higher in Japan than in other competitive markets.

(b) Borrowed technology. The Japanese borrow heavily from foreign technology, including a large number of purchased licenses and patent rights, and wholesale reverse engineering.

(c) Vertical integration of most manufacturing.

(d) Major investments. Major investments are made in modern plant, equipment and technology, both for the final product and throughout the vertical chain of manufacturing. Continued research, development and plant investment expenses are made.

II. Establishing an export market base.

(a) The establishment of world-wide sales organizations.

(b) Researching and understanding of the foreign markets.

(c) Establishment of a reputation for quality and reasonable prices.

(d) A limited focus, especially in those markets less attractive to domestic manufacturers.

III. Major market penetration. Major market penetration occurs usually during an economic downturn in Japan. Previous efforts by the industry have set the stage for them to be successful in this endeavor. It is marked by the following considerations:

(a) Cooperation among the Japanese companies with respect to models, prices, and markets.

(b) Focus at the mainstream of the foreign market.

(c) High inventories because of poor markets in Japan, i.e., an export push at any cost is necessary and expedient.

(d) Extremely low prices to the mass market to gain market share rapidly, i.e., a knock-out punch to the domestic manufacturers. Modern plants, reasonable costs, an established export organization, and good reputation set the stage for success.

At this time, marketing muscle is established. Not only was the export market share large, but the domestic market remained closed. It should be pointed out that this major market penetration had been made by a combination of factors, as outlined. The greater marketing muscle allows the Japanese manufacturers to profit from their long investment.

IV. Market exploitation. This period is marked by higher prices -- often higher than domestic manufactured models. However, the higher prices are often more than offset by perceived higher quality, both real and imagined. There is also continued cooperation on prices and markets, as well as continued limitations on imports to the Japanese market."

paper 1, Original paper 10/78.

IMPRESSIONS ON HOW WE AND THE JAPANESE ARE CONVERTING U.S. INDUSTRY INTO DISTRIBUTORS

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The island of Japan, with few natural resources and over 100 million people, virtually dominates world production of manufactured goods, including the components and processes to make these goods. Every Japanese knows that exports are vital to survival. Also ingrained is the understanding that savings and living within one's own means support the ability to manufacture and export. In contrast, the notion of balanced budgets, savings and manufacturing have gradually disappeared from U. S. culture.

For example, the United States still holds a dominant position in the production of computers and semiconductors, but the Japanese plan to dominate these industries. Unwittingly, U.S. industry, government and society continue to aid the Japanese. Forty odd reasons are given to support this conjecture, each one providing a lesson.

The Japanese have progressed from domination of low-technology simple commodities to complex manufactured goods. The progression has been from textiles, steel, radios, sewing machines, typewriters, quality cameras/optics, watches, small cars, television sets, tape recorders, video tape recorders, calculators and on to state-of-the-art semiconductors and computers. Their current position in semiconductors and semiconductor-making equipment indicates they are well on their plan to dominate this manufacturing as a base for the continued and future market domination of electronics and computers. High-technology industry is increasingly being concentrated in Japan while the Japanese-owned low skill textile and television factories are being located in the U.S.

Dataquest describes how the Japanese go about systematically to dominate a market. Appendix 1 describes the four, detailed phases: initial development of a domestic industry, establishment of an export base, significant market penetration in foreign markets and final market exploitation.

BASIC STRATEGY, AND TACTICS FOR DOMINATION

<u>Japanese industry and government operate as a team</u> reinforcing strategy and tactics with appropriate levels of competition. Unlike many companies and countries that have tried and failed, they successfully planned and built a mainframe computer industry.

The Ministry of International Trade and Industry (<u>MITI</u>), <u>with autocratic power</u>, <u>helps to amalgamate strategies within industry groups creating an organization commonly referred to as "Japan Inc</u>." Because there is no direct control, I prefer not to use the term "Japan Inc." but to name the phenomena "The Japan Club" since there's a structure for the essential competition at the market level. For example, MITI identified and encouraged early importing of minicomputers, including those from Digital Equipment Corporation, as a competitive "straw horse" to build their own industry. One of DEC's interactive data base systems, MUMPS, was sold in Japan for end-user applications. On seeing several lost sales, MITI funded the development of MUMPS on a Japanese minicomputer. In mid 1978, a Japanese researcher asked me, through an academic channel, for the internal architecture of MUMPS in order to study its structure from a so-called computer science viewpoint. We expect to catch MUMPS from Japan soon.

<u>The U.S. has no equivalent of MITI to protect major corporations as</u> national <u>resources</u>. In contrast, U.S. corporations are looked on as adversaries to the national interest. IBM, already under attack from Japanese competition, is also under the gun from most U.S. government departments. Together they seem intent on destroying IBM, leaving it and others as distributors for Japanese products.

<u>The strategy of MITI and the Japanese</u> companies <u>to win dominance of the computer industry is clearly evidenced</u>, but it is not understood by U.S. government and industry. In keeping with the priority, MITI is both very strong and attracts competent people. The Japanese companies, while maintaining competition in limited domains, both plan and talk with one another. For example, Fujitsu and Hitachi have developed IBM plug-compatible machines. Coupling individual, competing companies for

technological acculturation in this fashion is an important management technique to assimilate technology quickly.

The U.S. Department of Commerce and the U.S. Labor Department, in contrast to MITI, have neither a plan nor the personnel to help maintain U.S. dominance in high-technology fields important to the future of the country's economy and security. Furthermore, these two adversary departments are adversary to U.S. business. Trade trips to Japan by Secretary Kreps only emphasize our lack of understanding of the Japanese capability to use trade to introduce technology into their society. Our trade deficits cannot be turned around by hand-shaking missions, but demand a strategic and tactical plan based on understanding. Our political system is devoid of planning and accountability of government departments; even if the Secretary of Commerce could plan, her short tenure is inadequate to solve this problem. Once a new administration appears, any policies, plans and commitments are reset to zero!

Japanese tactics focus on the centrality of work and loyality to a company. A company screens each new employee carefully because when it hires an individual it takes on a lifetime commitment. The security promotes risk-taking, a phenomena generally unknown in large U.S. corporations. The team spirit is engendered as the various members learn how to get along with each other.

Quality control is in the hands of the workers. Although data is kept centrally, the analysis, corrective action and responsibility for manufacturing and quality rests with the employees concerned. Quality control is generally centralized and the organization of work often does not lead to self-esteem in the U.S. organization. Such participative management provides a key to the devotion to the workplace and sense of value achieved through work. The incompetent workers become the wards of the organization rather than wards of the state. Pride, family tradition, and because everyone is working, nonwork is socially unacceptable, embedding the importance of work into the fabric of society. A similar effect is observed in the U.S. during periods of high unemployment. At this time non-work is approved since others are unemployed.

In the U.S., the freedom of the individual has superseded work as a goal. The employee mobility is high and as a result companies screen very little as the short tenure is assumed. One recent semiconductor company ad claimed that no interviews were required at all. Turn-over and unemployment here are high with levels of consumption also rising so that some Japanese observers have concluded that the Japanese live to work and the Americans need to work to live. The measurable results are simply that the relative per capita productivity in manufacturing industries of Japan is now almost twice that of the U.S! Also, the sales per employee of a Japanese electronics corporation is about $100K, versus $45K for the U.S.

The Japanese government has been able to nurture both large and small companies while the U.S. government agencies seem to alienate the large and aren't effective at supporting the small ones. Much work in Japan is done in small subassembly operations. Competitive small shops keep the cost down by removing it from the large, hard to manage hierarchical organizations.

USING ACCULTURATED DESIGN AS THE BASIS TO DOMINATE

For centuries Japan has acculturated customs, but mostly it adopts and adapts technology. In the 16th century, for example they began manufacturing gunpowder a scant 18 months after the Portuguese brought it to Japan. Shortly thereafter they were banned. Any idea or product has always been fair game for adoption and improvement. Product and process evolution are merged in a long term view of achieving market domination. They orient the processes competitively considering quality, volume for growth, and flexibility to allow for the fast turn-around needed to maintain full-production capacity in a shifting market.

All the Japanese computer manufactuers have acquired their technology within the past ten years by dealing with U.S. manufacturers either as a joint venture or under license, including: Fujitsu (Amdahl/Siemens) and Hitachi (RCA); NEC (Honeywell, GE, Varian) and Toshiba (Honeywell, GE, Interdata); Mitsubishi (Xerox) and Oki (with Univac joint venture); Yokogawa (HP); and Nippon Minicomputer (DG). In all cases, the Japanese have improved the technology in terms of perceived quality, performance and manufacturability.

The agreement between Fujitsu and Amdahl Corporation, though still at an early stage, provides a good example of the classic Japanese computer acculturation process. In the late 1960's, Gene Amdahl, then head of IBM's San Jose Advanced System Development Laboratory, explored the basic technology for high-performance IBM computers. When he failed to interest IBM in building high performance machines, he formed Amdahl Corporation to develop the technology. When he needed more capital Fujitsu bought an interest and acquired the manufacturing rights to, and became the manufacturer for the Amdahl line. Fujitsu was also able to use the same technology to design and manufacture computers for the Japanese market. In only one computer generation, at the beginning of 1978, both Amdahl and Fujitsu announced their latest computers based on the Fujitsu-Amdahl circuits and packaging. Now, Fujitsu appears to have a machine with higher performance and reliability (the M200) than either Amdahl or IBM have so far announced. Fujitsu has produced a machine based on multiprocessing which provides users with new capabilities; furthermore they can buy more processors rather than trade-in when increased computation is needed.

In addition, Japanese computer manufacturers have a complete line of peripherals and test and manufacturing equipment that is based on counter-parts invented in the U.S. The designs range from "reverse engineered", to look-alike copies, to radically improved products based on Japanese inventions. With "reverse engineering" a product is dissected with micrometers, special gauges, etc. and made compatible in nearly every respect. The Japanese make only products for export to the U.S. market that do not violate patents. Tektronix look-alike scopes and reverse engineered IBM disks are common. In 15 months, Nippon Peripherals Limited produced a disk that was mechanically identical to the IBM 3340. From comparing the two drives, one might conclude that they were made from the same drawings.

PRODUCT DESIGN BASED ON NEED, QUALITY AND THE LONG-TERM

Traditional top-down marketing is characterized by expensive, thick market surveys that extrapolate history in a self-perpetuating fashion. Here, the goal is to fill various revenue gaps that develop. Using a market survey approach the U.S. continues to build heavy, gas-consuming cars, because the marketing managers can only think in terms of what has sold in the past. Freed from this approach, the Japanese have been able to look at the real needs, and they have appropriately adapted existing ideas. High-level corporate marketing does not design the products; engineers design according to needs using a bottom-up approach and based on technology.

Japanese companies, with long-term goals and commitments, similarly are not forced to depend on a short-term marketing approach. NEC, Fujitsu and Hitachi, unlike Xerox, GE, Westinghouse, and RCA, have all persisted with computer manufacturing and after years of investment have established successful products. Their long-range thinking from the outset allowed them to invest in long lasting quality.

Japanese companies focus on highly sophisticated quality products rather than ultra-high quantity, low-quality throw-away merchandise. The differences are characterized by comparing Seiko versus Timex watches and comparing Minolta or Nikon versus Kodak or Polaroid cameras. Japanese styling is often technical and gadget oriented, typified by multi-knob hi-fi sets and complex watches. It may be impossible for them to design a product like the Polaroid One-Step Camera because of the differences in picture quality. The emphasis is on an educated consumer who will value his purchase.

Concern for quality and long-term values leads the Japanese to build products that have a long lifecycle. Even their auto industry constrained by Detroit's yearly new model concept is now getting very high ratings for durability and serviceability. Accounting models lead to emphasizing production of long lived versus throw-away goods.

PRODUCTS RESULT FROM UNDERSTANDING AND MANAGING A COMPLETE PROCESS

The successful production of competitive performance products in high technology industries depends on understanding a complete process that includes basic research, going through applied research and advanced development, to product development. In addition, a parallel and equally complex process is required to design and build the process that manufactures such products. After a new product is introduced, it may then be necessary to modify and enhance it to adapt it to the real or changing market, and finally to eliminate it when it is no longer effective.

The Japanese need invest little in basic and applied research because they are effectively coupling the U.S. laboratories into their advanced development. In contrast, aside from the direct hiring of students and researchers, there is very little flow of ideas from our public laboratories into our own industry. As Carver Mead of Cal Tech points out, "I like the Japanese. They listen. Also unlike American industry, they're willing to build from our ideas." The university laboratories at Stanford, MIT, Carnegie-Mellon, the University of Illinois, receiving significant ($20-30M/year) Advanced Research Projects Agency (ARPA) funding for Computer Science, have post-doctoral Japanese visitors. The university and industrial laboratories of Japan are headed and staffed by researchers who've spent their research years in key American laboratories (e.g., MIT Multics). In contrast there is no Japanese training of U.S. engineers and scientists; furthermore, the flow of ideas is minimal.

Most recently, Japan has offered to spend one billion dollars in the U.S. for research, predominately for energy conversion. By accepting these funds, the Japanese can be even more effectively coupled to U.S. research and can "learn" to research, just as they've learned manufacturing, design and advanced development. The scientific community is anxious for more funds, independent of where they come from or what the consequences are. Of the large companies with research laboratories, the Japanese emphasis is on advanced development where the output is a testable prototype, often of a potential product. In contrast, U.S. corporate laboratories hide behind the veil of science where the output is vague and untestable. The quality of these laboratories is high versus many comparable large U.S. companies where research is to ease the corporate conscience instead of providing new development. Although such corporate research laboratories (e.g., GE, Motorola, RCA, Westinghouse and Zenith) were significant in the early development of television, the U.S. television industry has declined with few recent local advances.

MITI funds and manages other laboratories and corporations to carry out research that is oriented toward getting experience that will eventually produce products. Funding specific, as opposed to having a captive laboratory, not only provides a system of checks and balances, but also provides an incentive. Many of our government laboratories were initially set up for specific missions, and although the missions were completed, the laboratories continue to exist. Since they no longer have a real goal, or mission, negligible new work is done. The dust is blown off the equipment for visitors and the same demonstration is run year after year. A buyer-seller relationship, in which an independent organization, such as a university, manages the lab and takes responsibility for results can minimize this "dusty lab" syndrome. Moreover, funding for specific projects can bring together diverse groups and promote technical interchange.

The Japanese orientation is toward engineering for trade rather than being strongly science-based. Since the rest of the world provides research, why should they bother? This comes about because of their need to manufacture products and their total dependence on the export of manufactured goods. Since our basic federal research funding for computing comes through the NSF, ARPA, and the armed services, the emphasis is on science and research.

Their funding comes through MITI and from various corporations, and hence the orientation is on international trade.

The trade drive causes a strong emphasis on manufacturing, not just product design. In addition to the product engineering process there is a comparable and equally important process responsible for the development and operation of manufacturing. This discipline has been nearly eliminated from U.S. universities as it has moved from the engineering to the management school. There is a decided emphasis on manufacturing processes in Japan as people are rotated among the various processes and disciplines, making it equally desirable to be in all functions.

Everyone associated with science, engineering and manufacturing understands basic learning and demand curves and they are quantity (and growth) oriented, subject to the quality-first constraint. Knowledge of the learning curves (i.e., increases in the combined number of units produced cause a reduction in manufacturing cost) is everywhere. Fred Bucy comments on Japanese competition in TI's 1978 Annual Report: "...the big difference is that TI is the first major non-Japanese company they have run into that understands and uses the learning curve". The Japanese are willing to sell outside Japan at a lower exported price (dump) and lose money often by selling below cost for the short term (see also Appendix 1) in order to buy market share. This practice is illegal for both U.S. and Japanese companies. Although the Japanese pretend that their products are not competitive because the yen is so strong, they are consciously ignoring our dependency as a distributor now in many industries.

As a corollary to learning curves and market domination, it's necessary and they are willing to give up profit for growth. For example, RCA is now a rug maker (or distributor), car rentor, publisher, television component distributor; it hardly resembles the electronics company that pioneered television. It's difficult to put the whole blame on RCA management because they are constrained by the economic and business temperament of the U.S. environment. Whereas there is extreme pressure on our business for profit and return on investment, these factors are less important to the Japanese companies. Sony is only moderately profitable, Fujitsu does relatively poorly financially and NEC or Hitachi computer divisions may even lose money. None of these companies would compete for capital in the U.S. stock market where return-on-investment is the key criterion. Japanese companies are buying market share and this is clearly more acceptable to the U.S. investors than for GE, Xerox and RCA who left the computer business. They can buy the business through "dumping" and why not if there is long term reward?

JAPANESE DOMINATION IS PREDICATED ON OUR GREED AND VALUES`

As we watched the first few industries of textiles and steel become dominated by the Japanese, we unsympathetically stated that these industries were tired, the workforce was lazy, and the management was incompetent, unimaginative and unaggressive about getting capital. Certainly, there is no fondness for the automotive and petroleum industries and it seems fitting to import our cars as a lesson to our own U.S. manufacturers. Now, however, the domination of all manufacturing is becoming so clear that we must look deeper at the causes.

The domination can only happen with consenting buyers in the U.S. It is these buyers, called distributors, including tired, old, former manufacturers that are to blame, not the Japanese. Our values appear to be too short term and too basic. We really must understand that the following, simple, long-term consequence is complete economic domination.

The (Unstable) Three Island System - Or How and Why We Will Be Dominated

Since it's not clear that continued consumption, with no corresponding export means, let's look at what is the ultimate, singularly stable point simply. A system of three inhabited islands, all of which have adequate food, water, shelter and land, points out the dilemma:

#1. supplies energy; consumes negligible manufactured goods;

#2. supplies manufactured goods (is supplied raw materials from several small islands it owns, and from discarded goods of island 3); and consumes energy;

#3. consumes energy and manufactured goods; supplies information.

Given that information is generally treated as a waste commodity of zero value, there is no stable state for the system until islands 1 and 2 absorb island 3. Or conversely using any monetary system, island 3's paper or tokens will always be worthless. That is, islands 1 and 2 currency values will be out of balance with island 3, until 1 and 2 "own" island 3.

Through greed and short-term values, the Japanese and their counterpart American buyers have systematically transformed American business from inventor-manufacturer-distributor to simply distributorships. This transformation is in complete keeping with the goals of American business as reported in business magazines and the teachings of modern business schools. The goal and reward of American industry are clear: return on investment and profit. Secondary measures, such as market share, are occasionally used. Only a few corporations consider no lay-offs and full-employment to be important; as such, a clear, adversely separation has formed between management and labor. Following only the profit-based goals, subject to no other constraints, leads U.S. industry directly to distributorships for Japanese products. This strategy requires no investment, no planning, and no risk. All a company has to do to be successful is to buy the right product from Japan and then resell it.

This merely confirms the classic definition of a capitalist as someone who'll make and sell the rope to hang himself. However, in this case the capitalist is reselling someone else's rope because he is too lazy to design and make his own rope.

The essence of distributorships is completely counter to the principles that made American industry initially great. The new principle is simply that with no work and no capital, anyone (everyone) can do nothing and succeed. All that's important is to find a supplier who'll put up the capital, design, and manufacture products that we can distribute. In computing, the trend has also started: Itel is buying Japanese-manufactured IBM 370-compatible computers. Thus we expect Itel to have good financial metrics and be a good investment. It will also cause a high net flow of dollars from the U.S. as it becomes more successful.

American business, of course, is only slightly at fault because the U.S. non-business communities (politicians in government, consumers, and academics) have introduced and strongly support heavy borrowing, beyond income. These thwart an environment conducive to manufacturing. Both the per capita rate and amount of savings for both individuals and corporations in Japan is twice that of their U. S. counterparts! For example, the retirement system in Japan is actuarially sound. Of course, the Japanese government operates a balanced budget and taxation supports savings. Furthermore, as a society, they understand themselves simply as an island that must have a favorable balance of trade.

There's no way a manufacturer can re-enter a lost business once he has becomes a distributor. The spirit, and capability to catch-up and manufacture are gone. Society and the investment structure are all aimed at continuing a status quo. Radio, television, hi-fi, and video recorder products are all built using key U.S. developed ideas and patents, yet are no longer built by U.S. manufacturers. Again, we can blame the Japanese, but someone in the distributors had to choose to buy the products rather than design and build competitive products. In the case of Motorola, the television division was purchased by Matsushita in 1974 and included both manufacturing and distribution. By 1976, the U.S. plant was reduced by 2/3, but the distribution network was left intact.

We (U.S.) have a higher regard for business training versus engineering and technical training. In the U.S. many engineers regard the MBA degree as necessary for a career in industry. The Japanese do not yet have many business schools; therefore, instead of MBAs, engineering master's degrees are sought. This makes the Japanese better engineers for the same educational investment. Also, the management of manufacturing organizations are the better equipped to understand technology and products.

By having more people just concerned with distribution, we are becoming a nation of shopkeepers. The emphasis is simply to keep stores open longer and to find new ways to distribute Japanese manufactured goods. Not only does this further stimulate consumption, but it takes people from the primary production work force and makes us merely an island of consumers with no material means of support.

THE JAPANESE HAVE PRIORITIES AND SUPPORT FOR TRADE

At a government/society level the Japanese appear to have their act together. The Japanese seem to have a clear, crisp ranking of goals and priorities. For starters, the Japanese know their goals and priorities, whereas nearly all our goals that begin simple become entangled as special interest groups enter the fray. Some issues that compete for priority include: human rights versus equal rights; full employment versus inflation and balance of payments; environment versus region versus country; capital versus labor; and consumer protection versus business protection.

Because of the need to manufacture and export, the Japanese educational system supports engineering and technology, while we support lawyers and other semantic accountants. There are fewer lawyers per person by a factor of two than in the U.S. The Japanese emphasis (priority) is on physical output. The increasingly large number of U.S. lawyers: consumes productive and creative output of workers; creates a self-perpetuating, non-productive body; detracts from persons who would otherwise enter productive occupations; and tends to build an even larger governing body. With an increased emphasis on legal training, our output is measured by intergroup contracts, policies, laws, rules, regulations and other forms of bickering among semantic accountants.

As a simple explanation, more money is available in Japan for investment to enable them to manufacture (for their island) because of lower taxes. This clearly affects their ability to invest in industry.

Their government spending for military is nearly nonexistent. Although there are prototypes from our military spending, they seem small and are by-products. In the case of research for semiconductors and computers the benefit though impressive might have been as great, given a different goal (e.g., energy self-sufficiency).

The Japanese don't have the federal research over-expenditures, epitomized by NASA and NIH. In the event of results, the Japanese will capitalize on our research for their manufacture and export. The NASA goals, for example, appear to be vague now that they've stopped providing the world with exciting space shots and television pictures from the moon, and the immediate needs for this research is unclear to most of us.

National health research seems equally vague. This research appears to increase health care costs, through a number of secondary effects. By contrast the Japanese spend one-half of what we do per capita for health care and medical research. They can capitalize on our research, but since they have a longer lifespan, it is not clear what we gain with the extra expenditures. In effect, Japan's lack of spending in medicine goes to investments which result in full, lifetime employment which is probably the best solution to personal health.

The Japanese believe computers are fundamental for the long term and they are prepared to invest in them and wait for return. Non only are machines used in all products they build for export, but they save labor too. Labor is both precious and expensive in Japan: there are only about one hundred million people and two percent unemployment. They're considering raising retirement from 60 to 65 to get the extra productivity. They must have computers to raise productivity; computers are vital to their continued domination of manufacturing. As a separate research area, robots are an important component of manufacturing domination. While much of the pioneering work was done in the U.S., the continued work to make robotics practical takes place in Japan. By contrast, in Australia where there is increasing unemployment, there's a belief that computers must be eliminated. Australia buys nearly all Japanese products, produces less and less, and the small Australian automotive industry of GM- and Ford-based large cars is rapidly declining under the stress of small, mass-produced Japanese cars.

THE JAPANESE SOLUTION TO OUR BALANCE OF PAYMENTS PROBLEM: SELL (IN JAPAN)

Can we solve our balance of payments problem by selling to Japan? Selling to Japan is the answer our government and industry want and willingly, but foolishly, look to. However, the Japanese rhetoric is only for our gullible government and academic communities and the naive business people. Furthermore the trade missions are only stocked with powerless, non-responsible, short-lived politicians whose main purposes include visiting Japan and being able to say something to the folks back home. For example, when state trade envoys visit Japan with the expectation of selling high technology goods, they succeed in selling only a few prototypes. The real sales will come in 5-10 years when these products are resold in volume to the U.S!

There has not been, nor will there be any serious trading of American products with Japan. The distributor/trading network entirely thwarts such an effort! The results are clear and we must face them.

<u>Japan is a closed society and market</u>. As the most powerful, homogeneous culture in the world it has a long history of being closed. There is no counter-evidence that an open market exists. The <u>language is a code to</u> further <u>segment</u>. Although business people do learn the language in crash courses, the language is relatively useless without the societal understanding. We only teach Japanese minimally on the West Coast of the U.S. On the other hand the technically trained Japanese have several years of English language training.

Even though there are major cultural differences among Japan and other far eastern countries (e.g., China, Taiwan, Korea) there is closer proximity among them than with western countries. This closeness is especially advantageous in finding additional sources of especially low cost labor.

The <u>tariffs support the establishment of any industries</u> they target. Although the semiconductor and computer import duties have been "advertised" to be on a parity with the U.S. they aren't there yet, but this matters little since their industry is strong enough to withstand imports. Still prices of U.S. produced computing machines are cheaper. In semiconductors the rationale for high tariffs has been protection of infant industries, yet outside of Texas Instruments and Western Electric, Japanese companies have been manufacturing longer than all other U. S. corporations. As evidenced in other industries, this is a come-on to further strengthen the Japanese manufacturers for export competition by having them compete in a token way with the few imports and thereby gain ideas to sharpen their exports.

For example, in the early seventies the Japanese encouraged U.S. minicomputer imports, although there were high tariffs. These occurred and now there is a significant Japanese minicomputer industry. For example, the basic structure of Fujitsu's minicomputer is quite similar to the DEC PDP-11.

<u>Because of the closed nature of society</u> and the <u>emphasis on personal relationships, it is difficult, perhaps impossible to have significant Japanese sales</u>. There are no significant examples to the contrary. "Doing business" together appears to be done over a long time period and is almost ritualistic. This means that it's essentially impossible to have an effective international company as we know it. A foreign manager is clearly tabu and sales are limited to one-shot deals with trading companies. There is no trading except as joint ventures. A foreign-owned company with controlling equity is so rare that it is an effective unwritten law.

JAPANESE HIGH LABOR COST, LIMITED POPULATION, FULL EMPLOYMENT AND FEW NATURAL RESOURCES, CREATES IMPORTANT BY-PRODUCTS TO FURTHER HELP TRADE

<u>Japanese transportation and meetings run on time and at full capacity</u>. Roughly twice as much as in the U.S. can be accomplished per day in Japan, especially those requiring meetings. The cordial, formal protocols help meetings proceed rapidly.

<u>There's measurement of and pressure for efficiency</u>. That is, the work-out/work-in ratio is high. For example, taxis have a driver-operated back door opener so that passengers can load/unload faster. The notion of efficiency seems to be taught to all and factories measure, graph and display key results. Concepts like fuel efficiency versus speed, weight and pollution are difficult concepts for Americans to understand, yet the Japanese "feel" them.

Given a notion of efficiency, <u>there's real</u> concern for <u>saving physical resources too</u>. At the computation center, printing isn't automatic; it's queued and must be requested separately. Lights, always florescent for high efficiency, are off when not in use. Of course small cars, taxis, a good train/subway are other indicators. The cars have mandatory bells that ring when the car is going over 100 Kmh! None of these artifacts for efficiency exist in the U.S.

Contrary to our "feelings", they are working the environment issue by less consumption, for example. This will indirectly make more money and resources available for production at lower costs. For example, cars don't pollute. U.S. environmental people at conferences in Japan are politely ignored while taking their basically boondoggle-oriented conference registration fees paid for by the U.S. government research establishment.

There is a range of basically human and personal concerns which encourage and support productivity. The result is a longer life span in the face of stress on productivity. While the subways and high density trains jostle people pretty badly, and there's no segmented smoker areas (and many smoke), there's great concern for the feelings, privacy and treatment of individuals. On arrival and departure at every organization, one is given moist cloths and refreshments. Taxis and buildings are air-conditioned. The hotels, though very expensive, provide privacy, ambiance and excellent food and service. For example, one expects a cloth cover over the telephone to enable it to fit the room decor. There are Japanese baths, and these are great too!

They are compulsively clean. In an indirect way, this really helps the manufacturing of small, precise goods including cameras, semiconductors, high-speed computers and disk memories.

There's orderly queueing at each server. The Japanese appear to be the world's best self-queuers. Queued systems of this type have higher through-put and make the best use of resources. One might suspect there is lower general hostility arising from competing for a finite resource when queueing.

Inventions are to labor-saving devices. There are countless gadgets to save scarce labor. Computation center line printers have paper cutters and conveyors in order to bring printing back to a single station. There are no computer operators and people to serve the users! This direct use of facilities not only costs less, but provides better service and through-put.

Conclusions

We must be impressed with the intense drive coupled with the technical, manufacturing and marketing acumen of the Japanese. This drive and ability, coupled with many factors of our society, has enabled the Japanese to systematically plan and dominate every U.S. market that they've attempted. Although there's been a "feeling" that the market domination is limited to low technology, there is evidence that nothing is immune.

However, despite a desire to blame the Japanese for dominating our manufacturing, it comes about because there are U.S. buyers and distributors for their goods. Distributors come about because of the intense emphasis we have on profit and return-on-investment. By only distributing and not designing and manufacturing the investment is negligible, giving a high return-on-investment.

The intent of the paper is to describe variously "how" this market/product domination is carried out. Like any good Japanese product, the ideas within the paper have been taken liberally from many sources -- mostly without credit. It should be self evident that, we (the U.S.) have a problem. Each of us, whether we be part of industry, government, or academia, can now address the issues we're responsible for. There's no real need for another fact-finding trip to Japan to further define the problem. Japan is clearly not a place to search for the solution.

Many solutions are required. Freezing the current level of government size spending and non-productive people (e.g., lawyers) would be fine first starts. Living within our collective energy budget is also needed. Rather than engaging in a trade war the following mechanism could simply address the trade deficit:

> No company can import and distribute a foreign product without arranging an equal export credit. That is, a company; such as Itel who buys and resells Japanese computers can get agricultural products to sell or it could export its own services in an equal amount. The trade balance has to be the distributor's problem -- not that of the President, or the Secretary of Commerce or Congress.

Appendix 1. A Chronology of Systematic Domination*

I. "Development of a domestic Japanese industry. The Japanese industry is developed and grows rapidly. The major aspects that mark this development include:

(a) Market control. Imports limited essentially to zero. Only a few major manufacturers are permitted. Prices remain significantly higher in Japan than in other competitive markets.

(b) Borrowed technology. The Japanese borrow heavily from foreign technology, including a large number of purchased licenses and patent rights, and wholesale reverse engineering.

(c) Vertical integration of most manufacturing.

(d) Major investments. Major investments are made in modern plant, equipment and technology, both for the final product and throughout the vertical chain of manufacturing. Continued research, development and plant investment expenses are made.

II. Establishing an export market base.

(a) The establishment of world-wide sales organizations.

(b) Researching and understanding of the foreign markets.

(c) Establishment of a reputation for quality and reasonable prices.

(d) A limited focus, especially in those markets less attractive to domestic manufacturers.

III. Major market penetration. Major market penetration occurs usually during an economic downturn in Japan. Previous efforts by the industry have set the stage for them to be successful in this endeavor. It is marked by the following considerations:

(a) Cooperation among the Japanese companies with respect to models, prices, and markets.

(b) Focus at the mainstream of the foreign market.

(c) High inventories because of poor markets in Japan, i.e., an export push at any cost is necessary and expedient.

(d) Extremely low prices to the mass market to gain market share rapidly, i.e., a knock-out punch to the domestic manufacturers. Modern plants, reasonable costs, an established export organization, and good reputation set the stage for success.

At this time, marketing muscle is established. Not only was the export market share large, but the domestic market remained closed. It should be pointed out that this major market penetration had been made by a combination of factors, as outlined. The greater marketing muscle allows the Japanese manufacturers to profit from their long investment.

IV. Market exploitation. This period is marked by higher prices -- often higher than domestic manufactured models. However, the higher prices are often more than offset by perceived higher quality, both real and imagined. There is also continued cooperation on prices and markets, as well as continued limitations on imports to the Japanese market."

paper 1, Original paper 10/78.

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Gordon Bell is Vice President of Engineering for Digital Equipment Corporation. The native of Kirksville, Missouri, earned his B.S. and M.S. degrees in Electrical Engineering at the Massachusetts Institute of Technology.

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He has worked in the computer field on computer architecture, modularity of design, multi-processors, and applications. Publications include "Computer Structures" (McGraw Hill), co-authored with Allen Newell; the Digital Press book, "Designing Computers and Digital Systems, Using PDP-16 Register Transfer Modules", with John Grason and Allen Newell; and several papers.

In addition to his industrial interests, Bell has served the U.S. Government as a member of three COSINE committees of the National Academy of Sciences for computer engineering education, and the National Science Foundation, Office of Computing Activities. He is a department editor for the CACM, a Fellow of the Institute of Electrical and Electronics Engineers, and a member of the National Academy of Engineering.

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Updated: February 1, 1979

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PATENTS: Multistable Circuit, #3,275,848, 9/27/66, C. G. Bell (PDP-4,5); Digital Computing System, #3,376,554, 4/2/68, C. G. Bell, A. Kotok (PDP-6); Apparatus for Performing Character Operations, #3,401,375, 9/10/68, C. G. Bell, A. Kotok (PDP-6); Multiple Configuration Data Processing System, #141,282, 5/7/71, filed but not issued. C. G. Bell, John Eggert, Robert VanNaarden, Peter Williams (PDP-16); Homogeneous Memory for Digital Computer Systems, #188084, C. G. Bell, not assigned, filed 10/12/71 (for all machines); Branching Circuit for Microprogram Controlled Central Processor Unit, C. G. Bell, John E. Buzynski, Charles H. Kaman, James F. O'Loughlin, #3,900,835, 8/19/75.

COMPUTERS: PDP-4 (predecessor of PDP-7, -9, and -15) architecture, logical design and implementation; PDP-5 (predecessor of PDP-8 series) architecture; PDP-6 (predecessor of DEC System 10) computer and operating system, architecture, logical design, and implementation; TSS/8 (timesharing system based on PDP-8 codesign; PDP-11 consultant on structure and architecture; PDP-16 (Register Transfer Modules - RTM); C.mmp - a multi-mini-processor computer (Wulf and Bell, 1972), member - design group.

AWARDS: IEEE McDowell, Mellon Institute, Fellow of IEEE, NAE

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Subject: My Role In The Six Most Important Things the Company Has to Do!

To: Ken Olsen

CC: Operations Committee
OOD

Date: 8/16/80
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

HAVE REALLY GREAT PRODUCTS (Fundamentally responsible)
continuing: support the plan in Red and Beige Books
evolution: get quick resolution on VT/PDT/Gigi for low end
revolution: Interconnect and The Personal VAX
recover/lead: get organization and products for the office!
build fundamental technology base: physical interconnect, semis and disks

UNDERSTANDING THE TRUE COMPETITION: Japan, IBM, and new micro-based systems
Get the Japan competitive analysis and understanding-action groups going. Have a "Stratton" around Manfacturing and Engineering that targets these competitors. Get disk, semi, terminal and system M/E pairs to Japan!
Evaluate the inevitable competition based on the emerging lines of very fast, large address-space microprocessors enabling higher performance/cost.

STREAMLINE OUR ORGANIZATION to have a single stage, FAT-less product flow to
halve the inventory and double the turns based on point of mfg. and field merge. Improve product quality, minimize system configurations, pare old products and discourage mutations, provide a system to permit salesman to order "legal" systems (those specified, tested to work and can be built), and get the right product/plant/organizational structure which supports the manufacturing reorganization.

BETTER ORGANIZATION by location, coupling and decoupling (Operations Committee? responsibility. Offer a framework (cauldron) and plan. Encourage the troops to make (bubble up) a proposal.)

Have proposed a framework and got support to meet with Jack and Shel. We are organizing engineering to be better aligned with various business units based on technology (manufacturing) and market (product lines). Support a terminals and terminals based systems grouping. Improve Mass Storage coupling by review of plans. Significantly improve semiconductor M/E grouping. Align systems appropriately with new Mfg. organization.

IMPROVE ADMINISTRATIVE SYSTEMS: Order processing and product flow control seem to require a different structure. (Lend encouragement and moral support)

TOTAL RESOURCES (CAPITAL/EXPENSES, PEOPLE, SPACE, AND COMPUTERS) BASED
MANAGEMENT FOR PRODUCTS versus engineering expense-based resource allocation

EBOD is to do this review. Couple and check the Manufacturing and Engineering plans. Do a detailed example for Mass Storage to understand.

GB1.S6.5

BELL / PORTNER CONTRACT

DOMAIN: JOINT RESPONSIBILITY

	Bell	Portner
GENERAL: ORGANIZATION, CHARTER DEFINITION, CONTRACTS & MEASUREMENTS		
	Technology & products coaching & leadership	Resources, processes & control tutorials & mgmt
PRODUCTS: PROVIDE PRODUCT LONG RANGE PLAN (RED BOOK) TO OC		
	Do integrated overview and review of ELRP	Manage ELRP Process
	Review all projects at "critical" times	Establish & monitor proj control and reporting via

line groups (YB)
Manage Tech Director   Manage Strategy Plan Mgr
Run prod bus via Prod
Mkt

<u>RESOURCES</u>: REVIEW YEARLY GROUP OPERATING PLAN (BB) FOR PEOPLE, PROCESSES, PROJECTS, SPACE, BUDGETS, ETC.
Participate in review   Manage BB process

ORGS: DESIGN AND CONTRACT CLEAR CHARTERS. RESOLVE CONFLICTS.

DRT RPTS: ESTABLISH CONTRACTS AND MEASURE OUTPUT. PERF EVAL & COMP
Manage tech output,   Manage administration,
Be technical coach   Be managment coach

ALL PERS: PROVIDE COMPENSATION & WORK CONDUCIVE TO ENGINEERING
Technical coach   Mgmt training & coach

BUDGET:		via Controller
CAP EQPT:		via Controller & Admin.
SPACE:	Participate in lrp	via Admin Mgr
SYSTEMS:		via Admin Mgr
TECH OPS:		via TOPS Mgr
TECH STD:		via Technical Dir
ENG COMM:	?	

<u>PROGRAMS</u>

Q & P: SET GOALS AND REVIEW RESULTS VIA PEG

HRP/OD:		via Pers Mgr
TECH TRN:		via Pers Mgr
MGMT TRN:		via Pers Mgr
ENG LECT:		Review via Cadieux
EPIP:	Critic	PEG via van Roekens, Help 'em
FORCE 84:		Define and lead

<u>INTERFACES</u>

CORP:	OC & Group VP	F & A
CORP MKT:		via Corp PM
MFG:	work to clarify	
CUST SVC:	?	

June 13, 1984

Mr. Benjamin Rosen

200 Park Aveue
New York, New York 10166

Dear Ben,

It was good to talk with you about The Computer Museum. I'm enlisting your support for this first round of The Computer Museum when it opens in Boston, November 14. The Museum operated in a Digital facility for five years where it gathered artifacts, enlisted members and built a team. The Museum has achieved international-level excellence as a public insitution. Now it is going public in Boston to a wider audience and 240,000 visitors are expected annually.

The Museum is technologically current, yet archival and will be interactive. It will illustrate the dynamic growth of the industry and its potential. The Board of Directors is broadly representative of the industry with each of the 24 members having a 4-year non-reelectable term of office. The Curatorial Staff is lead by Dr. Oliver Strimpel who had been curator of the computer gallery at London's Science Museum. He is the best in the field.

Your leadership is needed now as a founding partner in several ways:

. help in collecting artifacts you have or believe are significant (eg. your statement about Visicalc, an early Osborne, a Compaq, Grid); The PC Gallery will use PC's interactively in lieu of text panels.

. direct financial support on this "first round"; and

. help in New York by sponsoring some affair at which the Museum could be presented. For example, in Silicon Valley, we are accepting Amdahl's WISC at Trilogy, and in Minneapolis, CDC is presenting Cray's Little Professor.

Since this is a request for your precious time and money, I know you'll want to visit the Museum before making a commitment. I hope we can discuss this at lunch or dinner at the Museum, or I'd be happy to meet with you in New York. You can call me at Encore (617-237-1022), at home (259-9144) or the Museum (426-2800) if your coming to Boston.

Sincerely,

Gordon Bell
Chief Technical Officer

P.S.
An essay on the current micro computer generation is also enclosed which I hope you'll find interesting or useful.

GB3.S10.12

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15:44:53

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TO: STEVE DAVIS DATE: WED 3 NOV 1982
10:25 AM

FROM: GORDON BELL
cc: see "CC" DISTRIBUTION DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

MESSAGE ID:
5180664739

SUBJECT: BERKELEY OPPORTUNITY: ETHERNET DIAGNOSTICS

Forest described the poor situation at Berkley vis a vis the 750's we
gave.

They flushed the RK07's due to the incredible space they require and
replaced them with 8" Winis. We now refuse to maintain the

machines
because of our policy and need to have an RKO7.

These machines are connected via Ethernet and ultimately, we expect
diskless and fixed disk VAX's to be diagnosed using Ethernet.

This is an incredible opportunity.

Let's work with Berkley to have them build and be a test site for this
kind of diagnosis. This means getting Maynard F.S. engineers involved
to make this a project. Could you please start this dialogue with
them?

I intend to visit there next week and hope to hear it's moving.

"CC" DISTRIBUTION:

FOREST BASKETT SAM FULLER DICK HUSTVEDT
BERNIE LACROUTE DICK POULSEN STEVE MUELLER @OAKB

Thoughts on various acquisitions and product companies

Both IBM and DEC are positioned as FULL service suppliers. NO niches of any significance. Old line minis, including DG and Prime are trying to get the range, but may be too locked into past to make it.

Am prejudiced about DEC's compatible, computing environment which provides a full range of computing from VLSI'd personals/super micros to clusters of mainframes. Only see niches around communication, real time, or specialized applications as the way to penetrate. Must have interconnectablity ot standardized envrionments (eg. IBM, LANs, x25).

The world is being standardized for software convenience and publishing: IBM compatible mainframes, UNIX/C/68K+... supermicros, and cpm or ms/dos 8086 compatible PC's. Note the history of BUNCH versus IBM compatible which shows steady erosion of a "loyal" base. Will software be done to any extent outside these environments?

BETA
Can a proprietary, vanity architecture exist at all unless it's capable of being used in the UNIX environment? (A cobol compiler runs for a particular machine, and can rarely run to compile acceptably for several environments.)

It's vital to look at a product strategy before it's too late to make changes and before all development resources are chewed up. The deal for UNIX with Nova university could be enhanced by working more closely with their president, Dr. Shure... provided UNIX can exist on the new machines. A similar relationship could be developed with the Lawrence Berkley Laboratory.

Is there a user base that is loyal enough to even care about staying with a vanity machine? (The very intelligent user may have already decided to bite the bullet.) Note DG came in later with an upward compatible machine and really hasn't extended its base. All the world's going compatible. How and when can Beta switch?

Will Beta's design work? is it manufacturable? or is it beyond the Soul of a New Machine in terms of complexity? What tools have they used? Is it probably or convincingly correct? What is the quality of the engineering? it's age and education?

We need to get into Beta to develop the product strategy:

- What is going to be the niche? real time lab, satelite processing, control, communication, Telext, Prestel, etc. What about a corporate switch and PC database server as front end to all terminals and machines?

. How are they going to get standards?

. Is there a relationship with a PABX? develop one?

. are there synergistic relationships with other vendors of terminals and factory controllers?

In general, we need to see and help develop a winning path.

RELIABLE, NON-STOP COMPUTING
Reliable computers are competitive with the establishment:
IBM has an effort, Tandem though established has been flattened and is coming out with a new offering, DEC is delivering the clusters and
these will come down in price with the micros!

Therefore, it's imperative to go after installations within the next year, getting to 100M level within two years, otherwise, don't bother.
This is a marketing, distribution and manufacturing problem... not a development problem, given the short gestation time of products aimed at reliablity.

WORKSTATIONS
Only 123 of them now. To bet now for the next two years: Apollo, Apple, DEC, SUN, HP, Teletype?, IBM ... on installed base 85.

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Subject: **Multiprocessors and the BI**

To: Jega Arulpragasam, ML3-2/E41 Date: 7/12/79 Thu

Roger Cady, MK1-1/E25
Dick Clayton, ML12-2/E71
Bob Daley, MK1-2/H03
Bruce Delagi, MR2-1/M64
Bill Demmer, TW/D19
Sam Fuller, TW/A08
Bill Heffner, TW/E10
Steve Jenkins, TW/C04
Andy Knowles, ML10-2/A52
Roy Moffa, ML1-2/H26
Herb Shanzer, ML12-2/E71
John Sofio, TW/D02
Bill Strecker, TW/A08

From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

follow up 7/27/79

The next chip set with large memory addressing <u>and</u> the BI will enable us to offer microprocessors.

RSX-11 M+ supports multiprocessors with the 11/70mP. Jega Arulpragasam has published a paper on Modular Minicomputers using Microprocessors of an experimental system based on M+.

Will M+ run on the BI-based multiprocessor system?

GB:swh

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Jega Arulpragasam	ML3-2/E41	Roger Cady	MK1-1/E25
Dick Clayton	ML12-2/E71	Bob Daley	MK1-2/H03
Bruce Delagi	MR2-1/M64	Bill Demmer	TW/D19
Sam Fuller	TW/A08	Bill Heffner	TW/E10
Steve Jenkins	TW/C04	Andy Knowles	ML10-2/A52
Roy Moffa	ML1-2/H26	Herb Shanzer	ML12-2/E71
John Sofio	TW/D02	Bill Strecker	TW/A08

Ken has been especially unhappy with the BI in terms of schedule, package, and the fact that we have appeared to make decisions which overally favor the OEM (especially the European OEM) versus end user. I (and Ken) are delighted with BI's performance, RAMP, multiprocessor, large address and user features!

Given the TAT020 demise, now is the time to look at BI and reaffirm or change the direction vis a vis the packaging. In this note I don't want to get into the decision on it being a standard, or whether we license National to use the bus, or even whether we focus on being an end user versus OEM company, but only the technical questions:

1 Do we have the right sized module? Why not use a standard quad?

2 Why are we using such an expensive connector with so many conductors when BI was made to be so narrow? What module needs so many conductors? Why not use unique slots and connect the i/o there, or use a connector on the backpanel?

3 Why don't we use cables that come off the side or back of the module ala the old days? or why not extend the module so that i/o can plug directly into the back ala Pluto line cards or IBM's PC? These both look much more elegant and relevant to our use.

Basically, as a strawhorse, let me propose an alternative package which is quad form factor, uses both rear connection (ala the IBM PC), and allows front or direct cable connection ala our traditional (old) Unibus and Qbus... even though I don't expect we'll use this. Can we compare the strawhorse and the current BI in terms of:

. cost (at module and set of modules level),
. time to market impact,
. ability to make system of small, medium and large size,
. OEM desirability and market size impact,
. compatibility with existing box package sizes (eg. Qbus) and module manufacturing, NOTE WE ARE SURE TO HAVE A Q TO BI CONVERTER, GIVEN THE PLETHORA OF QBUS MODULES WE ARE BUILDING!)
. RAMP
. Ease of customer installability of module and cables.

We just have to bring this BI package to a close. Can we do it soon?

.

The Museum Technician reports to the Exhibit Coordinator. The main duties of this part-time job are:

1. assist in display setup
2. dust, clean, polish all displays
3. make minor repairs
4. general maintenance
5. asist in bulk mailings
6. run errands (to post offfice, etc.)
7. rearrange furniture for lectures
8. other

June 25, 1984

Mr. William Gates, Chairman

Microsoft Corporation
Bellevue, WA 98004

Dear Bill:

The Computer Museum is opening in downtown Boston on November 12.

A first-rate team is designing the exhibits, including Dr. Oliver Strimpel, curator of the Science Museum in London and Dr. Paul Ceruzzi, a young history of computing scholar. In addition to the exhibits with historical artifacts, two major interactive galleries are being built for PC's and on the Computer and the Image. Predictions are that we should have attendance of over 200,000. This world-class, international Museum should be a major attraction and asset for the computing community.

The enclosed brochure describes the Capital Campaign. Note that Mitch Kapor has joined the Board. Now I want to enlist your support as a leader in the software industry:

1. Microsoft's "core" contribution to the Capital Campaign at the 4K level or becoming a founder ($2,500) during this last month of the two-year founding period,
2. your personal "core" contribution and foundership, and
3. assistance by making your "Flight Simulator" suitable for use in the Museum in the Image Gallery. The modifications are attached. The Museum is broadening its audience to include the computer interested, general public.
4. PC artifacts that you have in storage that would be appropriate for the galleries and archives.
5. Microsoft's own historical artifacts.

I'd like to call you next week to discuss these items and to get the name of a person who could modify the simulator. We need the modifications and artifacts quite soon for the exhibits.

Gwen and I will be in Seattle the first week of August and would enjoy seeing you.

Sincerely,

Gordon Bell

Enclosures

Mr. William Grinker, President
American Computer Company
? see the letter to me or literature

Dear Bill:

It was good to talk with you yesterday, and get your candid feelings about supporting The Computer Museum. The Museum started out with the name, The Digital Computer Museum, and that was probably a mistake because people thought it only had DEC computers in it. When it opened in 79 to DEC folks and friends it was already more than 50% non-DEC. Now, only a few artifacts are DEC computers. More importantly, the IRS believes the Museum is a public, non-profit institution -- eighteen months ago it achieved this status.

To make it a truly great (one of the top 6) world-class technology museums requires that it be in Boston and not tied to a particular company. DEC is still committing major support after the move. They bought the building, but unless we raise enough to make the move and get an endowement, the Museum won't exist. The target amount over the next four years is $10 million.

Today there are over one thousand members ranging from Amdahl to Zuse (both of whom have spoken at the Museum and are archived on videotaped). We are getting very strong support from other companies. For example, DG has pledged $75K, and CDC has committed to raise $1 Million in the midwest for the archives/library.

Enclosed is a letter which that describes why I think the Museum is so important to the future (and to Boston). Also enclosed are several Museum Reports that describe the various activities and list people involved with the Museum. I would like a chance to convince you and your partner to become a corporate founder, and to help us with the fund-raising. If the material raises your level of interest, let me know. I'd be delighted to offer a tour and dinner at the current site.

Several of us from Encore will visit you in the next few months to see if there are possiblities of interest.

Sincerely,

Gordon Bell
Chief Technical Officer

C O M P A N Y   C O N F I D E N T I A L

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Subject: **Bill Hogan**

To: OOD
Bill Green, ML1-4/E34
Roy Moffa, ML1-2/H26
Mike Titelbaum, ML1-2/E65

Date: 9 JAN 79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

follow up 1/23/79

He's looking for a job.

What do you think of him?

Microproducts?

Microprocessors?

Terminals?

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Dick Clayton ML12-2/E71 Jim Cudmore ML1-
5/E30
Bill Demmer TW/D19 Ulf Fagerquist MR1-
2/E78
Bill Johnson ML21-3/E87 John Kevill ML3-
6/E94
John Meyer ML12-1/A11 Larry Portner ML12-
3/A62
Bob Puffer ML12-2/E38

Bill Green ML1-4/E34 Roy Moffa ML1-
2/H26
Mike Titelbaum ML1-2/E65

D I G I T A L INTEROFFICE MEMORANDUM

DIST:
Dick Albright ML21-3/E87 Mary Beatrice ML21-
3/E87
Bob Beck ML21-4/E20 Len Beyersdorfer ML21-
4/E10
Dale Cook ML21-4/E10 Jim Deblasio ML5-
2/E77
Cindy Foster ML21-3/E87 John Friedrich ML5-2
Sam Fuller TW/A08 Ed Gianetto ML21-
3/E87
Judy Hall ML21-3/E87 John Hittell ML21-
3/E87
Marv Horovitz ML21-4/E10 Mike Jean ML21-
3/E87
Bill Johnson ML21-3/E87 Glenn Johnson ML21-
4/E10
Bill Keating ML12-3/A62 Ed Kenney
TW/F17
Jim Lacey ML21-4/E10 Ray Lechevet ML5-
2/E77
Dick Maliska MR1-2/E68 Bob Misner MK1-
2/B6
Bill Moran ML5-2/E77 Bill Segal ML3-
5/E82
Ollie Stone ML21-3/E87 Pete Straka ML21-
4/E10
Pat White ML12-3/E51

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Mary Beatrice	ML21-3/E87	Bob Beck	ML21-4/E20
Cindy Foster	ML21-3/E87	Sam Fuller	TW/A08
Ed Gianetto	ML21-3/E87	Judy Hall	ML21-3/E87
John Hittell	ML21-3/E87	Marv Horovitz	ML21-4/E10
Mike Jean	ML21-3/E87	Bill Johnson	ML21-3/E87
Bill Moran	ML5-2/E77	Ollie Stone	ML21-3/E87
Pete Straka	ML21-4/E10		

June 18, 1984

Dr. William Perry
Hambrecht and Quist
235 Montgomery Street
San Francisco, California 94104

Dear Bill:

Enclosed is a brochure on The Computer Museum which describes the plan for opening the Museum in downtown Boston in November. We believe that the Museum will draw 200,000 people annually. Since the Museum is both international and industry wide, including everything from semiconductors to computer users, we are anxious for wide-scale participation. We would like you to lead in getting participation within the financial community.

Given the important roles that you as the leading venture capital company has played in the industry formation, I would like to urge you to become a Corporate Founder and a "Core" Supporter. Since the founding period closes July 1, a letter of intent or phone call would suffice to meet the deadline.

I hope you, too will become a personal founder. We were delighted to have Bill Hambrecht as a founder, and hope you'll discuss this corporte membership with him.

When you're in Boston, I hope you'll stop by the Museum to get a better feel of the real thing.

Sincerely,

Gordon Bell

Enclosure

GB0004/45

d i g i t a l **i n t e r o f f i c e m e m o r a n d u m**

Subject: **Birnbaum (Head of Computer Science Research, IBM Watson Labs)**

To: OOD
Jim Bell, ML3-2/E41
Dick Eckhouse, ML3-2/E41
Andy Knowles, ML10-2/A52
John Leng, MR1-1/A65
Ken Olsen, ML10-2/A50
Joel Schwartz, MR2-4/M51
Will Thompson, ML1-5/E30
Jerry Witmore, PK3-1/M40

Date: 9/10/79 Mon
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

Follow-Up: 9/21/79

I was most impressed with the work that was going on at Watson in experimental computer science. Birnbaum was open...and we ought to find out as much as we can about the work they are doing. Apparently they are very open with the universities. Joel Moses, MIT, also commented that they are leading in both speech and robotics. In this regard, they are using Robots in the typewriter plant for assembly. They are also working on inspection. This has come out of much understanding about what is actually done in factories. He talked briefly about:

801 Minicomputer which they are open about. John Cocke designed this and is probably worth talking to. John McCarthy was at Watson this summer and could also be contacted. It is a machine designed for emulation, and for one chipness, taking advantage of the machine code statistics. A few instructions, e.g. move, jump, are hardwired and the rest are microcoded. It has been used for many purposes, especially IBM Channel emulation. It may also be implemented using Josephson Devices, because it is so simple.

FFT and Winograd Transform Research. Lots of it. They are going back in the <u>technical</u> domain cause they need it for speech, vision, and signal processing in general. Here again, the Josephson Devices will be used as the implementation form.

They view their work on their new relational Data Base language as being similar to that on APL. Namely, they have a much better, easier to use DATA BASE, and they believe that it will ultimately be THE data base system. Can we get the manual and get it up on one of our systems...as it was no doubt, first written on a DEC machine?

They are building a chip to help with routing that does Lee"s algorithm, just as we were planning to do with U of Leuvan.

They are exploring the repartitioning of their operating systems into functionally seperated parts, just as we are doing in Hydra/Mercury/HSC50.

They have lots of work aimed at GRAPHICS in the office, and at printing and print quality. Also, there is work on use of computers in home and includes sending lots of machines to homes. The MCA deal with video disk started at Watson.

IBM now has a system with about 1000 installations that read and interpret EKGs. This one hit me in the stomach, because this work was first done on LINCs and 12's.

All in all, impressive!

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Subject: **MIT's (Steve Ward) Bit Map Terminal**

To: Dick Clayton, ML12-2/E71
    Bob Glorioso, ML3-2/E41
    Len Halio, ML1-2/H26
    Roy Moffa, ML5-2/E93
    Charlie Rupp, ML3-2/E41

Date: 28 DEC 78
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

follow up 1/12

I've heard excellent reports about this.

What is it?

Can we use any of it?

GB:ljp

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Subject: **Please Transfer Your Work on Bit Maps for Personal VAX; Buy It!**

To: Jim Marshall, TW/A03
Nat Parke, TW/B02

Date: 4/9/79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

CC: Dick Clayton, ML12-2/E71
Bill Demmer, TW/D19
Sam Fuller, TW/A08
Len Halio, ML1-2/H26
Bill Johnson, ML3-5/H33

follow up 4/23/79

Can this display be designed and built by the terminals group? I shudder at another graphics terminal, graphics architecture, or terminals effort outside of Maynard, Albuquerque, LDP, CSS (several sites) and Tewksbury (Caltech).

Why not use a Gigi for now to do the software work, and get the higher performance, architectural compatible one through the single, graphics group (fund them and transfer people if the people aren't available to do the job)?

Let's get a quality, single, graphics group!

Go ahead with the mass storage exploration. Get the software going.

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Jim Marshall	TW/A03	Nat Parke	TW/B02
Dick Clayton	ML12-2/E71	Bill Demmer	TW/D19
Sam Fuller	TW/A08	Len Halio	ML1-2/H26
Bill Johnson	ML3-5/H33		

January 17, 1979

Stewart P. Blake
S. P. Blake Associates, Inc.
Management and Technical Services
750 Welch Road, Suite 204
Palo Alto, California 94304

Dear Mr. Blake:

Thanks for the book. Although it's not on managing R&D, I too try to understand this by writing. Enclosed is a book on Engineering that may be relevant to your work. Although I've scanned your book and hope to read it more carefully, I believe more recent work (past 1972) on the subject could be included. Let me encourage you to include these results.

Thanks again.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:ljp
ID#421

Enclosure

+---------------+
! d i g i t a l !   i n t e r o f f i c e   m e m o r a n d u m
+---------------+

Subject: **BLISS in Colorado**

To: Bob Barnes, Roger Cady,
Bill Johnson, Bill Heffner,
Bill Keating, John Kevill,
Richy Lary, Ralph Platz,
Mike Riggle, Pete van Roekens

Date: 26 JUNE 78
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

follow up 7/12/78

Given the availability of a 2020 (and eventually VAX) in Colorado, I'd like to get a commitment (plan) for using BLISS on diagnostics and NDS!

NDS especially worries me -- I want the discipline/structure, quality and productivity BLISS will give here.

Any problem in doing this?

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST: Bob Barnes ML3-6/E96 Roger Cady MK
Bill Heffner TW/C10 Bill Johnson ML21-3/E87
Bill Keating ML12-3/A62 John Kevill ML1-3/E58
Richy Lary ML4-1/B58 Ralph Platz ML3-6/E94
Mike Riggle ML4-1/B32 Pete van Roekens ML12-2/E71

ID#322

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Subject: **Bluefish Wind-down**

To: Bluefish Project Team
OOD
Jim Marshall, TW/C03
Nat Parke, TW/B02

Date: 31 OCT 78
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

I would like to congratulate the Bluefish team on the work and the creation of various ideas that have been and will be used in subsequent machines. It is important now to document the effort sufficiently so that others within DEC can utilize the concepts and I would hope that there would be various seminars given at the various DEC sites on what the structure of the machine is and what we learned. Also, although I would hope that it will not be necessary to build a follow-on 11 at the size of Bluefish, it is necessary to have the documentation and understanding of such, in the event that our planning proves wrong. In the strategy that I put forth, part of which has been accepted, I suggested going on with Bluefish and not marketing the 11/74 in order to insure a longer 11 life at the high end. Given that we did not do that the task ahead for us all is clear:

WE MUST AGGRESSIVELY IMPLEMENT VAX SYSTEM ACROSS A BROAD RANGE OF PRODUCTS!

Therefore, the task of the Bluefish team should be clear too. We must get on with the VAX enhancements, which I believe will most likely take on the form of a significantly improved communications and interface structure, together with peripherals to support this structure. This direction should emerge as the above wind-down work gets completed.

Again, let me say that I'm sorry that the work has not directly resulted in a product. It is essential now to get on with some of the products which we badly need from a total systems standpoint.

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Dick Clayton	ML12-2/E71	Jim Cudmore	ML1-5/E30
Bill Demmer	TW/D19	Ulf Fagerquist	MR1-2/E78
Bill Johnson	ML21-3/E87	John Kevill	ML1-3/E58
John Meyer	ML12-1/A11	Larry Portner	ML12-3/A62
Bob Puffer	ML12-2/E38		
Jim Marshall	TW/C03	Nat Parke	TW/B02
Caroline Atwood	AC/E36	Dick Barry	TW/C03
John Buzynski	TW/C03	Jim Campbell	TW/C03
Mike Carrafiello	TW/C03	Bill Coates	ML21-2/E64
Don DeRome	AC/E36	George Engman	TW/S17
Chris Gordon	AC/B38	John Groark	TW/B02
Gerry Hafner	TW/C03	Dave Hile	TW/C03
Bruce Hillegass	TW/B02	Dave Ives	TW/C03
Kim Meinerth	TW/B02	John Middleton	TW/C03
Barry Poland	TW/F17	Doug Rothenberg	BT
Tom Sherman	TW/A08	Don Smelser	ML21-2/E64
Mark Stecklair	TW/C03	Simon Steely	TW/B02
Jim Stegeman	ML21-2/E64	Dave Stoner	

TW/C03
Dave Thompson TW/C03 Hank Watkins
TW/S17
Cheryl Weicek TW/B02

November 20, 1978

Mr. Manuel Blum
Associate Chairperson
Computer Science
University of California, Berkeley
Berkeley, California 94720

Dear Manuel:

I just received the information and offer from you on the Regent's Professorship and Lectureship. Since our telephone conversation I've been thinking about the offer and discussing it with my family and colleagues.

With these considerations I must decline the offer because of the rather strenuous commitments here for the next two years.

I'm sorry, and hope I haven't delayed things at Berkeley.

It was regretful that we couldn't meet at the NSF meeting that Jerry Feldman organized two weeks ago.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:ljp
ID#358

October 24, 1978

Mr. Manuel Blum
Associate Chairperson
Computer Science
University of California, Berkeley
Berkeley, California 94720

Dear Manuel:

In reference to your letter of October 13, I don't know Dr. Despain's work and I'm in the midst of some work here that I can't interrupt.

Sorry, I can't help on this issue.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:ljp
ID#315
00 BURT DECGRAM ACCEPTED S 27505 O 173 08-JAN-81 1024:18

****
* d i g i t a l *
****

TO: OOD: DATE: THU 8 JAN 1981

9:29 AM EST

FROM: GORDON BELL
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: RELAYOUT

I think we are in agreement... but we still have a problem.

Manufacturing willl pay for relayout of boards, but it's up to engineering management to direct it. I'd like the list of requests to the various groups to be clear, and what the priorities are within the various groups.

There is going to be much conflict. I will push to have new products be the second priority, with the breadboarding of prototypes being the highest priority, and relayout being third. Highest ROI is on new products! ... and we have to get this turnaroud time substantially better.

IBM is rumoured to have ordered 25 multiwire machines. If I were them, I would have ordered at least one per engineering site so as to be able to compile designs as fast as software. Our overall prototyping facilities and ability to get hardware done is really abysmall. I would like to get Multiwire at each facility! (The issue is not getting the first pcb or wirewrap, relatively quickly, because this is improving I suspect (or would hope). The issue is getting it accurately, and keeping an up to date copy in a breadboarded fashion. And then getting a few copies maded quickly and easily.)

I don't see anyone except Ulf worrying about the Engineering process per se. This would seem to be about our highest priority in the 80's.

GB2.S1.34
00 BURT DECGRAM ACCEPTED S 22212 O 22 17-MAY-81 22:14:35

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* d i g i t a l *
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TO: JOHN HOLMAN   DATE: SUN 17 MAY 1981
22:10 EST

FROM: GORDON BELL

cc: ENG STAFF: DEPT: ENG STAFF
    WILL THOMPSON   EXT: 223-2236
                                                        LOC/MAIL STOP: ML12-
1/A51

SUBJECT: RE: RE: RE:ONE WEEK PROTO BOARDS

We must be careful not to abuse it. The goal of turn around accompanied by a comparable goal of each engineer to reduce the number of passes for a design by one, should also help turn around like crazy.

Therefore, the goal is: one week board turn around for a correctly stuffed pwb, given the suds input and reduce the number of designs submitted by one (currently it is about 3), by doing structured design, logic design walk through to check for correctness, and having the design right in the first place before antyone looks at it.

We must address quality by doing things right!

GB2.S6.47

May 18, 1984

Dr. Robert Metcalfe, Chairman
3 COM
1390 Shorebird Way
Mountain View, CA 94043

Dear Bob:

Congratulations on enlisting IBM's support to make Ethernet a success. It is truly gratifying to see that persistence (mainly yours) is beginning to payoff. This is going to make

LANs possible instead of the continued reinvention of physical links. I can't say that I'm very proud of the rapidity with which I lead the DEC products, but we spent a fair amount of time looking at new cables rather than just building Ethernet products. Unavailability of chips contributed to the slowness too. The newer chips, especially National's should really make it widely available for use with PC's and even terminals. Ethernet will become the base component to build new systems.

I met some folks at Excelan the other day at Electro and they indicated that the IBM cabling announcement was unleashing orders. AT&T's support, along with various vendors such as Prime, is encouraging too.

Maybe it's my inventive mind, but what's the possiblity that IBM has licensed the token ring patent in order to make their own net proprietary and NOT an open standard?

Is it possible to get all (or a few Ethernet vendors) together and make a big cabling announcment? I would lead this if I were at DEC, but you could count on me to be part of a serious spoof if you lead it. It would posit an alternative to their announcement which would solve the same problems, but has been here for two years. I think it needs to be done, and AT&T might be persuaded to join in if the announcement also says don't pull out your old telephones. It was surprising to see that IBM didn't include CATV in the bundle, since there were already 5 other cables.

When I get the full poop on their scheme, I'll try to work this out in more detail, but for now, what do you think of the idea, complete with manuals, cables, etc.?

The dream you inspired in me of "Ethernet is the Unibus of the Fifth Generation" is in sight. Thanks for inventing it, but the real contribution is persistence.

Sincerely,

Gordon Bell

Chief Technical Officer

GB13.19

CC: Ken Olsen, Pat Courtin
May 18, 1984

Dr. Robert Metcalfe,
Chairman
3COM
1390 Shorebird Way
Mountain View, CA 94043

Dear Bob,

Congratulations on going public. I now want to take you up on the offer to get The Computer Museum $5,000,000 (recall I agreed to work on the other $5,000,000).

The Museum is now moved to Boston, and we had our first opening, the Pre-Preview Party at which Bob Noyce recounted the invention of the IC for our archives and report. 300 people, including bankers, new company presidents and contributors visited the Museum for the first time.

The Computer Museum needs **both corporate and personal level support** right now in order to open on November 12 and demonstrate its capability. Enclosed is various material, including a short letter on why the Museum that I wrote.

Our goal is to have 200 companies who provide annual support between $2500 and $25,000. This will create the needed additional annual funds and insure that the museum is industry wide.

Digital is providing $600,000 annually (paying the building costs and a variety of operating costs), for the next four years. After that, The Computer Museum must be on its own. A large portion will come from visitors and other earned income, but the Museum also needs annual membership from a large number of corporations. At present, **the annual membership is $2500** (and 3COM can also become a Corporate Founder if this happens **prior to June 24.)**

$2500 annual support would insure that 3COM could use the archives, hold several membership cards for employee check out, and help us insure that artifacts are saved. The Museum will also make its facilities available after hours and on closed days, only to Corporate members. Gwen will be happy to prepare any documents for your contributions committee or appear before them.

On the other hand, the capital campaign to raise $10,000,000 is largely directed towards individuals. At the level of $100,000 gifts we are willing to consider a wide variety of commemorative and other opportunities to insure given exhibitions and collections. One possiblity is the "Bob Metcalfe Collection and Archive of LANs", that would be archived and targetted as a special exhibit. You could also make sure that the right things were saved just by creating the "shopping list" of things to go after, like the cable that IBM just announced. Currently, we have an Alto, and one of the early Ethernet Transceivers from PARC.

We are seeking about $1.5M for the November 12 opening, of which we have commitment now for about $350K from various companies, board members and others. Mike Spock, a board member and the director of the Children's Museum, believes we will have an audience of over 240,000. Our breakeven is about 120,000 so the push now is to get the Museum open in Boston in order to really test the market. I believe we have the plan and capability to do it, provided we get the money to open. The past five years have proven that The Museum can deliver what it promises. **This is why I sollicit $100,000 from you now.**

Gwen will be out to visit on Friday, June 8 to discuss this in more detail and to enlist help from you and Robin.

Sincerely,

Gordon Bell
Chief Technical Officer

Enclosures

GB13.

Bob Rau, one of the principles of ELEXSI called me about our interest in funding a Supercomputer company which he'd run. He's now in charge of the I/O devices and has designed several gate arrays for Elexsi. They want our marketing and overall management expertise since they feel well qualified to get the product to production status. They have people from TRW and a financial type. This has been in planning for about 3 years with several people from other parts of the country.

Elexsi is coming along fairly well with about 3 in the field. It's an 8 processor UNIX based computer... and could even be a source of multiprocessor UNIX to us.

Their product would be a Cray-like computer, built from MCA 2500 gate arrays and the goal would be to consistently deliver 50 Mflops by having a really good compiler married to the architecture. He was sketchy on the compiler person. The machine would sell for about $400K and deliver about what a Cray does. He doesn't see how it could have caches or demand paging and still get the speed, nor would it have multprocessing at fcs.

He believes it would take 2-2.5 years and cost $8-10M to bring to market. He wants to meet me when I'm out there the week of Thanksgiving in order to hand me their dozen or so page plan that'll be done.

Can we discuss this?
June 2, 1982

Bob Spence
ML1-1/T63

Dear Mr. Spence:

On behalf of Central Engineering, I would like to personally thank you for your contribution to the success of the Central Engineering Booth at the DECUS Meeting in Atlanta.

Very positive feedback has been received from our customers that were in attendance. Thank you for the effort you expended to support their needs. Your enthusiasm and endless energy in the preparation and execution of the booth is recognized as a key factor in our success.

I wish you continued success in the future and look forward to future activities that demonstrate the abilities of our products and our people.

Sincerely yours,

Gordon Bell

Vice President,
Engineering

GB:mal
GB3.S5.13

cc John Wagner
    Bill Avery

GB3.S10.26

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M e m o
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TO: SAM FULLER
6:10
    BILL STRECKER

DATE: SAT 27 NOV 1982

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

MESSAGE ID:
5183004524

SUBJECT: WHAT ABOUT THIS BOOK THAT WE MIGHT DO?

Am not sure you folks have any more time than I do, but
somehow
the following needs to be done. Maybe we could spend the
next
few months planning and then try to do it this summer.

What do you think of a book which the three of us might
sponsor and
edit?

It would have a bunch of parts which we'd each have to take
responsibility for and write introductions and then get the

various
authors (and spur them on).

THE DESIGN AND CONSTRUCTION OF THE DIGITAL COMPUTING ENVIRONMENT

I. Overview-GB
    The Corporate Strategy, December 79, goals
    Central, distributed computing, personal computing and clusters
    Technology driving the 5th generation and the transitions
    VAX as the basis for 5G computing-Strecker/Hustvedt
    The process to manage this-Fuller

II. The Links and Protocols
    NI-Rodgers
    BI-?
    CI-Strecker, ?
    II-

III. The Nodes and What They Do
    Chips-Supnik, Dickhut, Stan Lackey
    VAXstation and its architecture- Levy, Rupp,
    Venus-Kotok, Glorioso
    Implementing other models
    HSC-Rubinson, Riggle, Lary, ?
    Pluto and the gateways-

IV. CI Clusters, NI Clusters, Ethernet LANs and GANs
    Evolution of VMS for Clusters
    PC clusters
    The LAN

V. Using the system
    PC and its compatiblity
    Real time in this environment
    Building large systems- Hustvedt
    Office plus and VIA-Daley, Howell, Noyce, Travis
    Building a large, integrated CAD system-Peters, Kusik, Goldfein

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! d ! i ! g ! i ! t ! a ! l !          I n t e r o f f i c e
M e m o
!___!___!___!___!___!___!___!
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TO: SAM FULLER   DATE: FRI 7 JAN 1983
8:39 AM
    BILL STRECKER   FROM: GORDON BELL
                                                 DEPT: ENG STAFF
                                                 EXT: 223-2236
                                                 LOC/MAIL STOP: ML12-
1/A51

                                                 MESSAGE ID:
5187163828

SUBJECT: BOOK OUTLINE II

GB4.S1.13

Here's what Bill put on the board.

I.   Overview
      PC
      Departmental
      Organizational

II.   Distributed Computing (forms)
      PC Clusters
      Large Clusters
      LANs
      WANs

III. Digital's Architectural
      DNA
      SCA
      LAT
      DSA
      Terminals (TIA)
      ISPs

IV.   Datalink Technology (discuss broadband,PBX,fiber

optics)
      CI
      NI

V.   Node Descriptions
      PC
      WS
      AIWS
      Dept.
      Org.

VI.   Special Function Servers
      Print
      File
      Terminal Concentrator
      Router
      Gateway
      Real time
      Disk

VII. Distributed and Large Applications
      Office
      VIA
      IRIS (LDP's System)
      VLSI/CAD
      Engineering Network
      Customer Examples

April 18, 1979

Irving H. Thomae, Ph.D.
Thayer School of Engineering
Dartmouth College
Hanover, New Hampshire 03755

Dear Irving:

Enclosed is a copy of "Designing Computers and Digital Systems.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:swh
GB0002/28

GB3.S4.3

It would be great to have a book that counters Soul of A New Machine. My problem with it, other than the engineering, was that I don't think the author liked the subjects at all, nor did he understand them. Unfortunately, the book was successful as measured by the Pulitzer Prize, and there is some expectation about what a project book might look like. Fortunately, VAX and VMS didn't look like DG's project and hence it really would appear dull by comparison. Also, copies of books always turn out to be much less significant than the original. (I sure like dull engineering projects versus the exciting ones say like Venus.) Therefore, I am highly negative about Soul of VAX/VMS because it has the markings of a copy, which unlike VAX/VMS was original and which caused DG to have to have their project.

What I would really like to see is a companion book to COMPUTER ENGINEERING, entitled COMPUTER ENGINEERING: A DEC VIEW OF SOFTWARE ENGINEERING. Note that COMPUTER ENGINEERING has sold in the range of 20K copies the last time I looked, so I know there's an excellent market. Bob Supnik had talked about such a book and we often talk about this book along with the idea of a DEC Engineering Journal. Others have talked about writing various articles. I have a tree that Richy Lary drew that relates various versions of various Operating Systems to one another, for example to give an overall perspective.

It would seem to me you would be the ideal person to write and edit such a book. You would gather many articles that exist today plus you would write the really definitive article or section (set of articles) on VMS. The issues you raise in your outline could be addressed in a section on VMS... or even a book on just the Engineering of VMS.

It seems to me you could proceed on a book, but really write it from a technical perspective, although putting in the people parts, but the audience is really Engineers (Software and Hardware and others) and the emphasis is how to do it right. It isn't a book about a bunch of kids trying to build something where the management is playing games.

What you think? Let's get together on this to brainstorm if you think it has merit

<title>CONTROL DATA CORP. 1600-COMPUTER
<keyword>CONTROL DATA CORP.
<generic>MANUALS[6]
<author>CONTROL DATA CORP.
<year>1962
<loc>GB OFFICE
<date entered>9/16/80
<>

<title>MICROPROCESSORS
<keyword>ELECTRONICS BOOKS SERIES
<generic>TEXTBOOK
<author>L. ALTMAN, MCGRAW-HILL PUBLICATIONS CO.
<year>1975
<loc>GB OFFICE
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<title>CONFERENCE ON CONCURRENT SYSTEMS & PARALLEL COMPUTATION
<keyword>PROJECT MAC
<generic>CONFERENCE REPORT
<author>ACM, INC.
<year>1970
<loc>GB OFFICE
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<title>HANDBOOK OF MATHEMATICAL TABLES & FORMULAS
<keyword>HANDBOOK PUBLISHERS
<generic>MATHEMATICAL TABLES
<author>RICHARD BURINGTON
<year>1953
<loc>GB OFFICE
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<title>BURROUGHS B 2500&3500
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<generic>REFERENCE MANUAL
<author>MARKETING DIVISION
<year>1966
<loc>GB OFFICE
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<title>PDP-14 USER'S GUIDE
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<author>DEC
<year>1969
<loc>GB OFFICE
<date entered>7/10/80
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<title>SPECIAL PURPOSE TIME SHARING SYSTEM FOR PDP-8 COMPUTER
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<generic>REPORT - CMU
<author>VAN DE GOOR
<year>1967
<loc>GB OFFICE
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<title>TSS/8 SYS MANAGER'S GUIDE,MONITOR,USER GUIDE
<keyword>PDP-8/I
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<author>DEC
<year>1969
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<title>PDP-8/I DISK MONITOR SYSTEM,TSS/8 MONITOR,FOCAL
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<author>DEC
<year>1968
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<title>PDP-X PART II
<keyword>PDP-X
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<author>DEC
<year>1967
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<title>ADAGE GRAPHICS TERMINAL(SYS REF, 3 SYS/SOFTWR
DESCRIPTIONS)
<keyword>ADAGE
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<author>ADAGE
<year>1968
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<title>BURROUGHS 100 ELECTRONIC DATA PROCESSING SYS
<keyword>BURROUGHS
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<author>BURROUGHS
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<title>BURROUGHS VISIBLE RECORD COMPUTER (VRC)
<keyword>BURROUGHS
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<author>BURROUGHS
<year>1964
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<title>DDP-24 GENERAL PURPOSE COMPUTER
<keyword>COMPUTER CONTROL COMPANY INC
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<author>COMPUTER CONTROL COMPANY
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<title>SPEECH-UNDERSTANDING SYSTEMS
<keyword>CMU
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<author>NEWELL ET AL
<year>1971
<loc>GB OFFICE
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<title>NOVA COMPUTERS, HOW TO USE THE
<keyword>DG
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<author>DATA GENERAL
<year>1970
<loc>GB OFFICE
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<title>NOVA 2, OURS IS THE BEST WAY
<keyword>DG
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<author>DATA GENERAL
<year>1973
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<title>ECLIPSE COMPUTER SYSTEMS
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<title>ECLIPSE COMPUTER, PROGRAMMER'S REFERENCE MANUAL
<keyword>DG
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<author>DATA GENERAL
<year>1974
<loc>GB OFFICE
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<title>NOVA 2, TECHNICAL MANUAL
<keyword>DG
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<author>DATA GENERAL
<year>1974
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<title>NOVA 1210 COMPUTER, TECHNICAL MANUAL

<keyword>DG
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<author>DATA GENERAL
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<title>NOVA, HOW TO USE THE
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<title>NOVA COMPUTERS, HOW TO USE THE
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<author>DATA GENERAL
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<title>RD02, REAL TIME DISK OPERATING SYSTEM
<keyword>DG
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<author>DATA GENERAL
<year>1974
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<title>DRC MODEL 44, GENERAL PURPOSE PROCESSOR
<keyword>DYNAMICS RESEARCH CORPORATION
<generic>SPECIFICATION
<author>DRC
<year>1968

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<date entered>7/22/80
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<title>EAI 8400 SCIENTIFIC COMPUTING SYS--DESCRIP/PROGRAMMING
<keyword>EAI
<generic>BROCHURES
<author>ELECTRONIC ASSOCIATES INC
<year>1965
<loc>GB OFFICE
<date entered>7/10/80
<>

<title>PROGRAMMING THE EDSAC-EARLY PROGRAMG ACTIVITY AT U CAMBRIDGE
<keyword>EDSAC
<generic>REPORT
<author>CAMPBELL-KELLY, MARTIN
<year>1979
<loc>GB OFFICE
<date entered>7/10/80
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<title>ELLIOTT 503 COMPUTER
<keyword>ELLIOTT
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<author>ELLIOTT
<year>1961
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<title>MP12 REFERENCE MANUAL
<keyword>FABRI-TEK
<generic>MANUAL, REF
<author>FABRI-TEK INC
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<title>SPC-12 AUTOMATION COMPUTER
<keyword>GENERAL AUTOMATION INC
<generic>SALES BROCHURE
<author>GENERAL AUTOMATION
<year>1968
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<title>STARAN S ASSOCIATIVE PROCESSOR
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<generic>MANUAL SYS REF
<author>GOODYEAR AEROSPACE CORP
<year>1972
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<generic>MANUAL, REF
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<title>LIBRASCOPE L-90 COMPUTER
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<author>GENERAL PRECISION
<year>1961
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<title>LGP-21
<keyword>GENERAL PRECISION, INC
<generic>SPEC

<author>GP
<year>1963
<loc>GB OFFICE
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<title>SURVEY OF DOMESTIC ELECTRONIC DIGITAL COMPUTING SYS
<keyword>GOVERNMENT
<generic>REPORT
<author>WEIK, MARTIN, ARMY
<year>1955
<loc>GB OFFICE
<date entered>7/10/80
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<title>INTEL 8008, 8080 (2 MANUALS)
<keyword>INTEL
<generic>MANUAL
<author>INTEL
<year>1975
<loc>GB OFFICE
<date entered>7/10/80
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<title>S-1 PROJECT, ADV DIGITAL COMPUTING DEV FOR NAVY APPLIC
<keyword>LLL
<generic>REPORT
<author>MCWILLIAMS, WIDDOES, WOOD
<year>1978
<loc>GB OFFICE
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<title>PROGRAMS FOR AN ELECTRONIC DIGITAL COMPUTER
<keyword>EDSAC
<generic>BOOK
<author>WILKES, WHEELER, GILL
<year>1951
<loc>GB OFFICE
<date entered>7/10/80
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<title>MAC TR-75, SHARING OF RESOURCES IN ASYNCHRONOUS SYS
<keyword>PROJECT MAC
<generic>MANUAL
<author>HEBALKAR
<year>1970
<loc>GB OFFICE
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<title>MAC TR-84--DATA FOR UNDERSTANDING NATURAL LANGUAGE
<keyword>PROJECT MAC
<generic>MANUAL
<author>WINOGRAD, TERRY
<year>1971
<loc>GB OFFICE
<date entered>7/10/80
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<title>MACSYMA
<keyword>PROJECT MAC
<generic>MANUAL REF
<author>MIT
<year>1975
<loc>GB OFFICE
<date entered>7/10/80
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<title>COMPUTER DESIGN FOR ASYNCHRONOUSLY REPRODUCIBLE MULTIPROCESSING
<keyword>PROJECT MAC
<generic>THESIS
<author>VAN HORN,EARL
<year>1966
<loc>GB OFFICE
<date entered>7/10/80
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<title>INPUT/OUTPUT IN TIME-SHARED, SEGMENTED, MULTIPROCESSOR SYSTEMS
<keyword>PROJECT MAC
<generic>THESIS
<author>SMITH, ARTHUR ANSHEL
<year>1966
<loc>GB OFFICE
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<title>MONROBOT XII COMPUTER
<keyword>MONROE
<generic>MANUAL SERVICE-ORIG
<author>MONROE
<year>1966
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<title>OLIVETTI UNDERWOOD PROGRAMMA 101
<keyword>OLIVETTI
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<author>OLIVETTI
<year>?
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<title>PHILCO 950 COMPUTING SYSTEM
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<author>PHILCO
<year>1963
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<title>703 IC SYSTEMS COMPUTER

<keyword>RAYTHEON
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<year>1967
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<title>RPC-4000 ELECTRONIC COMPUTING SYSTEM
<keyword>ROYAL
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<author>ROYAL MCBEE
<year>?
<loc>GB OFFICE
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<title>SANDAC 200
<keyword>SANDERS
<generic>MANUAL, PROGRAMMER REF
<author>SANDERS ASSOCIATES
<year>?
<loc>GB OFFICE
<date entered>7/22/80
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<title>SANDAC 200 - TECHNICAL DESCRIPTION
<keyword>SANDERS
<generic>MANUAL
<author>SANDERS ASSOCIATES
<year>?
<loc>GB OFFICE
<date entered>7/22/80
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<title>SANDAC 200
<keyword>SANDERS
<generic>SALES BROCHURE
<author>SANDERS ASSOCIATES
<year>1968

<loc>GB OFFICE
<date entered>7/22/80
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<title>SDS 92 COMPUTER-CONTROLLED SYSTEMS
<keyword>SCIENTIFIC DATA SYSTEMS
<generic>MANUAL REF-ORIG
<author>SDS
<year>1965
<loc>GB OFFICE
<date entered>7/10/80
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<title>SDS SIGMA 7 COMPUTER
<keyword>SCIENTIFIC DATA SYSTEMS
<generic>MANUAL REF
<author>SDS
<year>1968
<loc>GB OFFICE
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<title>SDS--SIGMA2,SIGMA5,SIGMA7,SDS910,920,930,9300,940
<keyword>SDS-SCIENTIFIC DATA SYSTEMS
<generic>MANUALS,BROCHURES
<author>SDS
<year>1966
<loc>GB OFFICE
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<title>SDS SIGMA 5/7 BTM: THE BALANCED SYSTEM
<keyword>SCIENTIFIC DATA SYSTEMS
<generic>SALES BROCHURE
<author>SDS
<year>?
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<title>160 COMPUTER PROGRAMMING MANUAL
<keyword>CONTROL DATA CORPORATION
<generic>MANUAL-ORIG
<author>CDC
<year>1960
<loc>GB OFFICE
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<title>QUARTERLY PROGRESS REPORT, INFORMATION PROCESSING
<keyword>LINCOLN LAB
<generic>REPORT-ORIG.
<author>FRICK, F.C.
<year>1960
<loc>GB OFFICE
<date entered>7/10/80
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<title>FASTER THAN THOUGHT
<keyword>SYMPOSIUM
<generic>BOOK
<author>BOWDEN, B.V., EDITOR
<year>1953
<loc>GB OFFICE
<date entered>6/26/80
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<title>COMPUTER DEVELOPMENT (SEAC & DYSEAC) AT THE NATIONAL BUREAU OF STANDARDS
<keyword>NBS
<generic>BOOK
<author>NBS
<year>1955
<loc>GB OFFICE
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<title>INTRODUCTION TO ANALOG COMPUTATION
<keyword>ANALOG
<generic>BOOK-ORIG
<author>BLUM, JOSEPH

<year>1968
<loc>GB OFFICE
<date entered>6/26/80
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<title>IBM SYSTEM/7, A GUIDE TO
<keyword>IBM
<generic>MANUAL
<author>IBM
<year>1970
<loc>GB OFFICE
<date entered>7/22/80
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<title>IBM 360 - SEVERAL MANUALS
<keyword>IBM
<generic>MANUALS
<author>IBM
<year>1966
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<title>IBM 1401 DATA PROCESSING SYSTEM (2)
<keyword>IBM
<generic>MANUAL REF ORIG
<author>IBM
<year>1963/62
<loc>GB OFFICE
<date entered>7/10/80
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<title>COMCET 60 COMPUTER COMMUNICATIONS SYSTEM
(IBM360+COMNET60)
<keyword>IBM
<generic>MANUAL, GEN REF
<author>COMPUTER NETWORK CORP
<year>1969
<loc>GB OFFICE
<date entered>7/10/80
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<title>IBM 1301 DISK STORAGE WITH 7000 SERIES DATA PROCESSING SYS
<keyword>DISK
<generic>MANUAL, GENERAL INFORMATION
<author>IBM
<year>1962
<loc>GB OFFICE
<date entered>7/10/80
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<title>SYSTEMATIC METHOD FOR C. SIMPLIFICATION OF LOGIC DIAGRAMS
<keyword>IBM
<generic>PAPER
<author>ROCKET, FRANK A.
<year>1961
<loc>GB OFFICE
<date entered>7/10/80
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<title>IBM 704 DATA PROCESSING SYS PROGRAMMER'S PRIMER FOR FORTRAN
<keyword>PROGRAMMING
<generic>MANUAL, GENERAL INFORMATION
<author>IBM
<year>1957
<loc>GB OFFICE
<date entered>7/10/80
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<title>IBM 709 DATA PROCESSING SYSTEM MERGE 709
<keyword>IBM
<generic>MANUAL REFERENCE-ORIG
<author>IBM
<year>1959
<loc>GB OFFICE
<date entered>7/10/80
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<title>IBM 704/709/7090 SYSTEMS
<keyword>PROGRAMMING
<generic>TECH BULLETIN

<author>IBM
<year>1961
<loc>GB OFFICE
<date entered>7/10/80
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<title>IBM 700-7000 SERIES AUXILIARY OPERATION
<keyword>IBM
<generic>REFERENCE MANUAL-ORIG
<author>IBM
<year>1959
<loc>GB OFFICE
<date entered>6/26/80
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<title>INTERDATA MODELS 2,3 AND 4
<keyword>INTERDATA
<generic>REPORT
<author>AUERBACH
<year>1969
<loc>GB OFFICE
<date entered>7/22/80
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<title>INTERDATA COMPUTER SYSTEMS
<keyword>INTERDATA
<generic>MANUAL, REF
<author>INTERDATA
<year>1967
<loc>GB OFFICE
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<title>SPIRAS-65 USERS MANUAL
<keyword>IRA
<generic>MANUAL
<author>IRA SYSTEMS INC
<year>1969
<loc>GB OFFICE
<date entered>7/22/80

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<title>LABCOM - SOFTWARE DEVELOPMENT STATUS
<keyword>LCI
<generic>MANUAL
<author>LCI
<year>1970
<loc>GB OFFICE
<date entered>7/22/80
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<title>IMP-16C APPLICATION MANUAL
<keyword>NATIONAL SEMICONDUCTOR
<generic>MANUAL
<author>NSC
<year>1974
<loc>GB OFFICE
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<title>TRAVELS IN COMPUTERLAND,OR INCOMPATIBILITIES & INTERFACES
<keyword>BRITISH
<generic>BOOK
<author>SCHNEIDER, BEN ROSS
<year>1974
<loc>GB OFFICE
<date entered>6/27/80
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<title>PLANNING A COMPUTER SYSTEM
<keyword>PROJECT STRETCH
<generic>BOOK
<author>BUCHHOLZ, WERNER
<year>1962
<loc>GB OFFICE
<date entered>6/26/80
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<title>TAPE RECORDER AS AN INSTRUMENTATION DEVICE
<keyword>AMPEX

<generic>BOOKLET-ORIG
<author>WEBER, PAUL J.
<year>1959
<loc>GB OFFICE
<date entered>6/26/80
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<title>PULSE RESPONSES OF FERRITE MEMORY CORES*
<keyword>MEMORY
<generic>MEMO-ORIGINAL
<author>FREEMAN, JAMES ROBERT
<year>1954
<loc>GB OFFICE
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<title>NOISE MEASUREMENT
<keyword>GENERAL RADIO
<generic>HANDBOOK-ORIG
<author>PETERSON, ARNOLD P.G., BERANEK, LEO L.
<year>1954
<loc>GB OFFICE
<date entered>6/26/80
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<title>RICE UNIVERSITY COMPUTER, BASIC MACHINE OPERATION
<keyword>
<generic>MANUAL-ORIGINAL
<author>RICE UNIVERSITY
<year>1962
<loc>GB OFFICE
<date entered>6/26/80
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<title>160 COMPUTER PROGRAMMING MANUAL
<keyword>CONTROL DATA CORPORATION
<generic>MANUAL-ORIG
<author>CDC
<year>1960
<loc>GB OFFICE
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<title>INFORMATION PROCESSING QUARTERLY PROGRESS REPORT
<keyword>LINCOLN LAB
<generic>REPORT-ORIG
<author>LINCOLN LAB
<year>1960
<loc>GB OFFICE
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<title>M6800 MICROPROCESSOR PROGRAMMING MANUAL
<keyword>MOTOROLA
<generic>MANUAL
<author>MOTOROLA
<year>1975
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<date entered>7/22/80
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<title>M680 MICROPROCESSOR APPLICATIONS MANUAL
<keyword>MOTOROLA
<generic>MANUAL
<author>MOTOROLA
<year>1975
<loc>GB OFFICE
<date entered>7/22/80
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<title>PHOENIX YM PROCESS CONTROLLER DESIGN SPECIFICATIONS
<keyword>PHOENIX
<generic>SPECIFICATION
<author>PHOENIX YM CORP
<year>1974
<loc>GB OFFICE
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<title>SDS 92 COMPUTER CONTROLLED SYSTEMS
<keyword>SCIENTIFIC DATA SYSTEMS
<generic>REFERENCE MANUAL-ORIG

<author>SDS
<year>1965
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<date entered>6/26/80
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<title>INDUSTRIAL AUTOMATION SIMPLIFIED WITH COMM REGISTER UNIT
<keyword>TI
<generic>SALES BROCHURE
<author>TI
<year>1971
<loc>GB OFFICE
<date entered>7/22/80
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<title>BERICHT DER GESELLSCHAFT FUR MATHEMATIK UND DATENVERARBEITUNG
<keyword>
<generic>BOOK
<author>ZUSE,KONRAD
<year>1979
<loc>GB OFFICE
<date entered>6/26/80
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<title>DAS PROGRAMMESTEUERTE RECHENGERAT
<keyword>ZUSE
<generic>MANUAL
<author>SPEISER, VON AMBROS P.
<year>1950
<loc>GB OFFICE
<date entered>6/26/80
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<title>DER COMPUTER MEIN LEBENSWERK
<keyword>
<generic>BOOK
<author>ZUSE, KONRAD
<year>1970

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<title>GESELLSCHAFT FOR MATHEMATIK UND DATENVERARBEITUNG
<keyword>
<generic>MANUAL-ORIG
<author>ZUSE, KONRAD
<year>1972
<loc>GB OFFICE
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<title>WHIRLWIND CASE HISTORY
<keyword>WHIRLWIND
<generic>BOOK
<author>REDMOND,SMITH
<year>1975
<loc>GB OFFICE
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<title>ZILOG Z-80 MICROCOMPUTER PRODUCTS
<keyword>ZILOG
<generic>BROCHURE
<author>ZILOG
<year>1975
<loc>GB OFFICE
<date entered>7/10/80
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<title>ENIAC TO UNIVAC: A CASE STUDY IN HISTORY OF TECHNOLOGY
<keyword>UNIVAC
<generic>DISSERTATION
<author>STERN,NANCY FORTGANG
<year>1978
<loc>GB OFFICE
<date entered>7/10/80
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<title>ANNALS OF THE HISTORY OF COMPUTING (VOL1-#1&2)

<keyword>HISTORY
<generic>MANUAL
<author>AFIPS
<year>1979
<loc>GB OFFICE
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<title>LITTLE ENGINES THAT COULD'VE: THE CALCULATING MACHINES OF CHARLES BABBAGE
<keyword>BABBAGE
<generic>THESIS
<author>COLLIER, BRUCE
<year>1970
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<title>MECHANISM OF CHARLES BABBAGE'S ANALYTICAL ENGINE CIRCA 1838
<keyword>BABBAGE
<generic>LECTURE
<author>BROMLEY, ALLAN G.
<year>1980
<loc>GB OFFICE
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<title>HOW BABBAGE'S DREAM CAME TRUE
<keyword>BABBAGE
<generic>ARTICLE
<author>WILKES
<year>1975
<loc>GB OFFICE
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<title>BABBAGE AS A COMPUTER PIONEER
<keyword>BABBAGE
<generic>ARTICLE

<author>WILKES
<year>1977
<loc>GB OFFICE
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<title>BOOLE, GEORGE (1815-1864
<keyword>BOOLE
<generic>PAPER
<author>BELL, G.?
<year>?
<loc>GB OFFICE
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<title>BOOLE, GEORGE, FREESTYLE THINKER
<keyword>BOOLE
<generic>ARTICLE
<author>MOLLY GLEISER
<year>1977
<loc>GB OFFICE
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<title>EARLY BRITISH COMPUTERS
<keyword>BRITISH
<generic>BOOK DRAFT
<author>LAVINGTON, S.H.
<year>1979
<loc>GB OFFICE
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<title>DIFFERENCE ENGINES
<keyword>BABBAGE ET AL
<generic>ARTICLE
<author>WILLIAMS, M.R.
<year>1974
<loc>GB OFFICE
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<title>ROUGH ROAD TO TODAY'S TECHNOLOGY
<keyword>HISTORY
<generic>ARTICLE
<author>BOWERS, DAN M.
<year>1977
<loc>GB OFFICE
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<title>FRAGMENTS OF COMPUTER HISTORY
<keyword>HISTORY
<generic>ARTICLE
<author>YASAKI, EDWARD K.
<year>1976
<loc>GB OFFICE
<date entered>7/10/80
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<title>APPLY COMPUTERS TO SAVE OUR RESOURCES
<keyword>COMPUTER DATA
<generic>ARTICLE
<author>LAPRAIRIE, JEAN
<year>1979
<loc>GB OFFICE
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<title>REVIEW OF ELECTRONIC DIGITAL COMPUTERS
<keyword>AIEE-IRE
<generic>PAPERS
<author>AIEE
<year>1952
<loc>GB OFFICE
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<title>DEC TREES
<keyword>TREES
<generic>CHARTS

<author>BELL, GORDON
<year>1976 TO
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<title>25 YEARS OF SERVICE - VOL C-25, #12, DEC. 1976
<keyword>IEEE
<generic>MAGAZINE
<author>IEEE TRANSACTIONS ON COMPUTER
<year>1976
<loc>
<date entered>
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<title>PERSPECTIVES ON THE FUTURE OF COMPUTING
<keyword>IEEE COMPUTER
<generic>MAGAZINE
<author>IEEE
<year>1976
<loc>GB OFFICE
<date entered>7/10/80
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<title>EVOLUATION & CULTURAL HERITAGE OF COMPUTERS & COMPUTING
<keyword>DARTMOUTH
<generic>COURSE MATERIAL
<author>LUEBBERT, WILLIAM F.
<year>1979
<loc>GB OFFICE
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<title>MD-101 MEMORY SYSTEM EXERCISER
<keyword>MACRODATA CO
<generic>SPEC
<author>MACRODATA
<year>1972
<loc>GB OFFICE
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<title>MARK1,MEG,MERCURY,MUSE,ATLAS
<keyword>MANCHESTER MACHINES
<generic>BOOKLET
<author>NCC
<year>1975
<loc>GB OFFICE
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<title>MACHINE-AIDED ANALYSIS
<keyword>MIT
<generic>COURSE 6.25
<author>MIT, EE
<year>?
<loc>GB OFFICE
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<title>MILITARY CPU'S
<keyword>SURVEY
<generic>PAPER
<author>FROST, CECIL R.
<year>1970
<loc>GB OFFICE
<date entered>6/26/80
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<title>COMPUTER RESOURCE ACCOUNTING IN A TIME SHARING ENVIRONMENT
<keyword>RESOURCE
<generic>SJCC PROCEEDING-ORIG
<author>SELWYN, LEE L.
<year>1970
<loc>
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<title>ORIGINS OF THE COMPUTER INDUSTRY:A CASE STUDY IN RADICAL TECHNOLOGICAL CHANGE
<keyword>TECHNOLOGY
<generic>DISSERTATION

<author>WELL, JOHN VARICK
<year>1978
<loc>GB OFFICE
<date entered>6/26/80
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<title>MULTICS VIRTUAL MEMORY
<keyword>REPORT
<generic>MEMORY
<author>BENSOUSSAN, A.
<year>1970
<loc>GB OFFICE
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<title>MEET THE PC (PROGRAM CONSOLE)
<keyword>
<generic>REPORT-SEVERAL
<author>COX, J.R.
<year>1966
<loc>GB OFFICE
<date entered>6/26/80
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<title>TURING, THE OTHER TURING MACHINE
<keyword>TURING
<generic>ARTICLE
<author>CARPENTER & DORANT
<year>1975
<loc>
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January 21, 1980

Roger S. Borovoy
3065 Bowers Avenue
Santa Clara, California 95051

Dear Roger:

I'm happy to contribute, but I'm very poor at this kind of work. Also, I'm on the EE Visiting Committee, give a lecture every other year, and so I do contribute time already.

Sorry, I must decline.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:swh
GB1.S1.31

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a n d u m
|   |   |   |   |   |   |   |
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Subject: **NOAA and NCAR Visit**

To: Dawn Boyd, DV

CC: Bob Anundson, DV
Ted Johnson, PK3-2/A55
Gerry Moore, PK3-2/A66

Date: 10 OCT 78
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

Thanks for setting up, operating and taking care of me at NOAA and NCAR.

It's nice to be in the hands of professional sales people.

GB:ljp

BPO'S VIEWDATA

RAN '73, ANNOUNCED '75, DEMO'D '76, SERVICE BY '80

1200/75 bps LINK TO DUMB TERMINAL USING MODIFIED TELEVISION SETS

(40 X 24 CHARACTERS) AND SIMPLE KEYBOARD

CHARGES: INFORMATION STORED, ACCESSOR (AT LINE CHARGES AND PER MONTH)

June 18, 1984

Dr. Lewis Branscomb, Chief Scientist
International Business Machines
Old Orchard Road
Armonk, New York 10504

Dear Lewis:

I'd like to thank you for all the help you've given the Museum that resulted in IBM becoming a Corporate Founder. It is great to be able to "communicate" with IBM for photos and artifacts for the November opening.

Enclosed is a new brochure on the Capital Campaign that outlines the plan. If you have any ideas that might help get IBM support for the campaign or exhibits such as Sage or the 1401 that Travelers Insurance is sponsoring, I'd certainly welcome them.

A first rate team is designing the exhibits, including Dr. Oliver Strimpel, curator of the Science Museum in London and Dr. Paul Ceruzzi, a young history of computing scholar. In addition to the exhibits with historical artifacts, two major interactive galleries are being built for PC's and on the computer and the image. We predict attendance of over 200,000. This world-class, international Museum should be a major attraction and asset for the computing community.

Given the difficulty of obtaining large corporate support for public institutions, it is vital to get support from individuals. I hope you'll consider becoming a "Core" supporter to the campaign. Also, I hope you'll become a founder. (The founding period closes July 1.)

Thanks again. I hope you'll consider visiting the Museum in the near future when you're in Boston; Gwen and I would be delighted to give you a tour and a meal.

Sincerely,

Gordon Bell

Enclosure

October 15, 1979

Silvio Steinberg
Sao Paulo, Brazil, Branch Office
Subsidiary Operations Region

Digital Equipment Comercio e Industria Ltda.
Avenida 9 de Julho, 3741
01407 Sao Paulo-Sp
BRAZIL

Dear Silvio:

Please accept my warmest thanks for the fine hospitality shown Gwen and I in Rio and Sao Paulo. Manaus and the Amazon turned out to be great too.

I'm more enthusiastic than ever about the potential of Brazil and hope we can somehow act to make it a large, DEC market. We thoroughly enjoyed the sights, the conference, visiting customers, and the enthusiasm and competence of fellow employees. Will be sending you the paper soon on "Approvals to Establishing National Computer Industries" and look forward to your comments and it being a useful educational tool in effecting Brazilian policy.
Again thanks and I look forward to a continued interaction.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:swh
GB0005/10

CC: Dick Finn, AK
Carl Janzen - AK
Ted Johnson, PK3-2/A55
Rubin Olsher, MR2-4/M51
Bruce Ryan - AK

October 15, 1979

Koenraad Visser
Rio de Janeiro, Brazil, Branch Office
Subsidiary Operations Region
Digital Equipment Comercio e Industria Ltda.
Avenida Augusto Severo, 156-B
20021 Rio de Janeiro, RJ
BRAZIL

Dear Koenraad:

Please accept my warmest thanks for the fine hospitality shown Gwen and I in Rio and Sao Paulo. Manaus and the Amazon turned out to be great too.

I'm more enthusiastic than ever about the potential of Brazil and hope we can somehow act to make it a large, DEC market. We thoroughly enjoyed the sights, the conference, visiting customers, and the enthusiasm and competence of fellow employees. Will be sending you the paper soon on "Approvals to Establishing National Computer Industries" and look forward to your comments and it being a useful educational tool in effecting Brazilian policy.

Again thanks and I look forward to a continued interaction.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:swh
GB0005/13

CC: Dick Finn, AK

Carl Janzen - AK
Ted Johnson, PK3-2/A55
Rubin Olsher, MR2-4/M51
Bruce Ryan - AK

October 17, 1979

Professor Nelson Machado
UNICAMP
Universidade de Estatual de Campinas
Cidade Universitaria
Barao Geraldo
Campinus, Sao Paulo, BRAZIL

Dear Professor:

Thanks for the interaction at Campinas on October 12 and the tour of the campus. Regretfully we had such a short time. I sending you a copy of Computer Engineering which several of us here wrote on describing our computers.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:swh
GB0005/15
Enclosure

October 17, 1979

Professor Jose Fabio Marinho de Araujo
Universidade Federal do Rio de Janeiro
Nucleo de Computacao Electronica
Predio do Centro de Ciencias Matematicas e de Natureza
Bloco C-Sala E/1017
Ilha do Fundao - Cidade Universitaria
Rio de Janeiro - RJ
BRAZIL

Dear Professor:

I certainly enjoyed our interaction at the University of Rio on October 10.

Enclosed you'll find a list of the design programs we currently use together with an abstract of what each does. Also enclosed is a list of some of the test equipment we use in design and manufacturing.

If you want manuals on them, let me know and I might be able to send some to you. Please <u>do</u> <u>not</u> copy either of these documents. In case you don't have a copy, I'm sending a copy of the book, Computer Engineering, written by several of us here which describes the design of DEC's computers.

Again, I enjoyed meeting you.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:swh
GB0005/16
Enclosure

October 17, 1979

Professor Lucas A. Moscato
Universidade de Sao Paulo
Escola Politecnica
Depto. de Engenharia de Electricidade
CX. Postal N: 8.174 - Cidade Universitaria
Sao Paulo, BRAZIL

Dear Professor:

It was a great honor to visit your department and to learn about the activities of the Institute for applying computers through Professors Nelson and Zuanella. I enjoyed the interaction with your students and some of your faculty and deeply regret that the three of you could not attend my talk because I would have liked to learn more from you through discussion.

I am sending a copy of a book on Computer Engineering that several of us at Digital have written. Hopefully it will be of use in your teaching program. If you would like more copies for various faculty members or for the library please let me or the local Digital office know.

Again, thank you for the honor of meeting with me in Sao Paolo. I hope you visit us here and I have a chance to return the hospitality.

Sincerely,

Gordon Bell
Vice President, Engineering
Professor, Computer Science and

Electrical Engineering
Carnegie-Mellon University, on leave

GB:swh
GB0005/14
Enclosure

CC: Silvio Steinberg - Digital
July 15, 1980

Alain Brieux
Expert
48, rue Jacob,
PARIS VIe

Dear Mr. Brieux,

I have studied the Malassis Chauvin Collection in some detail and have a proposal that I believe would be advantageous to both of us.
There are a number of pieces in the collection that would round out my own, and would not essentially disturb the totality.

The offer that I have to make is in three sections -- each one conditional to the previous one.

I. 13 items for $25,000:

1 59. L. Bollee Calculating Machine

2 92. Comptometer No 5857.

3 103. Arithmometer Archimedes.

4 118. Gauss circular machine. 1905.

5 120. Adsumudi. 1907.

124. Millionaire with electric motor.
6
127. 5 Printing calculating machines.
7-11
132. Key Calculating machine. Burroughs
1907. 12
174. Nouvelle Machine D'Arithmetique.
c.1720. 13

II. An additional 24 items for $25,000,
totalling 37
items for $50,000. (I have listed 26 items
and you
can select any two that you would like to
withhold.)

3. SOUAN PAN.
1
8. STCHOTY.
2
20. PERSIAN LARGE ABACUS.
3
36. TRONCET ARITHMOGRAPH.
4
58. ADDIATOR.
5
78. COMPTEUR LAFOND.
6
84. ROTH ADDING MACHINE.
7
86. ILKA.
8
88. ADIX.
9
97. ARITHMOMETER. Thomas de Colmar.
10
101. SAXONIA.
11
105. UNITAS ARITHMOMETER
12
107. CALCULATING MACHINE.
13
121. ECLAIR.

14

125. MAQUETTE. Schickard replica.

15

146. THE THESAURUS.

16

150. MOKO LIGHTNING CALCULATOR.

17

185. LA MULTI.

18

186. NEPERIAN CYLINDERS.

19

194. REGLETTES DE GENAILLE.

20

195. MICHEL ROUS' ABACUS.
21
202. AIDE CALCUL.
22
229. CALCULATION RULER
23
257. ARITHMOGRAPH CALCULATING CIRCLE.
24
294. UNIVERSAL RULER.
25
299. LALANNE.
26

III. An additional 103 items for an additional $50,000 bringing the grand total to 140 items for $100,000. (Again, I have selected more items -- 107 -- and you can select four to withdraw.)
I am listing the numbers without naming the objects. I have tried to be very selective both to enchance my collection and not overly disrupt your collection -- so that it would be interesting as a complete and representative group. The additional items: 6, 13, 17, 22, 17, 31, 32, 37, 39, 41, 47, 48, 52, 57, 64, 66, 69, 74, 76, 79, 80, 82, 89, 90, 91, 95, 99, 103, 116, 117, 126, 128, 130, 131, 134 (15 items), 139, 141, 148, 152, 153, 159, 160, 164, 165, 166, 167, 168, 184, 187, 189, 190, 191, 196, 199, 206, 207, 208, 212, 213, 214, 215, 223, 228, 230, 231, 233, 234, 235, 237, 238, 239, 240, 245, 247, 253, 261, 263, 265, 272, 279, 282, 283, 286, 288, 292, 295, 300, 303-21, 303-24, 303-26, 304-1, 304,2.

I do hope that you will consider this offer seriously and hope that we can reach an agreement.

Sincerely yours,

C. Gordon Bell
Vice President, Engineering
Keeper, Digital Computer Museum

GB1.S5.23
July 28, 1980

Willard Gardner
Director of Computer Services
Brigham Young University
Salt Lake City, UT 84100

Dear Dr. Gardner,

Dick Eckhouse informed me that you were retiring the Stretch from active service. I would certainly like to preserve parts of it in the Digital Computer Museum. For your information, I'm enclosing a museum brochure and one of the first newsletters. Posters of computer genealogy and announcing J. Forrester's lecture are being sent under separate cover.

The goal of the museum to preserve computing history, and in so doing want to use every form of record keeping. Thus, I have a variety of ideas that for Stretch.

First, and most simply, we'd like some good color and black and white photographs of the machine in action, giving some concept of scale.

Second, we would pay $500 towards the making of a short video-tape record of the machine in use, demonstrating a simple program. I would hope that you would also find that this would be useful for the universities own archives.

Third, we would very much appreciate a console panel, with its lights and switches and some modules, and cables that could be integrated into a display that might simulate the environment of Stretch using some of the photographs of the machine. In addition, we would like some manuals and diagrams for archiving. We will, of course, pay all expenses for boxing and shipping the pieces to Marlboro and give you the appropriate credits. We would also like a single disk, and actuator from one of the drives if you dismantle them.

We hope that you would consider cooperating with us on this endeavour as I am distressed when the early machines are simply dumped without good records being kept and an exhibit created. Please feel free to call me or Gwen Bell if you have any questions.

If you have an opprotunity to come to Boston we would be delighted to show you the museum and will put you on our mailing list.

Sincerely yours,

Gordon Bell
Vice President, Engineering
Keeper, Digital Computer Museum

GB:swh
GB1.S5.64

CC: Gordon Stokes, Computer Science Department,
Brigham Young University
Dick Eckhouse - DEC
Gwen Bell- Assistant Keeper, Digital Computer Museum

Enclosure - Museum brochure + newsletter

August 20, 1979

British Science Museum
Jane Raimes, Assistant Keeper
South Kensington London SW72DD
ENGLAND

Dear Jane:

We can give you a Classic PDP-8 (circa 1965) that we believe was the first minicomputer. It would sit on some pedestal (we'll supply if you want) and is approximately 2 1/2' high and 20W wide x 30" deep. Do you still want it?

We're in the throes of opening our own Digital Computer Museum in Marlboro, Massachusetts this fall. It includes a reasonably good collection of calculators; a logic exhibit; MIT's Whirlwind and TX-0; MIT's LINC, a LINC-8, PDP-12, and our MINC Laboratory series evolution, a PDP-1 (first Spacewar), a PDP-8, and a collection of artifacts from our machines.

What's the chance of borrowing some parts from the Science Museum for a year?

Sincerely yours,

Gordon Bell
Vice President
Engineering

GB:mjf
GB0004/36

October 11, 1979

Jane Raimes
Assistant Keeper
British Science Museum
South Kensington
London SW7
ENGLAND

Dear Jane:

We are sending the PDP-8 to the Science Museum to your attention. Also, I'm enclosing the specification we use in describing it at our exhibit.

Sincerely yours,

Gordon Bell
Vice President
Engineering

GB:mjf
GB0005/3

Enclosure

CC: Bob Lane - DEC

ID#419

| d | i | g | i | t | a | l | **interoffice memorandum**

Subject: **VAX Advertising Input**

To: Doug Towle, MR1-1/M55

CC: Jim Bailey, PK3-2/M88
Bernie Lacroute, TW/A08
John Leng, MR1-1/A65

Date: 1/16/79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

Thanks for allowing us to have some input to the advertising and promotion of VAX. Please convey my thanks to the agency and pass along this note.

I'm sorry that we didn't learn more about advertising and PR in the process because it might be more helpful in the future. Although I think the ads so far are fine, and hopefully will win awards all over the place, I believe we were fed a baloney sandwich (there are other similies). Since I don't know the right adeeze for this, Clayton defines this sandwich as something you feedback, independent of what the input is. The meeting was relatively useless. Namely, we couldn't change anything, I don't feel any of our input was used, and in general there was lack of involvement to get what may of been a pretty good thing into the great categorie...which is how I feel about the machine. Since the PR and marketing has been so abysmally poor, I must be thankful that something is happening at last. John and you are to congratulated. Now, I have an understanding, given the support including the training program why the sales have been so disappointing and only the customers love and respect the product. Hopefully, the computer market will develop to the point it is needed and we will have to sell it.

The brochure could be really good and the future work could be too, but I don't feel you have a plan or idea in place as to the next ads and the direction of the brochure. The idea of interviewing people to me in an unstructured way and basing a program on what they feel like seems just somewhat leaderless.

Of course, the developement group is at your disposal to help on any future work because they are also dedicated to the success of the product. Please keep up the good work.

D I G I T A L INTEROFFICE MEMORANDUM

DIST: Jim Bailey PK3-2/M88 Bernie Lacroute TW/A08
John Leng MR1-1/A65 Doug Towle MR1-1/M55

October 28, 1983

Mr. Brook Byers
Kleiner, Perkins, Caufield and Byers
4 Emarcardero Center
Suite 3520
San Francisco, California 94111

Dear Brook:

Just a short note to follow our phone call last week requesting help for the Computer Museum. I understand your firm's reluctance in fund raising for the Museum at this time, and regret that you and Tom will be unavailable when Gwen and I visit the Bay Area Thanksgiving week. I do hope to call on you for personal assistance after your sabbatical. As a first step, I hope you can visit the Museum soon to see it and understand the vision behind it.

As I mentioned on the phone, the Museum is now raising 10 Million dollars in order to: buy 55,000 square feet of space with the Boston's Children's Museum; move from the current space within Digital's facility in Marlboro Massachusetts; build new exhibits; and provide an endowment for future growth. We will spend about $500,000 for San Francisco's Computer Mart exhibit when it opens in September.

I'm enclosing Reports which describe the Museum together with a Statement of Case for our fund raising. Note the extensiveness of the collection, it supporters, and hence why the institution is both unique and so important.

My plea right now is to urge you to **give a substantial gift this year**, perhaps with a conditional pledge for subsequent year gifts if our efforts continue to bear fruit. I have currently pledged $100,000 for the next 3 years, and hope to increase this as my earning power increases... hopefully along with the price of Digital's stock. We have a commitment of $1 Million from Digital for the building; $1 Million to be raised by CDC in the Midwest area; and several $ 50,000 gifts. The campaign just started this fall.

I do hope you can begin to support us now financially, and follow this with your very persuasive and enthusiastic personal support over the coming years.

Have a good sabbatical.

Sincerely,

Gordon Bell

Mr. Brook Byers
Kleiner, Perkins,
Caufield and Byers
4 Emarcardero Center
Suite 3520
San Francisco, California
94111

May 4, 1978

Dr. Harvey Brooks
Chairman, CSS
c/o Dr. Edward Epremian
Executive Director, CSS
National Research Council
Commission on Sociotechnical Systems
2101 Constitution Avenue
Washington, D. C. 20418

Dear Dr. Brooks:

Although the proposed study is sure to yield interesting and possibly useful results, I fear that the interpretation and popularization of the results could easily limit future and even stop computer science's study of various computer applications.

In reading the proposal most broadly, it encompasses nearly all use of computers. For example, personal computer aided instruction systems control the learner as he proceeds to scan and learn educational material. We could conjure up situations where erroneous material or even errors in the program had some consequences to the learner. Somehow, I see such a system as being quite analogous to a book -- society permits relatively free publication. A study committee could easily recommend a bureaucracy for the evaluation and qualification of all such systems -- including verifying whether the add key of a calculator adds properly -- because a calculator may be used in a vital control application.

I believe computers supplement other information processing (including transmission, switching, transduction and memory). There is always a human or organization responsible for the consequences of the application of the instrument, just as there is when employing a person to carry out a task. I'd like to leave the situation this way until there is a better way to test and regulate the largest body of information processors (i.e., people and society). I shudder at the thought of a committee singling out and looking at the problem for just computers. For example, computers and privacy once understood was really an issue of information and privacy, independent of how the information is stored and processed.

To answer the questions in your letter:

1. There may be a problem, but the study group is certain to make it a significant problem.

2. The study should be attacked from a very detailed case study and then attempts to generalize should be carried out. For every system, I propose that there be a parallel study of a system involving no computers in order to assess the same question of vulnerability, failure modes, graceful degradation, and include noise that may trigger erroneous control behavior, errors, certification and verification of capabilities.

3. The study is likely to trigger more studies, and more legislation with no public benefit.

4. Probably not. Detailed case studies over a long time period prepared by many individuals working on specific systems (with a wider board guiding the directions).
No. No.

Thank you for giving me the opportunity to comment on the CSS study. I hope that the comments have been helpful, however, I'm skeptical of anything that is likely to get large, legislative groups involved in detailed system or component designs (e.g., using catalytic converters, more mass for protection) instead of broad guidelines (e.g., greater than x miles/gal, less than y ppm of certain materials).

Good luck on the study.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:ljp
****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION
9:44 PM EDT

cc: MAURICE CONWAY @PVFS

DATE: TUE 4 MAY 1982

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: TREATING BROWN WITH RESPECT

I think we want to work with Brown somehow. I'm terrified of having another small group go there, Tom, and talk to them. They are really not in a mood to have us trapse through and be performed to with no action. If this is the design review portion, then George and the team ought to be there to get the
full benefit.

At the meeting we had with Brown, I got the sense that we have to go there (at least Sam, Dick, George and I, plus some others who'll benefit by the interaction on presenting the workstation). Because they are so close, we treat them the same sloppy way as we treat ourselves.

I think it's imperative that someone within engineering take on this liasion role and lead us to a conclusion (go/no go) with them. I do not want to be on the receiving end of Andy Van Dam's pithy letter to Ken that says what a jerk we are for not working with them and for leading them around by the nose. This next visit that you are proposing is

NOT at all what I think we agreed to in the meeting with them, and it will get us into just more hot water there.

We have a history of really screwing up these things by having everyone involved. The mess at CMU finally got straightened out by finding a sponsor who would take the lead.

I'm concerned that we set the right tone. If this is just a presentation on the onyz and opal architecture, fine. If it's
more, then we'd better get our act together so as not to just make this another visit for them to get their dogs and ponies out for. Clearly if it's to get their input, then it should be aimed at getting a large team down there to present so that we get the maxiumum learning. Sam, I'd like you or your delegee or me to go in order to take advantage of this independent
assessment of our WS architecture.

Clearly we must have someone taking the lead. Who is this??????

"TO" DISTRIBUTION:

GEORGE CHAMPINE	DICK ECKHOUSE	FORBES AND CONWAY
MARY JANE FORBES	SAM FULLER	TOM GANNON
DIETER HUTTENBERGER	AL LOPEZ	PETER SMITH

GB3.S5.21

July 9, 1979

Peter Wegner

Brown University
Program in Computer Science
Providence, Rhode Island 02912

Dear Peter:

I'd be happy to participate in your Department of Computer Science Opening, September 7. A topic will be forthcoming.

I assume I'm to make some statement that will take 15-30 minutes during the panel on "Rejuvenating Experimental Computer Science", followed by a free for all discussion.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:swh
GB0003/69

July 30, 1979

Peter Wegner
Brown University
Program in Computer Science
Providence, Rhode Island 02912

Dear Peter:

Enclosed is an abstract of the talk/position I intend to give at the Brown Inaugural Symposium. I would expect to take about 20 minutes for the position, although this is up to you. I am anxious to hear who else is on the panel and to see their abstracts.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:swh
GB0004/25

LESSONS ON REJUVENATING EXPERIMENTAL COMPUTER SCIENCE

+DON'T WAIT AROUND FOR SPECIAL FEDERAL FUNDING IF YOU HAVE IDEAS.

ALTHOUGH IT IS CLEAR THERE HAVE BEEN A PLETHORA OF BAD IDEAS FUNDED, IT IS UNCLEAR TO ME THERE IS A COLLECTION OF NEEDS RIGHT NOW JUST LOOKING FOR FUNDS. IN WORKING ON THE COSERS REPORT, IT FELT LIKE THESE WERE INDEED ONLY A FEW, MAJOR IDEAS.

+IT IS NOT CLEAR THAT EXPERIMENTAL CS IS SO DEAD THAT IT NEEDS REJUVENATION. -- IT DOES HOWEVER, NEED TO BE REDIRECTED. VIRTUALLY ALL PAST, SIGNIFICANT CONTRIBUTIONS CAME FROM A NEED (APPLICATION) OR WELL AS BY-PRODUCTS OF SOLVING A PROBLEM, AND I WORRY ABOUT WHETHER OUR WORK NOW IS NEED BASED!

IF WE LOOK AT THE GREAT CONTRIBUTIONS, ESPECIALLY IN THE HARDWARE AREA, THEY WERE ALL DOMINATED BY A SINGLE INDIVIDUAL AND THEN EITHER EXECUTED BY THE INDIVIDUAL OR A TEAM.

UNFORTUNATELY, BABBAGE ALTHOUGH ONE OF THE EARLY GIANTS MAY HAVE INITIATED BOTH GROUP WORK AND THE IDEA OF GOVERNMENT

FUNDING. BABBAGE ALSO LEARNED ABOUT OVERRUNS, MISSING SCHEDULES, AND MAY EVEN HAVE STARTED AREA RESEARCH BECAUSE HIS OUTPUT WAS NEVER FOR WHAT HE WAS FUNDED. THE SIDE EFFECTS WERE INTERESTING AND WE ATTRIBUTE THE IDEA OF COMPUTING TO HIM NOW! MOST OF THE EARLY WORK WAS DONE BY INDIVIDUALS WITHOUT GOVERNMENT FUNDING.

DON KNUTH'S TEX SYSTEM, IS REPRESENTATIVE OF THE KIND OF SYSTEM I'M TALKING ABOUT. IT IS RELATED TO A SIGNIFICANT NEED OF SOCIETY AND DON IS PERSONALLY DRIVEN TO SOLVE THE PROBLEM. THE CONTRIBUTION CAME BY BEING A GREAT CSCIENTIST <u>AND</u> LEARNING ABOUT TYPOGRAPHY VERY DEEPLY.

ENIAC, WHIRLWIND, AND EVEN CTSS WHERE GROUP PROJECTS GREW OUT OF VARIOUS NEEDS - AND IT'S HARD TO SEE SIMILAR ACTIVITIES NOW, WITH THE EXCEPTION OF VLSI PROJECT - WHICH TOOK TOO LONG TO START. WITH ALOT OF FUNDING, RESEARCHERS GET SOFT AND DON'T WORRY ABOUT NEED. TOO MUCH FUNDING COULD PREMATURELY AGE EXPERIMENTAL COMPUTER SCIENCE BEYOND REJUVENATION, BECAUSE RUNNING EXPERIMENTS IS HARD WORK.

<u>+DON'T BELIEVE THAT FUNDS, PER SE WILL SOLVE PROBLEMS.</u>

THE FELDMAN REPORT BEMOANED THE FACT THAT UNIVERSITIES LOST FACULTY TO INDUSTRY AND I HOPE GOVERNMENT. DEPARTMENTS SUCH AS HISTORY AND ENGLISH WOULD LOVE TO BE IN THIS SITUATION OF LOSING PEOPLE BY FLOW-THROUGH. THIS IS THE KEY WAY TO HAVE A DEPARTMENT REJUVENATED. THIS SEEMS IDEAL TO ME. MORE FUNDS WILL ONLY CREATE HIGHER SALARIES AND LESS EQUIPMENT BECAUSE THE GOVERNMENT EXPENDITURES IN THIS AREA BARELY KEEPS UP WITH INFLATION.

<u>+COPY FROM THE JAPANESE.</u>

THEY SEND ALL THEIR FACULTY AND INDUSTRIAL RESEARCHERS TO AMERICAN UNIVERSITIES THAT ARE ARPA FUNDED. MAYBE, JUST A FEW UNIVERSITIES FOR EXPERIMENTATION ARE ALL WE NEED, THE REST DO TEACHING.

THE JAPANESE UNIVERSITIES ARE FUNDED BY INDUSTRY, BUT USUALLY NOT BY GOVERNMENT. THIS IS BECAUSE THE JAPANESE DON'T HAVE SUCH A BIG GOVERNMENT AND INDUSTRIES CAN AFFORD TO FUND MORE RESEARCH AND RESEARCHERS (EITHER IN JAPAN OR ABROAD - WHICHEVER IS MORE COST EFFECTIVE). FURTHERMORE, JAPAN HAS INSIGNIFICANT GOVERNMENT LABORATORIES. THEY FUND THE COMPANIES AND BY THE FUNDS FLOW, THERE IS ALSO A PATH AND REASON FOR IDEAS TO FLOW.

<u>+WHILE GENERAL PURPOSE PROGRAMMING LANGUAGES (AND NOW I SHOULD ADD OPERATING SYSTEMS, EDITORS, TYPESETTING SYSTEMS) SEEM TO BE FUN TO INVENT, WE REALLY DON'T NEED ANY MORE, THEY TAKE UP PEOPLE AND MACHINE RESOURCES. WE NEED SYSTEMS THAT SOLVE PROBLEMS WITHOUT PROGRAMMING (AND LOOKING TO AN EVOLUTIONARY LANGUAGE REALLY LOOKS FRUITLESS).</u>

<u>+LOOK OUTSIDE THE COMPUTER SCIENCE DOMAIN NOW FOR APPLICATIONS (NEED) AND DON'T IGNORE BUSINESS OR THE ARTS!</u>

IT FEELS LIKE WE HAVE A REASONABLE BASE SET OF CONCEPTS (ALGORITHMS) AND MECHANISMS TO IMPLEMENT THEM, AND MOST OF THE ADVANCES NOW WILL COME FROM SEARCHING FOR THE APPLICATIONS LIMITS I.E. NEED. THIS FEELS QUITE SIMILAR TO HAVING VARIOUS MECHANICAL LAWS AND WAYS OF ANALYZING SYSTEMS AND THE VARIOUS MECHANICAL CONSTRUCTS (EG. LINEAR TO ROTATION, 4 BAR LINKAGE) THAT ABIDE BY THE LAWS. THE ISSUE AND REALLY SIGNIFICANT ADVANCES WILL COME (AS BY-PRODUCTS) FROM BUILDING SYSTEMS THAT DO USEFUL THINGS.

THE BUSINESS COMMUNITY IS CRYING FOR HELP. BUSINESS SCHOOLS ONLY UNDERSTAND THE COMPUTER AS A TOOL AND HAVE NO KNOWLEDGE OF BUILDING SYSTEMS - THIS COULD REVOLUNTIONIZE THE BUILDING OF ORGANIZATIONS THAT ALL END UP AS BUREAUCRACIES. ENGINEERING IS QUITE A LOT MORE ADVANCED IN THAT COMPUTERS HAVE BECOME COMPONENTS, AND THE ARTS IS JUST STARTING TO USE MACHINES. HUMANITIES COULD BE A FERTILE GROUND ESPECIALLY HISTORY.

FOR EXAMPLE, THE STANFORD COMPUTER COMMUNITY SUPPORTED THE JOHN CHOWNING OF THE MUSIC DEPARTMENT. JOHN, A COMPOSER BECAME INTERESTED IN CS AND CE AND CAME UP WITH AN IDEA FOR DIGITAL FM FOR MUSIC SYNTHESIS AND HAS A PATENT ON IT WHICH HE HOPES WILL BE SUFFICENT TO SUPPORT THE STANFORD MUSIC DEPARTMENT. RECENTLY, HE HAS APPLIED THIS FORMULATION OF SYNTHESIS TO VOICE, AND IT STANDS TO BE AN ALTERNATIVE TO THE VARIOUS THE VOCODERS THAT HAVE EVOLVED IN A RATHER SINGULAR DIRECTION FOR THESE LAST 50 YEARS.

<u>+WORK ON FIELDS YOU CAN EXCEL AT, MUCH OF THE EASY WORK HAS BEEN DONE IN CS; I BELIEVE THE MAJOR WORK WILL COME FROM A MULTIDISCIPLINARY APPROACH.</u>

FOR EXAMPLE, THERE'S A SIGNIFICANT NEED IN VLSI IN APPLYING WHAT WE UNDERSTAND ABOUT BUILDING COMPLEX SYSTEMS (MAYBE THERE'S NOT THAT MUCH EXCEPT THAT IT TAKES A LOT OF WORK, AND COMBINATORIALS WILL GET YOU IF YOU DON'T WATCH OUT). HOWEVER, LOOK OUT, IT REQUIRES KNOWING A LITTLE ABOUT THE FABRICATION OF CIRCUITS, WHAT ONE BUILDS WITH THE CIRCUITS, AND HOW CIRCUITS WORK. THE ENTRY COST IS HIGH!

<u>+WORK ON SOME PROBLEMS FOR WHICH THERE MAY BE SOLUTIONS AND WHERE PROGRESS CAN BE MEASURED.</u>

A VARIETY OF MEASUREMENTS SHOWING PROGRESS CAN INSPIRE CONFIDENCE THAT LEADS TO FUNDING AND UTILIZATION. IF MEASUREMENTS SHOW THAT AN UNEXPECTED RESULT LOOKS FRUITFUL, FOLLOW IT.

ALTHOUGH WORKING ON THE GENERAL PATTERN RECOGNITION PROBLEM IS FUN FOR COMPUTER SCIENTISTS WHEN THEY ARE LEFT ON THEIR OWN, IT DOES NOT REFLECT A NEED OR AN AREA IN WHICH A VARIETY OF USEFUL MEASURES CAN BE APPLIED. IN CONTRAST, WE DESPERATELY NEED PEOPLE TO WORK ON BANDWIDTH COMPRESSION THAT WILL BE SUITABLE FOR PROVIDING SERVICES LIKE THE PICTUREPHONE MEETINGS. THIS WOULD HELP THE ENERGY PROBLEM ENOROMOUSLY, BUT THERE ARE OTHER PROBLEMS IN THE COMMUNICATIONS DOMAIN TOO.

<u>+COMPUTER SCIENTISTS SHOULD ADDRESS OUR CRITICAL PROBLEMS:</u>

<u>ENERGY CONSERVATION BY SUBSTITUTING INFORMATION FLOW FOR MATERIAL FLOW IS; MANAGEMENT OF INFORMATION AND BUREAUCRACIES, BUT THE MOST IMPORTANT IS THE APPLICATION OF RESOURCE ALLOCATION TO THE BIG ISSUES , REPLACING THE ANTIQUATED CONCEPT OF THE INTERNATIONAL MONETARY SYSTEM WITH INTEGRATED ACCOUNTING OF THE FLOW OF ENERGY, IDEAS, AND HUMAN RESOURCES, IN ORDER TO GET US OUT OF THE UNSTABLE SYSTEM DEPENDENT ON THE DISTRIBUTION OF ARAB OIL AND JAPANESE GOODS, AND INTO A STABLE SYSTEM WHERE BOTH REGIONS AND THE WORLD HAVE SELF-SUFFICIENCY AND LONG TERM VIABILITY.</u>

June 2, 1982

Mr. Bruce Laskin
NYIT
Gerry House, Northern Boulevard
Old Westbury, New York 11568

Dear Bruce:

Thanks for the presentation of your graphics work that was presented to our engineering group on Friday. It was certainly impressive and we will certainly make good use of the videotapes.

I am trying to get a Professional Personal Computer for you so that your system might be transported for viewing at SIGGRAPH.

Because we had such a brief period of interaction, I do hope you can come and visit us at SIGGRAPH time. I'd like to invite one of you to present a lecture to our engineering community on your work there. We'll present our on plans for graphics, together with some demos to your group. I hope this will stimulate us.

I'd like to have the lecture at the museum in Marlboro, and have a reception afterwards, followed by a dinner there. The lectures typically start at 4 or 5. We might spread the events over two days to simplify scheduling if you prefer. In this regard, I have asked Geogre Champine to co-ordinate your visit.

I do hope this can be arranged because I believe we can work more effectively together.

Again, please extend my thanks to your group for the presentation of their fine work.

Sincerely,

Gordon Bell
Vice President of Engineering

GB3.S5.10

CC:
Bill Avery
Gail Barrett
George Champine
Andy Knowles
Dr. Alexander Schure, NYIT

EMS 23-APR-79
22:45:28 240 1
To: Dottie Hederstedt
CC: Mary Jane Forbes
From: Gordon Bell
Date: MON 23-APR-79 22:45:28 EDT
Subject: HELP HELP

M J verify that Shel gets this first thing in the morning...we need the DEC
muscle.

Situation: it is DEC nite and NE Conservatory Preprary nite at the posps on
june 15. We (DEC) apparently have a soloist (piano) and they have
traditionally had a soloist. This is the first time that we

both have
soloists (piano)..but with different pieces..shauman and we have a mendelsohn.
The posps is saying no to 2 piano pieces. I say yes to 2, and we gave a
computer to the BSO for their 200th anniversary.

Vern Alden is on the board there of the BSo, and must surely understand.

The NEC student is 15, a poor, bright, relatively new emigrant from Korea who
is really impressive and a person from Chelmsford who has already invited the
whole town to see her perform and has sold many tickets, etc. We have sold
more, given that we're a bigger organization. Can you intervene and help here.
I say press the posps to have them both perform. The final tryouts is
Thursday, but this is usually a token thing.

The person handling the affair there is Ronnie Lorenzo, and the person at NEC
is Nancy Carter, a fifriend, whose no is 262-1120. Could you call her and
plot to overthrow the BSO?

Command:

EMS 23-APR-79
22:56:19 040 1
To: Dottie Hederstedt
CC: Mary Jane Forbes
From: Gordon Bell
Date: MON 23-APR-79 22:56:19 EDT
Subject: more on help, help

The manager's name at the BSo is Tom Morris and he is the person we dealt with
when we gave them the computer. So, if worse, comes to worse, we should call

him with the dilema.

Command:

EMS   23-JUN-79 10:43:59
520 1
To: Grant Saviers, Michael S. Gutman
CC: Dick Clayton
From: Gordon Bell
Date: SAT 23-JUN-79 10:43:59 EDT
Subject: BTL visit

BTL bought a Xylogics interface to a CDC disk and an 11/23 (Q bus). It is a
dual and simulates a pair of RK05F's and RK05's apparently. Could we look at
this design and see what they know that we don't. Should the small system's
group do this?

Command: REA 32

EMS   23-JUN-79 10:48:14
110 1
To: OOD
From: Gordon Bell
Date: SAT 23-JUN-79 10:48:14 EDT
Subject: Visit to BTL and their wirewrap

One of the hardware groups had just bought a semiautomatic wirewrap machine
like the kind we use in mfg. It was to be used in their breadboarding and
other groups were getting similar devices. It costs about 2 K. Why doesn't
every site have their own? With decentralization, we have the chance to get
the performance of our service groups really up and highly motivated by having
the users and providers in the same group and under

the same management witthout going clear to me. Let's do it. (Another topic
for the OOD Jungle?)

Command: REA 33

EMS 23-JUN-79 11:04:08
210 1
To: Dave Rodgers, Wayne Rosing, William Strecker, Bill Demmer
CC: George Plowman, Alan Kotok, Anthony Lauck, Jim Bell
From: Gordon Bell
Date: SAT 23-JUN-79 11:04:08 EDT
Subject: BTL I/C Scheme for computers

Could you arrane to visit A G Fraser next week to look at their breadboard in this area? Our salesperson, Bob Rao, DTN 335-2211 or 201 469 9211 can set it up. This is their second one and it has a structure that solves many of the problems that is contributing to the high cost in ICCS, furthermore, it looks like it is applicable or an alternative to NI. For ICCS it is cheaper, not locked into the speed, and can grow beyond 16. Also, centers can be coupled together in such a way that we might consider it as hubs ffor radiating to local machines...avoiding the need for an NI. Certainly it could be a way to get NI quickly without having to wait for NI and the IC work that it is predicated on.

Fraser has done a superb job and we should build on it. I'd like to meet with you all about Friday after you've visited there and come back and thought about it.

Jim...who is supposed to be working with BTL on what they are doing? Why hadn't we heard about this work?

They are also working on a concentrator for it too. While you are there it might be good to also see a few of their other projects such as the TV phone.

I don't think more than 4 people should go. If it weren't for the need to
meet them and see the lab, I would recommen d that this be done by the
picturephone conference service of ATT.

Command:

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+---------------------------+                                GB0002/26
|   |   |   |   |   |   |   |
| d | i | g | i | t | a | l |   i n t e r o f f i c e   m e m o r a n d u m
|   |   |   |   |   |   |   |
+---------------------------+
```

Subject: **BTL-Conversation with Max Mathews**

To: Roger Cady, MK1-2/E25
Dick Clayton, ML12-2/E71
Patrick Courtin, MK1-1/D29
Andy Knowles, ML10-2/A52
Jack MacKeen, MR2-2/M65
Roy Moffa, ML1-2/H26
Joel Schwartz, MR2-4/M51
Mike Titelbaum, ML1-2/E65
Joe Zeh, WZ2

Date: April 17, 1979
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

CC: Jack Gilmore, MK1-1/J14
Mike Gutman, ML3-6/E94
John Kevill, ML3-6/E94
Stan Olsen, MK1-2/C36
Stan Pearson, ML12-2/E71
Grant Saviers, CZ

Just got a phone call from my friend, Max Mathews, head of speech and acoustics research at BTL. He is delighted with the 11/23 with RL01. It really does the job where they had tried, unsuccessfully, to use an 03 with floppy. A major piece is the RL01, in terms of size and response time. Shouldn't we capitalize on this aspect and maybe campaign against the micros and base it on the hard disk/response time?

It seems like everyone has floppies, but from a human engineeering and use standpoint, the cost of ownership is less when you have to figure the cost of people sitting around waiting for the terminal to search for the data or do a job. Maybe an ad showing that we have both, but pointing out the cost to do things like copy, or edit, or research, or do a database type thing really gets the message across. Let's use the fact that we have something unique!

GB:swh

D I G I T A L INTEROFFICE MEMORANDUM

DIST:	Roger Cady	MK1-2/E25	Dick Clayton	ML12-2/E71
	Patrick Courtin	MK1-1/D29	Jack Gilmore	MK1-1/J14
	Mike Gutman	ML3-6/E94	John Kevill	ML3-6/E94
	Andy Knowles	ML10-2/A52	Jack MacKeen	MR2-2/M65
	Roy Moffa	ML1-2/H26	Stan Olsen	MK1-2/C36
	Stan Pearson	ML12-2/E71	Grant Saviers	CZ
	Joel Schwartz	MR2-4/M51	Mike Titelbaum	ML1-2/E65
	Joe Zeh	WZ-2		

June 27, 1979

Dr. Ravi Sethi
Bell Telephone Laboratory
600 Mountain Avenue
Murray Hill, New Jersey 07974

Dear Dr. Sethi:

It was indeed an honor and a pleasure to visit the laboratory at Murray Hill last Friday and present my view of the evolution of Distributed Processing.

Even more enjoyable was the interaction with individuals and seeing Ken Thompson's Chess Machine, A.G. Fraser's Datakit and Dave Weller's CRT-based telephone. I also enjoyed the exchange of views with Drs. Aho, Bourne, Chesson, Ritchie, McIlroy, and Hank MacDonald and am sorry we didn't have more time. Somehow I'd like to work out some arrangement whereby individuals from the Laboratories could visit us and have similar interaction - provided they were interested.

Again, thank you and your colleagues for a most enjoyable day.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:swh
GB0003/64

CC: A.V. Aho
S.R. Bourne
G.L. Chesson
A.G. Fraser
H.S. MacDonald
D.M. McIlroy
K. Thompson
D. Weller

John Jones, DEC
R. Rao, DEC

LARRY DRAFTED THE FOLLOWING FOR YOUR APPROVAL

TO: Mike Tomasic
CC: OOD

SUBJECT: STRATEGY TO RAISE THE C.E. BUDGET A % OF NOR

As we discussed at EBOD, I would like Mike to apply his analytical talents to fleshing out the rationale for raising the C.E. budget by approximately 1%, based upon what I believe are the increased costs of necessary backward integration. I would like to look in detail at the apparent shift in cost from manufacturing (component cost) where the engineering investment is made by our supplier to engineering - namely, is the increased engineering expense offset by lower manufacturing costs? A good model might be as if DEC had a captive semiconductor division doing the engineering and manufacturing and transferring the chips to C.E. at market price.

Now is the time to tackle this problem. Mike, would you please advise me on how quickly you can proceed here? Let's discuss other alternatives also.

GB1.S2.13

EMS   25-APR-79
19:39:17 540 1
To: Mitchell Kur, Bill Thompson, Bob Puffer
CC: Larry Portner
From: Gordon Bell
Date: WED 25-APR-79 19:39:17 EDT
Subject: Budget adjustments

I would like us to get a list of adjustments that have been made to the
engineering budgets each year for the last two years at least. If these look
worth going back further, then let's do it. My feeling, is we get "nickled
and dimed" back in terms of % and don't use this to reset each year. Now, is
the time to make this clear and stop it! (And go back after the money) I
believe we need the full $5M, not just the $3.1M, and I want to get it all
back fair and square.

Command:

EMS 25-APR-79
22:32:30 130 1
To: Gordon Bell
From: Bill Thompson
Date: WED 25-APR-79 22:32:30 EDT
Re: Budget adjustments
From: Gordon Bell Date: WED 25-APR-79
19:39:17 EST
Message ID: EMS 25-APR-79 19:39:17 540 1
----
agree you should ask mitch to gather the facts. for the record we have
adjusted the planning at 2.3 to the number bob said was fair, but i reserve
the right to come after the rest in the may woods if necessary. i would not
want to be accused of jerking you around if this happens.

Command:

THOUGHTS ON ENGINEERING RESOURCE ALLOCATION FY84
(Objectivity by remoteness)
Gordon Bell
4/20/83

LOW END

VT'S

-I don't think there's a clear direction or any exciting products!

-While we have an aftermarket and a connection to our timesharing market, the vast market ALL want their own PCs for responsiveness, a larger screen, graphics, private ownership. Can VT's on shared systems survive ? (I think we can make them appear to be more responsive, given there's so much processing and memory in them.)

-The new chips don't appear to be useful for implementing the WS graphics; on the other hand, it's unclear whether WS Grahipics architecture is competitive.

LA, LP, PRINTERS

-(Strategy ~= development work ~= budget) = Disaster
(The writeup using coding and many inconsitent budgets was

virtually
unintelligible by an average person (me)).
-Still don't believe in our building a laser printer, buy it, and build a print server on Seahorse/Seaboard!
-The schedule and cost are terrible for the print server, given there's only one board to do and some applications software to write.
-The LA12 represents an interesting form factor (physical design) for building attractive, useful systems such as editing and forms (ie. the LA13). The LA13's schedule is ridiculous. It should take <6 months!
-Are we making our last acupuncture printer? and switching to thermal transfer? (What are we getting? What are we giving up? Make this decision much more visible and explicit!)

DECMATE
-I can't understand what it's trying to be, except a machine for doing everything. As 8 architect, engineer, resource allocation recommendor, and DEC stockholder it pains me to have seen us lose so much on the 8. Now, when we are about to make some money with it, we are about to piss it away. As such I don't see it as viable to be ALL of these:

- Super WPS (including full page) for all users including technical marketplace together with coupled.
- Configured with Wini so that users have to do backup, etc.
- IBM PC killer with WPS using Z80 and 8086.
- SBS based on the 8 (because we don't have the 3rd party software writers, nor are we spending money to enhance DIBS.)
- Multi-user machine (this one blew my mind).

-Why evolve it to be a Rainbow?
-Why not just concentrate on following the lowest cost line?
-Is the 19" that easy and that cheap?
-If we go all out like crazy to make the cheapest machine, giving us a true VT100/125 replacement, with these options, we could win big:

- Built-in modem
- Small screen and portable carrying case
- Z80 and appropriate software to do specific jobs (eg. Visi...)
- 19", if it doesn't drive the cost out of the ballpark

. VT125 emulator board, and ability to edit figures
. Improved WPS software, including interface to VAX, 11 (Business) and 10/20 for better total filing/file server system

RAINBOW

-What's the minimum set of constraints the group can be given so that they can concentrate on the competition versus internal conflict?
-Can the constraints include some minimal communication and file transfer to VAX?
-What additional resources are desireable?
-Charter should only be track and beat IBM (for awhile)!
-Resolve whether we are trying to be an alternative PC PC (Plug Compatible PC) so as to take advantage of IBM fallout or whether we are trying to be unique!!
-Who's going to supply the IBM compatible card for the Qbus in order to capture and migrate users to us that Ken talks about?
-Stay away from MicroVAX unless it is totally externally constrained versus having to meet DEC architectural constraints (and meetings).

PROFESSIONAL

-Fix the response time now, otherwise we won't get the sales!
-Decide on market: connected to VAX, UNIX, RT, Industry standard via standard language interfaces (eg. RM Cobol), softcard
-Decide on applications (if any) vs generic tools: WPS, Spreadsheet, database, plotting, etc. Is this for any of the business area? Just scientific? Should concentrate in applications that can be moved to MicroVAX... we seem to be in do everything mode.
-Minimize systems investment in 11's (POS for better graphics and response time, J-board, etc.)
-Just do DECnet and stay out of clusters world. CT attaches to VAX and its file system/file server.
-Microswitch seems idiotic and gets us another protocol and set of operating systems beyond DECnet, Omninet, Ethernet, and CX/DX. Why?
-Send people to Quality Design Methodolgy school. The ECO costs and time to market indicate poor hardware design

including the disk area.
-I doubt if a good PC can be made using the current, dispersed software organization: firmware, base system, mods, and applications.
-Overall: Cut the number of things down to meet the group. We must not expand the group forever to meet every opportunity, given the cost and performance of the current product.

MICROVAX PC
-VC (Microvax, 1/2-2 Mbyte, NI, bounded) is the ultimate product centered around a disk server. Requires an unbounded product too for stand-alone and interfacing to real time and other equipment.
-I believe a Qbus-based PC based on Seahorse I, and shippable in Jan. 84 is the most critical product for the PC/WS area. (See Workstations and Seahorse I) because:

- It forces the definition of an architecture for graphics and whether the Workstation Graphics Architecture is it.
- Lets us do the VC a year earlier and incrementally. Also trains VC crew.
- Provides a base for MicroVMS/PC, and applications ONE YEAR earlier. Low Cost Nebula/ Workstation could provide a similar base if you ignore the cost, heat, noise, size (it ain't a PC), and performance (Workstations aren't worried about this.).
- Said another way: LCN/WS sure doesn't look like the answer (see Workstations), nor does it look like one!
- Our users want unbounded VC's as well as bounded versions!

SEAHORSE I ++ or whatever they want
-We are getting more bang/$ from this group than any other, but we aren't building on their hardware or software yet!
-Build Cluster servers on this base for printing, files/Database, gateway
-Use as the base for a MicroVAX PC for shortest time to market!

SEAHORSE II (Lipcon's MicroVAX)
-Precisely what is it besides a board?

16-BIT - (Switch resources to MicroVAX)
-Can we minimize investment more in the Unibus J area (Unibaord)? Still think we should have just done a 24 board replacement that would have also been useful for existing customer upgrades in 11/04, 5, 20, 34, ... 44.
-Don't understand the formation of another group to do Qbus systems under Don Gaubatz, except to create overhead.
-How can we get work done and not spend it all sitting in wait for the J?

SAC

WORKSTATIONS
-An expensive, dumb terminals group with coupled software support... not a PC, nor a competitive WS due to performance, size, cost, power.
-LCN/WS looks ok, but still a factor of 2-4 off in performance, cost, size and power! This is why we have to do a WS based on Seahorse I!
-We must understand whether the performance bottleneck can be fixed, otherwise we should stop building on this architecture! (I say it has a 50-50 chance of being too roccoco.)

MID RANGE
-Scorpio has several critical issues associated with it: board size, connector and cable egress... as well as recovering from TAT020 fiasco.
-LCN addresses the VAX in the office by noise reduction, I hope.

GLORIOSO
-Let's get on with the VENUS follow-ons. We need them yesterday too.
-What can be done to get VENUS more quickly? Work harder? Smarter? In parallel?

36-BIT
-Ken's comment to me this morning, slightly parapharased: "There's got to be a better way, given the PC and WPS revolution, and the fact that we are investing in high end disk, file and database servers, and high performance VAXen."

Find it.
-It seems to late. It will be non-trivial to build a 4X KL with technology that doesn't appear to be 4X. Maybe a Minnow or a 2020 in an LCN box is a better solution now!
-The notion of ever stopping the line isn't there and hence I think we must stop it, otherwise we are committing for Jupiter's follow on too.
-The only attraction is the learning we'll get from doing the design following their new design methodology. But why not apply this technology to VAX?
-We really could use the resources to make some really hot machines: eg. PPA, VENUS etc, HyperVAX, TITAN into production!

DISTRIBUTED SYSTEMS
-Co-ordinate the myriad of servers.
-Answer Ken's concerns about getting large number of terminals into central, shared systems. Show the alternatives, and answer whether we ought to offer a (buy out) switch.

SYSTEM SOFTWARE
-When are you ready to try to reproduce DECwest elsewhere?

MASS STORAGE
-Am very concerned about design methodology for hardware (gate arrays, VLSI, 1 board complex microprocessor-based, and large systems).
-Send engineers to Quality Design Methodology school.

TAPES
-Maya should be it for build. Let's buy everything else.
-Don't see that we can do both IVIS and DAD. Pick one and do it.

LOW END
-After the AZTEC slips and long time to market for RX, it's clear we don't have enough uniqueness or capability or responsiveness to be making proprietary proudcts in what is fundamentally a commodity marketplace.

COLORADO

-Too many new, aggressive products. Can we do even a fraction of them?
-Am concerned about systems ability in the large systems area (ie. HSC). This requires a lot more software discipline than we may have.

BOSE

COMMERCIAL
-Don't we have a unique opportunity with VMS 3B (Hydra) and TP (ie. TDMS/ACMS? Should we invest anymore here until there's a marketing group? I see only an Office Marketing Group and a Small Business Marketing Group? (And a nil to marginal set of products for those area, yet I see strong basic commercial tools, and no marketing or Base Product Marketing.)
- Are we giving up what little momentum we had in Commercial processing?
-Can we continue putting money in the typesetting rathole? Now that I'm supposed to be more directly involved in this allocation on a line management basis, I must declare a clear failure! I have never been enthusiastic about this product, nor do I see it ever completing in my lifetime... Given what I know of it, I believe we should stop this project, not just rename it!

OFFICE
-The group has not shipped a single product outside of DECmate WPS, until the basic problem of ANY productivity is solved, it's crazy to consider any growth. The typesetting part of the budget is clearly and office product too, further exacerbating the spending.
-DECmate WPS Software evolves like molasses as it costs hundreds of dollars per instruction to make the most minor enhancement or hardware support. We must get to a 4th generation architecture, and modern language, eg. Rainbow and Pascal, if we are to provide a competitive product in terms of features.

SMALL BUSINESS SYSTEMS
-The plan to make the revenue on extending DECmate in every direction is as insane as the DECmate plan.
-What's our plan? Buyout from COEMs and PC software industry

OR Develop in house on TAP and DIBS base?
-Why use DIBS versus industry standard, unless we are prepared to support DIBS, given the revenue and architecture? Can we make it a standard? (And if you believe this, then I have some more tall tails.)

SEMIS

-Gate arrays look important. Where were you on the TAT020?
-Will J make it?
-Why are we making mundane, purchasable, commodity items like Octart?
-What is the role for Semis vis a vis unique applications and how are they discovered?

PRODUCT LINE MARKETING/ENGINEERING

OFFICE
-A $14M budget is clearly a typo... even $1.4M is quite high!
-Clearly wins the Proxmire Golden Fleece Award if we let it go anywhwere, or support such incompetence. This is what we spend in a large engineering group or project (such as the Office Engineering Group that's suppose to or actually brings in real (eg. 200M-1B /year) revenue.

MDC
-Am anxious to look at real time base (PDP-14+). How does this operate with the project in CSS?

CSS

-What's the small Graphic system?
-Why not take over the expensive VS300 and build it, given the low volume it will achieve? This looks like a better approach than Giant to get to the market quick. Do we really want or need anything bigger than the VS300?
-Why not collaborate with or combine with MDC's real time process control effort? The two plans look very similar! (I think that one competent group, located a great distance from New England could accomplish much!
-Why not go back to the geographically dispersed centers of competence to go after the vertical markets like real time, communiations, banking, etc.?

Love,
Gordon, 4/20/83 Wed

GB5.12
+---------------+
! **d i g i t a l !   i n t e r o f f i c e   m e m o r a n d u m**
+---------------+

Subject: **Budget Cuts and Physical Changes**

To: OOD, Paul Bauer,
Al Bertocchi, Shel Davis,
Ed Finn, Mitch Kur,
Pauline Nist, Bob Murphy

Date: 19 JUNE 78
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

follow up 7/3/78

Given the budget reduction (the Q1 slowdown + 2% cut), the sure method to frustrate engineers (especially me) is spending to improve surroundings that are superficial. While these may be necessary to meet our aesthetic standards please hold (indefinitely postpone) all of these activities until better financial times.

I don't have a complete list, but the things that must be postponed include:

1. A new sign at Tewksbury.

2. A fence around the air conditioners at Tewksbury.

3. Decorated halls and tunnels.

Anything to improve working conditions or get capacity (e.g., cafeteria) or keep clean the areas we have wouldn't be postponed...although these have to be done with 2% less resources!

Bob, will you please get the list of projects that are in progress and have them presented at OOD?

GB:ljp

EMS 19-JUN-79
14:34:18 090 1
To: Grant Saviers
CC: Larry Portner, Mitchell Kur
From: Gordon Bell
Date: TUE 19-JUN-79 14:34:18 ED
Subject: 80 Budget

Larry agrees to 80 budget and unallocated - till you decide. But you must
operate according to 81 and 82 guidelines!

Gordon

Command:

GB0002/46

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C O M P A N Y   C O N F I D E N T I A L

Subject: **FY80-81 Engineering Budget Redistribution and Comments**

To: EBOD
OOD
Senior Product Managers
Paul Bauer, ML3-3/B91

Date: 5/6/79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

Roger Cady, MK1-2/E25
Andy Knowles, ML10-2/A52
Mitch Kur, ML12-2/A16
Bill McBride, MR2-3/E70
Dave Quimby, ML3-3/B91
Mike Tomasic, ML12-2/E71

Given the situation of having inadequate support for the Mass Storage products in light of the systems we want to build, and the necessity to manufacture products like the RX03 because our suppliers are unwilling to commit so much to DEC, I am proceeding to redistribute the FY80 Engineering budget along the following lines. I ask that EBOD approve this so we can get our Redbook in place.

The suggested* net flows (in millions) are:

Mass storage	2.7
Mass storage (HSC delay)	-.5
PAX'd 23	-.5
CIS'd 23	+.1
11/24	-.4
LA/VT	-.5
Software	-.4
High end (2080/Venus)	-.5
High end (target)	-1.5
TOTAL (net)	0 to - 1.0 (depending on Hi end)

THE RATIONALE FOR THE SPECIFIC RECOMMENDATIONS

Mass storage gain
We have to have a low cost 6250 tape for back-up in our mid-range and small systems. There are no low end disks presently funded, and have to have either RL04 or Aztec. We have to have an interface to the IBM drive for the hi end.

*These are group guidelines. Just as it's necessary to "tune" based on projected products of engineering, it would seem worthwhile to "tune" with the various groups (eg. T/SS for chips, systems, LA and VT). This analysis should take into account ROI, survival, new market support, risk, and other factors.

It seems possible that we could get a better position if we could avoid doing the RX03 and instead concentrate on a combination of bubbles and the TU58 to get us a 1 megabyte system. Also couldn't we delay the RX03? While this bubbles/floppy crossover looks unclear now, I would believe that pushing the semiconductor companies might yield the necessary costs to make this happen.

It is necessary to identify people both in Mass Storage and in SS/T, MSD, and LCG who are going to do the planning. Now it's our big job!

<u>HSC</u>

This has been tied to Hydra FCS, and given the number of new pieces that form Hydra, it seems prudent to not have it also depend on HSC. Furthermore, the other systems that are equipped for HSC are non-existent. The main volume of HSC should go to Venus and 2080, and these are currently scheduled for later shipments. HSC has been detracting from solving our Hi-end problem on the Massbus, which is necessary for the short term survival.

Let's base HSC on the backplane interface currently being defined for Mercury and Nebula, and not start a new physical architecture for HSC along it's current lines. It should be clear that Hydra, 780, large and multiple Comet, Venus and 2080 systems within MSD and LCG are the customers here and the definition and schedule should match their requirements. This should relieve some of the apparent manufacturing cost (versus cost of ownership) pressure and put a better focus on reliability and availability that seems to be lacking. Also, I'd like Dan Siewiorek to review the design in terms of RAMP. It is distressing that this product has been described to a customer and that it's schedule is being predicated on when they want it. Now is the time to stop this behavior.

Given a delay in HSC to be in line with system needs, then it should be possible to delay the availability of the HSC IBM drive and this would hopefully result in additional savings (or budget slack).

<u>11/23 and 11/24</u>

Given the recent direction in terms of putting more devices on the 23 and that we are defining a new, modern backplane bus (UNIBUS 90 described below), it is essential that we not extend the two products in nearly the same system space... especially since neither are where we want or have to be long-term. We must conserve our resources for long term gain rather than on very short term 1 product market opportunity and incrementalism. The only conceivable market for 11/24 might be the 11/34 replacement market for customers who have a big investment in UNIBUS options. Since this is only the TOEM, then it might be prudent for them to fund this, although it feels like a fundamentally bad idea.

UNIBUS-90 IS THE PAX'D 23 AND 24

We are out of gas in both the Q and UNIBUSSES. The Q has become the Q' as it got 128Kw addressing and we must avoid forming the Q" to get it beyond 128Kw (i.e. the PAX'd 11/23) because such an extension would place us sadly behind the state-of-the-art as being defined by Intel in their Multibus. Our new backplane interconnect, need the UNIBUS-90, should be good enough for the 80's just as the UNIBUS almost made it through the 70's. The kinds of things we are asking this bus to do include: being better than Multibus; low cost, short and defined for backplanes, handling multiple processors and procesor-memory combinations connected to it, narrow to match LSI, checked for reliability, and fast enough to handle variations in successive implementations in technology.

It would be the bus for HSC, Mercury, Nebula and the follow-on DCG products where we are now limited. It is essential for the LSI-70 and for a VLSI-VAX.

We can not exist by incrementing ourself through this bus design space in the ad hoc fashion we are doing now. Happily Dick and Bill agree and will provide the leadership to make this happen.

<u>LA/VT</u>
Although there a large number of terminals requested, it seems prudent to get a better focus and organization on this combined area, particularly architecture. There are currently separate Advance Development, Support, Product Management, and Development groups; and Dick's and the groups current desire to combine these should have a very high payoff. In addition, by having a single architecture function to handle the commonality of terminal modems, interfaces to modems, line protocols, intelligence functions and behavior specifications we should have products that others can build on and that we can support in a rational way versus the current ad hoc approach. We must be careful about diluting our effort to get every possible terminal type (especially in the printing area), as this often reduces the volume (and raises the costs). By good planning we can have the necessary options and spend much less doing it.

<u>Software</u>
SCS-11 is the most common idea for budget reduction. I would hope that we don't need this system because it would, no doubt, have a high payoff by non-introduction. I want to see what it provides the user. We must look at it, however, in terms of what it offers the user and decide then if this is the area for reduction.

<u>High End</u>
Part of the reason for combining Venus with the 2080 was based on the desire for common components and processes. Although we have reduced this budget by .5 million, it seems we could reduce it even further. I would like to target a reduction of 1.5 million in these two products, subject to their definition and schedule. If we do not use the MCA gate arrays, then the project cost should be significantly less. I am predjudiced against the MCA approach because of expense, longer time to market, and difficulty of the designs for ECOs.

<u>REDBOOK FORMATS FOR 80 AND 81</u>
So far, I have only seen projects that are budgeted for FY80,

except for the Low End and Terminals. I asked to not have this done, but instead we want all projects considered in terms of their requirements in 80, 81 and beyond, so that we can tell the fraction of resources committed by starting some of these projects. This has to be done so that we can avoid the crisis that could arise when we find there isn't enough money to finish the started projects.

APPLYING SANITY CHECKS IN FUNDING NOT METRICS ON THE ALLOCATIONS
Given this redistribution of funds we should redo the evaluation of the allocations in terms of product price range and by market area. In addition, we should collect the Product Line funded parts that are outside OOD so that we can present the company a total picture in these terms. Dave Quimby did the original work and this should be redone for this new allocation even though there doesn't seem to be a size shift.

GB:swh

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Paul Bauer	ML3-3/B91	Roger Cady	MK1-2/E25
Dick Clayton	ML12-2/E71	Jim Cudmore	ML1-5/E30
Bruce Delagi	MR2-1/M64	Bill Demmer	TW/D19
Ulf Fagerquist	MR1-2/E78	Mike Gutman	ML3-6/E94
Per Hjerppe	MR1-2/E78	Bill Johnson	ML12-1/T32
John Kevill	ML3-6/E94	Andy Knowles	ML10-2/A52
Mitch Kur	ML12-2/A16	Bernie Lacroute	TW/A08
John Leng	MR1-1/A65	Julius Marcus	MK1-2/C37
Bill McBride	MR2-3/E70	John Meyer	ML12-1/A11
Jack Mileski	ML12-3/A62	Stan Pearson	ML12-2/E71
Larry Portner	ML12-3/A62	Bob Puffer	ML12-2/E38
Dave Quimby	ML3-3/B91	Jack Shields	PK3-2/A58
Mike Tomasic	ML12-2/E71		

00 CORE DECGRAM ACCEPTED S 004693 O 713 02-AUG-82 22:03:01

****
* d i g i t a l *
****

TO: EMC: DATE: MON 2 AUG 1982

9:45 PM EDT

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5171316640

SUBJECT: DEALING WITH THE BUDGET PROBLEM

I believe things are much worse in engineering than my outburst to you indicated today.

We have been doing a crappy job in making you face the hard issues of resource allocation within your groups.

For the last year, I have watched you identify needs in the product and process area, go present them and get the encouragement and approval to execute the addition. I have seen NO reductions in the product plans, nor have I seen an incredible increase in productivity that would say we could do the additions with the same resources and in the same time.

I don't think you (we) are being fair to the company because think we all love to engineer, and once a plan is approved, we proceed to execute it in any sort of fashion, even though it may mean that all other parts of our plans are destined to slip.

This latest request to operate at 320 is typical... we have signed up to execute about 360 worth of products. This means that we'll see at least a 12% slip accross the board, but since we only have about half of engineering working on new products, the demand on an engineering base of say 200 of 40% could mean a slip of say 25%, or possibly as much as 6 months if you assume all projects are 2 years.

Things aren't good. We are not being honest with ourselves or

the
company and the last people to say that we are fools are the troops who want to do more and ourselves.

It's clear to me we have to ask the really tough questions: Are you sure you have reasonable product plans that in be executed in the time and money of the plan?

WPS USERS - Leave HP mode and type <CR>

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Subject: **Budget/Redbook Guidelines and Categories**

To: ?

Date: 16 NOV 78
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

follow up <>

Let's move NOW to have better segmentation and more autonomy in managing engineering groups. Here, each group would:

0. Operate autonomously. This would not limit the buying and selling (e.g., common power supply, disk development) we currently do among groups! Here, the notion is that I do not want or have the responsibility to allocate funds within an engineering area. Thus an area would be <u>independent</u> as to:

   - budget (including all the categories in 2, below)
   - personnel
   - g + a + library
   - buildings and grounds (it would buy it unless a host manager corresponds to an area manager)
   - computers
   - diagnostics
   - drafting
   - product packaging
   - product architecture and standards, etc.
   - product specific design tools

1. Decide above the line (POTS preview)/below the line (less POTS preview).

2. Budget the following categories:

- product development
- product changes and ECO's (product contingency -- this _must_ be budgeted more aggressively)
- product support
- product management

- research
- advanced development
- architecture and standards
- development process and tools
- administration
- unallocated opportunities

3. Move to a point where the _whole_ budget (above and below the line) is scrutinized by POT. In this regard, each area should regard the POT as a review board, _not_ the executing or deciding body.

4. As phase 1, allocate and budget money for whole project.

5. Budget two years, with the _known_ commitments _beyond_ two years.

6. The eight autonomous, segmented product areas are:

memories
small, LSI MOS components and terminals
mid-range
large
(software)
base systems
networks and comm. hardware
commercial
technical

7. The five "common" areas are:

Central administration including
Control
EDP
CAD

Drafting standards
Space procurement
Personnel
Technical director including
Architecture and standards
Diagnostics techniques
Software tools
R&A/D review; process review
Central R&A/D
LSI development (including CAD)
Central product support
Power supply design
Packaging and interconnects development
Physical environment standards
Systems and performance testing

8. Engineering management (GB and RP) will recommend a "by-area" allocation. This will be reviewed and approvied by EBOD and/or Marketing Committee.

GB:ljp

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* d i g i t a l *
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TO: DICK CLAYTON
DATE: WED 30 JAN 1980 1:21 PM EST

FROM: GORDON BELL
cc: SI LYLE
MITCH KUR
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1 A51

SUBJECT: FY81, 82, 83 BUDGET

FROM: GORDON BELL & LARRY PORTNER

We believe we have adequately considered your request for redistribution of the FY82 & 83 Budget Package of January 15, 1980, and as we indicated, we feel the money should go toward chips. If you want to work with the Product Lines to add additional Terminals' funds we support those actions.

In any event, we wish to review the Terminals' strategy because
we feel uncomfortable that there are too many of the wrong products
being developed. Would you please arrange a review with us as
soon as practical?

Gordon & Larry

GB1.S2.24
00 BURT DECGRAM ACCEPTED S 1082 O 10 23-FEB-80 14:10:16

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* d i g i t a l *
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TO: see "TO" DISTRIBUTION   DATE: SAT 23 FEB 1980 2:02 PM EST

FROM: GORDON BELL
cc: see "CC" DISTRIBUTION   DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1 A51

SUBJECT: PROPOSAL TO RAISE THE ENGINEERING BUDGET

We must really get focussed in this endeavor. I'll try to write a preparatory memo to the OC, along the lines we talked about at EBOD. Here, we must have EBOD"s full support and we should shoot for a special meeting in not more than 2 weeks!

We should decide soon who's going to spearhead the effort. Mike
and his group together with Mitch's help will put together the
analysis and presentation.

Another approach I think we should examine is to demonstrate the effect of using gate arrays on Comet. We would look at the

costs and performance and development costs with and without the gate arrays to be able to show what the net results are. Here, it might not turn out like we hope for, but then I think
we have to understand this too (remember comet II, and Venus?).
Also, we can look at Fonz and the alternative we were looking at of building Jaws internally. In this way we have some real case studies versus the pure trend approah Mike has outlined below in 2.

EBOD was extremely supportive, as was Win, Bill Thompson, and Al Bertocci, when we explained our funding dilema of having to backward integrate into semis. (Also Mike has some very good insight from his days at being within TI.) Now we owe them some real meat showing that the cost of having our own architecture and semicondcutor capability is going to cost us x% more (corresponding to the parts of Intel, TI, etc.) and this will result in either lower product cost, better cost/ performance ratios, or simply allowing us to build higher performance machines.

Larry, Dick and Jim.
Let's get together by Tuesday, via at least EMS, and make someone responsible for working with the group to get this data and crucial story written.

Gordon

"TO" DISTRIBUTION:

DICK CLAYTON	MIKE TOMASIC	SI LYLE
JIM CUDMORE @CLEM		

"CC" DISTRIBUTION:

ROGER CADY	EBOD:	EBOD: @MR16
OOD:	OOD: @CLEM	

ATTACHED: MEMO;48

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* d i g i t a l *

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TO: GORDON BELL*
4:29 PM EST

DATE: FRI 22 FEB 1980

FROM: MIKE TOMASIC
DEPT: CORPORATE

MARKETING

EXT: 223-6536
LOC/MAIL STOP: ML12-2

E71

SUBJECT: ENGINEERING BUDGET

My group shall put together the following data to help understand if the 5.5% of NOR for the Central Engineering budget should be raised in the future.

1. Make versus buy content of cost of goods sold. If we are making (developing) more today, than in the past, there might be a correlation regarding the appropriate percentage of NOR for engineering investment as a function of the make versus buy mix.

2. Make versus buy semiconductor component. The transfer cost of in house manufactured semiconductors does not include the engineering development costs. When we buy from T.I., Intel, etc., their prices include covering their development costs. If we, in theory, raised the in house manufactured transfer costs, what amount is reasonable to consider for covering engineering chip development costs?

3. How much of our engineering budget is going into chip development? How big in dollars/percentage is this problem? How do the

resultant
products with in house developed chips compare with competition with
standard chips? Does this answer differ with system size?

4. Competitive R&D Investment Analysis. Essentially done by Bob
Flynn/Jeff Scott for the recent December 4 EBOD meeting.

Is this generally what you are looking for? We should have it in two
to three weeks.

GB1.S2.30
00 BURT DECGRAM ACCEPTED S 21055 O 35 14-SEP-80 12:25:50

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* d i g i t a l *
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TO: JULIUS MARCUS DATE: SUN 14 SEP 1980 12:18 PM EDT

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION DEPT: OOD

EXT: 223-2236

LOC/MAIL STOP: ML12-1/A51

SUBJECT: PARAMETERIZED SOFTWARE AND THE ENGINEERING BUDGET

BUDGET IMPLICATIONS

I want clarification with what you thought the Marketing Committee agreed to. I thought the vote was to allow you to spend money to start this project together with Stan's product lines, taking the money out of profit in both of your areas. To this I vote Yes!

If it should be a below the line investment that is corporate

wide and coming out of the technical marketplace, which I share
an extremely strong identity with, I vote No. If this is is the
case, we must have EBOD decide, cause they are responsible for
the corporate engineering budget.

After the fact, what you appear to hear from the Marketing Committee was go ahead, take it out of profits, and somehow factor it into the engineering budget next year. Given that the
engineering budget is very thin, and getting thinner by the day, then this is patently irresponsible.

I have been here before (remember the 11/74 Multi-processor, or
the PDT 150 ... and the grandest of all, WPS ?) Somehow the game
is to somehow start a product, and it is left to me to figure out
how to finish it... all, mind you, within the existing fixed engineering budget! How some of you folks that are supposed to
be business leaders (here, I am just a simle engineer) can believe that we can simultaneously forward integrate, backward
integrate (to get more margins to cover the mistakes in forward
integration and the absurdly high inventories implied by having
to have old and new in every range forever), meet the increasing
government regulations on all (including old) products, get a wider price range of products, while still designing products on
all old architectures, is more than I can understand. How can I
explain it so that I don't think you are a bunch of dumb, irresponsible, jerks that are totally devoid of any leadership or
understanding? Or, conversely, how can you help me

understand
how to get enormous gains in productivity by getting rid of negotiators who appear to introduce hassle, or by reorganizing to
be near the marketplace like we did in word processing, or by going over the bottom n projects so as to add these new goodies?
I ain't getting any help or understanding of our pligth! (And
another project with its on going budget, Engineering doesn't need!)

WE ARE NOT GOING TO START IT IF IT HAS ANY, ONGOING BUDGET IMPLICATIONS ON THE ENGINEERING BUDGET!

THE PROJECT
I have had too many meetings where the PM and Development person
has tried to convince me that this is the approach to product design. I bought it, made suggestions that they didn't follow
because it violates my model of software evolution, and waited
for substance. I continued to get a series of presentations over
a period of what seems like at least a year, which had no technical bone structure, but only added budgetting/staffing fat.
In this regard, the plan is totally unacceptable as it contains
no base architecture, or the key people who are going to do it.
If the person proposing it ever did one, he is probably all used
up in the process here of politicing. By spending 700K, the remaing part of this year, the only thing we will do is spend 700k!

Having watched about 6 projects like this recently, I say let's
go ahead with a small, competent team of about 3-5, one of whom

is a leader. This team will design and then implement. Let's
first review their design assumptions (which I call goals and constraints) so we know which way they are heading, and then let's review the general design when they have it. NO WAY CAN WE
SPEND 700K to do this! (They might even have a breadboard by now. My suspicion is that in this year we've spent selling, a
really good technical person could have designed and breadboarded
the whole thing!)

So the model I have of successful products has been violated, although I'm prepared to learn about hiring hoards of COBOL applications programmers that design and code like crazy and the
whole thing is a beautiful product when you finish.

Therefore, I'll listen patiently to the product design concept,
or to the plan of how we are going to get it, as long as I get
some new data. AM READY TO LISTEN, LEARN AND HELP!

"CC" DISTRIBUTION:

EBOD MEMBERS:	BILL JOHNSON	SI LYLE
OPERATIONS COMMITTEE:	LARRY PORTNER	OLLIE STONE

CONTINUED RE:BUDGET
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* d i g i t a l *
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TO: JULIUS MARCUS
DATE: MON 22 SEP 1980
6:31 PM EDT

FROM: GORDON BELL
cc: BILL JOHNSON
OLLIE STONE
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: RE: YOUR MEMO ON PARAMETERIZED S/W IN ENG'G. BUDGET

Julius,
I want applications and belive in them. Something smells funny
on this one. The project staffing and direction doesn't feel right vis a vis starting small with a quality group and then building up when the architecture (design is in place). I don't see the underlying design, so I am really queasy. Also,
it feels like a design of yesteryear (Cobol, batch, etc.).

I want it to go, and I will support it, I do want to get it into a form where it has only a single port through which people can view it so I and all the other engineers, committees
and marketers can walk by and review it and question it. This
is for its protection as well as ours (you get a product, and I'm convinced it is going to make it as a product).

CONTINUED RE:BUDGET
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* d i g i t a l *
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TO: BOB DALEY DATE: TUE 23 SEP 1980
10:01 PM EDT
BILL JOHNSON FROM: GORDON BELL
JULIUS MARCUS DEPT: OOD
LARRY PORTNER EXT: 223-2236
BRUCE STEWART LOC/MAIL STOP: ML12-
1/A51

SUBJECT: JULIUS' COMMENTS ON THE OFIS PROGRAM: HELP

I think you ought to get a briefing from BJ, Bob Daley and Bruce as to why do it in the UK. My reading is simple: there is some talent and a team there to bring it in and get a product
out.

I am distressed too, but I am heartened by the fact that we are
building a group that I think can build a product now. This view
has gone from: give us money and we can do anything in two years;
to complete hopelessness based on the way we interact and define
things (including the way we did it in Hydra); to some hope by putting a small team together and giving them all we know about this area and asking for a proposal. You are now where I was a few months ago... dispair.

You can throw us back into the pits, but for now, I would like
to give tthe group a couple of months. They have produced more
in 2 weeks here then all the meetings over the last 6 months have produced between the marketing and product management folks. Honest, we do not need more input to define the product,

we need some understanding of how to build it!

PS,
My recent concern about the parameterized software package stems from the fact that it's schedule and budget driven versus
idea driven. So far, I would predict it to go the way of Hydra,
although it is about 1/10 as complex to build and having 1/10 the product requirements. My message:
get some idea about what you are going to build and how you are going to build it before embarking on major hiring and product schedule promises.

ATTACHED: MEMO;33

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TO: GORDON BELL
DATE: TUE 23 SEP 1980
1:12 PM EDT

FROM: JULIUS MARCUS
DEPT: COMMERCIAL
GRP/ADMIN
EXT: 264-5362
LOC/MAIL STOP: MK1-2/C37

SUBJECT: OFIS IN EUROPE

I don't understand the logic behind doing software development
for OFIS in Europe. It is nine hours' time difference from the
source of the interim product, WORD-11, so there is absolutely
no ability to communicate between the documenters and the producers. It is nine hours and 6,000 miles, one quarter of the way around the world.

Furthermore, OFIS will be introduced very late in Europe because of the language; and we are not building a base of knowledge on which to build the future OFIS products close to the market where it will be sold.

I am personally extraordinarily depressed because of this and other issues. I feel it is impossible to influence projects, and this one makes no management sense to me. Since no one really cares about OFIS, maybe we should cancel it.

JM:DW
Dictated but not read

GB1.S7.6
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* d i g i t a l *
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TO: see "TO" DISTRIBUTION DATE: SAT 10 APR 1982
1:24 PM EST

FROM: GORDON BELL
cc: JOSEPH REILLY DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: ENG MGMT COMM & BUDGETS

Engineering Management Committee won as the name for us. Let's keep PEG as is for the guys who do the work. In addition
it probably could be added to.
I don't think we want a name for the old engineering staff, since this is in the process of being eliminated.

Grant was uncomfortable with his budget. The budget assignment
certainly looked reasonable. It was the first cut. Joe and Rick are putting together a look as it based on where we want to go strategically. I think there's a chance we are on the road to hell strategically! We have only accepted additions and shorter schedules. Furthermore, we are promising

everything in every product area I know of, except robotics.

We have to update the simple table that shows, by group, what we're spending and what the products and potential nor are.

Currently, I can't tell if the budget is crazy because I ca't relate to what SW is, vis a vis the NOR projections for it. The goal of the segmentation is to focus on systems. BJ, you have only 32, 36 and office components. We somehow have to look at the mass storage and technology budgets in terms of the systems they support. Jack, I still don't see the evidence that you are going to bring in revenues that are in anyway proportional to the spending in terminals, workstations, 16-bits, 12-bits.

The look at this budget also includes the under the table money like the 12-bit stuff and P/L's like DECset and others where we don't spend the money. WE have to put the push forward to do the right thing, cause the drive at this point could be really wrong.

Grant, you had some ideas to save/cut. Please share them quick.

"TO" DISTRIBUTION:

SAM FULLER   BILL JOHNSON   GRANT SAVIERS
JACK SMITH

GB3.S4.36
FROM: GORDON BELL   DATE: MON 18 FEB 1980 3:29 PM EST
DEPT: OOD
EXT: 223-2236
TO: OOD:

OOD: @CLEM

SUBJECT: FY81 BUDGET (5 PAGES)

GB1.S1.72

THIS IS A DRAFT

COMPANY CONFIDENTIAL

SUBJ: WHY WE MUST SIGNIFICANTLY INCREASE THE FY81 ENGINEERING BUDGET

The FY81 budget is the thinest in years, and truly depressing for the long term. We must not be mislead with our current euphoria of orders. From my standppoint, things were never worse. We'll pay the price in the next three years if we don't get the necessary increase in funds now. My concerns:

General

*Our range of products is increasing faster than the allocation of NOR, when corrected for inflation. The high end is constant and the low end is decreasing at 20%, creating a product thirst we are trying to satisfy. The recent rash of missed schedules in one of the best indicators of our overcommitment, where we promise everything, and end up slipping everything.

*Despite the strategy change, we still require a highly overlapped product set during the transition phase. In effect, the spending for overlap was reduced somewhat and traded for the necessary interconnect. However, the overlap is still present and apparently not further reducible (see each section below).

*We are entering a competitive era where we are in the big leagues versus competing with overgrown PC board stuffing garage shops (like GA, CA, SEL, etc.) and DEC trained amateurs (DG). These competitors include: well run semicomputer companies (Intel, TI); semicomputer company OEMs like

Olivetti, Apple, and Datapoint; IBM who has incredible depth in research, marketing and manufacturing and are getting better in products; well financed newcomers like the Exxonites and Xerox, who has both a vision and the R and D to pull it off; and finally the high volume consumer oriented, well financed Japanese are beginning to send terminals, microprocessors and mainframes into the money grubbing, MBA run, marketing oriented, non-manufacturing distributors like Tandy, Itel, etc. A recent memo by me on our Manufacturing / Engineering limits in the December plan describes the details of this dilema none of which are being addressed by this budget pass!

*We have sucked both the Research and Advanced Development funds dry, as we have tried to respond to our customer demands. This is fundamentally fool-hearty, but the pressures can't be overcome. The cost will be felt in the development areas, as we enter a project in a respond mode panic, and pay the inordinate price of on the job training (eg. comm options, quality printing, small terminals, Comet, the interconnect, WPS, databases, and applications). These budgets are currently flat, or only growing at inflation!

*We have cut the administrative growth to inflation, which will cost in the necessary technical and adminstrative control and productivity. We believe we have the administrative key to about 100 million dollars worth of expenses by a drastic rearchitecture of the product nomenclature scheme coupled with a systems configuration control process such that it will be impossible to express the systems that are now ordered on an ala carte basis and that manufacturing is left holding the bag to build. WE WANT A ONE TIME INCREASE THIS YEAR TO PUT THIS PROGRAM, FUNDED ON A SEEDLING BASIS WITHIN OOD, INTO OPERATION. We know it has one of the highest ROI's around.

*Europeanization and FCCization. The later is set aside fortunately for the potentially big eco that we is likely to come when the

FCC cracks down on radiation.

*Geography is hitting us with start-ups in Hudson, Spitbrook and another move which can not be amortized over more than engineering. Costs are higher with small sites over working in packed facilities like TW and ML. The mill appears to be the cheapest, and best service due to size.

Semiconductors and Backward Integration

*We are only now, beginning to understand the incredible cost of backward integrating, as we look at total product costs across engineering, manufacturing and the field. Perhaps we are doing too much and we have to have a major strategy look, but I think the disruptive cost of doing this would be more expensive than the few 10's of millions involved in additonal budget. Jaws, the VLSI VAX, Comet, and Venus are all about 50 million dollars a program, as opposed to their predecessor programs of 5-20 million, where all we had to do was to stuff boards with off the shelf MSI and LSI parts. This amounts to having to spend at a higher rate in engineering, somewhere in the range of 1/4 of what they spend on a per what we buy from them basis, because we are doing semiconductor engineering. I DON'T THINK THERE IS ANY ALTERNATIVE BUT TO SPEND THE MONEY AND BUILD THE CAPABILITY IF WE WANT TO BE A VIABLE MANUFACTURER, VERSUS DISTRIBUTOR OR SEMICOMPUTER COMPANY OEM! I would like a whole percent to be added to the engineering budget for this during the next few years while we are in the transition phases to VAX and have to dual spend in the 10/20 and mid range 11 areas.

Software, Applications and Forward Integration

*Our customers are demanding this too in terms of WPS, Electronic Mail, Profession Based Systems, and overall, systems that are readier to use. Previously, we were nowhere near this.

*New languages on the horizon

include Pascal and ADA, the first new ones in years.

*The commercial marketplace is now getting revd up requiring significant investments and good products in COBOL, DBMS, Transaction Processing, coupled to Distributed Processing (our forte'), plus applications.

*The RPG is also projecting a similar scenario and is acquiring software.

Terminals

*Our ECO budgets are significantly higher than expected as we have increased revenues recently and moved to distributed manufacturing plants.

*Increased terminals product thirst will hit in next couple of years as we build the bigger business and require more breadth. Note LA30 > LA36 > LA34 + LA120 > LA12 + LA34 + LA200. The designs for quality using anything other than dot matrix and for thermal printing for portability and / or VT quick look are non- existent. We have moved the LA12 portable terminal from CE to PL funding as a means of coping, but we are still too low, given the revenue expectations and competition.

*The evolutionary terminals to sustain the base and extend the VT100 life are not funded.

*High volume graphics are needed, possibly 66 lines in the short term for the word processing market, and then you might recall the recent color graphics announcement by IBM that Peter Christy has described recently from a user viewpoint. Built-in modems are also necessary for survival.

*The next VT100 (VT200/LA200) is funded too low to get a true replacement. A 66 line monitor and higher quality printing are required, neither seem to be forthcoming.

Chips and Low End

*For the next few years we are committed to continue to bring in 8-based chips and build systems with them in an overlappped fashion due to the WPS and RPG needs. Also, only recently do we see a way to get the price of small system 11's down to that of the 8. Also, we do have a plan for moving and preserving the software, but it has been expensive in the interim.

*Similarly, we must build VLSI VAX-11 chips AND continue to preserve the 11 base by building Jaws for our systems and micros business. Consequently we must double fund these two architectures. VAX is necessary to build the competitive personal computers (with chips such as the M68000 presently on the market) and for the 32-bit machines that each of the semiconductor companies is working on.

Mid-range

*Fundamentally, things are so thin that all we are doing here is finishing Comet, Nebula and the 11/24. We lack funds in getting the technology ready for Comet II and for enhancements to the 11/780 to stretch it out in the long three year wait for Venus. We have only a single VAX replacement and are waiting for Jaws to replace all the 11's from the 24 to the 70!

*The need for both Q and Unibus in the 11/23 and 11/24 still remains.

*The 11/23 has been n+1'd with requests to support RSTS too now. Here, we can deal by a discipline.

Interconnect and Distributed Processing

*Here, we need more funding to get the semiconductors (and cost) that is necessary for the next few years. Delaying this, will cause more bandaid solutions and more expense. We can't apply enough now, because we are bandaiding (11/24 versus NI and BI based systems). These will ultimately have a positive affect on spending percentages.

*.x25 We have a problem here with getting the work done versus what people need to stay in the market.

*We need modems for our terminals and systems, and we now have the ability to get them designed and integrated.

*The comm hardare group has been traditionally underfunded for years. We are within a year of being able to get the plans and people base that would be capable of spending the money wisely to get leadership products. Given our dependence and desire to serve TELCO and to have a leadership position in distributed processing, we need to build the group and get the products.

High End

*Both the 2080 and Venus require funds. This came about as we entered the detailed design phases and learned all the costs. The strategy change last year last year is now much clearly understood in terms of schedule and cost. Both projects can be accelerated with more money. We need to spell out the alternatives that will give us a better strategic position. Given the IBM announcements in the 4341 and its souped up successors in the 4300 and H series, we are clearly poised to lose by doing too many products, too late. I want to understand this, but I think we should make a choice as to funding one of them properly, and slipping the other.

Mass Storage

*The low end needs are coming in faster than we can start the projects. There are 9 specific product requests versus the two that we are working on for 1 Mbyte floppy and a cost reduced floppy. These include smaller and cheaper hard disks, two low end tapes to follow the TU58, another cheaper floppy, and RL03. These come about as we work to design systems for the store and for the single user. It is not acceptable to buy these out since no supplier will deliver our needs!

*We are not spending enough for Advanced Development and components. The videodisk and videotape for low cost archiving are really non-projects. The videodisk looks like a real possibility that we at least need to understand. Our outlook for a viable external source of a critical component such as thin film heads is grim. We also need backward integration here for critical fundemental components.

*The tape situation is going to get even worse when IBM announces its next product (soon). Hopefully it will be contained at the high end, but it likely would make a very nice high volume low cost product too, given much tooling (which IBM is traditionally good at).

*Overall, our product costs are too high because we aren't funding them to the extent they need to do the LSI work and get the lower costs. This is another problem with the wide range. I am asking Grant to look at buying out one significant product, and taking an apparently lower ROI, in order to get better cost of what remains. I believe we need much lower costs in the small systems areas to be competitive in the store.

*We believe the RP07 and RM05 will ship and be reasonable products. There are no projects going to follow them. The high end is clearly uncovered now in the marketplace, it will get somewhat better in the near term, and then be much worse, particularly as IBM moves traditionally high end technology hard into our main product ranges. We have to get a strategy (and work started) in this space.

Frankly folks, I am scared about our future, and engineering needs your help.

We can deal with the normal requests, but the above abnormal situation
requires significant funds!

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! **d i g i t a l !   i n t e r o f f i c e   m e m o r a n d u m**
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Subject: **How do we get positioned to take advantage of Industry Standard (i.e., 8080 bus based) Chips**?

To: George Beason, Rich Olsen

Date: 2 MAY 78
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

CC: OOD, Keith Amundsen,
Sam Fuller, Bob Glorioso,
Bill Heffner Len Hughes,
Bill Keating, Andy Knowles,
Roy Moffa, Craig Mudge,
Gil Steil, Don Vonada

follow up 5/16/78

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ndard chips.

a. we rewrite software for all the various operating systems for the new options

b. we use a second computer with the standard chips, an

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(alsoasoftwarechange)

c. we use a second computer system ala RXT-11 which

simulatesthebehavi

or of the UNIBUS interface, albeit slowly, so that software will, in principle, run

d. we try, by some sort of hardware interface, to convert the new chips to look like our old option

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1. We will be uncompetitive with the MSI design and can't afford the vanity chips in time, engineering dollars and manufacturing cost.

2a. We don't have any real data here, and I believe we must get experimental data on this. Bill Keating, can you perform a real experiment with the difficulty of the conversion and test the feasibility of including the alternative handlers in our operating systems for a comm option and a floppy option? I don't believe the cost of handlers can be as high as you have estimated.

2b. Someday we may have a way to handle this when we get an approach to i/o architecture. Possibly this is a time to revamp to the low end as well as the high end. In using this approach, we are switching most of our programming over to another ISP, and will end up with only languages being run on our own ISPs.

2c. I believe the performance differential is so bad that this will not be useful except in all but a very few, bounded systems. Certainly it wouldn't let real time options such as comm or disk interfaces ala TRAX to be built and let us evolve our current options and operating systems. The marketplace demands more and it isn't a general solution.

2d. Given that a program has been written (2c) to make a standard peripheral behave as an 11 peripheral, means that the problem is theoretically tractable. Now let's make it in hardware. I personally favor this approach. I would like to understand this approach by seeing some designs of Q and/or Unibus peripherals constructed using this hypothetical, magical interface.

Some of the questions that come to mind:

1. What's the cost/feasibility of 2a?

2. What are the peripheral options we could use right now and how much would we save using them? (I.e., does this memo identify a real problem?)

3. What would an interface look like? Can we use a PROM or ROM approach to handle the variability from device to device?

4. What's the effect with the SQUID (see Keith Amundsen) proposal?

Would you (and some people who could help address this) schedule some bi-weekly meetings with me when you've gone the next step in thinking here?

GB:ljp

D I G I T A L   INTEROFFICE MEMORANDUM

DIST:

George Beason	ML5-2/E93	Rich Olsen	ML1-2/E65
Jim Bell	ML3-2/E41	Dick Clayton	ML12-2/E71
Jim Cudmore	ML1-4/E30	Bill Demmer	TW/D19
Ulf Fagerquist	MR1-2/E78	John Kevill	ML1-3/E58
Julius Marcus	MK2/C37	John Meyer	ML12-1/A11
Larry Portner	ML12-3/A62	Bob Puffer	ML12-2/E38
Keith Amundsen	ML3-3/E67	Sam Fuller	TW
Bob Glorioso	ML3-2/E41	Bill Heffner	ML5-5/E76
Len Hughes	WZ	Bill Keating	ML12-3/A62
Andy Knowles	MR2-2/A52	Roy Moffa	MR2-1/M64
Craig Mudge	TW/D19	Gil Steil	ML5-5/E76
Don Vonada	ML3-3/E67		

BUS SCHEDULE - 1

Communications Lines (K.comm-L.comm)

Asynchronous	2->3
Synchronous	+1->
APT Asynchronous	

+x.25	0->5+
DEC DATAWAY	1->?
IBM Old (2780, 3270,...)	?
+IBM SDLC	?
IBM SDLC LOOPS ON 8100	?

Comm. Master to Comm Control and Line adapter

(K.comm-K.comm+L.comm)
+Mercury Dash Bus

BUS SCHEDULE - 2

Computer to K.io (general)

IEEE 488	1
IBM MPX, SELECTOR, BLOCK MPX	4

Control to Secondary Memory

TU58	
RL01/02	
RK05/05F	
RK06/07	
Massbus	RP, RM, TU
DEC 9762 (MBA)	
CDC 9762	
+Standard Disk Interface (SDI)	R80
+Network Interface	AZTEC

BUS SCHEDULE - 3

Computer to Computer (C-C, or nC)

DMC	C-C
DR11W, DR 32	C-C
+MA750,MA780	4Pc-mMp
+DMC-Q BUS	C-nC
+DMC-U Bus	C-nC
PCL	nC
+NI	nC
+CI	nC

BUS SCHEDULE - 4

Integral System and I/O Busses to attach Pc, Mp and Kio's

6120 (CMOS-8)

8080

8086 ?

LSI-11 chip bus

Fonz chip bus

BUS SCHEDULE - 5

Backpanel oriented

8086 Multibus	?
Omnibus	8's
Unibus and 22 bits for 11/44 memory	
Qbus quad, 18 and 22 bits	03,23,23B
Qbus dual, 18 and 22 bits	03,23,23B
+BI (Hg, Who else?)	nPc or Cio, Mp, K, Kci
+HSC-50 Colorado Bus	Cio,Ksdi,Kci

BUS SCHEDULE - 6

Machine specific backplane

11/70	Pc,Mp,Kuni,4 Kmbus
Nebula	Pc,Mp,Kuni,D,K.disk
COMET CMI	Pc,Mp,2 Kuni,2 Kmbus, Kci
780 SBI	Pc,Mp,2 Kuni,4 Kmbus, Kci
+Venus	?
+2080	?

GB1.S1.19 / 1/18/80

BUS SCHEDULE - 1

Communications Lines (K.comm-L.comm)

Asynchronous	2->3
Synchronous	+1->
APT Asynchronous	
+x.25	0->5+
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+Mercury Dash Bus

BUS SCHEDULE - 2

Computer to K.io (general)

IEEE 488	1
IBM MPX, SELECTOR, BLOCK MPX	4

Control to Secondary Memory

TU58

RL01/02

RK05/05F	
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Massbus	RP, RM, TU
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+DMC-U Bus	C-nC
PCL	nC
+NI	nC
+CI	nC

BUS SCHEDULE - 4

Integral System and I/O Busses to attach Pc, Mp and Kio's

6120 (CMOS-8)	
8080	
8086	?
LSI-11 chip bus	
Fonz chip bus	

BUS SCHEDULE - 5

Backpanel oriented

8086 Multibus	?
Omnibus	8's
Unibus and 22 bits for 11/44 memory	
Qbus quad, 18 and 22 bits	03,23,23B
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+BI (Hg, Who else?)	nPc or Cio, Mp, K, Kci
+HSC-50 Colorado Bus	Cio,Ksdi,Kci

BUS SCHEDULE - 6

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11/70	Pc,Mp,Kuni,4 Kmbus
Nebula	Pc,Mp,Kuni,D,K.disk
COMET CMI	Pc,Mp,2 Kuni,2 Kmbus, Kci
780 SBI	Pc,Mp,2 Kuni,4 Kmbus, Kci

+Venus ?
+2080 ? GB1.S1.19 / 1/18/80

****
* d i g i t a l *
****

TO: BILL DEMMER DATE: SAT 7 AUG 1982
2:07 PM EDT

FROM: GORDON BELL
cc: see "CC" DISTRIBUTION DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5171824787

SUBJECT: GETTING A WINNING BUS AND SYSTEMS STRATEGY

BACKGROUND (AIN'T IT AWFUL)
We've got to have a bus/system strategy for VAX. Many years ago
a bus strategy group recommended that every CPU would have its own backplane and that we would build adapters to this backplane for particular peripherals. Only the Unibus is common to all VAXs, so there's only really one common interface. We end up with long chains like: Venus Backplane to SBI to UB to NI, for example. Comet has CMI to SBI for the CI adapter because they can't afford to make the module to interface to 1 of the other 4
boards that make up the SBI to CI adapter. Scorpio will have 2
levels of busses during the transition. We can't get the cost of
CI down because we're building more CPU's (we have to, too), and
certain customers would still like higher bandwidth to memory. Personally, I think this need will decline with much more local memory and intelligence distributed, thereby making Ethernet acceptable, or in certain cases CI should be the interconnect!

WHERE DO WE WANT TO GO?

Declare what our public bus posture (in order of preference):
.NI is the preferred interconnect
.BI is for interconnecting high speed devices and for building small systems in a "Unibus" type design. These include disks, bus adapter to CI, dual ported memory for video, special processors for voice and signal processing. Dual Ported Memory will be the way to get very high bandwidth (eg. grahpics memory) interfaced to a VAX; not via the backplane or DEC provided bus.
.CI for interconnecting VAX systems and for connecting special processors to VAX processes tightly
.Unibus will be provided, but only via BUA
.DR will go away... or do we have to have a BDRA
.Specific backplanes interfaces (eg. CMI, NMI, SBI) won't be used
to build ad hoc interfaces by us; instead, we'll pay the cost of
the extra adapter to get to BI.
.HSCI may get more adapters for it

IMPLICATIONS?
0. Really get the NI products out, like Pluto Jr. etc. Get line
printing devices for example onto NI or to serial lines.
1. Bill Strecker has recommended we use the VAX processor which has the integrated NI, as the BNA. While this is great for Scorpio, how's it for Nautilus, or do we need to put an integrated NI in Nautilus too, or on the BI?
2. Get the BI and CI done asap for Nautilus and Scorpio. BCA would be high priority.

3. Really think out what we want NMI to be... who'll interface it, or will it be just another orphan, like CMI and SBI that we
have to feed and that we really don't get the world into.

NMI and NAUTILUS CONFIGURATIONS

I really like the dual processor of Nautilus, particularly because we can have a high performance memory port for designing and connecting array processors or other exotic device (if we don't use the CI). However, this is in direct violation of using a particular machine interface to build a bigger system product. Somehow this feels wrong to me because NMI is over 200 lines, and it would seem like more lines are going to take more design time.

CDC sends 16 bit packets every 20ns in a port to port protocol they use... therefore, I think there's room for much innovation in NMI as we look at the Nautilus configurations.

If we build Nautilus MCA will it still be 2 processor? (I think we should, even if the 2 Pc version comes out later.)

What I/O busses? (Let's make it simply BI (say 2 of them) and then bet BCA).

Is NMI public? (I say no, but we or someone may want to replace the second processor by an array processor or special device on occasion.

We have to have a relook at all we're doing in the base system's area, assess the risk (erring toward the very aggressive, but with a backup that can be executed in several years), and then make it all happen.

What you folks think? Can we say where it is we want to go and what we need to do to get there?

"CC" DISTRIBUTION:

BOB STEWART (VIA MCINNIS)	SAM FULLER	STEVE JENKINS
BILL JOHNSON	DEMETRIOS LIGNOS	DON MCINNIS
BILL STRECKER		

WPS USERS - Leave HP mode and type <CR>

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TO: WIN HINDLE DATE: THU 18 SEP 1980
9:48 PM EDT

FROM: GORDON BELL
cc: see "CC" DISTRIBUTION DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: ENGINEERING POSITION ON 10/20 BUSINESS

Ulf has put together the Engineering position on the 10/20 and I fully support it without any qualifications. Note:

Engineering has met its commitments to the product in every way: leadership, quality, and availablility. Now, we have proceeded to design a really great (in terms of cost/performance as measured over the life cycle) constant cost follow-on product we call the 2080. It is fully in agreement with the strategy which we and the BOD approved. Furthermore, we have a really competent team for designing machines in the range over 250K. We (EBOD and Marketing Committee) approved a constant budget spend plan which we are using for the next few years planning.

We want to keep the engineering hadware group intact to build high performance machines. Also, we need a dedicated group for the 10/20 software. The current organization, under Ulf and Bill McBride does this. In the event we want to increase the investment here, we can do it either at the direction of the Marketing Committee, a specific product line, or what might be a new 10/20 Product line. THE ENGINEERING GROUP WOULD NOT BE PART OF ANY PRODUCT LINE(S)!

The Product Lines have not met their commitments to sell 10/20's!

We believe the best organization is to create a product line which has expert marketing and product support people from the
selling product lines, and subcontracts to market 10/20s using
the various sales persons from the product lines and in turn will
deliver unto them, NOR and Product Contribution. In this way,
the NOR P/L budgets are left intact, and the sales careers are in
tact, and it is an all around win without conflicts at the customer site or within the sales or P/L organization.

It is especially important to manage the situations so as to not enter new markets or areas where we are going to have to invest in a subcritical fashion. (Eg. given that Europe has not
sold a large fraction on of 10/2's to date, then now is not the
time to start. We must continue to sell and support the installed European base however.)

Hope this is clear. Ulf says it too and better. Believe us!

"CC" DISTRIBUTION:

ULF FAGERQUIST ANDY KNOWLES JULIUS MARCUS
KEN OLSEN

GB1.S7.11

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TO: CORPORATE PGM: DATE: THU 20 JAN 1983
4:15 PM EST

MFG STAFF:
OPERATIONS COMMITTEE:
PEG:

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5188487216

SUBJECT: BUILD, USE, AND SELL -- BUS -- THE APPLICATIONS KEY

GB4.S1.20

Propose we rethink our direction regarding application products to follow a set of three guidelines:

1. Build, Use and Sell - BUS -

2. Buy and Resell

3. Refrain from MAKING software, such as small-business computing, where we have no design talent or way of testing and understanding the products.

BUILD, USE AND SELL - BUS - What this means

This parallels the make/buy policy: DON'T MAKE IT UNLESS WE USE IT

In essence, don't make it unless it's good enough to use internally.

We have been successful in providing tools to be used by hardware and software system's builders because our own system's builders are also the primary users of the product. All models of the product innovation process show that the innovative (not

evolutionary)
products come from the user. Thus for maximum innovation, we must
closely couple design and use - preferably in the same group. HP
traditionally adopted this philosophy which it calls designing for the
person at the next bench. Some examples at DEC include:

. Tops 10, VMS, Tenex (by a user) and Tops 20, OS-8, RT-11

. our electronic mail came from CCA, LDP group evolved it, and DIS
took it over

. MSG's medical tracking system being used in our semiconductor
group

. Manufacturing Control and engineering design

Our priorities: work from the lowest level of integration outward -
because it creates the largest base:

Base Products --
Clearly we have to remain tops as these feed all products.

AI System Base Products --
We have an edge in AI because we are active users. XCON could be the
basis of a generic configuration program which assists in the building
of systems from well-structured components (eg. cars, pre-fab houses,
tractors).

Generic Applications for People Communications -- i.e. Office --
Mostly all of us, including system developers, spend a large fraction

of our time at a terminal simply handling text. This area includes:

. word processing and list processing of text files
. electronic mail -- sending/receiving text
. typesetting -- producing high quality documents
. presentation slides and overheads including simple graphics

Other generic applications

. calculators and spread sheets
. tabular, relational databases (eg. Datatrieve) with graphing capability
. forms

Electronic, especially Digital Design

We build and use these systems. Note, Digital observes that when use and design are decoupled, we do not build effective design tools.
This should include tools for engineering management.

Discrete, especially Semiconductor, Electronic, Electro-mechanical and Mechanical Manufacturing

We are simply not building, using and then marketing what we build.
We should be incredibly strong in this area -- and we're not!

Sales and Field Support including Administrative Order Processing

We have a wonderful opportunity for raising our productivity by creating a sales support product which we can build and use! Such a product would support the salesperson with:

. electronic mail and generic text processing

. customer files, monthly quantitative reports
. fully electronic expense accounts
. automated quote and proposal generation
. order status enquiry
. configuration checking (XCON/XSEL)
. phone management for call backs including automated Rolodex

transaction processing

While this is a somewhat generic product for business applications, we need to find internal users who can verify that we have uniqueness.

BUY AND RESELL

Given the large number of experts developing software for sale in the outside world, I don't believe it's necessary for us to do any development, unless the product can be used both internally and externally.

We need to understand from ESG's success and build on this model for all other areas, especially for the small business.

REFRAIN FROM MAKING WHEN WE DON'T USE

What you think?

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TO: JIM CUDMORE DATE: FRI 29 APR 1983
1:35 PM DST
BILL JOHNSON FROM: GORDON BELL
cc: see "CC" DISTRIBUTION DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

MESSAGE ID:
5198355565

SUBJECT: BUS SCHEDULE AND ROUTES: UNIBUS, BI QBUS, CTI

GB5.24

We urgently need some general policy guidelines about what busses
we're going to use for our computers, because we're in a critical
decision period on J (Unibus), Scorpio, MICROVAX PC, and PRO (J).

Historically, we've not made much use of bus converters in our
systems, and instead have simply not offered options, or have
replicated options on both the Unibus and Qbus. If we're to reduce
the time to market in our systems world and are to support our
customers (mainly OEMs) investment in hardware, then the bus issue can
be important. We should plan to use bus converters, bearing in mind
things can get out of hand (eg. Venus bus->SBI->Unibus->NI).

We'll build various bounded, no bus systems like VT's, DECmate, and
Rainbow where there are no options or the options are afixed to the

board in various creative ways. This will continue like crazy.

DOUBLEDECKER BUS PROPOSAL

PHASE OUT AND DO NO NEW OPTIONS ON THE UNIBUS OR CT BUSSES.

Dec 1. Use Qbus for 11's, Personal 11 (any PRO follow-on) and Seahorse I and II (MicroVAX version). All kinds of systems will be built from these options including PC's, shared, rack mountable, rack and stack, etc. Build a BI/Qbus (and maybe BI/Unibus for customers) converter until we have the necessary options on BI.

Dec 2. BI will be used for systems starting with Scorpio, and we should drive like crazy to get the cost of these options to be competitive with their contemporaries (eg. Multibus II). Whether there's a MicroVAX processor on a module is a tactic.

VAX PRODUCTS
We're at a crucial period in the BI where it would be possible to change from a BI to Unibus converter to a BI to Qbus converter for the Scorpio system. This might make sense now that we're doing a QDA, and some Qbus comm options. Also, we're making several Qbus boards for PC video. Nautilus is committed to the BI.

The dilema is whether to introduce the Qbus into the VAX world.
Clearly, MicroVAX is bringing it in.

PRO QBUS and MICROVAX PC
As we are currently moving, the Qbus is the lowest cost bus
to
interface to. To me this means we made an error in CT, and
that we
should make PROs out of Qbus rather than having a new set of
options.
If we do this, then only a couple of options need to be done
to make a
Qbus PRO, and we can get back to a single investment stream
that will
feed the MICROVAX PC too.

UNIBUS 11
It sounded like we're not going to do a J based 11.
Therefore, this
need for various Unibus options will diminish.

POLICY STATEMENTS
Note, the above is just a proposal. We must decide because
right now
we do blow resources just to have group identify. The
customer's the
loser because it increases prices and we never seem to have
the right
rider on the right bus.

I'd like you folks to drive a proposal that we'd ratify at
EMC.

What you folks say?

"CC" DISTRIBUTION:

BILL DEMMER FU 5/4 BERNIE LACROUTE
DEMETRIOS LIGNOS ROY MOFFA KEN OLSEN
PRODUCT STRAT COMM:

WPS USERS - Leave HP mode and type <CR>

September 14, 1979

Bengt-Arne Vedin
Business & Social Research Institute
Skoldungagatan 2
S-11427 Stockholm
SWEDEN

Dear Bengt-Arne:

Thanks for the draft report. Since it's your report based on your interviews and observations, I don't think its' appropriate to comment on it.

It is all right to identify B as DEC, provided <u>all</u> companies are identified. Again, if all companies are identified, identify DEC as one.

Again, I enjoyed your report.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:swh
GB0004/52

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! d i g i t a l !   i n t e r o f f i c e   m e m o r a n d u m
+---------------+

Subject: **Busses: Help!**

To: Lorrin Gale

CC: OOD, Sam Fuller

Date: 10 MAY 78
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

follow up 5/24/78

I heartily support Dick getting you to write down the Bus Strategy. As per our discussion, the Red Book would have a section on these proposed or existing busses and a policy on them:

Speed	Bus	Use
9.6Kb	Communications DDCMP	C-nT's
56Kb	IPG Bus	IPG terminals C-n (T or C)
56Kb	Communications DDCMP	H.S. terminals; C-n (T or C)
?	Radial/Serial	?
1Mb	DMC11 Pt-Pt. DDCMP	C-C
1Mb	DMC11 multidrop DDCMP	C-nC
10-20Mb	"Official" CIOB	nC
16+Mb	Massbus	K-nK(Ms)
? or ? Mb	IBM Channel (MPX, Select,B.MPX)	Pio-nK
?	NDS - Host (pt.-pt.)	C-C
?	NDS - Ms.drive (pt.-pt.)	C-Ms
80?Mb	ICCB for inter-C transmission on	nC

	Reliable Computer	
?	8080 Bus	intra-C (Pc,Mp,K)
16Mb	Qbus	intra-C(Pc,Mp,K)
?	Omnibus for PDP-8	intra-C(Pc,Mp,K)
24Mb	Ubus	intra-C(Pc,Mp,K)
106Mb	SBI (STAR)	intra-C(Pc,Mp,K)

The section would include a plot of cost to interface (Howard Fineman has data on many of them) versus data-rate, with marks along the data-rate line of the devices that operate at a given speed.

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST: Sam Fuller TW/A08 Lorrin Gale ML3-5/E35

Jim Bell ML3-2/E41 Dick Clayton ML12-2/E71
Jim Cudmore ML1-4/E30 Bill Demmer TW/D19
Ulf Fagerquist MR1-2/E78 John Kevill ML1-3/E58
Julius Marcus MK2/C37 John Meyer ML12-1/A11
Larry Portner ML12-3/A62 Bob Puffer ML12-2/E38

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION

DATE: TUE 6 OCT 1981 15:38 EST

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: WILL OUR BUSSES DRIVE US OUT OF BUSINESS!

Every day, I run into this traffic jam when there's some system that needs to be built. We may be happy because we have (make) work to do by making all these components, but alas, they do little good in the marketplace because the user doesn't care! Note, we have:

1. a-c UNIBUS (system unit, hex, quad)

2. a-c Q(4,18), Q(2,18), Q(4,22), Q2,222), Q(4,22,?)

3. CT

4. BI (new VAX bus)

5. II (a virtual bus for building one board systems and interconnecting micro peripherals to processors.

6. NI and CI for connecting to Jupiter, Venus, HSC and various

servers:

The bottom line(s):

0. The plethora of similar options, on different busse drive our SW costs up.

1. These options (boards) may not be very competitive because they are not adequately using VLSI microprocessor peripherals.

2. It's virtually impossible to put together many desirable systems (options exist, but on wrong bus).

3. The systems aren't very cost effective.

4. Our development costs are being drained cause we have to do a job at least 2-3 times Big-11 [U+Q(4,22,?)] or Little-11 [Q(2,22)+CT] or VAX (U+BI).

5. The organization mitigates AGAINST learning curves because,

outside of disks, each group has its own bus...the cost is
even higher since an option has to be designed 1-3 times!

Surely there's a way out of this morass, or should we just accept the inefficiency to gain the independence? Are adapters possible? Virtual adapters? II-based futures? Can research help? Does QTA do it?

"TO" DISTRIBUTION:

SAM FULLER DON GAUBATZ BOB GLORIOSO
JIM KING JESSE LIPCON WARD MACKENZIE
PEG:

GB3.S1.31

Dr. Butler Lampson
Senior Consulting Engineer
Digital Research Group
Digital Equipment Corportation
Palo Alto, California
find out the address from sam

Dear Butler:

I was delighted to learn of your election to the National Academy of Engineering. Congratulations. I believe you can be very helpful to the Academy in providing a strong view, which it needs, on the nature of engineering and computer science.

Am also delighted that you have joined Digital and hope to see a string of creative ideas come from your lab.

I especially enjoyed your insightful paper, Hints for

Computer System Design.

Please stop by on a trip to Boston.

Sincerely,

Gordon Bell
Chief Technical Officer

FROM: GORDON BELL   DATE: TUE 12 FEB 1980
3:59 PM EST
DEPT: OOD
EXT: 223-2236
TO: BERNIE LACROUTE
    MIKE GUTMAN
cc: GRANT SAVIERS
    JOHN HOLMAN
    PHIL TAYS
    DEMETRIOS LIGNOS
    BILL DEMMER
    DICK SCHNEIDER
    LOU PHILIPPON
    DON MCINNIS
    DAVE KNOLL @CLEM

SUBJECT: CABINETS + RLO2'S   (<1 PAGE)   FOLLOW UP: 2/29/80

I understand that there are too many versions of cabinets (at varying heights), to have field merge of RL02's. Therefore, we have to bring RL02's into FAT plants because they can't possibly be stocked or forecast in anything other than an ad hoc basis.

Is there anything we can do to get the number down?

Why are our cabinets of varying heights?

GB:swh
GB1.S1.61

VII. **HARDWARE IMPLEMENTATION**

While logic and memory technology are often the prime determinant of the performance and cost of a computer system, fabrication and packaging technology are equally important. This section surveys logic, fabrication, and packaging technology as it affected the various DECsystem 10 models. Table Imp. summarizes the various logic, fabrication and packaging technologies.

Logic

The PDP-6 used a set of logic modules that evolved from the earlier PDP-1, which in turn were derived from the Lincoln Laboratory circuits developed for the TX-0 (Mitchell and Olsen, 1956) and TX-2 (Olsen, 1957) computers as part of the air defense program. These circuits were the forerunner of modern TTL, but included the series transistor circuits to give great flexibility in designs. The PDP-1 circuits operated at 5 mhz clock, and new transistors enabled the PDP-6 circuits to operate at 10 mhz. The computer's clock was derived from a delay line which carried pulses generated by a pulse amplifier using pulse transformers, (this too came from Lincoln Laboratory via the early work at MIT on radar and pulse transformers). The pulses were used for register transfer operations (i.e. moving data among the registers) and some logic gating.

Table Imp.: Implementations for DECsystem 10 Hardware

Processor	**PDP-6**	**KA10**	**KI10**	**KL10**
Design start	3/63	1/66	12/69	1/72
First ship	6/64	9/67	5/72	6/75
Logic	Germanium, Silicon transistors TTL (+series TTL) DTL	Discrete Silicon transistors TTL, DTL	TTL/H (MSI) Registers; assoc. memory	ECL 10K Fast, 1 Kbit memories
MIPS(avg.)	0.25	0.38	0.72	1.8
Packaging	1-bit of AR,	implemented	implemented	6-bits of

```
AR, ARX,
  (slice of         MB, MQ,       in R, S,      in R, S, W,  MQ, BR,
BRX, AD,
  Pc)               AD:88         W-series      M-series     ADX:70
MSI ECL
                    transistors,                flip chip    flip
chip                per module; 216
                    2-sided PC    (discrete)    (discrete    pin
connector;
                    etch; 2,      modules       + MSI)       (8" x
16" boards)
                    18-pin &      (5 1/2 x      modules
                    2-22-pin      5 1/4         5 1/2 x
                    conn. (11"    boards)       5 1/4 boards
                    x 9" boards)

Pc.size           2 bays       2 bays       2+ bays      1/2 bay
(including

internal channels)
```

```
Pc.price           $120K        $150K         $200K         $250K

Control            async. & sub-                            KL20 is
  Design             routine                  clocked sync. clocked
sync.;
                     logic
                   microprogrammed
-------------------------------------------------------------------
------------- Module            large modules small modules -   large
modules
  Size                            wire wrap                    (16
Kword core
                                                               memory
module)

Registers          16           16            4 x 16        8 x 16
-------------------------------------------------------------------
------------- I/O calls         prog.interrupts              vectored
                   UUO traps;                   interrupts

I/O                I/O & Memory
                   integrated
transmission         Bus
controller for

MASSBUS; I/O via
                                                               PDP-11
computers

Memory             18-bit phys.  2 protection 22-bit phys.  22-bit
phys addr.
  Management         addr.         & reloca-    addr; paged  paged,
using
                     protection    tion regs.   using 32word
associative
                     & relocation               for shared
associative          memory via cache
                     regs.         program      memory
                                   segments

ISP                see Table DT  conversion to hardware d.p. string &
conversion
                     (integers,    assist d.p.  float        for
d.p. integers
                     floating)     float
```

Parallelism		simpler (faster) data path	instruction look-ahead (4-word) fetch	instruction look ahead; 2 Kword cache memory	
Fabrication	(too) large modules	Gardner-Denver automatic wire wrap for backpanel interconnection	semiautomatic wirewrap for twisted pair	large (hex) modules with many pins; lost cost minis front end	(KL20) integrating Pc and Mp together--eliminating Memory Bus=> high density core memory modules
Consequences	served as PDP-10 production prototype	buildable in production	more performance (scientific & real time); and paging for operating systems	more performance via cache; microprogramming for better COBOL ISP; i/o computers	lower cost

Instead of using a small number of lines in a fixed, synchronous clock, many delay lines were used. The route through the control path determined the state of the machine. At each decision point, the next line or chain (set of lines) was selected. Hardware subroutines were also unique with this implementation. A control sequence consisting of a set of delay lines was defined as a subroutine and a calling module marked the calling site (e.g. add, subtract, and complement are at the lowest level). The basic multiply subroutine used add or subtract, and finally floating multiply used the normalize, and multiply subroutines. In this way, the implementation was kept structured and turned out to be quite straightforward. The flowcharts for the PDP-6 were only 11 pages, where each page has about 25 unique statements (actions), yielding a total of only 250 microsteps (each step causes 1 to 6 operations and corresponds roughly to current microprogram statements). The asynchronous adder was designed so that on completion of all the carries, the sequence would restart. Thus we took advantage of the observation made by von Neumann, et al in 1946 (see Ch.4, Bell and Newell, 1971), that the average number of carries is log base 2 (36) or slightly over 5, versus the worst case of 36. And since the average delay time was about 20ns per carry, this reduced the average add time to only 100n versus 720nsec., yielding a very simple and fast circuit.

The KA10 used essentially the same circuitry but with significantly better packaging so that automatic wire wrap backpanels could be used. Note that in Table Imp, the existence of certain semiconductors were the basis of new machines. The TTL/H series logic appeared about 1969 and formed the basis of a machine (the KI10) with roughly the same power dissipation and physical size as a KA10, but with a factor of 2.2 more performance. In scientific applications requiring double precision computation, this performance differential is much greater. Surprisingly, the TTL/Schottky (TTL/S) series was first available in production quantities about the time of the PDP-11/45 which was delivered at the same time as the KI10. The KI10 design was started earlier and design options chosen so as to preclude the subsequent advances in speed, power and density that the TTL/S gave.

The other important logic advances employed in the KI10 were the MSI register file and associative memory packages. The register file provided four sets of accumulators and thus decreased the context switching time. (This probably had a higher psychological than real value but was useful where special devices were operated on a high speed, real time basis.) The associative memory package permitted the construction of a 32 word associative memory to support a paged environment.

The KL10 provides almost a factor of five performance improvement over the KA10 for programs using the basic instruction set. An even larger performance improvement is realized for COBOL or extended precision scientific programs. The organization and much of the base work for the KL10 was done by Dave Poole, Phil Petit, John Holloway and Jack Wright at the Stanford Artificial Intelligence Laboratory.

The KL10 is microprogrammed using one Kbit bipolar RAM. A cache memory is also constructed from the one Kbit chips. The cache provides a substantial speed-up over larger memories and their associated cabling. The KL10 is implemented in the Emitter Coupled Logic (ECL) 10K series rather than the TTL/Schottky of the original Stanford design. It was felt that the ECL speed advantage with 3 nsec. gate delay vs 7 nsec. gate delay for Schottky was worth the extra design effort especially since the ECL could supply more power over the board and backplane.

Fabrication

The Gardner-Denver automatic wire wrap machine was significant in the fabrication of machines. Automatic wire wrap economically provided accurately wired backpanels. As a more important side effect, it made the high volume, low cost fabrication of minicomputers possible! Some backpanel wiring on the KI10 and KL10 processors using twisted pairs can not be done using the Gardner-Denver machinery. For this, DEC developed a semi-automatic wire wrap machine which locates the pins, and selects the wire length for an operator.

Computer design aids have evolved to support computer implementations on an "as needed" basis, barely keeping ahead of the implementations. These have included printed circuit board layout/routing, backplane layout/routing, circuit/logic simulation, wire length/logic delay checking, and various manufacturing aids. One notable exception to this trend has been the Stanford University Drawing System (SUDS) developed by the Stanford Artificial Intelligence Laboratory. SUDS was used for drawing the entire KL10 design. The design time and cost would have been significantly greater if SUDS had not been available.

Packaging

Semiconductor density is a major determinant of the system size, and size in turn is a major determinant of speed (e.g., shorter interconnection paths). Seymour Cray has stated in a lecture at Lawrence Livermore Laboratory (Dec., 1974) that for each generation of his large computers, the density has improved by a factor of five. But semiconductor density is not the sole determinant of speed; how circuitry is packaged and interconnected is equally important.

The packaging for the PDP-6 was identical to that of the PDP-1, 4 and 5 and used a board area of about 40 sq.in. with a 22 pin connector. A logic density improvement of two was achieved over the previous designs by using six special function modules. However this density turned out to be too high for the number of pins. A natural extension was a board twice as large with 44 pins. The most interesting module was the bit slice of the working registers: accumulators, multiplier-quotient, and memory buffer. This module required more than 44 pins, so the extra signals were bussed across the back of the module. This bussing increased module swap time and the mechanical coupling increased the probability that fixing one fault would cause another. Because of this, the designers of the KA10 and KI10 became fearful of large boards. Only with the KL10 in 1972 were large boards re-introduced into the DECsystem 10. On the other hand, large boards had been used in DEC minicomputers since 1969.

Multilayered boards were required for the KL10 ECL logic. These boards were adapted from the multilayered boards developed for the TTL/S PDP-11/45 (1972).

Price/Performance

Surprisingly, over time the various models of the DECsystem 10 have been implemented at an essentially constant cost. The option to apply technology at constant performance with reduced price was never examined as an alternative strategy. In the minicomputer part of the company, both alternatives were vigorously pursued in order to provide a growing business and stimulate design alternatives. The relatively static DECsystem 10 strategy with constant price, no doubt, stems from the highly coupled interaction of: builders (wanting to go on to provide the next highest level of performance which was the founding principle of the group); the salespeople (many of whom came from other companies and are only used to working with a particular user class); users (who want more performance so as to reduce their overall cost/performance ratio); and marketing (which integrates needs and alternatives). This is illustrated in Fig. PerfPr. Here we give the performance in terms of the number of general purpose users versus the system price.

Figure PrSys gives a single price of the system for each generation, together with the percentages going of each for the system components. The best cost/performance systems are shown (except, in the case of the minimal PDP-6). Figure PrPc gives the price of the various processors versus time for the family; note the processor price has been increasing roughly at the inflation rate, suggesting a manpower intensive (or service-type) market structure. Note that since the performance (Table Imp) has improved at roughly a factor of 10 in 10 years, the increase in performance/cost is nearly 20% per year. In contrast, a minicomputer line (constant performance) is plotted which shows the price decreasing at 21% per year, with a factor of 10 price decline in 10 years. We should ask--could a PDP-6 level processor be built in 1975 to sell for $10K? (Clearly!)

Such a system has been built as an advanced development project. This small 10 has a unified bus structure like the PDP-11 with a connection to use the Unibus family i/o devices. A system with 512 Kwords and the performance of greater than a KA10 occupies a cabinet somewhat smaller than an 11/70 minicomputer.

Figure PrMp shows how the price of memory has decreased with time. Note that even though there was growth in memory size of the monitor of 25%/year, there was a positive improvement in the memory price performance. In reality, many functions which the user was explicitly responsible for were moved to the monitor as a basic operation. A similar plot for secondary memory prices is given in Fig. PrMs.

Conclusions

We believe the existence of the DECsystem 10 has been beneficial to the many environments for which it has provided real time and interactive computation, including the computer science and computer engineering communities. In turn, we have tried to respond to the needs of these users. It's existence has also been a positive force in encouraging alternative, competitive products in what otherwise might have been a dull, batch environment. The system has also been used by and influenced minicomputer, and now microcomputer development including: hardware technology (e.g., wirewrap); support for machine development (including simulation); and exemplary design leading to timesharing systems (e.g., DEC's TSS/8, RSTS) and user environments (e.g., RT-11 and microcomputer systems).

We believe the key to the 10's longevity is its basically simple, clean structure with adequately large (one Mbyte) address space that allows users to get work done. In this way, it has evolved easily with use and with technology. An equally significant factor in its success is a single operating system environment enabling user program sharing among all machines. The machine has thus attracted users who have built significant languages and applications in a variety of environments. These user-developers are thus the dominant system architects-implementors.

In retrospect, the machine turned out to be larger and further from a minicomputer than we expected. As such it could easily have died or destroyed the tiny DEC organization that started it. It is a tribute to the machine and to all those involved with it that we consider it successful.

Hopefully this paper has provided insight into the interactions of its development.

Acknowledgements

Dan Siewiorek deserves our greatest thanks for helping with a complete editing of the text. The referees and editors have been especially helpful. Mary Jane Forbes, Louise Principe, and the DEC WPS8 are to be commended for the typing, editing and filing of the numerous drafts. The important program contributions by users are too numerous for us to give by name (e.g., APL, BASIC, BLISS, DDT, LISP, Pascal, Simula, SOS, TECO, and TENEX). Likewise, there have been so many contributions to the 10's architecture and

implementations within DEC and throughout the user community that we dare not give what would be a partial list.

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THE EVOLUTION OF THE DECsystem 10

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Keywords: computer structures, architecture, operating system, timesharing

ABSTRACT

DECsystem 10 [sic] PDP-10 evolved from the PDP-6 (circa 1963) for five implementation generations to presently include systems covering a price range of five. PDP-6 was the first commercial computer designed explicitly for timeshared use. The origin and evolution are described.

I. INTRODUCTION

The project originating the PDP-6, DECsystem 10, and DECsystem 20 series of scientific, timehsared computers began in the spring of 1963, and continued with the delivery of a PDP-6 in the summer of 1964.

Initially, the PDP-6 was designed to extend DEC's line of 18-bit computers by providing more performance at increased price. Although the PDP-6 was not constrained to be a member in a family of compatible computers, the series evolved into five basic designs (PDP-6, KA-10, KI-10, KL10, and KL20) with over 700 systems installed. The notions and need for compatibility were neither understood then nor did we have adequate technology to undertake such a task. Each successive implementation in the series has generally offered increased performance for only slightly increased cost. Currently, the KL10 and KL20 systems span a 5 to 1 price range.

TOPS-10, the major user software interface, developed from a 6 kiloword monitor for the PDP-6. A second user interface, TOPS-20, with upgraded facilities is based on multi-process operating systems advances.

The paper is divided into seven sections. Section 2 provides a brief historical setting followed by a discussion of the initial goals, constraints, and basic design decisions. The instruction set and system organization are given in sections 4 and 5 respectively. Section 6 discusses the operating system while section 7 presents the technological influences on the designs. Sections 4 to 7 begin with a presentation of the goals and constraints, proceed to the basic PDP-6 design, and conclude with the evolution (and current state). We try to answer the often asked questions "Why did you do ____?", by giving the contextual environment. Figure TL helps summarize this context in the form of a time line that depicts the various hardware/software technologies (above line) and when they were applied (below line) to the DECsystem 10.

II. HISTORICAL SETTING

The PDP-6 was designed for both a timeshared computation environment and real time laboratory use with straight-forward interfacing capability. At the initiation of the project, three timeshared computers were operational:

a PDP-1 at Bolt, Beranek and Newman (BBN) which used a high speed drum that could swap four kiloword core images in one 34-millisecond revolution;

an IBM 7090 system at MIT, called CTSS which provided each of 32 users a 32 Kword environment; and

an AN/FSQ-32V at SDC which could serve 40 simultaneous users.

The Bell Laboratory's IBM 7094 Operating System was a model operating system for batch users. Burroughs had implemented a multiprogrammed system on the B5000. Dartmouth was considering the design of a single language, timesharing system which subsequently became BASIC. The MIT Multics System, the Berkeley SDS 940, the Stanford PDP-1 based timeshared system for computer aided instruction, and the BBN (Bolt, Beranek and Newman) Tenex System all contributed concepts to the DECsystem 10 evolution in the 1960's.

In architecture, the Manchester Atlas (Ch.23, Bell and Newell, 1971) was exemplary, not because it was a large machine that we would build, but because it illustrated a number of good design principles (architecture). Atlas was multiprogrammed with a well-defined interface between the user and operating system, had a very large address space, and introduced the notion of extra codes to extend the functionality of its instruction-set. Paging was a concept we just could not afford to implement without a fast, small memory. The IBM Channel concept was in use, on their 7094, and was one we wanted to avoid since our minicomputers (e.g., PDP-1) were generally smaller than a single channel and could outperform the 7094 in terms of i/o concurrency and i/o programmability by a clean, simple interrupt mechanism.

The DEC product line in 1964 is summarized in Table 1964. Corporation wide sales totaled $11 million at that time and it was felt that computers had to be offerred in the $20,000 to $300,000 range. Architecturally, we were sensitive to the problems encountered by not having enough address bits by watching DEC and

IBM machines exceed their addressing capacities.

Table 1964. DEC's 1964 Computer Products

Name	Year Introduced	Word Size (Bits)	Price ($K)	Status
PDP-1	1960	18	120	Marketed
PDP-2	1960	24	-	Reserved for future implementation
PDP-3	1961	36	-	Paper machine
PDP-4	1962	18	60	Marketed
PDP-5	1964	12	27	Introduced
PDP-6	1964	36	300	Introduced

On the software side, most programmers at DEC had been large machine (16 to 32 Kwords) users although they had most recently programmed minicomputers where program size of 4 to 8 Kwords was the main constraint. There was not a good understanding of operating systems structure and design in either academia or industry. For example, MIT's Multics Project was being formed and IBM's 360/TSS Project didn't start until 1965. Generally there were no people who directly represented the users within the company, although all the designers were computer users. A number of users in the Cambridge (Mass.) community advised on the design (especially John McCarthy, Marvin Minsky and Peter Sampson at the MIT Artificial Intelligence Laboratory).

Although there was little consensus that Fortran would be so important, it was clear our machine would be used extensively to execute Fortran. The macro assemblers, basically unchanged even today, were used in various laboratories and our first one for PDP-1 was done by MIT in 1961. We also felt the list languages, especially LISP for symbolic processing were important. There was virtually no interest in business data processing although we had all looked at COBOL.

In technology, there was no concept of evolution, especially in view of the new integrated circuit then under development.

Germanium transistors were available, and silicon transistors were just on the market. IBM was using machine wirewrap technology, while DEC back panels were handwired and soldered. The basic DEC logic circuits were saturating transistor as distinct from the more expensive current mode used by IBM in the 7094 and Stretch computers. Production core memories of 2 microseconds were beginning to appear, and their speed was improving. Our PDP-1 used a 5 microsecond core. Hence, it was unclear what speed memory a processor should support.

The notations of compatibility and family range were not appreciated even though SDS (eventually XDS and now non-existent) had built a range of 24-bit computers. We adhered to the then imposed convention of the word length being a multiple of six bits (the number of bits in the standard character code), but designed the machine to handle arbitrary length characters.

III. OVERALL GOALS, CONSTRAINTS AND BASIC DESIGN DECISIONS

Table IGC lists the initial goals, constraints and some basic design decisions. Presentation of this list separately from the design is difficult because the goals and constraints were not formally recorded as such and have to be extracted from design descriptions and our unreliable, and self justifying memories. Table IGC will be used in discussing the design.

The initial design theme was to provide a powerful, timeshared machine oriented to scientific use, although it subsequently evolved to commercial use. John McCarthy's definition (McCarthy, 1962) of timesharing, which we subscribed to, included providing each user with a large computer. Thus our base design provided protection between the users (not himself) and a mechanism for the common resources to be allocated and controlled. The machine had to also support a variety of compiled and interpretted languages. The construction was to be modular so that it could evolve and users could build large systems including multiprocessors. It should add to the top of DEC's existing line of 12- and 18-bit computers. It should be simple, buildable, and supportable by a small organization. Thus, it should use as much DEC hardware technology as possible.

Table IGC: Initial Goals, Constraints and Basic Design Decisions

User/Language/Operating System

cheaper cost/user via timesharing without inconvenience of batch processing

timeshared use via terminals with protection between users

independent user machines to execute from any location in physical memory

unrestricted use of devices e.g. full duplex use of terminals

support for wide range of compiled and interpreted languages

no special batch mode, batch must appear like terminal via a command file

device independent i/o so that programs would run on different configurations and could be shared among the user community

direct i/o for real time users

primitive command language to avoid need for large internal state

minimum usable system < 16 Kwords

modular software to correspond to modular hardware configurations

Instruction-Set Processor (ISP)

support user languages by data-types and special operations

scientific (i.e., Fortran) = > integers, reals, boolean

list processing (i.e., LISP) = > addresses, characters

support recursive and reentrant programming => stack mechanism

support operating systems

effective as machine language = > booleans, addresses, characters, i/o

operating system is an extension of hardware via defined op. codes

word length would be 36-bits (compatible with DEC's computers)

large (1/4 million 36-bit words = 1 million 9-bit bytes) address

require minimal hardware = > simple

general-register based (design decision) with completely general use

easy to use and remember machine language

orthogonality of addressing (accessing) and operators completeness of operators

direct (not base + displacement) addressing

few exceptional instructions

2's complement arithmetic (multiple precision arithmetic)

PMS Structure

maximum modularity so that users could easily configure any system

easy to interface

asynchronous operation - system must handle evolving technology

multiprocessor for incremental and increased performance (2-4 in design)

no Pio's (IBM Channels), use simple programmed i/o with interrupts and direct memory access for high speed data transmission

Implementation

simple; reliable

asynchronous logic and busses for speed in light of uncertain logic and memory speed

all state accessible to field service personnel via lights

use DEC (10 mHz vs 5 mHz) circuit/logic technology (manpower constraint)

buildable without microprogramming (no fast, read-only, memories in 1963)

Organizational/Marketplace

add to high end of DEC's computers

use minimal resources, while supporting DEC's minicomputer efforts

IV. THE INSTRUCTION-SET PROCESSOR

The goals of an ISP are:

. to efficiently encode the various programs using both compiled and interpreted languages

. to be understandable and able to be remembered by its users;

- to be buildable in current technology at a competitive price; and

- to permit a compiler to provide efficient program production

Data Types and Operators

Earlier DEC designs and the then current 6-bit character standard forced a word length which was a multiple of 6, 12, and 18 bits. Thus a 36-bit word was selected.

The language goals and constraints forced the inclusion of integer and real (floating point) variables. We chose two's complement integer representation rather than the sign-magnitude representation used on the 7090, or the one's complement representation on PDP-1. The floating point format was chosen to be the same as the 7090, but with a format that permitted comparison to be made on the number as an integer in order to speed up comparisons and only require a single set of compare instructions. Special (common) case operators (e.g., V=0, V=V+1, V=V-1) were included to support compiled code.

Our desire to execute LISP directly resulted in good address arithmetic. As a result, both LISP and FORTRAN on DECsystem 10 are usually encoded in less space than the 360/370.

Since the computer spends a significant portion of its time executing the operating system, the efficient support of operating system data types is essential. A number of instructions should be provided for manipulating and testing the following data-types: boolean variables (bits); boolean vectors; arbitrary length field access (load/store only); addresses; programs (loops, branching and subprograms); ordinary integers; and the control of i/o. A significant number of control instructions were included to test addresses and other data-types. These tests either controlled flow by a jump or skip of the next instruction (which is usually a jump). Loop control was a most important design consideration.

Table DT gives the data-types and instructions present in the various implementations.

The KA10 and PDP-6 processor instruction sets were essentially the same, but differed in the implementation. The PDP-6 had 365 instructions. A double precision negate instruction in the KA10 improved the subroutine performance for double precision reals. The instruction, find first one in a bit vector, was also added to assist operating system resource allocation and to help in a specific application sale (that fell through). Finally, double precision real arithmetic instructions were added to the KI10 using the original PDP-6 programmed scheme. A few minor incompatibilities were introduced in the KI to improve performance.

Table DT: Data-types of DECsystem 10/20

Data type	Length (bits)	Machine	Operators and [#instructions]	Operator Location
boolean	1	all	0,1,-, test by skip [64]	AC <--f(AC)
boolean - vector	36	all	all 16 [64]	AC and/or mem <-- f(AC,mem)
characters	0-36 = v	all	load, store [5]	AC <-->(mem)
character-string	v x n	KL	compare [8]; move [4]	f(mem)=g(mem); mem <-- f(mem)
digit-string	v x n	KL	convert to double integer	f(AC) <-->f(mem)
half word, 2's comp. integers= addresses	18	all	load, store [64]; index loop control	AC <-->mem; AC <--f(AC)
full word, 2's comp. integers (and fractions)	36	all	load, store, abs., -(negate)[16] +,-,x,/,+1,-1, x2's, rotate test (by skip & jumps)	AC and/or mem<--f(AC,mem)
double word, 2's comp. integers (and fractions)	72	KL	load, store, -(negate)[4]; +,-,x,/[4]	AC <-->f(mem); AC <-- f(AC,mem)

real 9 all load, store, abs., AC and/or mem
(exponent) -(negate),+,-, <--
f(AC,mem)
(exponent)+ x,/,x2's,[35] immediate
mode was
(mantissa) test (by skip, added in KA
+27(mantissa) jump) [16]

double real 9 + 54 KI,KL load,store,abs, KA provided
negate
9 + 63 KI,KL negate,+,-,x,/[8] instruction

word stack 36 all load, store, call, Stack <-->
Memory
return[4]

word vector 36 x k all move [1] mem[a:a+k]<--
mem[b:b+k]

[unclear]
i/o program 36 all short call/return;
AC, mem
UUO

With the decision to offer Cobol in 1970, better character and decimal string processing support was required from the instruction set. The initial Cobol performance was poor for character and decimal arithmetic because each operation required software character by character conversion to an integer, the operation (in binary or double precision binary) and software reconversion to a character or a decimal number. The KL10 provided much higher performance for COBOL by having the basic instructions for comparing character and decimal strings--where a character can be a variable size. For arithmetic operations, instructions were added to convert between string and double precision binary. The actual operations are still carried out in binary. For add and subtract, the time is slightly longer than a pure string based instruction, but for multiplying and dividing, the conversion approach is faster.

Stack vs General Registers Organization

A stack machine was considered based on the B5000 and George Interpreter (which later became the English Electric KDF9). A stack with index register machine was proposed, but rejected on the basis of high cost and fear of poor performance, for executing the operating system, LISP, and FORTRAN. The compromise we made was to provide a number of instructions to operate on a stack, yet use the general registers as stack printers.

An interesting outcome of our experience was that one of us (Bell) discovered a more general structure whereby either a stack or general register machine could be implemented by extending addressing modes and using the general registers for stack pointers. This scheme was the basis of the PDP-11 ISP (Bell, et al 1970).

Currently we believe that stack and general register structures are quite similar and tend to be a tradeoff between control (either in a program or in the interpretation of the ISP) and performance. In use, compilers for general register machines often allocate registers as though they are a stack. Table SGR compares the stack and general register approaches.

Table SGR: Comparison of Stack and General Register Architectures

	Stack	**General Register**
Number of registers	approximately the same	

Register use	fixed to stack operation	can be arbitrary
Control program when	built in hardware (implicit)	simple, explicit in used as a stack
Access to local registers variables	1 or 2 elements at top of stack	full set in general
Compiler problem	easy (no choice)	an assignment (use)
Program encoding to registers index values	fewer bits	more bits give access for intermediate and
Performance registers	high if element on stack top	high if in general (performs relatively better than stack)

A general register architecture was selected with the registers in the memory address space. The general registers (multiple accumulators) should permit a wide (general) range of use. Both eight and sixteen were considered. By the time the uses were ennumerated, especially to store inner loops, we believed sixteen were needed. They could be used as: base and index, set of booleans (flags), ordinary accumulator and multiplier-quotient (from 7090), subroutine linkage, fast access for temporary and common sub-expressions, top of stack when accessed explicitly, pointer to control stacks, and fast registers to hold small programs.

Since the AC's were in the address space, ordinary memory could be used in lieu of fast registers to reduce the minimal machine price. In reality, this rarely happened; hence eight registers may have been enough. A smaller number would have provided more rapid context switching and assisted the assembly language programmer who tried to optimize (and keep track of) their use. In fact, Lunde (1977) has shown that eight working registers would be fine to support the higher level language usage. Multiple register sets were introduced in the KI10 to reduce context-switching time.

Instruction-set Encoding and Layout

The ease of implementation goal forced an instruction-set design style that later turned out to be easy to fabricate with the KL10 microprogram implementation. This also simplified the fabrication of compilers. In fact, of the 222 instructions useful for Fortran data-types, the earliest compiler used 180 of them and the current compiler uses 212. We used three principles, we now understand, for the ISP design:

a. Orthogonality - an address (with index and indirect control fields) is always computed the same, independent of the data-type it references. Indirect addressing occurs as long as the instruction addressed has an indirect bit on an indefinite basis.

b. Completeness and symmetry - where possible each arithmetic data-type should have a complete and identical set of operations.

c. Mapping among data-types--instruction should exist to convert among all data-types. Several data-types were incomplete (characters, half-words) and these should be converted to data-types with a complete operator set.

The instruction is mapped into the 36 bit word as follows:

```
  !-----------------!---------!---!-------!-----------------------
-----!
  !      Op Code    !   AC    ! I !  XR   ! Address or 18-bit
Literal !
  !-----------------!---------!---!-------!-----------------------
-----!
   0              8  9      12 13   14   17 18
35
```

AC is 1 of 16 accumulators (general registers)
XR is index register designation (1 of 15 AC's)
I is indirect bit

The entire instruction-set fits easily within a single figure (see Fig. IS). The bold face letters denote instruction mnemonics. The data-types and operations are generally deducible by the instruction names: operator names (e.g., ADD) for word (or integer); D-double integers; H-half word; BL-vector; 16-operator names (e.g. AND) for boolean vectors, Test-boolean (bits); J-jump/skip for program control; F-floating; DF-double floating. The i/o and interrupt instructions are described in the PMS section.

<u>Multiprogramming/Monitor</u> <u>Facilities</u>

The initial constraint (circa 1963) of a timeshared computer with a common operating system led to several hardware facilities:

1. two basic machine modes: user and executive (each with different privileges);

2. protection against operations to halt the computer or affect the common i/o when in user mode;

3. communication between the user and operating system for calling i/o and other shared functions; and

4. memory mapping--separation of user programs into different parts of physical memory with protection among the parts and program relocation beyond the control of uses.

An executive/user mode was necessary for protection facilities in a shared operating system while providing each user with his own environment. Although there was a temptation (due to having a single operating system) to eliminate or have the executive mode and the general registers be an option, we persevered in the design and now believe this to be an essential part of virtually every computer! (The only other necessary ingredient in every computer is adequate error detection, such as parity). Separation into at least two separate operating regions (user and executive) also permits the more difficult, time constrained i/o programs to be written once and to have a more formal interface between system utilities and user.

The UUO (Unimplemented User Operation) is an instruction like the Atlas Extracode and IBM 360 SVC to call operating system functions and common user-defined functions. It also calls functions not present in earlier machines. Thus a single operating system could be used (by selecting the appropriate options) over several models. This use appears to be more extensive than in the IBM System 360/370.

The goals of low cost hardware and minimal performance degradation constrained the protection facilities to a single pair of registers to relocate programs in increments of 1 Kwords. Two 8-bit registers (base and limit registers) with two 8-bit adders were required for this solution. Thus each user area was protected while running and a program could be moved within primary or secondary memory (and saved) because user programs were written beginning at location 0. This is identical to the CDC 6600-7600 protection/relocation scheme.

In the KA10 a second pair of registers was added so that the common read-only segment of a user's space could be shared. For example, this enabled one copy of an editor, compiler or runtime system to be shared among multiple users. Programs were divided into 128 Kword read-write segment and a 128 Kword read only segment. Since each user's shared segment had to occupy contiguous memory, holes would develop as users with different shared segment requirements were swapped. This led to "core shuffling" and in a busy system up to 2% of the time might be spent in this activity. The operating system was modified in the early 70's at the Stanford Artificial Intelligence Laboratory so that the high, read only segment could share common, global data. In this way a number of separate user programs could communicate, to effectively extend the program size beyond the 256 Kword limit. In retrospect, instructions to move data more easily between a particular user region and the operating system would have been useful; this was corrected in KI10 and is described below.

With the availability of medium scale integrated circuits, small (32 word) associative memories could be built. This enabled the introduction of a paging scheme in the KI10. Each 512 word page could be declared sharable or private with read only or read-write access. The basic two mode protection facility was expanded to four modes: Supervisor, Kernel, Public and Concealed. There were two monitor modes: Kernel mode provides protection for i/o and system functions common to all users; and Supervisor mode is specialized for a single user. The two user modes are: Concealed for proprietary programs, and Public for shared programs. For protection purposes, the modes are only changed at selected entry portals. The page table was more elaborate than the Atlas (circa 1960) whose main goal was to provide a one level store whereby large programs could run on small physical memories. In fact the first use of KI10 paging required all programs to be resident rather than having pages being demand driven. A gain over the KI10 was realized by not requiring programs to be in a single contiguous address space. The KI10 design provided more sharing, and increased efficiency over the KA10. The KL10 extended KI10 paging for use in the TOPS 20 operating system to be described later.

VI. **OPERATING SYSTEM**

PDP-6 Monitor Design Goals and Philosophy

The initial goals and constraints for the user environment are summarized in Table IGC. The most important goal was to provide a general-purpose timesharing system. The monitor was to allow the user to run in the mode most suited to his requirements, including interactive timesharing, real time, and batch. In timesharing there was no requirement for a human operator per se. Instead, the operator's console was a user terminal with special privileges. Real time programs had to be able to operate i/o directly, locked in core, and batch was to be provided as a special case of a terminal job.

Because of the modular expandability of the hardware structure, the software system had to be equally modular to facilitate varying system configurations and growth. The core resident timesharing monitor was only fixed at system generation (i.e., IBM's SYSGEN) time when software modules could be added to meet the system requirements. The core space required for monitor overhead had to be minimized. Thus job-specific functions were placed in the user area instead of in the monitor. The first 96 locations of each user job contained pertinent information concerning that job. A temporary area (stack) for monitor operations was also included. In this way, the monitor was not burdened with information for the inactive jobs. This structure permitted the entire job state to be moved easily.

Adequate protection was to be given each user from other non-malicious users. However the user was not protected against himself because various user status information in the job area could be changed to affect his own job. Since common system resources were allocated upon demand and deadlocks could occur, the term "Gentlemen's Timesharing" was coined for the first monitor.

The UUO (Unimplemented User Operation), or system call instruction, provided both monitor-user communication and upward hardware compatibility. In the latter case, the instruction would use the hardware if available, otherwise the instruction would trap to the monitor for execution. For example, double precision hardware was available on later CPU models. The number of UUOs implemented in the monitor for monitor-user communication has been significant. The initial use of UUO's included requests for: core, i/o assignment, i/o transmission, file control, date and time, etc.

<u>PDP-6 Monitor</u>

Monitor was the name given to a collection of programs that were initially core resident and provided overall coordination and control of the operating environment. A non-resident part was later added with the advent of secondary program swapping and file memories (i.e., drum and disk). The Monitor did not include utilities, languages, and their run time support.

The PDP-6 Monitor was constrained to run in 16 Kword (minimum) machine with console printer, paper tape reader (for maintenance) and two DECtape units. DECtape was a 128 word/block, block addressable media of 450 Kcharacters for which a file system was developed. The goal of minimizing memory led to very sparing use of shared tables. The key global variable data was restricted to: core allocation table, clock queue, job table, linked buffers for Teletype and other buffered i/o devices (e.g., DECtape directory), and a directory of system programs and monitor facilities.

The original PDP-6 Monitor was less than six Kwords. The monitor has increased at about 25%/year with the KA10 at 30 Kwords, KI10 at 50 Kwords, and KL10 at 90 Kwords. This increase provided increased functionality (e.g., better files, batch, automatic spooling), larger system configuration size, more i/o options, increased number of jobs, easier system generation, and increased reliability (e.g., checking, retries, file backup).

Note that with a 16 Kword memory, a nine Kword Fortran compiler with five Kword runtime package, and one Kword utility programs, two users could simultaneously reside in PDP-6 memory and use the machine for program creation and checkout. By keeping the monitor program size small, subsequent functionality increases kept the monitor module sizes in bounds such that program swapping was reduced. This provided high performance for a given configuration with little monitor overhead.

Monitor Structure

Table MonF summarizes the development of the monitor with the various systems. The facilities are arranged beginning with basics. The following sections will deal with the various facilities, in turn.

Protection Swapping - These basic environment was discussed above in the ISP section on Multiprogramming/Monitor Facilities.

Facilities Allocator - The Facilities Allocator was a module called from a console or program for an i/o device or memory space request. This module would attach (or assign) a given peripheral or contiguous physical memory area to a given job. Although this module was relatively trivial initially, it evolved to a more complex module since improper resources allocation caused deadlocks.

The KA10 generation software introduced queued operation. A line printer (output), paper tape (input/output) and a card reader (input) spooler were implemented. These spoolers ran as timeshared jobs, accepted requests from other user jobs and managed the input/output operation.

Table MonF: Monitor Functions Evolution

Facility	PDP-6 (1964)	KA10 (1967)	KI10 (1972)	KL10 (1975)
Protection machine shared	one segment per user	two segments with shared program segment (required re-entrant programs)	four modes for shared segments	virtual with segments
Program paging (job swapping be resident	core shuffling	core shuffling; with swapping (via drum disk)	paging used for core management	demand need not wholly to run)
Facilities of all allocator	devices assigned to users upon request (dead-lock's possible => gentlemen's timesharing	printer & card reader	spooling of line devices	spooling
Scheduler and system mgr.; job and pie-schedule	round robin parameters for scheduler scheduling set	scheduler to favor interactive jobs using multiple queues	swapping efficiency considerations	fairness by priority classes slice
User head movement Files	user files on DECtape, optimization; Magtape, Cards, reliability,	significant enhancement of	improved file structure file function;	disk

	and Magnetic tape	on-line, random access disk-based files	error recovery, protection and sharing; mountable structures	
Command control program	simple (to implement) requiring little state	evolution to more powerful, easier to use command language	Common Command Language (CCL)	extensions to CCL
Batch	no real batch	remote & local single-stream batch	multi-programming batch	improved multi-programming batch

Terminal handling & communica-tions	asynchronous task-to-task communications communications (for inter-active terminals) as monitor module	synchronous communications for remote job and concentrator stations; "birth" of networks with simple topologies; ARPA network	synchronous communications in complex topologies; new protocol; IBM BISYNC for 2780 emulation/ termination	DECnet*
Multi-processing	- symmetric multi-processing	dual processor support (master/slave)	high availability through bus switching hardware	

*DECnet is DEC's computer network protocols and functions.

Program Scheduler - The scheduler was invoked by line frequency (50 or 60 Hz) interrupts to examine run queues and to determine the next action. The first monitor employed a round robin scheduling algorithm. At the end of a given time quantum of 500 milliseconds, the next runnable job was run. A job was runnable if not stopped by the console or when not waiting for i/o.

Because terminal response time is the user's measure of system effectiveness, subsequent scheduler improvements have favored interactive jobs. With the KA10, separate priority queues were added so that jobs with substantial computation were placed in the lowest priority and then run the longest without interruption. This, in effect, approximated batch operation; for example, jobs from a card reader would operate as a batch stream. Later, batch operation was added for interactive users.

The introduction of disk/drum swapping caused additional complexities since runnable jobs might be located in secondary memory. The concept of "look ahead" scheduling was required and a more complex queueing mechanism was implemented. As the monitor selected the next job to be run, it would "look ahead" to determine future queues, and invoke the swapping module if required to move a runnable job into core. Because of the higher swapping overhead it was essential to run large jobs longer and less often. A "fairness" consideration also assured that each job, whatever its size, received enough run time to maintain responsiveness.

Recent enhancements permitted a Systems Manager to set scheduling parameters including established priorities of job classes, and specifying "pie-slice" where classes of users are guaranteed parts of the machine resources.

User Files and I/O Device Independence - In the initial PDP-6 design, resources such as magnetic tapes, unit record devices (e.g., card readers, line printer, paper tape reader/punch) and DECtapes (which were file structured) were requested by each user as they were required. The monitor allocated the device to a requesting given job until released.

I/O calls were evoked by the UUO call instructions. A particular device program call could specify the number of i/o buffers to provide so that arbitrary amounts of overlapped i/o and computing could be realized.

In order to realize the goal of modularity, each i/o device handler was implemented as a separate module. These modules used a common set of subroutines. The device tables were made as identical as possible to help achieve the device independent goal. Thus, a user specified an i/o channel, not a specific i/o device. The channel to name assignment could take place at various times from log-on to program run-time.

In the original monitor, a user was allowed to assign file devices to his job and read and write named files with the devices. The current permanent, on-line user files with automatic backup was not implemented until the KA10 generation Monitors. The concept of Project/Programmer Number was adopted (after MIT's CTSS) in order to provide increased file security and sharing. In the same evolution, a user was required to enter a project/programmer number with his associated password. This not only established a job, but identified the user to the monitor. In additon to having resource privileges associated with better ID numbers, the user received a logical disk area for files. File access can be allowed (by the creator of the file) to any of the following levels with decreasing protection (increasing privileges): no access; execute only; plus read; plus append; plus update; plus write; plus rename; plus alter protection.

Significant evolution occurred in the user file facility. Improved file structure reliability and error recovery (such as writing pointer blocks twice) was achieved. With moving head disk availability, disk head movement optimization for file transfers on single or multiple drives was added. The concept of "mountable" structures was implemented to allow disk packs to be mounted and dismounted during timesharing operation as well as allowing a user to have a "private" pack mounted. As the number of users supported on the system and the diversity of their applications grew to include "business data processing" both hardware and software allowed expansion of the number and capacity of on-line disks.

<u>Command Control Program</u> - This program processes all commands addressed to the system from user terminals. Thus terminals served to communicate monitor commands to the system, to communicate to the user programs, and to serve as an i/o device for user programs. Terminal handling routines were an integral part of the PDP-6 Monitor. The original commands were designed to minimize the amount of state in the Monitor. As a result, users had to type several commands to control programs. The evolution

was to a much more powerful command language.

Batch Processing

Batch processing has evolved from the original, fully interactive PDP-6, where a user was expected to interactively provide commands for each step in the generation/execution of a program. The first batch on the KA10 was based on a user-built command file that mimicked his terminal actions. The user invoked this command file to execute his programs. Later, a multi-programmed batch system was added and the job control syntax evolved to provide more functions per command. However, batch/interactive command commonality has been preserved through the current monitor versions. Still, batch control ran as a timeshared job using queued batch control files. Thus, the ability to log in a job, run to completion, and log off, is accomplished from a card reader, or any other storage or file device. Symbiant (queued) operation allowed control of card readers, line printers, etc., by the batch control program so that the machine could be scheduled more effectively. During this batch evolution, little monitor enhancement was necessary to specifically address the batch environment. Modules to improve efficiency (by multiple strands and better scheduling) and increase functionality were implemented as "user" jobs and interprocess queueing allowed communication between the "user" modules.

A line printer spooler, for example, was run as one of many jobs by the operator--a notion that evolved beginning with the KA10. If a special form was required for a print job, the operator would be notified and act accordingly. The user was relieved of this responsibility. Operator allocation, control, and media loading of the card reader, magnetic tape, private disk pack, DECtape, and plotter were provided in the KI10.

Terminal Handling and Communications - We believe the users' perception of system effectiveness related directly to his feeling that he was interacting and was in control. The requirement to communicate effectively with the user via the terminal was one of the most difficult design constraints. The very first version of the Monitor used half duplex communication for simplicity. But finally we decided to pay the additional price to gain the benefit of full duplex communication, i.e., being able to continuously input and output independent of system load. These philosophies have guided subsequent monitor generations.

A hardware module was constructed to facilitate terminal communication. This hardware was called the scanner because it looked at all the interface lines connected to Teletypes and interrupted the software when a character was received or needed to be transmitted. These line units, which we built on a single card, formed the basis of the UART (Universal Asynchronous Receiver Transmitter) LSI chip. A software monitor, called SCNSER (Scanner Service) handled interrupts from the hardware. SCNSER provided the important function of logically coupling a physical terminal with a job running under timesharing. The user was never burdened with attempting to relate his terminal with his job. This software module, by far the most logically complex, has been rewritten two times to increase terminal functionality.

Later the KA10 terminal interface was implemented via a "front end" concentrator PDP-8 computer for large numbers of terminals - particularly where variable line speeds were involved (up to 300 baud). This implementation allowed some off-loading of the processor. Characters were assembled (serial parallel conversion) in the front-end PDP-8 and communicated with the KA10 via the I/O Bus on an interrupt basis.

In 1971 a front-end PDP-11 was provided direct memory access over the I/O bus. This connection provided high speed, full-duplex, synchronous communications and was the prototype for the current KL10/PDP-11 front-end computer. Software modules were added to the Monitor to allow these synchronous lines to terminate remote PDP-8 and communication concentrator stations in simple point-to-point topologies. A remote station (e.g., line printer) is viewed by the user in the same manner as a local priniter.

With the KI10, a second front-end was produced which allowed BYSINC protocol of the IBM 2780 terminal to be used. However, most of our users were laboratory oriented and wanted greater performance and functionality. Thus, concentrator/remote station capability including route-through (i.e., communication via multiple concentrators) and multiple hosts was added. These formed the basis of some of our understanding for subsequent DECnet protocol standards and its functions. The use of DECsystem 10 in the Advanced Research Projects Agency (ARPA) funded projects formed another key base for our DECnet protocols and functions (Roberts, 1969).

DECnet 10 now provides the capability to have processes in different computers (including PDP-8's and PDP-11's) communicate with each other. These jobs appear to each other as i/o devices in the simplest applications.

Throughout all of this communications functionality evolution, the goal has been to free the user from concern with the link, communications mode, hardware location and protocol.

<u>Multi-Processing</u>

Although we predicated the original PDP-6 hardware on multiprocessing, the monitor was not designed explicitly for it. Lawrence Livermore Laboratory did build a two processor system with their own operating system and special segmentation hardware. To meet the needs of the predominately scientific/computation marketplace in achieving higher processor throughput, a dual-processor KA10 was implemented using a master/slave scheme with wholly shared memory and one monitor. The slave CPU scanned the queue of runnable jobs, selected one and ran it. If a monitor call was encountered, the job was placed in the appropriate queue and the monitor located another runnable job. The "master" handled all i/o and privileged operations. In a CPU-bound environment, the dual processor provided approximately a 70% increase in system throughput.

An off-shoot (and evolved design goal) of the dual processor implementation was higher availability. Monitor reconfigurability and bus switching hardware allowed redundant components to be fully utilized during normal operation and, in the case of a hardware malfunction, separated into an operating configuration (with all available i/o) and a maintenance configuration (consisting of CPU, memory, and the faulty component).

At Carnegie-Mellon University (CMU) we proposed to build a 16 to 32 PDP-10 structure (Bell and Freeman, 1971). It would have 16 Mwords of primary memory available via 16 ports at a bandwidth of 2.1 to 8.6 gigabits/sec. Using larger than KL10 processors, performance would have been over 50 mips (million instructions per second). The 16 processor, C.mmp (Wulf and Bell, 1972) based on PDP-11's at CMU is a prototype of such a system.

Language and Utilities

Monitor commands called the utilities and languages. The utilities, we called CUSPs (for Common User System Program), and languages included: EDIT, an editor for creating and editing a file from a user console; PIP, the peripheral interchange program to convert information among the i/o media and files; LOADER to load object modules; DESK, an interactive calculator; MACRO, an assembler; and Fortran II. Figure TL shows these programs at various times, together with their origin.

Utilities and language has taken advantage of the interactive, terminal-oriented environment. Thus highly interactive editing/debugging facilities have evolved in terms of the program's own symbols. The file/data transfer utility, PIP, for Peripheral Interchange Program, is still in existence today, although in a much enhanced form. It has since been expanded to support the peripheral devices and the data formats encountered in the DECsystem-10 memory and i/o devices. Such a utility eliminated the need for a "library" of utilities and conversion program to transfer data between devices. Such tasks as card-to-disk, card-to-tape, tape-to-disk, etc., conversion are controlled by a terminal using common PIP commands. PIP evolved in a somewhat ad hoc fashion from one or two Kword size in 1965 to ten Kwords with substantial generality.

A powerful and sophisticated text editor, TECO (Text Editor and COrrector) was initially implemented at MIT using a graphics display. TECO is character-string oriented and requires a minimal number of keystrokes to execute commands. It included the ability to define programs to do general string substitution. As the sophistication of users was later perceived to decline, the powerful editor created training and use problems. Thus a family of line- and character-oriented editors evolved which were easier to learn and remember. These were based on other line-oriented editors, but especially Stanford's SOS, which replaced the initial DEC line editor in 1970.

Many of the higher level languages were initially produced by nonDEC groups and made available through the DEC User Society (DECUS). For example, APL, BASIC, DBMS and IQL (an interactive query language) were purchased from outside sources and are now standard, supported products.

BLISS, Basic Language for Implementing System Software, developed at Carnegie-Mellon University, became DEC's system's programming language (Wulf, Russel, Habermann, 1971). A cross-compiler was subsequently developed for the PDP-11. It's use as a system's program language has been due to the close coupling it provides to the machine, its general syntactic and block structures, and its high quality code generator. BLISS has been used for various diagnostic programs, the BLISS Compilers, the PDP-10 APL Interpreter, recent Fortran IV (compilers for both PDP-10 and PDP-11), and the BASIC +2 system. BLISS has also been used extensively within DEC for Computer Aided Design Programs.

TENEX and the TOPS 20 Operating System

Bolt, Beranek and Newman started a project in 1969 to build an advanced operating system called Tenex based on a modified KA10 (including rather elaborate paging hardware). This work was influenced by both the Berkley SDS 940 and MIT Multics Systems. Subsequently Tenex imported the KI10 design and became the base of TOPS 20. The system was described by Bobrow (1972), and the three major goals stated in the reference were:

"I. **State of the Art Virtual Machine**

a. Paged virtual address space equal to or greater than the addressing capability of the processor with full provision for protection and sharing.

b. Multiple process capability in virtual machine with appropriate communication facilities.

c. File system integrated into virtual address space, built on multi-level symbolic directory structure with protection, and providing consistent access to all external I/O devices and data streams.

d. Extended instruction repertoire making available many common operations as single instructions.

II. **Good Human Engineering Throughout System**

a. An executive command language interpreter which provides direct access to a large variety of small, commonly used system functions, and access to and control over all other subsystems and user programs. Command language forms should be extremely versatile, adapting to the skill and experience of the user.

b. Terminal interface design should facilitate intimate interaction between program and user, provide extensive interrupt capability, and full ASCII character set.

c. Virtual machine functions should provide all necessary options, with reasonable default values simplifying common cases, and require no system-created objects to be placed in the user address space.

d. The system should encourage and facilitate cooperation among users as well as provide protection against undesired interaction.

III. **The system must be Implementable, Maintainable, and Modifiable**

a. Software must be modular with well defined interfaces and with provision for adding or changing modules clearly considered.

b. Software must be debuggable and reliable, allowing use of available debugging aids and including internal redundancy checks.

c. System should run efficiently, allow dynamic manual adjustment of service if desired, and allow extensive reconfiguration without reassembly.

d. System should contain instrumentation to clearly indicate performance."

Dan Murphy (one of Tenex's designers/implementers) came to DEC and led the architecture and development that became TOPS 20. The effort at DEC has been to increase the performance of TOPS 20 to be competitive with the highly tuned TOPS 10 Monitor while not losing its generality. The TOPS 20 structure does provide significantly increased reliability and modifyability.

V. PMS *STRUCTURE

Table IGC gives the major goals and constraints in the PMS structure design. This section describes system configurations, the i/o system, the memory system, and computer-computer communication structures.

System Configurations

We wanted to give the user considerable freedom in specifying a system configuration with the ability to increase (or decrease) memory size, processing power, and external interfaces to people, other computers, and real time equipment. Overall, the PMS structure has remained essentially the same as the PDP-6 design, with periodic enhancements to provide more performance and better real time capability. (A PDP-6 memory or i/o device could be used on a KI10 processor, and a PDP-6 i/o device can be used on today's KL10 systems.) A radical change occurred with the KL20 to a more integrated, less costly, design for the processor, memory, and minicomputer i/o preprocessors.

The PMS block diagram of a two processor PDP-6 is given in Fig. PMS6. But, for simple uniprocessor systems, the PMS structure was quite like our small computers with up to 16 modules on both the i/o and memory buses:

```
Mp...Mp              Kio-...KMs...
!____!_____Pc________!______!
(Memory Bus)          (I/O Bus)
```

Interestingly, a unified i/o-memory bus like the PDP-11 Unibus was considered. The concept was rejected since a unified bus designed to operate at memory speed would have been more costly.

The goal to provide arbitrary, modular computing resources led to a multiprocessor structure with shared memory. The interconnection between processors and memory modules was chosen to be a cross-point switch with each processor broadcasting to all memory modules.

An alternative interconnection scheme could have been a more complex, synchronous, message-oriented protocol on a single bus. More efficient cable utilization and higher bandwidth would have resulted but physical partitioning into multiple processor/memory subsystems for on-line maintenance would have been precluded. All in all, the crosspoint switch decision was basically sound although more expensive.

____

*Processor-Memory-Switch. The PMS notation is a scheme for concisely representing the "block-diagram" level of computer organization. Common abbreviations in PMS are P for processor, M for memory, S for Switch, K for control unit, C for computer. Abbreviations may be quantified by lower case letters such as c for central (i.e., Pc => central processor), p for primary (i.e., Mp => primary memory), and s for secondary (i.e., Ms => secondary memory). For a complete description of the PMS notation see (Bell and Newell 1971).

Figure PMS10 shows a PMS block diagram for the KA10 and KL10. There are up to 16, on 65 Kword, 4-port memory modules, giving a total of one megaword of memory. (Each processor addressed four megawords). With high speed disk and tape units (e.g. 250 Kwords/sec.) a program controlled i/o scheme would place too much burden on the central processor. Therefore a direct port to memory was provided like in the PDP-6. In the KA10/KI10 systems, a switch (called a multiplexor) was introduced to effectively expand the number of ports into memory to four for each Memory Bus used. The communications controllers were also expanded to handle more asynchronous and synchronous lines.

The KL10 was, by comparison, a radical departure from previous PMS structures (see Fig. PMSKL). In order to gain more performance, four words from four low order interleaved memory modules were accessed each cycle. The effective processor-memory bandwidth was thus over four Mwords/sec. The processor also contacts to as many as four PDP-11 minicomputers (shown as C(11) in the figure). Most of the i/o is handled by these front end computers.

Each PDP-11 can access the KL10 memory via indirect address pointers and transfers data in much the same manner as the peripheral processing units of a CDC 6600. Notice also that the KL10's console is tied to a PDP-11. This PDP-11 can load the KL10 microprogram memory, run microdiagnostics, and provides a potential remotely operated console. Each of the PDP-11's can achieve a word rate of 70 Kchar/sec.

Up to eight DEC Massbus controllers are integrated into the processor. The Massbus is an 18-bit data width bus for block transfer oriented mass storage devices such as disks and magnetic tapes. Each Massbus can transfer 1.6 Mwords/sec. yielding a maximum 12.8 Mwords/sec. transfer rate for all channels. However, contemporary disks need about 250 Kwords/sec. so that all eight channels only require 2.0 Mwords/sec. of the 4 Mword/sec. memory bandwidth of 4 modules. Individual disks and tapes can be connected to a second port for increased concurrency. For larger memory configurations, a memory bandwidth of 16 Mwords/sec. is not uncommon. A processor cache (with a 90% hit rate) also reduces memory bandwidth demand by nearly a factor of ten.

The cost reduced KL20 evolved by integrating the Massbus controllers and PDP-11 interfaces onto a single high speed, synchronous bus. The model 2040 and 2050 computers are based on the KL10 processor and integrate 256 Kwords of memory in a single cabinet with the processor (thereby eliminating the external memory bus). The i/o bus is also eliminated and all i/o transfers are either via the Massbuses or the PDP-11 i/o computers. (It must be noted that the 2040 structure is only possible because of the drastic increase in logic and memory density!)

I/O System

Relatively low speed i/o (200 Kwords/sec.) in the PDP-6 was designed to be under central processor programmed control rather than via specialized i/o processors (IBM System 360/370 Channels). This method had proven effective in our minicomputers and was extended to handle higher data rates with lower overhead than specialized i/o processors.

The rationale for not using the IBM-type channel structure was based both on high overhead (cost) in programming and hardware. Since i/o record transmission usually caused a central processor action, we felt the processor might as well transfer the data while it had access to it. This merely required a good interrupt and context switching mechanism, not another specialized processing entity. However, when an inordinately high fraction of the processor's time went to i/o processing, a second, fully general processor was added...not a processor that was fundamentally only capable of data transmission.

The PDP-6 interrupt scheme was based on our previous experience with a 16-level and 256-level interrupt mechanism for PDP-1. The PDP-1 scheme was an extension of the Lincoln Laboratory TX-2 (Clark, 1957). The PDP-6 had a 7-channel interrupt system and each device on the I/O Bus could be programmed to a particular level. Hence a programmer could change the priority of a particular device that caused interrupts on the basis of need or urgency. The PDP-6 also had an i/o instruction (Block Input or Block Output) to transfer a single data item, between a block (vector) in primary memory and an i/o device. Thus as each word was assembled by a controller, an interrupt occurred and the block transfer was executed for one word, taking only three memory references (to the instruction, to increment the address pointer and block counter, and to transfer data). Most of the hardware to control the count and address pointer was already part of the processor logic.

In applications requring higher data transmission (e.g., swapping drums, disks, TV cameras) a controller with a data buffer (erroneously called an i/o processor) and link to memory were provided. These controllers only required a single memory reference per data transfer with the address pointer and block counter in hardware. In the KA10 the name was changed to channel, and parameters for transferring contiguous records into various parts of memory were part of the channel's control. The device control was via the I/O Bus hence we ended up with a structure for high speed device control not unlike the IBM channels we originally wanted to avoid.

Competitive pressure from the Xerox Sigma series caused a change in the way interrupts were handled beginning with the KI10. Although the Xerox scheme had many priority levels, its main utility was derived from rapid dispatch to attend to a particular interrupt signal. We kept compatibility with the 7-channel interrupt by using a spare wire in the bus and adding the ability to directly dispatch to a particular program when a request occurred. At the interruption, the processor sent a signal to requesting devices and the highest priority device responded with a 33-bit command (3-bit function, 18-bit address, 12-bit data). The functions were:

1. execute the instruction found at addressed location
2. transfer a word to/from addressed location
3. trap to addressed location
4. add data to addressed location

Little use was made of these functions (especially number four), since only a small number of devices were typically connected to a large system thus relaxing the requirement of rapid dispatch. Anyway, the competitive problem was solved (or went away). In systems that did have a large number of devices, a front end i/o processing minicomputer was more cost-effective than central processor controlled i/o.

Memory Systems

Because it was unclear how memory technology would affect memory speed, a completely asynchronous, interlocked memory bus was designed. Thus the 16 fast, general registers, the initial five microsecond memory, and the next generation two microsecond memory could all operate on a single system. (Most memories are now less than one microsecond cycle time.) The asynchronous bus avoided the problem of distributing a single high speed clock and allowed interleaved memory operation.

Modularity was also introduced to clarify organizational boundries within the company and to make low cost, special purpose, production and engineering testors for the memory and i/o equipment. We believe the concept of well-defined modules was relatively unique, especially for memory, and was the basis for the formation of third party add-on memory vendors. MIT and Stanford University purchased memories from Fabritek and AMPEX respectively in the mid 1960's to start this trend. (Note, this design style differed significantly from the IBM System/360 design with its relatively bounded configurations, special interfaces and integrated memory. Add-on memory did not appear until the early 70's for the IBM machines because, we believe, of the difficulty of the interface definition.)

The KI10 memory system was improved by assigning signals to request multiple, overlapped memory accesses and to increase the address size to 24 bits (up from 18). The additional physical memory addresses are mapped into a program's 18-bit addresses as described in the ISP section.

The KL10 processor-memory organization was a significant departure from the KI10 as previously discussed. The KL20 eliminated the original Memory Bus to provide an integrated system. It should be noted that this evolution was based on the drastic size reduction (a factor of about 300) from a single cabinet (6'x19"x25" or about 34,000 cu.inches) for 16 Kwords to a single logic module for 16K words (15"x8"x1" or about 120 cu.inches).

<u>PMS Structures for Computer-Computer Intercommunication</u>

Throughout the evolution a number of schemes have been used to interconnect with other (usually smaller) computers. The schemes are given in Table IC.

Table IC: <u>Computer Interconnection Structures</u>

Scheme	**Data Rate**	**Structure**	**Models**	**Examples**
Standard communication link	300 1200, 4800, 9600, 50K bits/sec.	network	all	
Specially parallel, block transfer via hardware or software	100K-1M words/sec.	tightly coupled	all	
Multiprocessors proposed	at mem. access rate	multiprocessor	all	2 Pc 16 Pc,
Access into computer mini address accesses data in space with small computer interruption	at mem. access rate	multiprocessor shared memory	PDP-6	The large the
The mini can used to	at mem.	tightly coupled	KA10-	Scheme

transfer data interconnect minis into large machine via special control   access rate   KL10 to do i/o. Multiple logical channels are provided.

Note, the first four schemes were conventional while the last scheme was used in the KL10/20 structure so that an attached PDP-11 minicomputer could transmit data directly into the memory of the KL. This scheme was first used in the early 1970's for handling multiple communication lines.

Digital **Interoffice Memo**

Subject: **Review of DEC's CAD Activities**

To: Bob Puffer

CC: Jim Bell
Leo Bennett
Ed Vrablik

Date: 22 SEP 76
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

F/U 9/29

I've asked John Gray (University of Edinburgh, Department of Computer Science, Edinburgh, Scotland, UK.) to come visit DEC within the next month to be a member of a CAD review group which I'd like you to organize and get someone to chair. It might consist of 3 or 4 internal people too, who have CAD and/or performance analysis capability (especially from Stanford Drawing System Groups). Some of the concerns in systems like this are:

a. Where are we versus

commitments? expectations?

b. Can we ever afford to use it? Can we get the 10's?

c. How much tuning will be needed to make them useable (for the level of machine support)?

d. What's the likelihood that we'll have to abandon the DBMS system and go to an ad hoc data base like in the past? When will we know?

e. Was PGP a good idea? a good design?

f. What's the likelihood that a significant decrease in memory price will "save" the system? I.e., since the system was designed on the basis that "core is cheap", will it ever be cheap enough to permit the co-residence of the 6 or so very large jobs that the system is also predicated on to avoid "expensive, time-consuming, swapping"?

I really don't know how to start this review, but it's past time to, and I'd like to get some external interaction with John to help kick it off. We also might want to hire him. Since Luther (and Ed?) know him, it should be no problem to have him help here.

GB:ljp
00 BURT DECGRAM ACCEPTED S 22764 O 554 05-NOV-81 14:51:20

****
* d i g i t a l *
****

TO: WILL THOMPSON DATE: THU 5 NOV 1981 9:47 AM EST

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION

DEPT: ENG STAFF

EXT: 223-2236

LOC/MAIL STOP: ML12-1/A51

SUBJECT: EXTRA 600K MULTI YEAR MULTIWIRE SUPPORT

I believe we should hold the CAD budget constant for physical interconnect. This would mean not having a direct translation from multiwire to PWB or we would do it manually until such time as we got around to making the translation.

I'd like to participate in a detailed review of all the projects we have in this area and what we might alter. Can I also recommend your MR, TW, CX and ML customers also participate?

"CC" DISTRIBUTION:

BILL AVERY ULF FAGERQUIST RICHARD GONZALES
LARRY PORTNER ROY REZAC GRANT SAVIERS
PETE STRAKA

GB3.S2.30

GB0001/13

| d | i | g | i | t | a | l | i n t e r o f f i c e   m e m o r a n d u m

Subject: **Thoughts on CAD Machines and Personal VAX**

To: Bert Bruce, ML1-1/E24
Bernie Lacroute, TW/A08
Bob Puffer, ML12-2/E38

Date: 2/14/79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

I was happy to hear about the general direction in the CAD effort and would like to support a continued interchange here about the general direction. Here's what I gleaned:

1. The DBMS approach doesn't really work very well. A simpler file structure is being considered along the lines of the BNR system. It seems like a better approach would use the techniques which large programming systems use to manage its files is more appropriate. Earl Van Horn is doing such a file library management program that might be appropriate. Before we leap again, however, we will understand why we are leaping and what the problems are likely to be with this new approach...which could be construed to be back to the ad hoc set of files approach (albeit better organized) we've always used for a design.

2. We will try several experiments before we go out in a single, direction.

First, a 2020 should be used to see just how many terminals and how much work can be done.

Second, we would get an Applicon system for some of the layout. Also, we will talk to them about futures and whether we can work with them.

Third, we will buy programs or parts of programs in preference to doing any programming.

Fourth, we will generally set off in the direction of the corporate stategy and use VAX. In this later regard, the first program to migrate will be the interactive PC Layout System which will have a tube directly attached to VAX in the form of the GT62...because VAX supports the terminal. The program would be moved over to carry out the editing, and the 10 would be used for main routing and clean up. Although we stated that mag tapes could be carried back and forth, I say get a VAX and get at least a 9.6 KB DECnet link. We got no work done in a similar situation and DECnet really works (note all the VAXs that are interlinked between Maynard and Tewksbury).

Fifth, new work could be/(should be?) done on VAX or in compatible BLISS. Should we start a SUDS redo effort so as to use the latest McWilliams/Stanford work (uses Pascal and needs a larger address space)?

This should be the start of ...

Personal VAX

Many people have pointed out the essential need to get a common, personal VAX rapidly and to get experience with it. The above use is one case (we'll have to use a 780 to start with now) and we want the same systems for use in the LSI area in order to do the LSI VAX. In this later case, the plan right now, as I understand it is to get 3 of the CALTECH scopes connected to one or more systems. In order to get experience with this, we need to think through the packaging on Nebula, because I assume it is the ideal computer to first try out the notion. Here, we would give 6 of these to various universities ASAP (e.g., CalTech, CMU, MIT and Stanford)...and I believe it is essential to have a uniform system structure, otherwise we have no guarantee of getting any useful software or sharing work.

Rather than design IT (one) here, I'd like to encourage ideas. Somehow, I like the idea of a pedestal package like the HP 300, but I don't see what we should do for the scope...hence, should we make a desk package that can handle several terminals, but maybe two should be standard, with corresponding hard copy output. Therefore the system might just include the computer, two RL02 disks, comm interfaces (DECnetting to 10/20 and other VAXs including personal VAXs). What are the current plans on the Nebula package?

Who is co-ordinating its definition? Anyone interested?

These are thoughts, not commands.

GB:ljp

CC: Leo Bennett, ML4-4/E99
Jack Burness, WZ-2
Bill Demmer, TW/D19
Rattan Dhar, MR1-1/M42
Ulf Fagerquist, MR1-2/E78
Sam Fuller, TW/A08
Bill Johnson, ML3-5/H33
Bill Keating, ML12-3/A62
Si Lyle, MR1-1/M42

Jim Marshall, TW/A03
Craig Mudge, CalTech
Dave Rodgers, TW/C04
Wayne Rosing, TW/A03
Dick Schneider, ML11-4/E53
Bill Segal, ML3-5/E82

D I G I T A L INTEROFFICE MEMORANDUM

DIST: Leo Bennett ML4-4/E99 Bert Bruce ML1-
1/E24
Jack Burness WZ-2 Bill Demmer
TW/D19
Rattan Dhar MR1-1/M42 Ulf Fagerquist MR1-
2/E78
Sam Fuller TW/A08 Bill Johnson ML3-
5/H33
Bill Keating ML12-3/A62 Bernie Lacroute
TW/A08
Si Lyle MR1-1/M42 Jim Marshall
TW/A03
Craig Mudge CalTech Bob Puffer ML12-
2/E38
Dave Rodgers TW/C04 Wayne Rosing
TW/A03
Dick Schneider ML11-4/E53 Bill Segal ML3-
5/E82

+---------------+
! d i g i t a l ! i n t e r o f f i c e m e m o r a n d u m
+---------------+

Subject: **CAD Strategy**

To: Bill Green

CC: Leo Bennett, Bill Johnson,
Bob Puffer

Date: 19 JUNE 78
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

follow up 7/3/78

I'd like to get Bob Kusik freed up in October for a couple of months to work with me and Bill Johnson to look at our overall CAD strategy.

Some of the questions I have:

1. What groups are into this? What are their charters, goals and strategies?

2. Are the directions we have adequate? For example:

   a. DBMS versus a Relational Data Base
   b. What Graphics consoles?
   c. When will designers be on line?
   d. Will we see any increase in productivity?

3. How do we prioritize projects (e.g., backpanels vs chips) so as to allocate resources?

4. How do we motivate/keep people in this area?

5. How do we couple to outside work (research, current products, new developments)? Can we sell our work via ESG?

6. How do we become much more effective?

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST: Leo Bennett ML4-4/E99 Bill Green ML1-4/B34
Bill Johnson 21-3/E87 Bob Puffer ML12-2/E38

GB0001/50

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|   |   |   |   |   |   |   |
+----------------------------+
```

Subject: **Selling our CAD Tools**

To: Bert Bruce, ML1-1/E24
Rattan Dhar, MR1-1/M42
Bill Johnson, ML3-5/H33
Bob Kusik, ML3-5/H33
Si Lyle, MR1-1/M42

Date: 3/22/79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

follow up 4/6/79

Why don't we start by seeing if we can sell SAGE II?

SUDS?

Other?

GB:ljp

Can you get us two with two to follow for immediate experiments and/or use in Venus CAD?

We are trying to give our Venus designers immediate access to drawings via VT125 in their own offices! Dick Helliwell is in Colorado to do the interface and we also need ours in Marlboro. The other two would go to VLSI and PC CAD.

Our PC CAD terminals and workstations are really abysmal. For example, LSEG and others have:

A ten year old VB10 that Bill Bruckert designed and has to maintain.
GT40's
GT60's operating as GT40's, but functioning poorly due to prom problems
An Aydin hi-performance Color Processor
Homebuilt Cal Tech Color workstations
VSV11's
PDP-15's
Applicon
Calma, etc.

Can the CAD group Managers get together and agree on some decent, standard graphics workstations?

This is a Mess!

****
* d i g i t a l *
****

TO: PEG:
DATE: TUE 9 JUN 1981
9:39 EST

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: CAD, OUR KEY TO SURVIVAL AND WHO CAN MANAGE IT?

I'd like to discuss candidates who might take over the functional management of CAD, report to BJ, so that we might start to manage this software intensive effort as a large, complex, software engineering project. It is clear we have a disaster of major proportions in CAD at all levels including planning, programming, and computer operations. We are spending something like 10% of the budget in this area, and are getting substantially worse, as measured by gestation times, product quality, productivity, etc.

We are in deep, deep trouble with VENUS, and I see no one to get us out of the hole! Only Scorpio sounds like it has a chance of working. Venus needs help and other areas either will or also do too. I think we have to act now.

Let's discuss on Thursday for a few minutes.

GB2.S6.23

EMS 13-JAN-79 15:13:19 310 1

To: Robert Kusik
CC: Bob Puffer, Bill Johnson
From: Gordon Bell
Date: SAT 13-JAN-79 15:13:19 EDT
Subject: Your suggestion on breadboarding PCLayout

Yes, I have to agree on this. Somehow, we have to restructure theCAD group

to do this. I believe now, that the fundamental probelm is that we have
never had the CAD person (Bert/Ber't predecssor) report to a software manager
and the fundamental problem is that they don't know how to plan and manage
these projects, especially ones that theere i{sn't a lot of proior art.
I want to change the reporting strucutre. Thus, let's tlk 3 changes: 1. remove
the simulation work and cluster it elsewhere as we discussed
giving both critical mass and less for bert to do. 2. restructure to have
definition and prototyping out from parts that are either maintainence or
ongoing, well-defined projects. 3. change the reporting to either technical
director, software
or quite possibly to Dick Snyder who a Larry is discussing to have a roll
change. Note also Ulf is the technical products group which
is an application we are also marketing. There may be other ideas,
please prepare some alternatives for the meeting (jungle type).

Regrarding the breadboarding of PCLS: I'd be happy ot brainstrom this.
Bringin some people who are knowledgeable here too like Helliwell and grooss.
I see taking the existing system and making it work by getiing the rightr
coupling with craphics and the system. Here we could: 1. Fix the program by
understanding the interaction and move some parts 2. give them a2020 with a
tightly coupled display to it...that doesn't take any other development. 3.
give them a VAX with the tightly coupled GT60 as we sell/support it. 4, Keep
them away from doing this on an 11 only becasue of the large databaase and
total recodeding /etc required.

```
You convened the right gurus and get us over there to explain
what it is we
have to sove and why it doen't work.
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Command:
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                          |SAT 1/10 - SUN 1/11
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Adams etal|8:30 PK3,A/V--FILM                |HOME: BANK DEMO
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Res.                     |
10:00 Holman - here      |                     |
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(Eckh)                   |
 Re Product Assurance    |                     |
                         |                     |
4:00 McBride here        |                     |6:00 Museum/U
dinner|                  |3:30 Bob Supnik-here|
 LSG Advanced Dev.       |                     |
                         |                     | J11
issues/status            |
<>--------------------------------------------------------------
----------------------------------------------------------------
--------
MONDAY  1/19             |TUESDAY  1/20        |WEDNESDAY 1/21
                         |THURSDAY 1/22        |FRIDAY 1/23
                         |SAT 1/24 - SUN 1/25
                         |                     |
                         |8:30 WPI + AK        |
                         |
                         |                     |
                         |at Hudson            |
                         |
12:00 MC at MK           |Jungle               |Jungle
                         |11:30                |8:00A Dr.
Harrington|
<>--------------------------------------------------------------
----------------------------------------------------------------
--------
MONDAY  1/26             |TUESDAY  1/27        |WEDNESDAY 1/28
                         |THURSDAY 1/29        |FRIDAY 1/30
                         |SAT 1/31 - SUN 2/1/81
                         |                     |ARRV SF 12:55P
                         |LV SF 3:15P          | U of Texas
                         |SAT L 7:55A
OC                       |1:00 OFIS-Spitbrk |7:00
ACM/Cupertino            |AR Austin 9:55P   |
                         | A COZUMEL 2PM
```

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MONDAY  2/2/81              |TUESDAY  2/3      |WEDNESDAY 2/4
                            |THURSDAY 2/5      |FRIDAY 2/6
                            |SAT 2/7 - SUN 2/8
                            |                  |OC Operating Rev
(0)|                        |                  |SAT COZUMEL -
BOSTON
11:00 OC+SAL REV (LP?)      |12:00 MC (LP)     |
                            |12:00 OOD         |
                            |
Mexico ---)                 |---)              |---)
                            |---)              |---)
                            |
<>------------------------------------------------------------
------------------------------------------------------------
--------
MONDAY  2/9                 |TUESDAY  2/10     |WEDNESDAY 2/11
                            |THURSDAY 2/12     |FRIDAY 2/13
                            |SAT 2/14 - SUN 2/15
BOD                         |1:00 OFIS--Sptbrk |
                            |                  |
                            |
                            |                  |
                            |                  |12:00
Semiconductor
                            |                  |
                            |                  |/ Eng. Plans-
Hudson                      |
                            |                  |
                            |                  |5:00
<>------------------------------------------------------------
------------------------------------------------------------
--------
MONDAY  2/16                |TUESDAY  2/17     |WEDNESDAY 2/18
                            |THURSDAY 2/19     |FRIDAY 2/20
                            |SAT 2/21 - SUN 2/22
                            |                  | Woods
                            | Woods            |
                            |
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--------
MONDAY   2/23                |TUESDAY  2/24     |WEDNESDAY 2/25
                             |THURSDAY 2/26     |FRIDAY 2/27
                             |SAT 2/28 - SUN 3/1/81
                             |                  |8:30 OC Opr.Rev-
LSI                          |HOLD FOR CS&TB - -)
                             |---) WASH.D.C.    |
12:00 MC                     |1:00 OFIS-Spitbrk |
                             |12:00 OOD         |
                             |
```

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--------
MONDAY  3/2/81            |TUESDAY  3/3      |WEDNESDAY 3/4
                          |THURSDAY 3/5      |FRIDAY 3/6
                          |SAT 3/7 - SUN 3/8
11:00 Salary Review       | EBOD             |
                          |State of Company  |
                          |
12:00 OC                  |                  |
                          | Ann X2603        |
                          |
                          |                  |5:00 Zuse
lecture                   |                  |
                          |
<>------------------------------------------------------------
------------------------------------------------------------
--------
MONDAY  3/9               |TUESDAY  3/10     |WEDNESDAY 3/11
                          |THURSDAY 3/12     |FRIDAY 3/13
                          |SAT 3/14 - SUN 3/15
                          |                  |3:30 Lecture
                          |                  |Hold possible
Japan                     |
12:00 MC at MR            |1:00 OFIS-Sptbrk  |CMU
Distinguished             |12:00 OOD         | day at Hudson
                          |
                          |                  |  Lecture Series
                          |                  |
                          |
<>------------------------------------------------------------
------------------------------------------------------------
--------
MONDAY  3/16              |TUESDAY  3/17     |WEDNESDAY 3/18
                          |THURSDAY 3/19     |FRIDAY 3/20
                          |SAT 3/21 - SUN 3/22
                          |                  | Woods
                          | Woods            |
                          |
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MONDAY  3/23                |TUESDAY  3/24     |WEDNESDAY 3/25
                            |THURSDAY 3/26     |FRIDAY 3/27
                            |SAT 3/28 - SUN 3/29
                            |                  | OC Review
                            |                  |
                            |
BOD                         |12:00 OC          |
                            |12:00 OOD         |1:00 OFIS--
Sptbrk                      |SUN-FLY TO SF
<>-------------------------------------------------------------
---------------------------------------------------------------
--------
MONDAY  3/30                |TUESDAY  3/31     |WEDNESDAY 4/1/81
                            |THURSDAY 4/2      |FRIDAY 4/3
                            |SAT 4/4 - SUN 4/5
12:00  MC                   |LLL seminar---)   |----------)
                            |------)           |fly home
                            |
visit Intel                 |Eve: Corp.Seminar |Corp.Seminar
                            |Corp. Seminar     |
                            |
```

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<>------------------------------------------------------------
------------------------------------------------------------
--------
MONDAY  4/6                 |TUESDAY  4/7      |WEDNESDAY 4/8
                            |THURSDAY 4/9      |FRIDAY 4/10
                            |SAT 4/11 - SUN 4/12
11:00 Salary Review
12:00 OC                    |                  |
                            |12:00 OOD         |
                            |
<>------------------------------------------------------------
------------------------------------------------------------
--------
MONDAY  4/13                |TUESDAY  4/14     |WEDNESDAY 4/15
                            |THURSDAY 4/16     |FRIDAY 4/17
                            |SAT 4/18 - SUN 4/19
                            |EBOD              | Woods
                            | Woods            |8:30 Mudge/via
                            |
                            |5:00 Wilkinson    |
                            |                  | via Hanover-
here
                            |  museum lecture  |
<>------------------------------------------------------------
------------------------------------------------------------
--------
MONDAY  4/20                |TUESDAY  4/21     |WEDNESDAY 4/22
                            |THURSDAY 4/23     |FRIDAY 4/24
                            |SAT 4/25 - SUN 4/26
HOLIDAY                     |12:00 MC          | Jungle
                            | Jungle           |
                            |
<>------------------------------------------------------------
------------------------------------------------------------
--------
MONDAY  4/27                |TUESDAY  4/28     |WEDNESDAY 4/29
                            |THURSDAY 4/30     |FRIDAY 5/1/81
                            |SAT 5/2 - SUN 5/3
                            |                  | OC Review
                            |                  |
                            |
 BOD                        |12:00 OC          |
```

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--------
MONDAY  5/4/81            |TUESDAY  5/5      |WEDNESDAY 5/6
                          |THURSDAY 5/7      |FRIDAY 5/8
                          |SAT 5/9 - SUN 5/10
12:00 MC at MK            |                  |
                          |12:00 OOD         |
                          |Sun: Mother's Day
<>------------------------------------------------------------
------------------------------------------------------------
--------
MONDAY  5/11              |TUESDAY  5/12     |WEDNESDAY 5/13
                          |THURSDAY 5/14     |FRIDAY 5/15
                          |SAT 5/16 - SUN 5/17
                          |                  | Woods
                          | Woods            |
                          | FLORIDA????
<>------------------------------------------------------------
------------------------------------------------------------
--------
MONDAY  5/18              |TUESDAY  5/19     |WEDNESDAY 5/20
                          |THURSDAY 5/21     |FRIDAY 5/22
                          |SAT 5/23 - SUN 5/24
Florida------>            |------>           |DECUS - talk
                          |DECUS - talk      |
                          |
11:00 Salary Review
12:00 OC                  |                  |
                          |                  |
                          |Florida
<>------------------------------------------------------------
------------------------------------------------------------
--------
MONDAY  5/25              |TUESDAY  5/26     |WEDNESDAY 5/27
                          |THURSDAY 5/28     |FRIDAY 5/29
                          |SAT 5/30 - SUN 5/31
HOLIDAY                   |                  | OC Review
                          |                  |
                          |
BOD Scotland              |12:00 MC          |
                          |12:00 OOD         |
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                          |
DECUS?-----)              |-----)                |-----)
                          |-----)                |-----)
                          |
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MONDAY  6/1/81            |TUESDAY  6/2      |WEDNESDAY 6/3
                          |THURSDAY 6/4      |FRIDAY 6/5
                          |SAT 6/6 - SUN 6/7
11:00  Salary Review
12:00 OC                  |                  | EBOD
                          |                  |
                          |
                          |                  |Museum lecture?
                          |  MIT REUNION     |  MIT REUNION
                          |SAT:MIT REUNION
<>--------------------------------------------------------------
----------------------------------------------------------------
--------
MONDAY  6/8               |TUESDAY  6/9      |WEDNESDAY 6/10
                          |THURSDAY 6/11     |FRIDAY 6/12
                          |SAT 6/13 - SUN 6/14
12:00 MC                  |State of Company  |
                          |12:00 OOD         |
                          |
                          | Anne X2603       |
                          |
<>--------------------------------------------------------------
----------------------------------------------------------------
--------
MONDAY  6/15              |TUESDAY  6/16     |WEDNESDAY 6/17
                          |THURSDAY 6/18     |FRIDAY 6/19
                          |SAT 6/20 - SUN 6/21
                          |                  | Woods
                          | Woods
<>--------------------------------------------------------------
----------------------------------------------------------------
--------
MONDAY  6/22              |TUESDAY  6/23     |WEDNESDAY 6/24
                          |THURSDAY 6/25     |FRIDAY 6/26
                          |SAT 6/27 - SUN 6/28
                          |                  | OC Review-CSD/
                          |                  |
                          |
12:00 OC                  |                  | & Terminals
                          :
<>--------------------------------------------------------------
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MONDAY  6/29                      |TUESDAY  6/30     |WEDNESDAY 7/1/81
                                  |THURSDAY 7/2      |FRIDAY 7/3
                                  |SAT 7/4 - SUN 7/5
12:00 MC at MR                    |                  |
                                  |                  |
                                  |
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--------
MONDAY  7/6/81             |TUESDAY  7/7      |WEDNESDAY 7/8
                           |THURSDAY 7/9      |FRIDAY 7/10
                           |SAT 7/11 - SUN 7/12
11:00  Salary Review
12:00 OC                   |                  |
                           |12:00 OOD         |
                           |
<>----------------------------------------------------------------
----------------------------------------------------------------
--------
MONDAY  7/13               |TUESDAY  7/14     |WEDNESDAY 7/15
                           |THURSDAY 7/16     |FRIDAY 7/17
                           |SAT 7/18 - SUN 7/19
                           |                  | Woods
                           | Wods             |
                           |
<>----------------------------------------------------------------
----------------------------------------------------------------
--------
MONDAY  7/20               |TUESDAY  7/21     |WEDNESDAY 7/22
                           |THURSDAY 7/23     |FRIDAY 7/24
                           |SAT 7/25 - SUN 7/26
12:00 MC                   |                  |Jungle
                           |Jungle            |
                           |
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----------------------------------------------------------------
--------
MONDAY  7/27               |TUESDAY  7/28     |WEDNESDAY 7/29
                           |THURSDAY 7/30     |FRIDAY 7/31
                           |SAT 8/1/81 - SUN 8/2
12:00 OC                   |                  |
                           |                  |
                           |
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<>----------------------------------------------------------------------------
--------
MONDAY  8/3/81              |TUESDAY  8/4       |WEDNESDAY 8/5
                            |THURSDAY 8/6       |FRIDAY 8/7
                            |SAT 8/8 - SUN 8/9
12:00 MC                    |                   |
                            |12:00 OOD          |
                            |
<>----------------------------------------------------------------------------
--------
MONDAY  8/10                |TUESDAY  8/11      |WEDNESDAY 8/12
                            |THURSDAY 8/13      |FRIDAY 8/14
                            |SAT 8/15 - SUN 8/16
BOD                         |                   | Woods
                            | Woods             |
                            |
<>----------------------------------------------------------------------------
--------
MONDAY  8/17                |TUESDAY  8/18      |WEDNESDAY 8/19
                            |THURSDAY 8/20      |FRIDAY 8/21
                            |SAT 8/22 - SUN 8/23
11:00 Salary Review
12:00 OC                    |                   |
                            |12:00  OOD         |
                            |
<>----------------------------------------------------------------------------
--------
MONDAY  8/24                |TUESDAY  8/25      |WEDNESDAY 8/26
                            |THURSDAY 8/27      |FRIDAY 8/28
                            |SAT 8/29 - SUN 8/30
12:00 MC at MK              |
<>----------------------------------------------------------------------------
--------
MONDAY  8/31                |TUESDAY  9/1/81    |WEDNESDAY 9/2
                            |THURSDAY 9/3       |FRIDAY 9/4
                            |SAT 9/5 - SUN 9/6
12:00 OC                    |                   |
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|12:00 OOD |
|

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MONDAY  9/7                |TUESDAY  9/8      |WEDNESDAY 9/9
                           |THURSDAY 9/10     |FRIDAY 9/11
                           |SAT 9/12 - SUN 9/13
Labor Day                  |12:00 MC          |Museum Lecture?
                           |                  |
                           |
<>-------------------------------------------------------------
-------------------------------------------------------------
--------
MONDAY  9/14               |TUESDAY  9/15     |WEDNESDAY 9/16
                           |THURSDAY 9/17     |FRIDAY 9/18
                           |SAT 9/19 - SUN 9/20
BOD                        |                  | woods
                           | Woods            |
                           |
<>-------------------------------------------------------------
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--------
MONDAY  9/21               |TUESDAY  9/22     |WEDNESDAY 9/23
                           |THURSDAY 9/24     |FRIDAY 9/25
                           |SAT 9/26 - SUN 9/27
11:00 Sal Rev              |
12:00 OC                   |                  |
                           |12:00 OOD         |
                           |                  |Museum Lecture?
                           |                  |
                           |
<>-------------------------------------------------------------
-------------------------------------------------------------
--------
MONDAY  9/28               |TUESDAY  9/29     |WEDNESDAY 9/30
                           |THURSDAY 10/1/81  |FRIDAY 10/2
                           |SAT 10/3 - SUN 10/4
12:00 MC
                           |                  |Museum Lecture?
                           |                  |
                           |
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--------
MONDAY  10/5             |TUESDAY  10/6     |WEDNESDAY 10/7
                         |THURSDAY 10/8     |FRIDAY 10/9
                         |SAT 10/10 - SUN 10/11
11:00 Salary Review
12:00 OC                 |                  |
                         |12:00 OOD         |
                         |
<>-----------------------------------------------------------
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--------
MONDAY  10/12            |TUESDAY  10/13    |WEDNESDAY 10/14
                         |THURSDAY 10/15    |FRIDAY 10/16
                         |SAT 10/17 - SUN 10/18
                         |                  | Woods
                         | Woods            |
<>-----------------------------------------------------------
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--------
MONDAY  10/19            |TUESDAY  10/20    |WEDNESDAY 10/21
                         |THURSDAY 10/22    |FRIDAY 10/23
                         |SAT 10/24 - SUN 10/25
12:00 MC at MR           |                  | Jungle
                         | Jungle           |
                         |
<>-----------------------------------------------------------
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--------
MONDAY  10/26            |TUESDAY  10/27    |WEDNESDAY 10/28
                         |THURSDAY 10/29    |FRIDAY 10/30
                         |SAT 10/31 -SUN 11/1/81
12:00 OC                 | Annual Meeting   |
                         |Colo Review - Colo
                         |                  |
```

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MONDAY  11/2/81          |TUESDAY  11/3     |WEDNESDAY 11/4
                         |THURSDAY 11/5     |FRIDAY 11/6
                         |SAT 11/7 - SUN 11/8
12:00 MC                 |                  |
                         |12:00 OOD         |
                         |
<>-----------------------------------------------------------
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--------
MONDAY  11/9             |TUESDAY  11/10    |WEDNESDAY 11/11
                         |THURSDAY 11/12    |FRIDAY 11/13
                         |SAT 11/14 - SUN 11/15
11:00 Salary Review
12:00 OC                 |                  |
                         |12:00 OOD         |
                         |
<>-----------------------------------------------------------
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--------
MONDAY  11/16            |TUESDAY  11/17    |WEDNESDAY 11/18
                         |THURSDAY 11/19    |FRIDAY 11/20
                         |SAT 11/21 - SUN 11/22
                         |Woods             | Woods
                         | Woods            |
                         |
<>-----------------------------------------------------------
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--------
MONDAY  11/23            |TUESDAY  11/24    |WEDNESDAY 11/25
                         |THURSDAY 11/26    |FRIDAY 11/27
                         |SAT 11/28 - SUN 11/29
MC                       |                  |
                         |                  |
                         |
<>-----------------------------------------------------------
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--------
MONDAY  11/30            |TUESDAY  12/1/81  |WEDNESDAY 12/2
                         |THURSDAY 12/3     |FRIDAY 12/4
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|SAT 12/5 - SUN 12/6

OC

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--------
MONDAY  12/7/81          |TUESDAY  12/8     |WEDNESDAY 12/9
                         |THURSDAY 12/10    |FRIDAY 12/11
                         |SAT 12/12 - SUN 12/13
12:00 MC at Mk           |                  |
                         | Colo Rev - Colo  |
                         |
<>----------------------------------------------------------------
----------------------------------------------------------------
--------
MONDAY  12/14            |TUESDAY  12/15    |WEDNESDAY 12/16
                         |THURSDAY 12/17    |FRIDAY 12/18
                         |SAT 12/19 - SUN 12/20
BOD                      |                  | Woods
                         | Woods (OOD)      |

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MONDAY  12/21            |TUESDAY  12/22    |WEDNESDAY 12/23
                         |THURSDAY 12/24    |FRIDAY 12/25
                         |SAT 12/26 - SUN 12/27
11:00 Salary Review
12:00 OC                 |                  |
                         |                  | Christmas Day
                         |
<>----------------------------------------------------------------
----------------------------------------------------------------
--------
MONDAY  12/28            |TUESDAY  12/29    |WEDNESDAY 12/30
                         |THURSDAY 12/31    |FRIDAY 1/1/82
                         |SAT 1/2 - SUN 1/3
12:00 MC


****FORM****
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MONDAY  <> (RL0.S5.2)    |TUESDAY  <>       |WEDNESDAY <>
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                         |THURSDAY <>       |FRIDAY <>
                         |SAT <> - SUN <>
GB Calendar
1980-------------------------------------------------------------
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----
MONDAY  12/22            |TUESDAY  12/23    |WEDNESDAY 12/24
                         |THURSDAY 12/25    |FRIDAY 12/26
                         |SAT 12/27 - SUN 12/28
----)                    |----)             | Florida
                         |---)              |---)
                         |---)
12:00 OC                 |                  |
                         |                  |
                         |
                         |                  |
                         |                  |
                         |
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-----------------------------------------------------------------
--------
MONDAY  12/29            |TUESDAY  12/30    |WEDNESDAY 12/31
                         |THURSDAY 1/1/1981 |FRIDAY 1/2
                         |SAT 1/3 - SUN 1/4
---)                     |---)              |---)
                         |---)              |---)
                         |--)
Maynard ]                |                  |
                         |New Year's Day    |
                         |
<>1980-----------------------------------------------------------
-----------------------------------------------------------------
--------
MONDAY  12/15            |TUESDAY  12/16    |WEDNESDAY 12/17
                         |THURSDAY 12/18    |FRIDAY 12/19
                         |SAT 12/20 - SUN 12/21
                         |                  |Home-sign papers
                         |                  |
                         |
8:30 Glenn Reyer         |8:30 Lee Williams |8:30 Bob Gray -
here| Woods              |8:30 KO et al     |
                         |  here            | lqp02 activity
```

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                        | 8:15 - 4:45      | KO CR
                        |GB - Florida
11:00 TOM GRILK - HERE  |                  |10:00 LP RE 12-1
                        |   Eng. CR        | Re product
devel.                  |
 LEGAL/DG SUBPOENA      |11:00 Demmer here
                        | (KO COMM inputs)
12:00 Bob Flynn-here    |12:30  Patent lunch
                        |                  | \tab | \tab |
 LRG SYS Update
1:00 JOAN ROSS --EMS    | ML cafeteria     |12:00 Mudge -
here                    | \tab |  \tab |
                        |2:30 R&D Oper.Rev | lunch
                        |                  |1:00 VMS &
DECNET                  |
                        |                  |
                        |                  |
SAM,CUTLER,LAUCH        |
                        |                  |1:00 Avram -
here                    |5:00 Demmer - here
                        |                  |
2:00 ACOUSTIC LAB ML2-1|GLORIOSO ML4-4     |
                        | re KO meeting Fri
                        |3:30 Gilbert et al
                        |
 opening-Bob Lotz       |5:00              |4:00 Lewicki -
here                    |6:00 ST.Amour-retire|
                        |
4:00 Doug Clarke-here   |5:30 Craig party  |4:30 Turkey Give
Out| Sheraton Box       |
  personal              | Antonia's        |  Nancy Star
                        |                  |
                        |                  |6:00 Jenks etal
                        |                  |
                        |                  | Chez claude
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MONDAY  12/8              |TUESDAY  12/9     |WEDNESDAY 12/10
                          |THURSDAY 12/11    |FRIDAY 12/12
                          |SAT 12/13 - SUN 12/14
                          |8:00 EBOD - MK aud.
                          |                  |
                          |hold for Gwen/Pell
                          |9:00 Rodgers/Dement
8:00  Dick Yen - here     | to               |
                          |                  |
                          | Fredkin--Lincoln
9:30 HOLMAN               |12:30             |9:00
                          |                  |
                          |
10:00 Meany re CMU-here| 12:30 GLEN REYER   | Wash. D.C.
                          |10:15 BRIDGET -here
                          |                  |Sat: Spit Brook
Open
11:00 Pat Ward-new mkt    |  WILL MEET AT MK
                          | NAE              |
                          |                  |   house 2:30
 newsltre  interview      |  AUD. - LUNCH    |
                          |                  |11:30 Eric
Pollack                   |
 (Bob Lane group)         |                  |
                          |11:30 VMS - here  | TechRev Rap--
Your Of
                          |                  |
                          | WD,LP,BJ,SAM
12:00 MC - Maynard        |2:00 Plowman - TW
                          |                  |12:00 OOD
                          |1:00 OFIS - Spitbrk
                          |
                          | re Hydra-pole C5 |
                          |                  | Eccles-Jordan
                          |
                          |3:00 CI demo--TW  |
                                             |5:00
5:00 OOD update -here     | Rodgers
                          |6:00 Eur.Eng.     |
```

| |
|
| LaPetite, Maynard

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MONDAY  12/1                |TUESDAY  12/2     |WEDNESDAY 12/3
                            |THURSDAY 12/4     |FRIDAY 12/5
                            |SAT 12/6 - SUN 12/7
(DEC-BOD)                   |(OC+Sal Rev)      |
                            |(State of Corp.)  |
                            |10:40A L Munih
Newcastle                   | Geneva           | Munich
                            | Munich/Siemens   | Munich/DEC
                            | 5:00P A Boston
<>--------------------------------------------------------------
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--------
MONDAY  11/24               |TUESDAY  11/25    |WEDNESDAY 11/26
                            |THURSDAY 11/27    |FRIDAY 11/28
                            |SAT 11/29 - SUN 11/30
(8-9--DEMMER IN GB'S        | (LRP__LP)        |
                            |                  |
                            |
OFFICE)                     | London           | Infotech
Lecture                     | Thanksgiving     |
                            |Sun: Newcastle
(MC--LP) Reading            |                  |
                            |                  |
                            |
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MONDAY  11/17               |TUESDAY  11/18    |WEDNESDAY 11/19
                            |THURSDAY 11/20    |FRIDAY 11/21
                            |SAT 11/22 - SUN 11/23
8|15 Mike Gutman - here|
9:00 Stewart - here         |8:15 WD - here    |
                            |(OOD)             |8:00 ENG ORG
                            |
 EMS/VMS                    |9:15 Per here
                            |                  | Technical
Strategy                    | Woods (GB+LP)    | SHEL,KO,LP,SI
                            | 6:25A A London
12:00 WD,Si,-here re        |1:00 Tech Meeting |
                            |                  | Page Farm Road
                            |
 + Doyle                    |  ML23-3          |
                            |                  |
                            |
1:00 SI'S off + LP          |                  |
                            |----)             |
                            |
                            |                  |
                            |                  |
                            |
SET $ ENVELOPES             |6:00 Dinner/Antonios| 5:00 Holman +
arch                        |                  |7:15P L Boston
                            |
5:00Bob Gillespie U-Wsh|  |  plans for 12 lobby|
                            |                  |
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MONDAY  11/10              |TUESDAY  11/11    |WEDNESDAY 11/12
                           |THURSDAY 11/13    |FRIDAY 11/14
                           |SAT 11/15 - SUN 11/16
GB CAR CHECKUP             |                  |
                           |8:30 Pell/Rudman-home8:45
Rodrigues- here|
9:30 Shebell re Dan        |8:30  EBOD - MR   |8:30 R&D BOD -
here                       |10-12 MTZ-monthly |  GB,RC,BJ
                           |Sat: Mudge Wedding
                           |                  |
                           |                  |10:30Gutman
career                     |
10:00 SO+RC re KO MKT      |\tab |Glorioso et al
                           | meeting--here    |12:30 RT32/VMS
DEMO                       |
11:00 Salary Review        |1:00 SMALLTALK demo
                           |12:00             |
                           |  Hustvedt--Sptbrk
12:30 OC                   | MR1-2,POLE M12   |1:00 BERNIE et
al                         |12:00 MEYER Rap-here|1:00 OFIS -
Spitbrk                    |
                           |                  | here re CT arch
                           | 1:00 LP rap-here |
7:00 Reception             |3:00 TI - Museum  |
                           |3:00 LP space     | Jordan Eccles
Rm                         |
20 yr Award Dinner         |5:00 Atanasoff Lect
                           |Atanasoff dinner  |\tab |5:00
                           |
                           |8:00 CHEZ CLAUDE  |
                           |5:00              |
<>1980------------------------------------------------------------
------------------------------------------------------------------
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MONDAY 11/3                |TUESDAY  11/4     |WEDNESDAY 11/5
                           |THURSDAY 11/6     |FRIDAY 11/7
                           |SAT 11/8 - SUN 11/9
8:45 Santini-Bedford       |                  |8:30 SHANZER-
5159                       |7:00A             |8:15 OC--LRP
```

|
| |10:00 Duane
Dickhut | Wash. D.C. | (GB+LP)
11:00 CSS Cooperative | |11:00 MAURCIE--
here | |
Graphics, here |1:00 OFIS - Travis
|1:00 Lauck-here NI
| CS&TB | AK CR
| | arch support
| |
|
2:00 MC - Maynard | Spit Brook |2:00 PRE EBOD
| |
|
| Eccles/Jordan | SI's OFFICE
|Ret: 8:31P Boston |
|
|5:00 |3:00
<>1980--

MONDAY 10/27 |TUESDAY 10/28 |WEDNESDAY 10/29
|THURSDAY 10/30 |FRIDAY 10/31
|SAT 11/1 /SUN 11/2
| |8:30 Kobyashi -
here| | |
| |9:15 MIKE W. re
Fri.|
9:00 BTL visit | |10:00 FRIDAY-
here | Wash.D.C. | Wash. D.C.
| Pitts/Boston
ENG. CR |11:00 Annual Meet |12:30 Lunch-
Hudson |11:15 Panel | NAE Peer
Meeting |
11:00 | BOSTON | ARPA/Titcomb
|
|
12:00 OC | | + meeting
|
4:30 Space concept | | Birch Room--to
rt | |
|

Pfyffer,LP's off		of front door

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<>1980-------------------------------------------------------
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MONDAY  10/20               |TUESDAY  10/21    |WEDNESDAY 10/22
                            |THURSDAY 10/23    |FRIDAY 10/24
                            |SAT 10/25 /SUN 10/26
8:30  Bernie Geaghan        |8:30 ULF OPER REV | Drive with
Cudmore                     |                  |8:15 Avram -
here                        |
9:00 KO+WH - GB REVIEW      |AT MR (AK CR)     |  Jungle
                            |  Jungle          |9:30 KO
Brochure-Don J.
11:00 BJ+LP RE              |12: BOB NEALON-AK CR|
                            |                  |10:30 MEYER IDP
                            |
  Cutler Project            |1:00 OFIS - Travis
                            |   Minary - NH    |  Minary - NH
                            |  LP office       |
                           SUN-SI WINE & CHEESE
                            |                  |
                            |                  |12:00 LP+WD-here
12:00 MC at MA              | Spitbrook        |
                            |                  |1:00 Schalke re
PS                          |    PARTY???
4:00 Kotok/here               Eccles/Jordan    |
                            |                  |2:00 Glorioso-U
rela|
  COMM Strategy             |5:00              |
                            |                  |3:00 EMS--Morris
etc|
<>1980-------------------------------------------------------
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MONDAY  10/13                |TUESDAY  10/14   |WEDNESDAY 10/15
        |THURSDAY 10/16     |FRIDAY 10/17      |SAT 10/18 /SUN
10/19
8:30 RT, Sam, Larry Wade|8:30 Grant Oper Rev|
        |                   |8:15 THE KO       |SAT:9:00 SPIT
BROOK
/      et al,ML12-3 Gld Rm  |                  \tab | Woods
        |                  Woods               |9:00 Annual
Meeting|
```

```
10:00   |12:00 OOD--ENG.CR |  PK3 Aud          |  PK3 Aud
        |                  Review - KO CR     |
                           |                  |
        |                    |10:00ISH museum   |
11:00 Tom Kobayshi-here   |2:30 Leave-Weston |
        |                    | Shel,Bill T.,GWEN
        |
12:00 Moffa/here/lunch    |3:30 Geo.Ball Panel|
        |                    |1:00 hold WD NI COMM|
1:00 DIST SYS LATE '80    |  Henderson House |
        |                    |                at TW,Site Mgm
CR|
P. etal-Gold Rm           |  (4:00-6:00)      |
        |5:00 SHEL ET AL   |                  |
4:00 BJ 10/20 Review      |6:30 OOD dinner   |7:00 IEEE talk
        |                  his office         |
        |
       LP OFFICE          |  Page Farm Road  |  Museum
        |                    |                  |
<>1980-------------------------------------------------------------
-------------------------------------------------------------------
------
MONDAY  10/6              |TUESDAY  10/7     |WEDNESDAY 10/8
        |THURSDAY 10/9    |FRIDAY 10/10      |SAT 10/11 /SUN
10/12
8 avram
9:30 Si Oper Rev          |8:30 Boston Sales |8:l5 Oper Rev-
hdq     |9:00 Bill Lukens |8:l5 THE KO       |
|       Eng. CR           |  brkfst talk     |9:30 Oper Rev-MS
        |                  Page Farm Rd       |10:00 ID lab re
VT      |
                          |                  |
        |                    | & CABs/Urbanis
        (GWEN use office) |                  |
        |                  +3 Christ.Sct.Cust|11:00 Mileski-
here    |
12:00 -avram et al        |  Sheraton Lex.   | Str-KO CR
        |                    |                DECMAIL
        |
1:00 Bernie - here        |11:00 Ollie--Spit |
        |11:30 tour Bedford  |12 Glorioso--lunch
        |
```

Re Nebula |Aiken Rm-2E-B |10:45
|12:00 OOD CR-A2 |1:00 R&D Lab re |
|1:00
2:30 MFG./ENG--GB,WD |3:00 OFIS Travis |11:30 5-yr award
| BEDFORD | robots
|
\tab SHEL*,SMITH, Hansen | Spit brook | Powdermill
Res. | |2:00 Leave |
3:30 here |\tab Eccles Rm-Jordan
|2:00 Ulf - Tech. | |3:00 Automatix
|
3:30 Sam - re CAD |5:00 |3:00 Ulf -
IDB+LP
et al--Gold Room | |
|
6:00 OOD Dinner-Lapetite| | |
| |
<>1980--
MONDAY 9/29 - SEPT. |TUESDAY 9/30 |WEDNESDAY 10/1
|THURSDAY 10/2 |FRIDAY 10/3 |SAT 10/4 /SUN
10/5
8:30 RC Operat. Review |8:30 Eng.Buy out |8:30 KO +LP,GB
| NEW YORK | NEW YORK
| NEW YORK
HL--Hall of White | WORKSHOP--Concord |
re org.of the KO | |
|
Mists | Dave Carlisle |10:30 SAM--SYS
ARCH| | |
11:00 Leave for MK |1:00 BJ,GB,LP re DC| HOLD
|1:15 ICC80 panel | |
12:00 MC at MK |2:00 Kur Oper.Rev |12:00 Glorioso
| | |
| Mill Cafe | U programs
| | |
| |1:00 RT
continued
| | BJ et al/gold
rm |
|5:00 |2:00 Ulf VENUS

REV | | |
| |\tab LP office
| | |
| |5:00

May 24, 1982

John D. Roberts
Vice President and Provost,
Dean of the Faculty
California Institute of Technology
Pasadena, CA 91125

Dear Jack:

Following are my expenses incurred during my visit last week, May 19 thru 21, to attend CALTECH's Visiting Committee meetings:

Mileage (Lincoln/Boston/Lincoln)	
50 miles @ 20 cents per mile	$10.00
Tolls	.60
Parking	15.00
Airfare	514.00
Total	539.60

I received the honorarium and have endorsed it to the Digital Computer Museum. California Institute of Technology is now a founder of the museum...congratulations!

I thoroughly enjoyed learning about computing at CALTECH and I hope we have helped clarify the direction.

Sincerely yours,

Gordon Bell

Vice President, Engineering
Keeper, Digital Computer Museum

GB:mal
GB3.S5.7
****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION DATE: TUE 25 MAY 1982
4:02 PM EDT

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: FASTER VAXES AND SCIENTIFIC COMPUTING AT CALTECH

At a CalTech Visiting Committee on computers, I got an enthusiastic endorsement for CDC's Vector Fortran for the 205. They endorse it because it helps them write better programs! I said: Get it standardized! (This totally agrees with my own biasses and historical observation that "Hardware follows software" and the reason we don't have vectors is that Fortran and nearly all other languages don't support them.)

They are currently ecstatic users of VAX, because none of them have any of the hotter 32-bit machines. They use external supercomputers. Let's look at the Fortran and extend ours, and see if we can speed things up by the language. (See Professor Geoffrey Fox) Vector

microcode in some form might help a language.
Noyce Comment on Vectors. Jeff reports that a scientific chip to supplement the 432 is coming to boost performance X 100.

Using the 2080 Accelerator

If the 2080's as fast as we're hoping for, the big market is as a VAX accelerator, at these sites not another general purpose timesharing system. IBM and IBM-compatibles have the large, shared central system market. VAX's have been undermining these centers. Let's play to our strengths.

Using the FPS 164 as a 780 Accelerator

We MUST really understand this and really support it as we're faced with the high performance 32-bit minis that'll try to capture VAX market. Who can take it on?

SPSS

On VAX is apparently very slow. Why? Who? Isn't this an LDP responsibility?

Multi Computer Project

Professor Charles F. Seitz (CS) and Professor Geoffrey Fox (Theoretical physics) are going balls out to get an easy to build, 64 computer system up that's 20 x a 780 or 1/2 a cray based on an 128K byte 8086/8087. The 64 computers pass messages to their peers on 6 busses, in packets, at a rate about equal to the 8087 FAD time. I'm

sending a paper around on this. It looks like a great alternative to
the FPS. They're confident it'll work and can be programmed by
mortals for many problems. I see it useful as a simulator and router.

Having been directly involved in designing 4-50 multiprocessors, I say
- fantastic - it would be great to have a simple solution. Note, if
they find it, the whole computer market becomes one large commodity
business. Let's get them J-11's A.S.A.P., and then MicroVAX when they
go to 1000 computers! Frankly, I'm impresed with this work. The key
just maybe the user involvement of their system.

"TO" DISTRIBUTION:

FOREST BASKETT	RON BRENDER	BILL DEMMER
DON HOOPER	ULF FAGERQUIST	SAM FULLER
ROSE ANN GIORDANO	BOB GLORIOSO	PER HJERPPE
PETER JESSEL	BILL JOHNSON	JEFF KALB
BILL KEATING	BILL LONG	MAHENDRA PATEL
MARY PAYNE	BILL STRECKER	BOB SUPNIK

GB3.S5.49

At a CalTech Visiting Committee on computers, I got an enthusiastic endorsement for CDC's Vector Fortran for the 205. They endorse it because it helps them write better programs! I said: Get it standardized! (This totally agrees with my own biasses and historical observation that "Hardware follows software" and the reason we don't have vectors is that Fortran and nearly all other languages don't support them.)

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****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION   DATE: WED 26 MAY 1982 11:11 AM EDT

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: CALTECH VISITING COMMITTEE TRIP REPORT

A VAX, DISTRIBUTED PROCESSING SHOWCASE

As a member of a visiting committee to look at their computing, I got a glimpse of CalTech, one of my favorite places. The committee included McCredie, Dave Pensak and Ralph Gomry, VP of Research IBM. Their problem is that distributed computing has removed support for all central computing. Now they're installing Ethernet to make our computing environment a reality. Note that a really good service is operating the Network, as the need for centralized computing could disappear. In effect, distributed VAX's undermined the Computing center and overthrew it.

LET'S MARKET, ADVERTISE AND SELL VAX. We need a product marketing group that would go back and finish the "ask any user" series. Here, we'd just show CIT. They are fanatics about owning and running their own VAX's at personal, project and departmental levels. (They don't like the central VAX's). They love it because it's: cheaper, run exactly like they want (priority-wise) - switching daily if necessary, less people intensive, more convenient good for instructing people on how computers really work, and giving them much more service. They use the honor system to control expendables, do all their own systems work, hire DEC maintenance and buy third party peripherals. (Incidentally, this may also mean we shouldn't have computation centers within DEC! VAX's could be owned/operated by person or group just as WPS's are.) A strong CIT ad would have a profound effect on our own marketing to education and laboratories!

The students (800 of them) have a VAX, but want much more. Currently they're lobbying for a 2060. They've unfortunately just bought a 4331- and are starting to do interactive, administrative dp on it. We should have gotten this order! Is this a problem of the fact that CalTech is LDP and not EDU or a Commercial account? Apparently SCT (System and Computing Technology) is coming in to do their administrative computing. Do we sell VAX software here?

They need supercomputing too and individuals use Cray's and

205's
whenever possible on an ad hoc basis. The 2080 can help. They're also looking at an FPS 164 but are worried about getting the performance out of it. They recommended Heath 789's at $2.9K for Word Processing. We really should now push Professionals and DECmate II's!! Note, DECmate has BASIC. We really ought to have tried to push DECword, together with BASIC as a high performing, VAX compatible system. Since there's little graphics, we need to get them some 125's to get started.

They're just starting to install powerful PC's in CS. Carver got a bunch from HP using the 68K.

They're very interested in the Professional also as a VAX compatible alternative to their low cost Heath P/C's.

"TO" DISTRIBUTION:

BILL DEMMER	SAM FULLER	WIN HINDLE
BILL JOHNSON	BILL KEATING	ED KRAMER
R.L. LANE	LARRY STAHL @WLAB	BILL LONG
KEN OLSEN	MAHENDRA PATEL	JACK SHIELDS
BILL STRECKER	DEL THORNDIKE	BOB TROCCHI

GB3.S5.53

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GB0002/60

d i g i t a l **i n t e r o f f i c e m e m o r a n d u m**

Subject: **Phone call with John Gray of CALTECH re: Funding in their Silicon Structures Research Program these next 2 years**

To: Jim Bell, ML3-2/E41
George Chamberlain, MS/B80
Dick Clayton, ML12-2/E71
Dick Eckhouse, ML3-2/E41
Bill Green, ML1-4/B34
Ted Johnson, PK3-2/A55
Bob Kusik, ML3-5/H33
Craig Mudge
Rich Peebles, ML3-2/E41
Bob Puffer, ML12-2/E38
Jerry Witmore, PK3-1/M40

Date: 5/13/79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

John Gray called me regarding his concern over the funding deal that we are proposing with CALTECH. His concern was that the other sponsors (i.e. IBM and HP) were really upset because they have other policies about equipment grants, etc. In effect, they are paying for DEC equipment. It seems like the only way out is for us to get out of the program, but this may be premature.

The problem comes because they are using our equipment for the work, and it feels like we are even profiting from the deal. This last proposal, which seemed ok by me is: we give them 20% off on the equipment and then we give our share in 2 - 100K equipment grants for two years. This, said another way, is we give them a 300K equipment grant and they buy 500K worth of equipment.

The other sponsors see it as: DEC sells 500K worth of equipment which the other sponsors buy with their cash grants; the equipment costs us somewhere between 125K and 167K (actually 250K?); 400K of cash comes to us and we make a cool 75K or 33K.

Somehow we're supposed to suffer (John Gray's englishman attitudes showing through). He feels we should pay something what amounts to an out of pocket expense of 100K in cash and not treat them as a customer, but rather as part of our engineering which doesn't have to pay that much for equipment.

I suggested that we give early delivery. We should get the equipment there before the end of this fiscal year because we have it in stock and the budget can afford it...here it could come out of the engineering budget cause we are underspent.

Any ideas? (I would hate to go because we want something like this arrangement at CMU.)

GB:swh

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Jim Bell	ML3-2/E41	George Chamberlain	MS/B80
Dick Clayton	ML12-2/E71	Dick Eckhouse	ML3-2/E41
Bill Green	ML1-4/B34	Ted Johnson	PK3-2/A55
Bob Kusik	ML3-5/H33	Craig Mudge	
Rich Peebles	ML3-2/E41	Bob Puffer	ML12-2/E38
Jerry Witmore	PK3-1/M40		

January 8, 1980

The Cambridge School
Weston, Massachusetts 02193

Dear Ms. Youngren:

Enclosed is one box of floppy disks.

Please contact Don Curns, DEC Waltham, (895-5000, X5060) for purchase of additional floppies and supplies for your machine. They can also send you a supplies catalog.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:swh
GB1.S1.9
Enclosure - box of floppy disks

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+---------------------------+                            GB0003/37
|   |   |   |   |   |   |   |
| d | i | g | i | t | a | l |   i n t e r o f f i c e   m e
m o r a n d u m
|   |   |   |   |   |   |   |
+---------------------------+
```

Subject: **Camera Pass**

To: Al Alexanian, NR

Date: May 30, 1979
From: John Kulik
Loc: MS/B61 Ext: 223-4569

CC: Gordon Bell, ML12-1/A51

Russell Turner and Brigham Bell have permission to bring their cameras into the warehouse to carry out their assignment of cataloging/photographing DEC museum parts. This is effective from May 29 thru September 1.

John Kulik   Date

00 BURT DECGRAM ACCEPTED S 1665 O 31 12-FEB-81 13:02:00

```
*****************
* d i g i t a l *
*****************
```

TO: ANDY KNOWLES DATE: WED 11 FEB 1981
16:23 EST

FROM: GORDON BELL
cc: see "CC" DISTRIBUTION DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: RE: YOUR PROJECT IN CANADA

Fantastic. Let's get cracking! This is a product that can make it on a worldwide basis, and there's a very high volume follow-on in 85. The display technology is Canadian with Philips and I'd support recruiting the engineering persons from here on the display. You could also work in the image processing area which would get lots of R and D support from the Canadian government, plus there can be some immediate products.

"CC" DISTRIBUTION:

BILL DEMMER DENNY DOYLE SAM FULLER
TED JOHNSON BILL LONG BOB ROCKWELL

GB2.S4.24

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+---------------------------+                             ID#336
|   |   |   |   |   |   |   |
| d | i | g | i | t | a | l |   interoffice   memorandum
|   |   |   |   |   |   |   |
+---------------------------+
```

Subject: **Capabilities vs Rings**

To: Rich Peebles, ML3-2/E41
Bill Strecker, TW/A08
Dick Hustvedt, TW/D08

Date: 7 NOV 78
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

follow up 11/21/78

Are you aware of the paper in this area by Denning?

What does it mean?

GB:ljp

The Store Manager reports to the Director. There are presently two part-time store assistants each working two days 1-6 p.m.

The Manager's main functions are to plan, organize, direct and control the operations of the store as follows:

A. Physical Store
   1. Display merchandise
   2. Layout
   3. Maintenance
   4. Storage
   5. Security

B. Store Personnel
   1. Recruitment, Selection and Training
   2. Supervision and Team Meetings
   3. Scheduling
   4. Duties of store assistants
      a. open, operate, close store
         1. clean cases
         2. display merchandise
         3. inventory control
         4. address mailings for museum and store
         5. greet public who are potential customers (most important duty)

6. answer questions about museum and store merchandise

b. other duties

1. update display board in lobby
2. artwork such as posters, placecards for dinners, signs,etc.

C. Buying

1. Determine needs and interests of customers
   a. Coordinate merchandise with exhibits
   b. determine big sellers

2. Locate sources
   a. search for new products
   b. attend gift shows
   c. read catalogs
   d. spend time with salespeople
3. negotiate prices and place orders
4. Delivery schedules
5. Follow up orders
6. Check in merchandise

D. Merchandising

1. Unit Control
2. Taking Inventory
3. Pricing
4. Advertising: high tech vans, Digital This Week (DTW)

E. Systems

1. Sales System

2. Accounting

3. Sales Summaries

4. Check Invoices

5. Record gifts and loans to Museum personnelwithin the organization

F. Customer Service

1. Mail Orders
   a. check incoming order form for arithmetic, checks, charges
   b. check merchandise out of inventory
   c. pack order
   d. thank you note to customer or note explaining an incomplete order
   e. phone customers to correct errors in charge or inventory
   f. record and document sale
   g. returns
   h. feedback

2. Telephone orders

3. Catalogs
   a. Fall catalog with Fall Report
   b. Spring catalog with Spring Report

4. Merchandising Mailing List
   a. List of merchandise carried in store other than that in catalogs
   b. List in process of being compiled
   c. to be sent to printer
   d. then to customers who request it

G. Long-range Planning

1. Business Plan for 1983
   a. Projections of sales in 83
   b. justify salary
   c. inventory control - what to carry, how much for store, how much for mail order business
   d. sales contacts and contracts; lock in inventory for year

e. inventory on regular basis and computerized
f. match expenses with revenues

H. Documents, reports, lists used in operation of Store are stored or filed in Store office. No floppies are used at this time.

1. Sales Slip
2. Monthly Sales Reports to staff
3. Daily Sales Summaries (to Bus. Mgr.)
4. Inventory Turnover
5. Purchase Orders
6. Invoices
7. Catalog Order Forms
8. Inventory Lists
9. Personnel Schedules
10. Accounting System is being devised

I. Daily Schedule

1. Sales Slips
2. Tally Sales Slips
3. Check inventory from sales slips
4. check MC/Visa charges

J. Weekly Sales Summary

1. Mail Orders

2. In Store Sales

3. Inventory

K. Monthly schedule

1. Monthly Spread Sales Sheet

2. Monthly Reports

a. what was sold
b. best sellers

Professor Carver A Mead
Computer Science Department
California Institute of Technology
Pasadena, California

Dear Carver:

Was delighted to finally learn of your election to the National Academy of Engineering. As one who has been part of your election process (hopefully as a helper) over the years, it is indeed gratifying that the Academy has finally made the right decision. I think and hope you can be helpful in the Academy by providing some strong, revolutionary views about Engieering... which it badly and often needs.

How about stopping by and meeting the Encore principals on a trip through Boston?

Will see you in Palo Alto soon. I am getting to be very concerned about having to reinvent all the standard tools for Silicon Graphics before we can go into business with "The Compiler", because I don't think the company or board understands the investment or time this is going to take. I would like to hit this issue head on at the next meeting.

Sincerely,

Gordon Bell
Chief Technical Officer

+---------------+
! d i g i t a l !   i n t e r o f f i c e   m e m o r a n d u m
+---------------+

Subject: **Marketing Computer Corporation of America's (CCA) Mail System**

To: John Alexanderson, Don Alusic, Jim Bell, John Buckley, Roger Cady, Al Crawford, Jack Gilmore, Ken King, Andy Knowles, John Leng, Julius Marcus, Stan Olsen, Art Krusinski, George Plowman, Chuck Stein, Marketing Committee

Date: 20 JUNE 78
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

follow up 7/5/78

For the last few years we have been engaged in a joint development with CCA. Julius Marcus gave them a machine on which to develop the software, Al Crawford has been operating their system on a test basis and Ken King has been working on the co-ordination. It'll run on RSX-11/M 11/34 or bigger.

They are advertising (see the attached ad) and have about six organizations in a market test of several hundred subscribers, and they have many enquiries for more subscribers from commercial, lab and government customers. Telenet is threatening to build and offer a similar service.

Now it's time to get a serious marketing/distribution thrust. They believe the potential is bigger than they can satisfy, and they would like us to either get involved so as to install the hardware and their system or take on the marketing. If we did this there would be several product groups routes:

0. Treat them like a hardware or software OEM.

1. Commercial.

2. Word Processing (Office Automation -- if Stan takes over this charter area too).

3. Communications P/L (if we only had one).

4. A basic DECnet product (like Fortran) that all groups would sell.

5. A basic software product sold through ASG.

6. Other?

The president, Tom Marill, is a friend and since I believe he has a very nice product (in this case unique), I'd like suggestions and help on how we can get the product into the marketplace -- and sell a lot of RSX-11/M systems!

Any suggestions?

Which distribution method?

Who can carry on this banner in order to get this product to the market?

GB:ljp

Attachment

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Win Hindle	ML5-2/A53	Ted Johnson	PK3-2/A55
Andy Knowles	MR2-2/A52	Stan Olsen	MK
Bill Thompson	ML12-1/F41		
John Alexanderson	NQ	Don Alusic	MK
Jim Bell	ML3-2/E41	John Buckley	MK
Roger Cady	MK	Al Crawford	PK3-2/F34
Jack Gilmore	MK	Ken King	ML3-2/E41
Art Krusinski	WA	John Leng	MR1-1/A65
Julius Marcus	MK2/C37	George Plowman	ML5-5/E97
Chuck Stein	ML5-5/E97		

EMS 30-JUN-79 18:43:06 130 1

To: Al Crawford, Don Alusic, Jack Gilmore, Murray Copp
CC: Al Bertocchi, Stanley C. Olsen, Mary Jane Forbes
From: Gordon Bell
Date: SAT 30-JUN-79 18:43:06 ED
Subject: Embarassing Discussion with Tom Marrill last nite

Tom asked me what was happening given that his people have heard many rumours and probably started some. He had heard that we had pirated the ideas from Comet, put together a system and are now in the throws of test marketing it, having sold it and announced it a recent show in Chicgo. They (his people)

believe with the actions according to to the rumour, that we are violating
the contract we had with CCA. They are frustrated with the issue of not being
able to deal with a large company in a straightforward way such that there
are clear actions that follow the general trend (which they had been thinking
was positive). Now, this is a big yank around and opposite what they got as
signals from us. For some reason, they perceive this as unfair... because it
is certainly easy to understand why he /they think this way.

I told him the following: we (CIS) had decided to use the LDP system and I
knew not why, given the unclear direction of MUMPS on it and where it was
heading and what the performance of such a system would be...because Kramer
wanted it, it had more features, and d maybe becuase it was internal; we
could probably show him a manual of the LDP system; there is no way that we
are anywhere near announcing or even test marketing a product based on this or
any other system..

Unless you can see anything wrong with it, I would like to meet with you and
CCA when you have the message ready. I asume it is approximately what I
believe it to be as I relayed to him. It seems like there is nothing with
giving them the LDP spec and our internal reasons. After all, I presume they
have been working hard to make Comet met our idiosyncratic requirements, etc
and that as a minimum this is what should happen.

You guys ever read any of that garbage called DEC Philosophy where we go into

how to treat vendors, people etc./

Command:

EMS 2-JUL-79
11:19:55 590 1
To: Gordon Bell
CC: Don Alusic, Jack Gilmore, Murray Copp, Al Bertocchi,
Stanley C. Olsen
CC: Mary Jane Forbes
From: Al Crawford
Date: MON 2-JUL-79 11:19:55 ED
Re: Embarassing Discussion with Tom Marrill last nite
From: Gordon Bell Date: SAT 30-JUN-79
18:43:06 EDT
Message ID: EMS 30-JUN-79 18:43:06 130 1

I had heard Marrill was naive in business dealings. On the other hand, from
his recent conversation with you, he seems to know how to negotiate--subtly.

Obviously, the decision must be a disappointment to CCA. From what I have
observed, we have been quite ethical and "upfront". His people have been
informed of the decision and why. We have failed, however, to formally close
the transaction with them on the internal product. I do not know what is
occurring insofar as external relationships with whatever Product Lines have
been dealing with CCA and COMET, eg, GIS.

Yes, we shall arrange to get the principals together with Marrill. There is a
User Handbook available for the LDP package, and there is no reason why we
cannot give CCA a copy.

Command:

EMS 2-JUL-79
11:01:50 070 1
To: Gordon Bell
From: Roger Cady
Date: MON 2-JUL-79 11:01:50 ED
Re: I'm frustrated
From: Gordon Bell Date: SAT 30-JUN-79
18:49:30 EDT
Message ID: EMS 30-JUN-79 18:49:30 390 1

Gordon, please be careful that we don't let a vendor yank us around either.
I do not feel that the Comet product is as good as the LDP one, and we
shouldn't necessarily let the MUMPS base be the determining factors. I
believe the salient reasons for chosing one over the other should be:

Ease of use -- the comet editor is an abortion

Features -- the LDP system has calendar etc.

Tie in with wordprocessing -- The comet will not allow direct coupling
of wordprocessing, you can't dump a word processed message into
the EMS system.

Ability to standardize on WP format (ala DEC) -- should be easier on our
own product.

Human Engineering -- I still get lousy backslashes on my CRT because
apparently no one thought about anything but hard copy. I also can't use
a VT05 because the format is fixed at 80 char. and the VT05 only shows
72.

I could go on forever, but lets make sure that we do the

right thing for
DEC and the marketplace not just for a vendor who "feels" screwed. I trust
that we have not really don that and he is trying to make noise to get
reconsidered.

Thanks for forwarding me your note.

Command:

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+---------------------------+                              GB0003/51
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| d | i | g | i | t | a | l |   i n t e r o f f i c e   m e m o r a n d u m
|   |   |   |   |   |   |   |
+---------------------------+
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Subject: **Winston Hodge - FYI**

To: Ron Bingham, MR1-2/E85
Sam Fuller, TW/A08
Bill Strecker, TW/A08

Date: 6/11/79 Mon
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

CC: OOD

He claims that CDC has just given them a contract to emulate their cyber 170. His approach costs only 5K, gives the performance of their large machines, and ultimately allows them to emulate IBM.

He's building a directly executable COBOL language machine.

GB:swh

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Ron Bingham	MR1-2/E85	Sam Fuller	TW/A08
Bill Strecker	TW/A08		
Dick Clayton	ML12-2/E71	Jim Cudmore	ML1-5/E30
Bill Demmer	TW/D19	Ulf Fagerquist	MR1-2/E78
Bill Johnson	ML12-3/A62	John Meyer	ML12-1/A11
Larry Portner	ML12-1/T32	Bob Puffer	ML12-2/E38

CDC 6600

WORD LENGTH: 60 bits for the Main Processor and 12 bits for the 10 Peripheral and Control Processors (PCP)
Memory Size: 131,072 words in 32 banks of 5 4096 12-bit word modules and 4096 12-bit words for the PCPs.
Speed: 250 million bits per second; 2 million instructions per second for the Main Processor and .5 million instructions per second for each of the PCPs.
Clock Rate: 10mhz (4 25 nanosecond phases)
Arithmetic element: Main cpu contained 10 functional units that could operate in parallel on the 16 word general register array.
Instruction format: 15 bit (operations on registers) and 30-bit (memory access)
Technology: All transistor logic; 6700 modules with 64 transistors in a 2.5 x 2.5 x 0.8 inch module, "cordwood package"
Number produced: 10 by the engineering group at Chippewa Falls
Price: approximately $3 Million.
Project start: Summer 1960

First delivery: September 1964 to Lawrence Livermore Laboratory
Software: COS (Chippewa Operating System) and FORTRAN
Project leaders: Seymour Cray with James Thronton
Predescessor: CDC 1604 and 3600
Successor: CDC 6400, 6500 and 7600
Use: Batch processing and shared use in large scientific computing centers
Achievements:
6600 and 7600 were the fastest supercomputers until the Cray I was introduced.
Development of freon-cooled, "cordwood" packages proving a ten-fold increase in logic density.
Fine multiplexed control for Peripheral and Control Processors.
Independent parallel, functional units for high speed with tag control.
15 February 1983

Mr. Neil Lincoln
Control Data Corporation
Advance Design Lab
4290 Fernwood Ave.
St. Paul, MN 55112

Dear Neil:

On behalf of the DEC engineering community, I'd like to thank you for the presentation last week. We all enjoyed the candid comments and interchange.

You mentioned a videotape of you and the designers of ASC, ILLIAC IV and the BSP. Could you tell me where we might obtain a copy?

As a fellow computer and organization biographer, I was delighted to hear of your book on the STAR. Could I get a copy, provided that I don't copy it? I'm sure Digital Press would love to publish it. After I've read it, I might have suggestions on how it could be released from CDC.

The discussion on networking was interesting. If you'd like to proceed, to examine using our protocols, then let me know. I'd think it would make sense to use our protocols around CI (Computer Interconnect) which is 2 x 70 Mb/s and NI (National Interconnect, or Ethernet).

Sincerely,

Gordon Bell
Vice President, Engineering

GB4.S1.35

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+---------------------------+                           GB0002/31
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|   |   |   |   |   |   |   |
+---------------------------+
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Subject: **CDC'S VISIT (TOM KAMPE**)

To: Henry Crouse, ML1-5/B98
Mike Gutman, ML3-6/E94
Bob Jack, ML1-3/E58
John Kevill, ML3-6/E94
Andy Knowles, ML10-2/A52
Stan Olsen, MK1-2/C36
Grant Saviers, CZ

Date: April 20, 1979
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

Follow Up: 5/4/79

I'm glad that Henry and Grant are going to review the buying decision on the RP07/RP08 because it feels like we went out on a limb with ISS just because they were nice guys. CDC feels harder to deal with than either ISS or Memorex, but then the issue was we may have asked these folks to commit suicide when interfacing the MASSBUS.

They have really tried to understand the issue of the 8" drive and have a pitch on it, which they have agreed to give in Minneapolis. Somehow they see it as the wave of the future. Quite possibly now IBM is playing the game our way where the issue is lowest entry cost. Their main points are that it is the cheapest to make, quiet, and has the most flexible form factor for an office. (I don't fully appreciate the form factor, but do appreciate that a floppy in a WT/78 is too noisy if one uses it in a reasonably quiet environment.) It would be nice to have smaller cartridges too. Also, by having a light weight, users can replace their own disk units, for serviceablity.

They described their products under development: Fixed and Removeable of either 7 or 14 and 7 megabytes using 8" disks in a floppy package, with power and the SMD interface at a price of < $2K. The fixed-only version would be less than < $1K. Both use lots of LSI. He described their fixed and removeable versions of the 14" series. It was interesting to note that he sees the problem as we do: you have to get the fixed part off in good sized pieces and the hard disk is the cheapest way. Watch out for IBM, they have to solve this problem somehow, as the fixed-only disk doesn't feel right.

Note that the RL02 drive cost isn't too far off either of these costs...so let's not panic! How do we make it quiet enough? Can we get Bob Lotz to help here? Is there a way to make it more replaceable by a single individual?

We also discussed the 8809 tape unit, which they are doing. Given our recent experience with the TS04, let's get a product from them. Quite possibly we ought to encourage some other manufacturer too, or do a joint effort, if we can agree (in writing) up front.

He described their efforts in making a new, interface which assumes intelligence in the disk. Here, he wants to push it as a standard. Watch out, SDB, we have another form of the MASSBUS, in that we can't move to use a disk that's out there and have to wait till we get our own done. How can we get a strategy that doesn't lock us in to a lag everywhere across the product spectrum?

They spend about $ 30M on product R and D. I'd like to be part of a tour of their facilities when the next visiting firemen go.

GB:swh

D I G I T A L   INTEROFFICE MEMORANDUM

DIST:

Henry Crouse	ML1-5/B98	Mike Gutman	ML3-6/E94
Bob Jack	ML1-3/E58	John Kevill	ML3-6/E94
Andy Knowles	ML10-2/A52	Stan Olsen	MK1-2/C36
Grant Saviers	CZ		

ID#318

d i g i t a l   **i n t e r o f f i c e   m e m o r a n d u m**

Subject: **Teaching a Course Using Computer Engineering**

To: Heidi Baldus, BY
Bob Clark, PK3-1/A32
Shel Davis, PK3-1/C21
Marcie Kenah, BY
Ron LeBleu, PK3-1/C20
Del Lippert, BU
Craig Mudge, Cal Tech

Date: 30 OCT 78
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

follow up 11/30/78

Now that the book, Computer Engineering is available, we need a course for our employees taught either by Ed Services or by the universities or by both using it.

A key goal of the book, as indicated in the preface points at the need to educate our own people (DEC). Craig is teaching a course now at Cal Tech using the book and he is producing a study guide. Also, we have talked about making a full blown package with overheads, instructor material, and possibly videotapes with guest lectures. I've agreed to give some talks on it, and I believe the other chapter authors might do the same, so we have a really great opportunity.

I don't want to do the lectures unless they are taped, because I don't want to do them twice. Similarly, I won't do them without a live class and an instructor who is running things. Also we need problems.

Is there a way to get this going before the book gets obsolete?

What about a course starting in January?

What youse think?

D I G I T A L INTEROFFICE MEMORANDUM

DIST: Heidi Baldus BY Bob Clark PK3-1/A32
Shel Davis PK3-1/C21 Marcie Kenah BY
Ron LeBleu PK3-1/C20 Del Lippert BU
Craig Mudge Cal Tech

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!   !   !   !   !   !   !   !
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TO: see "TO" DISTRIBUTION

DATE: WED 16 FEB 1983 8:56 AM EST

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

cc: ROSE ANN GIORDANO
ED KRAMER
BILL LONG

MESSAGE ID: 5191131339

SUBJECT: BETTER COST, PERFORMANCE AND PERFORMANCE/$

GB4.S1.24

Cycles for the Masses is beginning to look up. The following table indicates we have some very interesting possibilities for competitive machines everywhere. It also shows we are in a new computer generation, the Fifth, as the cost decreases by a factor of 10 or performance increases by a factor of 10. This gives a factor of 5-50 in performance/cost over where we are today. Note the following table of machines.

	Time	Price($M)	Perf.	Mflops	flops/$	# Users
Microvax W/S	85	0.01	0.9	0.45	45.0	1
Scorpio	85	.04	0.9	.45	11.0	5- 500
780	78	0.4	1.0	0.5	1.25	5- 500
790	6/84	0.5	5.0	2.5	5.0	5- 500
Nautilus	4/85	0.25	4.0	2.0	8.0	5- 500
dual proc.		0.4	8.0	4.0	10.0	
PPA	6/85	0.25	40.0	20.0	80.0	5- 500
Titan (proto)	12/83	0.1	10.0	5.0	50.0	1- ?
KL	74	0.75	1.3	0.66	0.9	10- 500
Jupiter	+30(mos)	0.75	6.0	3.0	4.0	10- 500
Cray 1	76	10.0	40.0	20.0	2.0	50-1000
with vectors			100.0	200.0	10.0	
Cray 2/XMP	85	10.0	120.0	60.0	6.0	
with vectors			300.0	600.0	30.0	

Notice there are several ways to get a performance:

1. Supercomputers (eg. Cray) operate in batch mode. At LLNL, a large user gets a maximum of 1 hr/day. Therefore, if one of our systems can deliver only 1/8 to 1/24 the performance, the price performance is likely to be better with a Supermini depending on the problem. In a real environment, most users would rather have something else so they can escape from the center.

2. Supermini, operated as a personal or with a small number of users.

3. The new, powerful microprocessor based personal computer with 750-780 performance. This gives a user the most power. I believe our technical marketplace wants this.

4. The new, shared, Supermicro such as Scorpio - These computers have the best cost/user, but will the added sharing be worth it versus the low cost PC's? This is quite attractive.

5. New, specialized facilities such as PPA, a 32 processor based on MicroVAX, FPS-164, XYCAD for high performance batch. All are quite interesting.

Performance/price depends on the fraction of a system that can

be
dedicated to a user. With MicroVAX PC - the price may be in the don't
care range 10K-20K (or 10% of a professional's salary) but the performance is at 780 level. Therefore, work will migrate both from
supers and superminis.

We have some incredible opportunities. It would seem desireable that
we first simply consider Titan and PPA as purely computational processors, although Titan would eventually be a PC when it has software. They would be operated as servers running, say Fortran, to
off-load KL's or VAXen via CI.

This VLSI generation is going to generate many more kinds of computers
than ever. Supers, Mainframes, and Superminis are all going to feel
the impact of Supermicros, PC's and interesting specials.

Bottom Line

We've entered an era (the Fifth Generation) driven by the powerful
microprocessor and this drastically changes the price, price/performance and maximum performance of the systems we can build.

The numbers should reinforce the gut feel that the Fifth Generation is
going to be exciting.

"TO" DISTRIBUTION:

BILL AVERY	CFM TASK FORCE:	BILL DEMMER
ULF FAGERQUIST	BARRY JAMES FOLSOM	BILL JOHNSON
DEMETRIOS LIGNOS	AVRAM MILLER	OPERATIONS

COMMITTEE:

WPS USERS - Leave HP mode and type <CR>

00 CORE DECGRAM ACCEPTED S 000356 O 41 22-AUG-82 17:07:11

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION   DATE: SUN 22 AUG 1982
4:49 PM EDT

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

cc: RICK CORBEN
JACK SMITH

MESSAGE ID: 5173246177

SUBJECT: CFM: CYCLES FOR THE MASSES

BASIC PROBLEM

Based on a feeling of the market, I believe our current inability to sell machines and grow is mostly unrelated to the recession, but is due to products. We are at a point where we don't provide the best cost performance or highest performance in a given class. This means we are now dependent on marketing, applications, basic software and the remainder of the system for success. While these are ALL good and give us a cushion, it goes away when someone reputable (eg. IBM) has a product to sell.

CFM

I've asked Sam and Bill to lead us to define a program that is aimed at getting us back in the technical computer business. It's imperative that several of us start full-time to define, staff and then execute this program.

PREMISE OF CFM

Microprocessors are improving at 65% per year, whereas our high

performance machines using bipolar are only improving at 20%. A
780 performance machine's available on a chip; in 85 we'd expect
to see a Venus. The Japanese have targetted 100x improvement in
supercomputers for Knowledge and Database systems (late 80's).

The premise is that we have to BOTH get our high performance
processors to be effective AND we have to use multiprocessors and
multicomputers of various forms including large arrays of micros.
Los Alamos has tested and intends to use multiprocessors (of up
to 16) for their work, so we can't ignore extending conventional
multiprocessing.

Seitz et al is building a 64 microcomputer array (loose coupling)
to solve particular physics problems, and the Cm* experience
shows that problems can be run across large arrays of computers.

CFM RELATIONSHIP TO ALPHA OMEGA (POST VON NEUMANN COMPUTING)
The MCC sponsored project, which we've been driving, has a high
likelihood of being started by the first of the year. The site
will be Los Alamos, and we'll have several people located there.
Both CDC and Univac will co-sponsor the work. Los Alamos will
probably do much of the work. Please read the proposal.

We're sponsoring a conference at Los Alamos this next month to
further define the program. About 10 applications areas will be

examined, including: database machines, image encoding and storage, ultra and high speed LANs, scientific computation tasks,
knowledge based system with parallel interpretation, etc.

CFM must parallel the external program with the short term goal to get a plan to build competitive machines in the next few years
and then to follow-on such that we'll have competitive machines in the late 80's.

Los Alamos has 50 or so 780's. I want to get them:
1. CI's to do work on multicomputers for
2. GIPPER when we get them available
3. 784's if we can go that way

WHAT ARE WE WE GOING TO BUILD?
1. High end processors... not an option. We gotta have 'em.
2. NI Workstation clusters to offload whatever mainframes we have. Note if we have 5-10 x the performance of the Workstation in the mainframe, we still have an advantage. Again, not an option. We have to do it propitiously. Don't we need some work aimed at parallel procesing on NI?
3. Get VMS to do parallel processing. Los Alamos' results are quite spectacular both using the 1108 and the Dennelcor. They are confident of being able to use 4 processors routinely and have coded many of their programs for up to 16. Cray has a multiprocessor coming out and this will change the languages and
patterns of use. This looks important.
4. More than 16 multiprocessors, even though they are hard to build. Bill Strecker's proposing an array that would map into VAX memory and I hope this would be worth doing. Why not go to
5. Multicomputers.
5a. CI clusters provide by far the best multicomputer cluster I
know of. The great thing is that we can install and evaluate it
right now. It's an ideal test and debug facility for
5b. GIPPER. This sounds right as a first attempt, although the address space and intercommunication is always a concern. The

nice thing about GIPPER is that it can be built now using J's.
6. Architectural alternatives
6a. RISC. What does it look like to date with benchmarks?
6b. RISC with vectors. Is this possible? I don't want us to architect a machine that can't be built easily.
6c. Easy VAX microcode extensions without additional state that can be put in any machine with enough microcode space.
6d. Some attachment to execute operations on specific data-types.
7. Dataflow. Why not wait for the university results? Arvind would probably be delighted for us to build his machine.

CCCP-CHRISTY'S COMPUTATION CENTER FOR PARALLELISM
Peter can proceed IMMEDIATELY to build his facility into a dual operations and experimental site where the 780's are located in
one room and interconnected via BOTH CI's and NI's. The rationale is that SEG needs cycles so bad that we have to do this
work in order to get the cycles performance (historically, invention often occurs out of extreme need). In addition, the research machines would connect into this cluster so as to be

used as support for when benchmarks were run. I would hope that
we could also make them into 782's.

This facility would clearly look very much like the Alpha Omega Centers I proposed, except that it would be within DEC, and have:
1. CI/NI connected cluster of 18 or 36 computers (for 782).
2. an FPS164 for evaluation of vector processing especially for circuit simulation and for scientific benchmarking.
3. Zycad logic simulator for evaluating DECSIM speed up. We

need
a factor of 100 to really satisfy our needs.
4. Microcode support for the 780's to investigate VAX extensions.
5. Build and attach GIPPER (Jesse's project with Seitz to get a
Giga-instructions per second machine using a large cluster of J's
used as computers... not a multiprocessor, but a multicomputer).

We would first benchmark:
1. Logic simulation across 782's, Zycad, CI and NI clusters.
2. Circuit simulation matrix operations: compare it with the CRAY, FPS, and CI based clusters. We'd also explore the use of
microcode to extend VAX for sparse matrix operations.
3. Routing and DRC using CRAY, CI clusters and microcode accelerators. This could be compared with the Dataflow approach.
4. Signal processing tasks using microcode, FPS and the cluster.

The goal would be to get the facility and orient it to breaking problems to work in parallel for the clusters, seeing whether NI
is adequate for certain problems. Also, we need to know CI's limits. CI would serve the basis of design tuning for projects like GIPPER. Also, we look at: microcode, FPS and Zycad, etc.

ACTION
0. Identify resources for the planning part of CFM. Execution will have to be done in the various projects we form or changes to existing projects.
1. Build CCCP starting now.
2. Let's get ALL the alternatives out on the table as to what's possible together with who's doing what. This would include Gipper, Strecker's machine, the Dataflow machine, the NI clusters
for performance.
3. Identify resources for Alpha Omega. Bruce and I have been doing this. I need full time help for the next 6 months to refine the proposal and really drive it with CDC, Univac and

Los
Alamos. Any takers?
4. Firm it all up at a conference Oct. 14-15.

"TO" DISTRIBUTION:

PETER CHRISTY	BILL DEMMER	ULF FAGERQUIST
SAM FULLER	BOB GLORIOSO	MIKE GUTMAN
DICK HUSTVEDT	JEFF KALB	ALAN KOTOK
JESSE LIPCON	BILL STRECKER	BOB SUPNIK

WPS USERS - Leave HP mode and type <CR>

00 CORE DECGRAM ACCEPTED S 000840 O 49 14-AUG-82 17:29:24

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION DATE: SAT 14 AUG 1982
5:15 PM EDT

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION

DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5172535137

SUBJECT: PRODUCTS AND A/D TO GET MORE CYCLES TO THE USER (AND WIN)

The situation is clear: We are going to be pressed for orders until we get VENUS and Scorpio. The good news is that we're going to have to learn to market in order to survive.

Bill and I talked about several short term efforts that would address the problem. Jesse has a set of strong arguments that says it's going to be difficult to have a big seperation in performance anyway (eg. putting an r81 on a Scorpio is awfully powerful), and putting 5 of these out is probably going to deliver as much as a Venus with 5 r81's... except in the single job case.

Clearly we have to go after high end machines and we have to do it cleverly, while at the same time we provide shrinks in the Scorpio based machines.

The basic theme is then one of multiple machines to increase performance. The real issue is what are the structures and how can we get them asap?

1. nebula's for PC's on NI sure gets a lot for a single user

assuming there's access to something like a 782 for files and heavier computes. Maybe this should be the highest priority because it gives us the most uniqueness and it gets us into the cluster market we keep talking about and appollo is going to get!

2. Making 782 symmetrical, or lower cost by a single sbi or allowing a 784 (with major change? to vms) would permit the conventional multiprocessor to be supported, and we could exploit the fact that it's possible to use 4Pc's on a single job relatively easily.

3. We're coming out with 8 Pc J's as a standard product... but will it be supported?

4. Jesse and Bill are supporting the construction of 2, large multiprocessors (32) and multicomputers (the Hypercube) for special problems.

5. The CI probably represents the most exciting possiblity for immediate experimental results, especially since it does all the things the Hypercube will, except being very large. Furthermore, we can take any of our comp centers (eg. Hudson), attach CI's and start to run the experiment.   Here, let me urge that we do this for supporting DECsim, especially since it's so vital to our success on Scorpio!!

I see lots of resources being poured into efforts that are redundant or unnecessary relative to improving our product position (to provide more cycles). The first step is to define these projects. Given the need, the resources will follow.

Can we set about defining the project asap??
Can we get together soon to refine and further define?
How about after the talk I'm giving in Hudson on Monday?

"TO" DISTRIBUTION:

PETER CHRISTY	BILL DEMMER	ULF FAGERQUIST
SAM FULLER	HUSVEDT AND CARCHIDI	JESSE LIPCON
MAHENDRA PATEL	BILL STRECKER	BOB SUPNIK

"CC" DISTRIBUTION:

JOE CARCHIDI EMC: MARY JANE
FORBES
BOB GLORIOSO ALAN KOTOK

WPS USERS - Leave HP mode and type <CR>

Prompted by the Japanese visit and sitting many hours in meetings, we have an incredible number of challenges ahead:

0. We have the greatest product array and strategy in existence today based on VAX-NI-CI compatiblity and as such should easily continue our position. We do have to follow it though! DEC has promoted a major style of computing which has evolved for 22 years that is much deeper than the cabinet skins. (About 7 years ago I went to a hardware session at DECUS and almost no one showed up.)

The Japanese approach computing totally as a commodity supplier problem without a feeling as to what computers can and should do. Ironically, I think it is the language and Kanji character set that puts up the boundry. As they get human interaction, they'll become an even bigger threat because their higher intellect will enable everyone there to become programmers. Recently, Dr. Kobayashi, the chairman of NEC stated that every employee MUST have and use a personal computer.

Right now I don't see us being a great commodity supplier because the technology depth, and manufacturing aren't good enough. The DEC versus Brother Keyboard is a good example. We've built an obsolete, lower technology, relatively poorer keyboard... maybe because it looked easier or who knows why.

This requires even stronger architectural leadership because there are so many opportunities around and this is the best differentiator we have. Most products are dead ends or don't allow enough control or are really poor. (Robin and Rainbow aren't off to a very good start, but they could/should be.)

The bottom line of this point: now our strength is our incredible architecture and it must remain so. If we are going to be serious in the commodities (eg. floppies, keyboards, monitors) and commodity computing (8086, 68,000 and 16032 x CP/M, UNIX), we'd better put the management and resources to succeed. We can not win at trying a little bit of everything! I don't think there's any way to even look at and decide on some of these issues because we (OC) encourage EVERYTHING and decide nothing. Making incremental decisions ultimately kills off a direction.

1. Getting everyone settled to sell what we've got and what we could easily have especially since Patti Seybold blessed us. Office/tp/data management/dp are the greatest and we've got to segment and approve the organization now. Julie's great here.

2. Segment the part of the organization in either a quasi or real divisional structure so that common engineering, manufacturing and marketing are together. Also, then ask these group leaders to come with some recommendations. In this way, the various operational committees can be cut down to manageable sizes and aligned to a common goal set. The notion of commodity terminals and personal computers seems like a natural. Also VAX and the main systems business are another natural.

Right now, decision making seems to be very slow because it has been clogged by the low end problem for the last 2 years. In engineering complex systems it has been observed that the design time is proportional to the number of people involved squared. The meetings are just too large to get the work done. People just want to know what the NEW DIGITAL is and what to do.

3. I'm very excited about the pipeline that's been established from: technology boutique (expensive, fast response, competitive, state of the art); systems (constrained to be compatible); and commodity (designed in Japan or Taiwan) for cost. I don't think an engineering/manufacturing group can be in more than one mode at a time. For example, it's crazy to ask a group making state of the art products to do low cost, third time around products. This is impossible emotionally for engineers. I've decided to be less involved in these products, but will continue to provide some direction including sending ideas into the hopper.

4. I share your view of having a great small business computer, but am concerned about whether you can be articulate enough as to what it is to get someone to take on

the charter. The parameterized software looks like a key here, but it's the first pass. Is it the motorcyle shop or the engineering department or the manufacturer with $10M sales (I can show you a company who's using a 780 in this mode, including mail)? The range is immense and hard to define. Given your intense interest, and the ambiguity of the space, you might ask: Is anyone smart enough to do the job, too smart to avoid the job because of personal risk?

5. There are the Japanese and I hope we get concerned before it's too late. Fujitsu has 10,000 engineers at Kawsaki all determined to make them number one. I intend to push to join the Alpha Omega and packaging consortia parts of MCC because they are really a way to reduce the development costs and get the vital research we need. This would be coupled to the work I would like to do aimed at a high performance machine structures.

6. An approach is needed to build machines. They aren't fast enough now, nor can they be designed. There are several approaches. This is the highest priority of all, especially since the recent announcement of the Japanese to TARGET MINICOMPUTERS because NTT has asked the big 3 to supply them machines for distributed processing (again, expecially now that they've conquered supers and mainframes and are en route to commodity personals). I don't have the answer now, but only understanding that we are headed toward a cliff.

This is the area that I must work in, even though I would also like to remain part of the management team on an as needed and as desired basis.

7. Going with National. I fully support this and we must make it happen!!! They will supply the peripherals (can not be underestimated) and the marketing outlet. I see our leverage and control as software. This means we would command a premium for MicroVMS and NOT sell it on look-alikes. This means it is bundled!! We could also bundle UNIX in a similar fashion, or we could allow it to become a commodity that all the random unicee suppliers support... probably the best way to not support unix.

8. The organization does bother me both in content and form because I see it becoming typically American and it is the antithesis of the Japanese companies. I looked at the top 17 of NEC: 13 are engineers, there's a lawyer, salesman, and 2 accountants. About 8 are PhD's. This is typical of a highly divisional structure. Similarly, I had dinner with the head of engineering of Sharpe, who was a very deep and thoughtful engineer (he has Maxwell's Equations chiseled in stone at their research center); three days later he became President. They believe in and do real, very directed research (eg. a class 1 room and 0.8 micron line width at Hitachi Central Research) and this pays off. We have little directed research or advanced development outside of a tiny bit in semis and in disks.

The organizational form is of concern: they have NO marketing groups per se. Marketing is done in either sales or in engineering. This is the famous 3 body problem or 3 stage pipeline. We must get back to this before it's too late. For example, we've allowed the real time response of our systems to be dissipated because the engineers only see customers at DECUS. NEC has the two groups meet quarterly for a week where sales and engineers listen and present to each other.

June 25, 1984

Mr. Charles Sporck, President
National Semiconductors
2900 Semiconductor Drive
Santa Clara, CA 95051

Dear Charlie:

The Computer Museum is opening in downtown Boston on November 12. A major semiconductor exhibit is being planned and John Payne is really helping on an overall conceptual level. I am delighted at National's support as a founder and driving force of the semiconductor exhibit, your contemporary chips will be shown as a result. Of course, the historic chips from Fairchild and Intel will be appropriately placed in the evolutionary story.

A copy of the statement of purpose and case for raising $10,000,000 is enclosed. The levels of giving start with 4K ($4096) and get as large as a megabit. Our latest thought is that we will burn all contributor's names into ROM! I'd like to ask you for a personal pledge because like all public institutions, the main financial support comes from individuals. My own gift so far has been $128K from a relatively small net worth, and provided Encore is successful, I intend to give all gains to the Museum. Bob Noyce has just made a very generous contribution. Could I get a pledge from you for $128K over five years?

A first-rate team is designing the exhibits, including Dr. Oliver Strimpel, curator of the Science Museum in London and Dr. Paul Ceruzzi, a young history of computing scholar. In addition to the exhibits with historical artifacts, two major interactive galleries are being built for PC's and on the Computer and the Image. Predictions are that we should have attendance of over 200,000. This world-class, international Museum should be a major attraction and asset and resource for the computer and high-technology community.

I'm visiting Silicon Valley on July 5 and 6. Could I see you then?

Sincerely,

Gordon Bell

Enclosure

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* d i g i t a l *
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TO: TOM STOCKEBRAND DATE: SAT 11 OCT 1980
12:07 PM EDT

FROM: GORDON BELL
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: RE: DUTIES

I thought you were going to get into more serious product development we need for monitors. If not, then having another
bright person there would be ok, especially aimed at applications.

Fundamentally though, I think you should get from Bob Glorioso
the measures we use for research. Here, it is papers, people transferred, ideas, patents and you measure flow. Can you go back over the last 2 years and point to the work in these terms? Given your proximity to the government labs, I advocate
a strong outward flow of results. Namely, what can you flow from them into our products? Here, as a conduit, you measure idea flow?

Mostly now, your raise concerns:
Ken Fine (Intel) is building a bit map control chip for Intel which he says is a direct embodiment of the ideas presented
to him (while at Intel) at one of your conferences. Worse yet,
he won't let us interact with him or find out what it is because
he is working with some other company (probably HP or IBM) which
will come back to bite us in the ass. I joke about helping the
competition so that we can then respond to them. This one isn't
especially funny.

On the other hand, I'm not so sure that your charter shouldn't
be directed at Manufacturing. Here, the important area of inspection could be addressed, or managing flow or simple assembly operations.

What your question evokesd was some thoughts. It sure looks like a problem to me that you have to address. I have no biasses.

GB1.S7.47

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Subject: **Visit to Chicago Office and Their Observations**

To: OOD
Don Busiek, PK3-2/S17
Al Crawford, PK3-2/F34
Ward Davidson, RL
Bruce Delagi, MR2-1/M64
Bruno Durr, PK2/S56
Ulf Fagerquist, MR1-2/E78
Jack Gilmore, MK1-1/J14
Bill Heffner, TW/E10
Per Hjerppe, MR1-2/E78
Ted Johnson, PK3-2/A55
Bill Keating, ML12-3/A62
Andy Knowles, ML10-2/A52
Bernie Lacroute, TW/A08
John Leng, MR1-1/A65
Julius Marcus, MK1-2/C37
Stan Olsen, MK1-2/C36
Bob Savell, ML5-2/E50
Chuck Scheibe, RL
Jack Shields, PK3-2/A58
Charlie Spector, ML5-2/A33
Bob Travis, MK1-1/J14
Alan Wallack, MR2-3/M84

Date: 9/21/79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

Follow-Up: 10/15/79

I enjoyed the discussion with Chuck Scheibe, Ward Davidson, and the Regional Software Support managers. They do have some concerns however, which I'm sure we can address:

10/20 Support- We have all sorts of good messages to the field, but they are largely for naught because there isn't adequate support back in the product lines. We have a choice here: support at the P/L level, the Group Level or within the Product Management structure. I say, let's do basic marketing at group level, field support that is financial related deal at the P/L level, and do all technical and configuration support via the Product Management Support group (ie. Per Hjerppe). Ulf, can you and John get a proposal for the TPG and maybe this might also work in CPG?

11/74- When? Tandem continues to make inroads. Will the 74 do any good at all?

MDC Terminals- Expensive and need for integrating other manufacturers terminals. Is there a better strategy?

MINC off the shelf delivery is nonsense, given a 6 mos backlog- Proposal: get rid of FAT and use the effort for manufacturing more!

VT100- Needs a printer port. Chuck Scheibe noted that the way to get a hard copy from the EMS system is to send a TWX via the RCS system. This is wierd. He also noted that the EMS system is maybe too expensive to use in terms of line charges and he is going to hire someone to build a concentrator and work the comm problems. Why doesn't the corporate communications or corporate sales systems people have someone to do this and let Chuck motivate his managers? Why did a system get put in if it wasn't feasible to use?

WPS - I also note the September DM Report has 3 pages on this. There are a number of problems here ranging from we need Sort, Math and Formating...to the 200 System Doesn't Work! I think it's time to slow down in WP before we damage our reputation anymore. We have to learn again that a given system design can only be pushed so far... and the 8 system is way beyond what can ever be made reliable (my gut says). Hence, continued enhancements will mean a progressively unreliable, poor product. Chuck is sending a sheaf of memos, etc. discussing the problems in his region, which I assume is just typical. For now, I think we should seriously consider putting the 200 on hold and reviewing just where the development is and should go. There will be more, as soon as I get the documentation. Jack Shields how visible are these problems in the service organization?

Software Patching Can Still BE Significantly Improved-- The 20 is apparently doing it reasonably, but the SWS group would like to have a history of the patches, versions, etc provided by the machine so they can see what's happening. Can we get this looked at for M, VAX, RSTS, ant RT?

The Patches are bad! -- How can we have QA before we send out the patches so as to avoid the looking bad syndrome?

Remote Patching- When?

We have a poor policy for Synchronizing O/S's and our layered products-- In essence, it is really quite impossible to evolve each of the components independent of one another, and believe that a system composed of various levels will work. We must have more stringent rules and test as to what will work with what. I would propose some scheme that says all components of an outer most layer have to be at the same or less layer as the inner most part they have to work with. Alternatively, why can't we put in the software a compatibility plug that checks to see that the components it depends on are present? Can we simplify this by just having things synch'd better? Clearly there is little or no communication between SWS and SWE... a recurring theme.

Are Maintenance and Development too tightly linked-- It has been observed that there is little or no response in the first few months after a release.

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Subject: **A China Junket Opportunity**

To: OOD

CC: Ted Johnson, PK3-2/A55

Date: 22 JAN 79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-

2236

follow up 2/7/79

Who can/would like to go?

It would be both a presentation of DEC and a fact-finding trip.

GB:ljp

Attachment

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Gordon Bell	ML12-1/A51	Dick Clayton	ML12-2/E71
Jim Cudmore	ML1-5/E30	Bill Demmer	TW/D19
Ulf Fagerquist	MR1-2/E78	Bill Johnson	ML3-5/H33
Ted Johnson	PK3-2/A55	John Kevill	ML3-6/E94
John Meyer	ML12-1/A11	Larry Portner	ML12-3/A62
Bob Puffer	ML12-2/E38		

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TO: see "TO" DISTRIBUTION

DATE: TUE 4 JAN 1983 10:40 AM EST

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5186857193

SUBJECT: GETTING ALMOST FREE 100K TRANS. CHIP,YOUR THOUGHTS?

GB4.S1.9

I visited Craig Mudge's group of about 15 doing VLSI R & D in Adelaide, South Australia. They've put together a good tools / VLSI
publishing system whereby they do several multi-chip systems per year
for all sorts of government, university and private companies. (e.g.
Evans and Sutherland).

They now have access to an advanced US 2 metal 2.5 micron process, and
they're building tools to use it. They're in the process of defining
and building a 100K chip to do speech recognition of isolated words.
I was quite negative on using this chip as a test because it's unclear
what such a chip would do, and failure of the algorithm would equate
to failure of the chips.

Craig is now soliciting chip ideas. He would like us to spec an
interesting chip, and he would build it for us. The goal is to
experiment with and test the methodology. We have to tell him soon
what such a chip would be and what its characteristics are. I'm sure
we could get access to it if he's successful. I'd like to solicit
your ideas.

What about: speech, video, a processor of some sort, a FPS-compatible
processor, n-digital filters, MicroVAX , an 11? What you say to this
very low cost, but medium risk, high payoff possibility?

Ideas ?

"TO" DISTRIBUTION:

BILL BABCOCK PETER CHRISTY DUANE DICKHUT
ARNY GOLDFEIN DON HARBERT JOANNE SMALL @HPLT
JEFF KALB MARY ELLEN LEWANDOWSKI @HPLT
NED FORRESTER @MLXXFRANK PAGLIAPEG: CAROL PETERS
RAD: MIKE RIGGLE BOB SUPNIK
STEVE TEICHER WALT TETSCHNER DEL THORNDIKE

ID#0162

| d i g i t a l | **I N T E R O F F I C E M E M O**

SUBJ: Chip Policy

To: Dick Clayton

Date: 7/11/78
From: Gordon Bell
Dept: Office of Development
MS: ML12/A51 Ext: 2236

CC: OOD, Marketing Committee, Bill Green, Roy Moffa, Mike Titelbaum

The following was decided at the last Marketing Committee:

"Andy Knowles recommends that we not enter the chip business, instead push a strategy that looks much like Dataquest scenario #3.

- Ken's not convinced that we shouldn't take on Intel on their own terms, concerned that we have become too inward focussed, not heeding our competition.
- Andy has arranged for funding Tiny again.
- Put another way, strategy is to compete with Intel's customers, rather than Intel.
- Gordon is convinced we should be working harder toward applications products rather than intermediate level products.
- General agreement is that we should not be striving for chip sales in the commodity market. It's important to realize that, though this item was

intended for discussion only, we have blessed a de facto decision not to pursue the PDP-11 chip business."

Ken has asked that you come to the Marketing Committee to give the competition, their rates of introduction, and costs for various system configurations for F, T and the 8086. This should give us a pretty fair benchmark as to where we stand competitively. (I'd also like to see channel width vs. time, and the FCS's of the products that use them.)

For OOD, the message is clear:

1. IF THE 11 IS TO REMAIN A VIABLE ARCHITECTURE AGAINST THE CHIP COMPETITION, IT IS SOLELY UP TO OUR OWN INTERNAL DEVELOPMENT OR ANY SUPPLIER WE CAN GET TO DESIGN CHIPS FOR US.

2. WE CAN NOT LET THE FONZ AND TINY CONTINUE TO SLIP...THEY HAVE TO GET DONE, WE NEED THEM NOW TO AVOID LOSING THE CURRENT RACE!

3. With Intel supplying us technology, we are pretty well locked into where they want us (at 2-3 years behind them). We have to know this position accurately so that where we can not build competitive parts, we can move to the standard chips. (This is where we should be with programming anyway, because we are moving more into applications.)

4. We have to make the funding reflect the move to applications.

5. For programming, we must become machine independent. While this is easy at the applications level, it looks more difficult for operating systems.

gb

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Dick Clayton	ML12-2/E71	Jim Cudmore	ML1-5/E30
Bill Demmer	TW/D19	Ulf Fagerquist	MR1-2/E78
Win Hindle	ML5-2/A53	Bill Johnson	ML21-3/E87
Ted Johnson	PK3-2/A55	John Kevill	ML1-3/E58
Andy Knowles	MR2-2/A52	John Meyer	ML12-1/A11
Stan Olsen	MK	Larry Portner	ML12-3/A62
Bob Puffer	ML12-2/E38	Bill Thompson	ML12-1/F41
Bill Green	ML1-4/B34	Roy Moffa	MR2-1/M64
Mike Titelbaum	ML1-2/E65		

00 BURT DECGRAM ACCEPTED S 30510 O 78 15-DEC-81 03:35:23

****
* d i g i t a l *
****

TO: JIM CUDMORE
DATE: MON 14 DEC 1981
8:03 PM EST

FROM: GORDON BELL
cc: JACK SMITH
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: THIS AIN'T GOOD ENOUGH

I believe you have to drive this via Kalb (with Roy's help). This means we lose a month.

Today at GVPC we got a strong endorsement to:
Go get a VAX subset chip with a reputable US vendor such as TI, Motorola, or Intel and to permit that vendor to market the microprocessor chip on the open market too.

DEC would put a VMS compatible run-time environment on this system and provide other software.

DEC would market boards and perhaps chips (?) and make a bus that would be suitable for this market. Maybe this would get BI off the dime, or maybe it would mean we would select an existing or emerging bus standard.

We want to work through this scenario in order to make a recommendation BY no later than the last of Jan. This means the subset, bus direction, software environment and vendor recommendation have to be done by then.

I will not support any effort that says we do this work in
We are not on an adequately aggressive course to get this work done by then.

Jack and I both agree you should take a much more active role via Jeff and stop this nonsense. If the meeting isn't until he 14the, this will mean that the whole effort has taken 6 weeks from the Dec. 1 request to you folks to just get started!!
(No wonder we have not made ONE competitive chip in Hudson!)

Jack will give you his perspective tomorrow, and I'm around all week to help get this moving.

ATTACHED: MEMO;16

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* d i g i t a l *
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TO: GORDON BELL DATE: MON 14 DEC 1981
4:23 PM EST
JIM CUDMORE FROM: ROY MOFFA
SAM FULLER DEPT: LSI MARKETING
BILL JOHNSON EXT: <225-4760>
JEFF KALB LOC/MAIL STOP: HL2-2/N11

SUBJECT: VAX TASK FORCE

A 2 day Task Force meeting has been schedule for the 14th and 15th of January.

GB3.S2.52
The Programs Coordinator reports to the Director.

I. The Coordinator's programs include the organization of:

A. Pioneer Lecture Series

1. 6 annually - 3 in Spring, 3 in Fall
2. held in Lecture Hall of cafeteria
3. for members or by special invitation
4. content of talks generally deals with pioneering developments in the field of computing and/or major contributions to the industry
5. checksheet for procedures has been developed to make sure everything gets done
6. most scholarly (and often technical) of all museum lecture programs and always archived for scholarly use.

B. Gallery Talks

1. usually held Wednesdays at 4 p.m. during summer months
2. one hour talks by local speakers or others who are in the area
3. talks relate to speakers' area of expertise, usually as it relates to a particular museum exhibit
4. Museum visitors, DEC employees and/or

customers, interns and staff attend

5. talks are audio-taped

6. less technical and scholarly than Pioneer lectures but still for relatively "initiated" into the world of computing

C. Bits and Bites

1. Sunday series of one hour talks by local speakers

2. Spring and Fall series with an average of 8 speakers each

3. free to the public; refreshments sold at modest prices

4. not too technical in approach; the lighter side of the computing world with a historical or artistic bent

D. Excursions

Trips to significant computer installations, or exhibits relating thereto, access to which might normally be difficult for general visitors

E. All Special Events

Past events include Babbage Play. Future event will be Archiving Conference in May 1983.

II. Another major area of responsibility for the Programs Coordinator is public relations through

A. Publicity and Promotion

1. Computer Conferences both locally and nationwide--making all exhibit arrangements and occasionaly representing the Museum at conference

2. developing press releases and acting as Museum liason for general level promotion (e.g. Boston Globe Calendar, Middelesex

News)

3. liason to the membership assocition which functions as a resource pool for volunteers, to provide suggestions, and to act as a sounding board for prospective programs

B. Dinner Functions

1. held in museum galleries outside function spaces or lecture hall following lectures

2. by request for outside groups (connected to the computer field)

3. in connection with lectures or special events

III. Other Responsibility

A. Tours

l. Docent training - tour guides come mostly from the staff or DEC

2. Scheduling of tour guides

B. Other

l. Request donations for special events (e.g. champagne for play)

2. Some solicitation letters sent for fundraising when Program Coordinator is the primary contact

IV   Documentation used in Programs Area

A. Floppy - Chris R. (correspondence, etc.)

B. Chronological list of major publicity since 6/10/82

C. Chronological list of programs since 6/10/82

January 16, 1979

Don Christiansen
IEEE Spectrum
IEEE Headquarters
345 East 47th Street
New York, New York 10017

Dear Don:

I would like to submit this to the IEEE Spectrum for publication.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:ljp
ID#<>
00 BURT DECGRAM ACCEPTED S 19806 O 42 13-DEC-81 13:15:29

****

* d i g i t a l *
****

TO: ENG STAFF: DATE: SUN 13 DEC 1981
1:11 PM EST
ENGRG. USERS: FROM: GORDON BELL
OPERATIONS COMMITTEE: DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: TYPE CHRISTMAS = MERRY; NEW_YEAR = HAPPY...PRODUCTIVE;

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                             Gordon
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GB3.S2.51

May 23, 1978

Yaohan Chu
Professor of Computer Science
University of Maryland
College Park, Maryland 20742

Dear Yaohan:

Enclosed are copies of the Technical Summary, Volumes 1 and 3 of the VAX Reference Manuals series.

I'm also sending a copy of the Computer Engineering Book draft as it now stands -- please bear in mind it's still rough (e.g., the chapters on C.mmp and C.vmp have been eliminated due to size.)

I'd hope you could use it in your courses -- it'll be ready by fall. Please let me know what you think.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:ljp
To: Steve Chapin, Ike Nassi, Chuck Wegrstyn
CC: Hydra and Resolution Boards, Steve Emmerich, Ken Fisher

Subject: Chuck Wegrstyn Operating System Software Group

Chuck has joined us and will report to me and reside in Wellesley. Chuck will begin work on ??, but will be available ?? for discussions.

The motivation (goals) for this group and approach is:

0. to get the kernel exec that's required for building BOTH tightly coupled multiprocesing and network oriented UNIXen that will deliver the highest performance. Decisions to tradeoff various goals

including performance, especially for real time in EITHER environment, against schedule, reliability, security, and extendability must be explicit.

1. to get another experienced software group to assist in our ambitious product plans and increase the parallelism especially in Hydra (because it is at a later stage) by allowing the kernel exec and MPUNIX to be implemented in parallel
2. to design a single kernel specification and have a common implementation (to ensure compatiblity) for creating a homogeneous environment within Hydra and its extended DLA, within a single Resolution Workstation, among multiple Workstations, and among the Workstation and Hydra environments
3. to build a common system which can use and preserve the very large software investment we are making in adapting UNIX (4.2 and V) to run in our environment
4. to build a common system which can use and preserve the very large investment in special software that results in a vanity kernel

By all accounts, the investment in UNIX 4.2 and V, its utilities such as networks and databases, and special servers built directly on the Kernel is going to be both very costly to build and it is also the Encore value-added. Therefore it is vital that this "systems level" standard be identical across the environment.

Our first effort is to define the goals of the system to be built. The most critical issue is performance in both the multiprocessor and uniprocessor/distributed workstation environments.

Then we must proceed immediately to get a specification so that a phased, work plan can proceed with the utmost urgency. For example, I would hope a kernel could be written to run on VAX to test the interface to various mPUNIX functions and to operate in a reliable environment before migration to Hydra hardware.

Attached is the Encore Computing Environment which has some very sketchy high level goals which I would like us to really

firm up.
subject: ci clusters, our hottest product. now what?
to: ed kramer, jack shields, market/sales committee, demmer, ryan, berube
cc: roseann, psc, heffner, carchidi, hustvedt, burneice

In Colorado, they're running a maximum configuration VAX Cluster with:

12-780's
4-HSC's, with
2 x 24-Dual ported R81's (over 20 Gigabytes)

It was very impressive in terms of performance and reliability... now that it has been tested. Also, American Bell has some running and gave a very strong endorsement at DECUS.

Recall that 5 years ago HYDRA was started as the most important project to build a comptetitive (especially with Tandem) system, providing high reliability and incremental upgrade. Also, we have a unique product in the HSC disk server. IT's HERE now.

It's incredibly disturbing to see such a lackluster approach to the marketing and sales, especially since we seem to need the revenue.

While one might observe that we're following Land's guideline that "marketing is what you do when you don't have a product", since

1. we've put all of our marketing and sales attention on PC's
2. VAX clusters are good enough to sell themselves.

However, I think we need someway to tell the world we have this unique product. Also, it might be possible to get sales from competitors like IBM because of our uniqueness.

Marketing and Sales Committee, is there anyway to get off the dime with this great product? How about at least a review at your committee? Why can't Rose Ann get this marketing charter?
.

FROM: GORDON BELL DATE: MON 22 OCT 1979
10:35 AM EST
DEPT: OOD
EXT: 223-2236
TO: LARRY PORTNER
PETER VANROEKENS
BILL STRECKER
DAVE RODGERS
BILL DEMMER
GEORGE PLOWMAN
MIKE RIGGLE
SAM FULLER

SUBJECT: THE HIGH COST OF THE CI - BUT KEEP GOING

GB0005/20/EMS

I understand that it's more expensive than we thought. The temptation to start over now should be avoided. Note, there is a much larger market for high cost somethings, versus zero cost nothings. Even if we want to redo it, start over or cost reduce it, it's essential that we build and operate this one at least as a breadboard. Remember we built the 780 after the VAX breadboard. This was to avoid building the product right the first time.

Someday I hope us product development people will learn that doing advanced development is essential - if we've never built a thing like this before. Doing Advanced Development as part of product development is expensive, prone to missing ship dates, and occasionally not having products at all.

GB:swh

June 17, 1982

Mr. Felix Tuan
Assistant Vice President
Citibank Corp.
111 Wall Street
New York, N.Y. 10043

Dear Mr. Tuan:

Enclosed is a package of literature I thought you might find interesting.

Regards,

Gordon Bell
Vice President,
Engineering

GB:gr
GB3.S14.2

September 13, 1982

Mr. Kenneth Hope
Acting Director
Prize Fellows Program
J.D. and C.T. MacArthur Foundation
Suite 700
140 South Dearborn Street
Chicago, Illinois 60603

Dear Mr. Hope:

Wesley A. Clark is one of the most creative people I know. For evidence of this, I'm attaching a letter in which I nominated him for the Eckert-Mauchly Award which recognizes innovation in computer systems design. (He did get the award.) To sum up the creativeness, I believe he invented and developed the first personal computer... it was the LINC and is described in the recommendation.

It's hard for me to know just how Wes compares with others at this stage of their career. I do expect more accomplishments from Wes, and I believe they'll be significant.

For others who might comment on him, try:

George Pake	Chief Scientist, Xerox, Stamford Conn.
Ivan Sutherland	Carnegie-Mellon University
Larry Roberts	Telenet Corporation (don't know address)
Frank Heart	VP, Bolt Beranek and Newman, Cambridge, Mass.
Dr. Larry Weed	U of Vermont Medical School
Prof. Carver Mead	Cal Tech
Prof. Jerry Cox	Washington University, St. Louis
Prof. Charles Molnar	Washington University, St. Louis

In my opinion Wesley Clark possess the exceptional qualifications for a Prize Fellow Award.

Sincerely,

Gordon Bell
Vice President of Engineering,
Digital Equipment Corporation

Enclosure

GB3.S7.27

CLASS CALCULA

ORDER	FAMILY -Technology	GENUS	SPECIE
Analog or Digital	Complexity	Structure	
ANALOG	Single Part	Drawing instruments	
		Fixed rule	proportional rule, parallel rule,
	2-3 Part	Gunter rule	Gunter rule, Navigator's gunter rule
		Sector	Navigator's sector
		Slide rule	straight circular spiral log-log
		Level reference	gunnery level
		Integrator	mileage reader
	Multiple part	Drawing instrmnts	pantograph
		Level reference	quadrant, sextant, octant
		Integrator	platometer planimeter

	Complex	Level reference	telemeter auto-pilot
	Programmable	Differential analyzer Analog computer	

CLASS CALCULA

ORDER	FAMILY -Technology	GENUS	SPECIE
Analog or Digital	Complexity	Structure	
DIGITAL	Single register		
		Bead	abacus soroban
		Pascal Wheel	Pascal wheel
			Pascal strip
			keyed wheel
	Two register	Tab indicator	
		Keyed wheels	
	3-4 register	Stepped wheel	Liebniz, arithmometer
		Automatic stepped wheel	Millionaire
		Rotary	Balwin, Odhner
			Curta types
		Motor-geared wheels	Monroe, Friden
		Battery/electronics	"Pocket" calculators
	Complex	Tabulator	Hollerith census machine
		Equation-solver	Atanasoff-Berry

Computer,

pocket

calculators

difference engine

Programmable relay calculator Bell

Telephone

calculators

tabulator

plug-board ENIAC

analytic engine Babbage's

analytic

engine,

Harvard Marks

5 + register Telephone relays Bell Labs

Calculators

Electronics ABC

breadboard

Slide

rule calculator

CLASS MEMORY

ORDER -Technology	FAMILY	GENUS	SPECIES
Machine Interface	Storage Phenomena	Structure of Access	
Non-mechanical	Physical state	Fixed	
		- permanent	stone
markings			
			Napiers bones
		- erasable	Quipu, beads,
			abacus,
stones			
Writable or	Paper	Fixed	
Readable		Linear	scroll
		Cyclic	rolodex
		Random	book
	Mechanically stable	Fixed switches	
		Linear	piano roll,
		Cyclic	drum, disk

		Random	card,
Chemically stable	Linear Random	microfilm microfiche, video disk	
Magnetic	Random	rope	
Electric charge	Random	capacitor	
Electronic	Random	diode Semiconductor (rom)	

CLASS MEMORY

ORDER -Technology	FAMILY	GENUS	SPECIES
Machine Interface	Storage Phenomena of Access	Structure	
Writable &	Mechanically stable Fixed	calculator registers	
Readable logic			**tinker toy**
		register	
	Random	Zuse memory	
Wave storage	Cyclic	mercury delay, magneto-strictive, optical delay	
Electric charge	Cyclic	Atanasoff drum	
	Random	Williams storage tube capacitor, semi-conductor	
Magnetic flux	Linear	tape, wire,	
	Linear-cyclic	datacell	
	Cyclic	fixed head disk, drum	
	Cyclic-linear	disk	
	Random	core, disk	
Electronic-stable	Fixed	flip/flop, relays, stepping switches	
	Random	semiconductor array, relay arrays	
Chemically stable	Linear	photo store	
	Cyclic		
	Random		

Digital **Interoffice Memo**

Subject: **Classical Symmetric Multiprocessors**

To: Bob McPherson

CC: John Holz

Date: 29 SEP 76
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.:

2236

Thanks for the input/thoughts on classical symmetric multiprocessors versus dual computer (which are also classical and predate classical, symmetric multiprocessors). I don't agree in terms of cost (i.e., utilization of resources), cost to program, availability, switchover time, and secondary benefits for giving performance and incremental performance.

I've passed your paper on to John Holz who heads a group looking at this question.

GB:ljp

CLASS CALCULA

ORDER	FAMILY -complexity	GENUS -structure	SPECIES
Analog	single part	drawing instruments	protractor, pen etc.
		fixed rule	proportional rules
	2-3 part	gunter rule	gunter rule
		sector	sectors
		slide rule	straignt, circular, spiral, log-log
		level reference	gunnery level
		integrator	mileage reader
	multiple part	drawing instruments	pantograph
		level reference	quadrant, sextant etc
		integrator	planimeter, etc.
	complex	level reference	auto-pilot

		equation solver	harmonic analyzer etc
			tide predictor, etc
	programmable	diff. analyzer	Bush, Hartree
		analog computer	Genl Precision, etc.
Digital	single register	stone, bead	counting table,
			abacus, soroban, etc
		Pascal wheel	Pascal wheel, strip,
			keyed wheel
	two register	tab indicator	
		keyed wheels	Burroughs
	3-4 register	stepped wheel	Leibniz,
			arithmometers
			automatic stepped wheel
		rotary	Baldwin, Odhner,
			Curta, etc.
		motor-driven wh.	Monroe, Friden etc
		battery electronic	"pocket" calcs.
	complex	tabulator	Hollerith census,
			Powers-Samas
		equation-solver	ABC machine, pocket calculators,
		relay calculators	Bell Labs I difference engines

	programmable	relay calculators	Bell Labs II-IV, Z3-4
		analytic engine	Babbage, Harvard MKs
		tabulator	Hollerith, Powers,etc
		plug-board	ENIAC
		battery electronic	pocket

CLASS MEMORY

ORDER -interface	FAMILY -technology	GENUS -structure of access	SPECIES
Non-mech.	Physical state	Fixed-permanent	stone marks, Napiers
		Fixed-erasable	Quipu, beads, abacus
Writable or Readable	Paper	Fixed	
		Linear	scroll
		Cyclic	rolodex
		Random	book
	Mech. stable	Fixed	switches
		Linear	piano roll
		Cyclic	drum, disk
		Random	card
	Chem. stable	Linear	microfilm
		Random	microfiche, videodisc
	Magnetic	Random	rope
	Electric charge	Random	capacitor
	Electronic	Random	diode, semicon. rom
Writable & Readable	Mech. stable	Fixed	calculator registers
		Random	Zuse memory
	Wave storage	Cyclic	mercury, optical, & magneto-strictive
	Electric charge	Cyclic	Atanasoff drum
		Random	Williams

		tube, capacitor, semicond.
Magnetic flux	Linear	tape, wire
	Linear-cyclic	datacell
	Cyclic	fixed-head disk, drum
	Cyclic-linear	disk
	Random	core, disk
Electronic stable	Fixed	flip/flop, relays, stepping switches
	Random	semiconductor array, relay array
Chemically stable	Linear	photo store

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Subject: **AUSTRALIA -- Clocks on 11's**

To: Dick Clayton, Bill Demmer, Bill Johnson, Jim Marshall, Larry Portner, Wayne Rosing

Date: 78 AUG 14
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

I got another input for good clocks that run forever and can't be tampered with because they enable software to be rented! In this way software destroys itself at the right time. Monash University has apparently built such a device.

A customer would also like a good clock which gives consistent measures of cpu use versus elapsed time so that constant bills result.

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST: Dick Clayton ML12-2/E71 Bill Demmer TW/D19
Bill Johnson ML21-3/E87 Jim Marshall TW/C03
Larry Portner ML12-3/A62 Wayne Rosing TW/C03

Am giving the following next week, what do you think?

CLUSTER

.Aggregation of homogenous single and multiuser systems
(eg. VAX/VMS, VAX/UNIX, Tops 20, Altos, Xerox Star)

.Behaving as a single, multiple access system
(usually sharing a common file system)

.High speed interconnect (10-100 Mbits/sec)
High connectivity among systems
Systems located in a machine room or office area

.Extenesion of low-level O/S service
(eg. file, print/plot) via network procedure calls

LOCAL AREA NETWORK-LAN

.Aggregation of heterogeneous systems
(eg. VAX/VMS-PC-Tops20-Unix; gateways to others)

.Purpose is to connect a network of autonomous systems
(message, file, process, terminal intercommunication)

.Relatively high speed interconnect (1-30 Mbits/sec)
High connectivity among systems (and clusters)
Systems located in an office area, building, or campus

.Based on ISO 7 layer network protocols (application)

WIDE AREA NETWORK-WAN
.Aggregate of heterogenous systems and networks

.Purpose is to connect systems across a wide area

.Relatively low speed interconnect (4-64Kb)... 128Kb
 Low connectivity via PABX, and packet switches
 Systems located in different regions

.Communication services between autonomous systems via
 DECnet and with other networks via X.25/SNA... gateways

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****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION   DATE: SUN 16 MAY 1982
2:26 PM EDT

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

cc: PATRICK COURTIN
    TONY SUKIENNIK

SUBJECT: YOU MAY NOT HAVE GOTTEN THIS IDEA ON CLUSTERS

We really do have the basic architecture and technology in place.

We should sell what we've got. It's very good. Looking at a price only model of the world that we did is crazy, since it's a price, price per terminal and software that's the issue.

We should go balls out and get the CI cost reduced and get the next round of products to be aggressive price leaders. Nautilus, Scorpio and even an NI based Nebula may get all the price leadership we need.

I am not willing to get into the usual marketing war where unless we win on every dimension, we don't sell it... this is our classic behavior. Here, look at how we've built up incredible overheads in WPS and we didn't sell it because of the features or whatever. Similarly, the CT was the same story. I say we don't need a marketing group if we don't have a product!!

Therefore, Let's decide can we compete now, soon, never? Then, let's decide whether we need any marketing? or whether we continue the engineering?

"TO" DISTRIBUTION:

BILL DEMMER BILL JOHNSON OPERATIONS COMMITTEE:

ATTACHED: MEMO;27

****
* d i g i t a l *
****

TO: GORDON BELL DATE: FRI 14 MAY 1982 1:59 PM EST

FROM: TONY SUKIENNIK
DEPT: CLUSTERS
EXT: 264-4727
LOC/MAIL STOP: MK1-1/G31

SUBJECT: RE: RE: CLUSTER PROGRAM REVIEW

I have been responsible for looking into this space for the past 3 months
Lets get together and discuss some of the announcement and product
alternatives at our disposal. Tandem has made some recent announcements
that need looking at. My view is that if we take what we have and
package it properly, its a very strong message. I'll give you a call
to set up a meeting. Thanks...

14-MAY-82 14:00:58 S 26571 EMMK

14-MAY-82 15:51:44 S 02210 EMMK
EMMK MESSAGE ID: 5163341083

GB3.S5.34

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TO: see "TO" DISTRIBUTION   DATE: MON 6 JUN 1983
4:03 PM DST
                                             FROM: GORDON BELL
cc: see "CC" DISTRIBUTION   DEPT: ENG STAFF
                                             EXT: 223-2236
                                             LOC/MAIL STOP: ML12-
1/A51

                                             MESSAGE ID:
5202115201

SUBJECT: CI CLUSTERS, OUR HOTTEST PRODUCT. NOW WHAT?

GB5.52

It's incredibly disturbing to see such a lackluster approach to the
marketing and sales, especially since we seem to need the revenue.
The announcement should have been front page news!

In Colorado, they're running a maximum configuration VAX Cluster with:

    12-780's
     4-HSC's, with
         2 x 24-Dual ported R81's (over 20 Gigabytes)

It was very impressive in terms of performance and
reliability... now
that it has been tested. Also, American Bell has some
running and
gave a very strong endorsement at DECUS.

Recall that 5 years ago HYDRA was started as the most
important
project to build a competitive (especially with Tandem)
system,
providing high reliability and incremental upgrade. Also, we
have a
unique product in the HSC disk server. IT's HERE now.

While one might observe that we're following Land's guideline
that
"marketing is what you do when you don't have a product",
since
    1. we've put all of our marketing and sales attention on
PC's
    2. VAX clusters are good enough to sell themselves.
However, I think we need someway to tell the world we have
this unique
product. Also, it might be possible to get sales from
competitors
like IBM because of our uniqueness.

Marketing and Sales Committee, is there anyway to promote
this great
product?

How about at least a review at your committee?

Can Rose Ann get this marketing charter, given the clear
marketing
failure to date?

"TO" DISTRIBUTION:

DICK BERUBE   BILL DEMMER   ED KRAMER
MKTG/SLS STRAT COM: BRUCE RYAN   JACK
SHIELDS

"CC" DISTRIBUTION:

TOM BURNIECE JOE CARCHIDI ROSE ANN GIORDANO
BILL HEFFNER DICK HUSTVEDT PRODUCT STRAT COMM:

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!   !   !   !   !   !   !   !
! d ! i ! g ! i ! t ! a ! l !        I n t e r o f f i c e  M e m o
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TO: JIM CUDMORE
BILL JOHNSON
cc: see "CC" DISTRIBUTION

DATE: MON 6 JUN 1983
FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5202114925

SUBJECT: CLUSTERS - WHERE WE ARE & WHERE ARE WE GOING

GB5.59
BACKGROUND
Bill and Mahendra got our terminology turned somewhat, but we still aren't organized right to get the various products.

We aren't moving rapidly or with enough focus to get a MicroVAX PC Cluster, a single system formed from a collection of single user and single function servers to provide what is fundamentally a shared, system. They're tied together using a LAN cable, and might be

called
a LAN-based cluster.

The CI Clusters are great as one can see in Colorado. These are
really the aggregation of several, shared systems to form a single
system where many more users can operate together in a shared file
system, using a set of computers. These might be called Close Are Net
(CAN) Clusters.

LANs on Ethernet are creeping into existence as we have hopes someday
to have our own, Ethernet controller for VAX. However, systems built
this way are still networks of independent systems with more formal,
hierarchical protocols. They're an evolution on our Wide Are Nets.

Seaboard/Seahorse is an excellent base for building specialized
function clusters, providing network-wide construction, debugging,
loading, etc. Clearly OEMs will use it this way for real time. This
should be used for specialized servers for the MICROVAX PC CLUSTERS:
file/database (being done in CX), communications (gateway to Ethernet
Network of VAXen), printing (if we ever get a printer and a group to
write the software). This is really a SEAcluster.

MICROVAX PC CLUSTERS is what we need. Finally it looks like we're
going to get a CRT controller for Seahorse, and VC100's being defined
as the first, bounded version of the MicroVAX PC. Dick Hustvedt's
doing the SDA graphics architecture implementation. We still

need:
0. The Person Server- Hardware's not committed yet, Dick software
1. Someone to take overall responsibility for the Cluster
2. File/DB Server- Rubinson
3. Communication Server to Ethernet- ?
4. Print Server- ? (We still don't have a Printer interface spec'd.

In doing it this way, there's a major question as to how and when we
build a standalone MicroVAX PC, as the Cluster is predicated on being
diskless. (These work just fine at Stanford using SUN Workstations

and 750's for file servers!)

I'd like to get together and find out who's doing what, since it's
beginning to look like we have the right components coming. For
starters, I'd like to see someone take the responsiblity for the whole
cluster and be given as many resources as possible to get the product
done. This could get us a quality product most rapidly! (I have less
faith that we should do it again like PRO.)

Can you folks set up a meeting to start this discussion? (or state
that it's all decided?)

"CC" DISTRIBUTION:

FU 6/17	SAM FULLER	DICK HUSTVEDT
MAHENDRA PATEL	JACK SMITH	BILL STRECKER

WPS USERS - Leave HP mode and type <CR>

Digital **Interoffice Memo**

Subject: **CMOS-8**, **8080**, **LSI-**11, **F-11**, **and** **T-11**

To: Dick Clayton

CC: John Clarke
Lorrin Gale
Steve Teicher

Date: 29 NOV 76
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

F/U 12/13

Remember how frustrating the enivronment used to be without a policy on 8080 chips and their support versus LSI-11? Is it possible, things will be 5/2 = 2 or 25/4 = 6.5 or 10/1 = 10 times worse with the new interactions?

The troops are frustrated with at least 2 groups working chips issues.

Who should drive for clarity? I've gotten no help yet here from Lorrin.

Who are the appropriate chips level systems managers/architects? Can we assign them? How does this interface to a higher level PSG structure for market use? Are chips just an internal issue or can we get components/OEM to lead/help here?

Can we state:

0. Our goal is to be competitive at as low a level as possible.

1. No new designs should use an 8080 without OOD approval.

2. Low end should be CMOS-8 or LSI-11.

3. Our board level systems should have bus adaptors to

industry standard; i.e., 8080 and 6800 peripheral chips.

Martin Hall talked with me on this and is anxious to help. He'll direct CSS designs to CMOS-8 immediately if we give the nod of chip support. Also, he might want to join us.

By saying nothing, the 8080 is getting more embedded, and we defer what we do. Now we have no written plan to be competitive at anything but systems or sum-of-boards level...not the 1 special board level.

Let's talk...we're not leading when the world wants consensus, and we don't provide it.

GB:ljp

00 CORE DECGRAM ACCEPTED S 000859 O 167 18-JUN-82 10:21:37

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION DATE: FRI 18 JUN 1982 10:19 AM EDT

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION

DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5166852193

SUBJECT: CM'S AS A PERFORMANCE ALTERNATIVE TO BIG MACHINES

Pete Smith informed me that the FPS 164 delivers ten times a 780 for $300K when it's connected to a VAX.

Computer modules may represent a real alternative to the large machine. For years, there's been hope. Now, the gap is so great in terms of cost and performance (64-8086/8087's = 1/2 cray = $100K), but the software problem may be insurmountable.

I feel a knowledge-based system may be a way to do the programming.

Right now I'd like to watch this effort carefully, but try to do
some applications for such a structure.

Some candidates:

1. Routing using Ivan's dataflow model.

2. Simulation ala DECSIM.

3. Various tasks which Pete Smith has benchmarked.

4. Knowledge engineering (say running OPS5 on XCON).

Could your group posit a structure such as the hypercube, and then let's try to apply it to these particular problems?

Note: If we can build these systems, they could have a very radical impact on the future course of computing.

"TO" DISTRIBUTION:

SAM FULLER	JESSE LIPCON	BILL STRECKER

"CC" DISTRIBUTION:

PETER CHRISTY	BILL DEMMER	ELSIE/DOBES @CNS1
ULF FAGERQUIST	BOB GLORIOSO	ARNY GOLDFEIN
MIKE GUTMAN	BILL JOHNSON	JEFF KALB
CAROL PETERS	BOB SUPNIK	STEVE TEICHER

ATTACHED: MEMO;33

****
* d i g i t a l *
****

TO: GORDON BELL DATE: TUE 8 JUN 1982 8:42 PM EDT

FROM: PETER CHRISTY
DEPT: SEG
EXT: 225-4887
LOC/MAIL STOP: HL2-2/N07

SUBJECT: SEITZ HYPERCUBE

Gordon,

I'm delighted that you're as enthusiastic about this as I am. When Chuck gave the VLSI course in January we discussed it and I tried to create some enthusiasm for (say) building J-11 modules
for them. I couldn't penetrate their interest sphere at that time; hopefully, you'll have more luck!

I have asked Chuck if it is possible for him to come and give a
talk on the ideas in the nearish term future. I'll let you know what comes (although you may be in Japan).

What do you think of building a uVax hypercube module? I'm looking
for some target systems that we might breadboard. Strikes me that this configuration aimed at VLSI CAD workstations, presuming
that we can decompose some of our key algorithms, would be a nice,
incestuous target to drive some system understanding. Comments?

/p

WPS USERS - Leave HP mode and type <CR>

.MAIL - 23 APRIL 79

To Whom? Allen Newell
Subject: Vax's you ordered for the CSD
Enter mail terminated by <escape>:
ON THE TWO VAX'S YOU'VE ORDERED FOR THE CSD: YES, THEY'RE PART OF THE RESEARCH PROPOSAL AS GIVEN; AND IF WE CAN NOT AGREE ON THE DETAILS OF THE RESEARCH, THEN YOU CAN CANCEL THEM AT NO PENALTY.

I FEEL THE RESEARCH AS PROPOSED IS REALLY ESSENTIAL TO US AND WE NEED THE WORK DONE, HENCE I'M ENTHUSIASTIC. THE MODEL IS MORE LIKE THAT THAT WE WORKED ON WITH CSD ON C.MMP AND CM* ALTHOUGH IN THIS CASE I WANT TO DO MORE WORK HERE TO UTILIZE YOUR WORK. BY OUR PUTTING MORE INTO IT, I WOULD HOPE TO BETTER INFLUENCE THE RESEARCH DIRECTION TO BE MORE IN LINE WITH THE NEEDS WE SEE. HOPEFULLY, WE CAN GET ON WITH THE DEFINITION AS YOU PEOPLE SORT OUT FIRST WHERE YOU WANT TO BE.

ALLEN NEWELL (A310AN02): Mail sent

GB0002/41

| d | i | g | i | t | a | l | interoffice memorandum

Subject: **ALLEN NEWELL'S COMMENTS ON CMU MEETING**

To: Jim Bell, ML3-2/E41
Bob Bonocore, PH
Ulf Fagerquist, MR1-2/E78
Sam Fuller, TW/A08
Rick Peebles, ML3-2/E41
Pete Smith, MR1-1/M82
Bill Strecker, TW/A08
Jerry Witmore, PK3-1/M40

Date: May 1, 1979
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

They believed we believe the two proposals are independent.

Allen was surprised at the panels and how they would enter into the process. Are they buy in for the liaison? Are they to direct CMU? To approve? (I'm curious too.)

They've gone from an early view where they wanted a gift and wanted us to get out, to the point where they're worried about involvement. They want to use standard software and to affect the way people compute...through us.

They'd like something that feels more like a joint venture in R & D versus a buyer-seller and arms length transaction. They want to be part of our engineering effort for this. They'd hoped we had gotten into the second session to find out details like interfaces, SW license cost exclusion, foreign peripherals, interaction with other projects, etc.

Allen sees two critical issues:

1. Can they and we afford to go this way - especially given CMU's resources? Allen also asked whether they needed to go out for another $1M from somewhere.

2. How's the cost relative to others?

    a. The 4331 is cheap and it looks like IBM might just be willing to buy them with a fat contract plus give them the machine. They have a bias against this. The SW is a nightmare, but IBM is beginning to see the merit (cost-effectivness) in their research.

    b. The Pascaltos Personal Computer (by a small Pittsburg company) which can be obtained for $30K. It came out of the Xerox Research Lab as a 3rd generation Alto.

People were confused about taking the next step. Overall they want to get started and are excited. (Thursday there is a meeting on putting DOD-1 on VAX) with the possibilities if we can get going. I called Bob Sproull and he can help on our personal computer definition - but not until July 1.

I'm worried that we are going to mess this up by losing to IBM and by our attitudes and hassling them. <u>I want to work with them.</u>

GB:swh

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Jim Bell	ML3-2/E41	Bob Bonocore	PH
Ulf Fagerquist	MR1-2/E78	Sam Fuller	TW/A08
Rick Peebles	ML3-2/E41	Pete Smith	MR1-1/M82
Bill Strecker	TW/A08	Jerry Witmore	PK3-1/M40

September 25, 1979

Dennis Jackman
Computer Science Department
Carnegie-Mellon University
Schenley Park
Pittsburgh, Pennsylvania 15213

Dear Dennis:

Following are my expenses for the trip to CMU, September 29, 1979, to give a lecture and university interaction:

Meals	$21.00
Taxi	6.25
Limousine	3.40
Taxi	20.00
Hotel	33.17
TOTAL	83.82

Sincerely yours,

Gordon Bell
Vice President, Engineering
Professor, Computer Science
Carnegie-Mellon University (on leave)

GB:mjf
GB0004/60

Q. How long have you been at DEC?

A. I came to DEC in 1960. Before that, I was at MIT. I had gotten a Master's Degree there in 1957, went on a Fulbright to Australia in 1958, then came back and started down the Ph.D. route. But I really wasn't that much interested in a Ph.D.

Q. You were at MIT when you met Kenneth Olsen and the others who founded DEC?

A. Yes. There was a computer called the TX-0 at MIT--the first transistorized computer--and I started using it on a speech research project. The people who designed the TX-0 were the same ones who had founded DEC in 1957. I was working on some circuitry associated with that computer, using DEC products. They'd just built the PDP-1 when I came aboard in 1960 as the second computer engineer.

Q. You preferred DEC to the academic life at MIT?

A. I had pretty much decided that I didn't want to work as an engineer because of my experiences as a co-op student for a large corporation. I had wanted to be an engineer since I was old enough to know what they were. But practicing as a co-op student and my mental image of engineering just didn't match. I thought I'd <u>have</u> to go to academia for more freedom, responsibility, and more interesting work.

Now we're faced with trying to keep the engineering environment here from becoming like it was in the places where I worked as a student.

Q. You left DEC in 1966 to come to CMU. Why?

A. Yes. I worked here from '60 to '66. I did a lot of design and engineering. I was in charge of computer design. DEC was at about $15 million in sales then. We had more computers than we needed from a market standpoint, and I was feeling burned out--as a manager, and I wasn't designing things. I wanted to learn and do projects again.

That's a period I see many of our engineers go through here. It's the dual-track/dual-ladder problem--wanting to be fundamentally technical, to do design, to do projects as an individual, and, at the same time, wanting or feeling that one has to be a manager just to get more leverage on the projects one wants to do.

Traditionally no company is supposed to work this out very well, but I think we are. We try to keep both paths open. We try to have comparable positions as both management and individual contributing engineers.

Q. Why did you come to CMU instead of going back to MIT?

A. I had met Newell, and Perlis. Also Everett Williams, Head of the Electrical Engineering Department, influenced me to come. Carnegie had really put together the first computer science department. Ivan Sutherland, a Carnegie graduate aid head of ARPA (Advanced Research Projects Agency of the U.S. Dept. of Defense) also suggested CMU.

Q. Was the CMU experience what you'd hoped it would be?

A. Absolutely. CMU's a great place. Compared to other state and private universities I'm familiar with--it seems to be the right size and scale. I thoroughly enjoy the student-faculty interaction, general atmosphere and learned more than during any other period of my life. Writing the book with Allen Newell was especially rewarding.

Q. Your work at CMU was, of course, the computers. It's been said that by the end of the twentieth century, every major enterprise of science, goverment, education, and industry will rely on them. What does that mean in terms of how managers are or should be trained at GSIA and other business schools?

A. I think there's still a long way to go. many of the business schools, CMU, Wharton, Harvard, Chicago--they all have their own departmental PDP-10's. But they're just scratching the surface of what they could do. It all pretty much revolves around the difficulty of using computers. The students do solve some problems on a canned basis. They're given a program to run, and they put some numbers in. Computers are used for building simulation games. Students learn a little bit about programming--perhaps just enough to make them dangerous. Then they think they know what computers are all about because they've written some one-page BASIC programs. I think they need to build some large, non-toy systems and solve non-toy problems where they write reasonable programs.

The business schools have to change a lot in this area, and I don't know how they're going to do that. The computer science departments could help if they became much more strongly involved with the application in business schools. So much business school activity is in the industrial organization that that's a good application area. And I think every science or engineering discipline needs a target user to really understand systems design.

Q. You're implying that there are problems inherent in the use of computers by people who don't know as much about them as they should?

A. We get management reports that are absolutely impossible to deal with. The computer's made that possible. And it's probably made organizations grow bigger than they might have otherwise simply because you can keep your hand on a lot more information. You'll never be able to test that as a hypothesis. But we're far away from being able to have any kind of understanding or control in an organizational sense because of the way a lot of the reports are done. The touch part is putting machines within a human organization so that you can get more out of that system, not strangle it with paper.

The way the computer ultimately has to go will really be as something that supplements human information processing.

Q. Has the problem been compounded by the fact that computers have changed so much in recent years?

A. Right. Many managers still think everything has to go through one central place. That's sort of like having the Electronic Data Processing person be in charge of every telephone that's put in. Sure, you can do that. But is that the right way to build or run an organization? That's saying that person has to be <u>so</u> bright, because he's really setting and controlling the organizational structure.

But computers are being built differently now. Soon they'll be in every telephone, in every typewriter, in every copying machine, in every mechanism--and we all will be interfaced with very many of them in various ways.

Q. In another vein, how do you keep in touch with what's happening at DEC's 23 manufacturing plants? Do you do a lot of traveling?

A. Not as much as I should. I get out a couple of times a month. Unfortunately I haven't visited all of the plants. I should. It's too stimulating and frustrating because it causes me to push for changes in products, the plants, and the engineering process.

Q. Your work is mainly here in Maynard?

A. Yes. Every manufacturing plant has engineers responsible for the product flow in that plant. Design engineering is here and the design engineers do a tremendous amount of traveling.

Q. Do you rely on information sent to you by computers from the various plants?

A. Not really, although we use it extensively for message switching. Also, I don't stay that coupled to manufacturing. To really know what's going on I have to be more direct by visiting the plant or talking with somebody who has been there. The financial numbers tell superficial kinds of things. The whole notion of control should not be so oriented to financial numbers to the exclusion of other metrics. Mostly what's being controlled is not an item that is easily assigned a dollar value. In several years when classical engineering control theory gets into business schools and then can be taught and also learned, some change may be possible.

There are two basic ways to control: the input and the output. Business schools seem to teach controlling (actually just accounting) the input. For instance, one might control spending into the library. But whether or not that's at all right, one has to look at the output and its value. Controllers don't report on how many books get checked out or other transactions because these are non-financial. Much of the output of an organization really is non-financial. For a drafting room, the response time and the drafting they do per dollar are the control metrics.

Q. Do you try to control what's happening in your plants from your headquarters in Maynard?

A. That's manufacturing's domain. When we set up our first remote plant years ago, our Puerto Rico operation, we started out with just assembly there. All the controls were from here, all the ordering. Parts were taken down, assembled, and then testing was done back here. And from a control standpoint, it was not very satisfactory because there were long delays in the information channels. Now plants control their own raw materials and are self-sufficient.

Q. How do you spend your time on the job?

A. I try to avoid going to meetings, with little success. I try to work by phone, and I like to walk around and visit the projects--contribute to them and critique them. Sometimes I visit customers to see how other people use our computers--at Kodak, Dupont, and other customer sites. Applications are all different at each site in terms of what their problems are. I also try to spend a fair amount of time on product issues. If I look at the problem list that I deal with, it includes everything from defending the engineering budget, to supporting a product that I feel particularly strongly about, to hiring. I like products. So I worry about strategies, advanced development, research and things we ought to be doing that we're not.

I worry some about space and that people, space and capital and equipment are in balance. I worry about keeping all the processes going. Essentially we've got a whole zoo of processes that have to be kept on-going. Traditionally, in a high growth company, these are the things that you ignore until there's a disaster because all the effort is on product strategy, hiring and training.

As a hobby, I like to write about computing. This was training I got at CMU. Now, one of the engineers and I are doing a book of readings with several original papers on the engineering aspects of our computers.

Q. Do you pay close attention to your competitors?

A. Sure. I'm always worried about the competition. they can come from everywhere. IBM, the semi-conductor vendors, all the people the semi-conductor vendors put in business, the existing institutions, the Japanese.

Very often the only thing our engineers understand, however, is market feedback or competitive feedback, and I detest our behaving that way. The minute you start responding like that, you're building a development process that's going to produce obsolete products. I think that's always the biggest danger when you get bigger. Keying off of a conventional marketing structure is the biggest worry that I have. And DEC traditionally hasn't done that. It doesn't mean we don't listen to the marketplace. But the minute you start responding, then in fact you're gearing a process that is going to be about eighteen to thirty-six months behind--or whatever the gestation period of a product is.

Q. Are you concerned about what IBM is doing with minicomputers?

A. IBM has such vast resources to do things that by and large it sets its own standards and goes off and does what it wants. Everybody has to couple in with them in some way. We have to be able to communicate with their machines.

Q. Are you working on tieing machines together and what standards exist?

A. In the network area, standards are very desperately needed. Yet the standards work didn't progress rapidly enough so people could key off them. IBM seems to have made some mistakes in the network area that we think will be too limiting. They may move the users around so much that it'll be too hard to track.

When we went off on our DECnet system and standards, which allows users to build a variety of networks connecting our computers to each other or to those of other manufacturers, we felt we knew networks. Still, it's turned out to be harder than we thought. We are successful now.

Q. What about standards for computing?

A. Historically, I believe computers have evolved rapidly because the government has been an intelligent and demanding user. They have not designed the systems by specifying standards. The government really bothers me in terms of the way it seems to now want to operate in the standards area. One particular standard that I was very much opposed to is supposed to reduce their disk acquisition costs. I worry that it will impede technology and cause higher costs too?

Then, too, on something like the networks, communication protocols should have been standardized before now. That one's trailing, and we're facing some real problems as a result. It's like having a bunch of private telephone exchanges, each with different signal levels so that every phone network needs a converter if it wants to communicate with another.

The government, together with the telephone company, should have set the standards. I don't think it would have been political, and it would have saved an incredible amount of time on everybody's part. We'll ultimately have to do that anyway.

Q. The computer industry isn't regulated by a government commission. But you do have numerous regulations to deal with?

A. Sure. there are product safety regulations, guidelines for power suply efficiency, radiation, noise--I could go on and on. We've got the government pulling at us. And I don't want us to get into a relationship like that which exists between the FCC and the telephone companies. Little happens outside of that structure. That doesn't mean the telephone company hasn't changed over a long period of time. They've improved service a great deal. But computers have evolved rapidly over a short perod of time. Looking at our indicators on an exponential basis, for the short time we've been in business, things have changed rapidly and a great deal. What was important a couple of years ago isn't going to be important in two years, just when the standards begin to come out. The government standards process can't deal with these very rapid exponential changes.

Q. Looking at computers in a general way--are they overrated?

A. Not at all. Historically we'll look back and say that they really started being used about 1975. It will be similar to the Industrial Revolution but more significant. There will be a clear line of things that have changed and were totally impossible without machines. People's lifestyles will change. I don't know what the revolution will be called at that point, but the computer is clearly the root of it.

Q. Will there be a number of computer-related inventions?

A. Much will be keyed off of supplementing existing information processing. On the other hand, we'll be doing things that we couldn't have done otherwise. For instance, having a robot in the room that's smart enough to know when there are people in it and controlling the lighting and heating accordingly--and doing other trivial tasks. Doing all the things that no one can train his children or wife or himself to do will be possible. Computers can take over a number of chores that are in the resource control domain.

Q. How will they be used in the near future?

A. In all kinds of ways in the communications area--for message switching, for all the office automation. I think computers will come to be used widely--simply for communications and text preparation, storage and transmission (e.g. electronic mail). More and more people will start to do local, totally distributed processing. I think most all conventional tasks computers perform will move to a totally distributed form to be associated with each organizational entity.

We have a word processing system here in my office. We moved from a big machine to this. My secretary loves it because she's not dependent on the large machine. Also, I can type memos and messages myself. It's got processing associated with it, and there's much that it can do that we use to go to the large machine for--report generation. In fact, we can operate and do a lot more control now. We keep a list of all the projects we track, for instance. To get that kind of thing done from the corporate data base is virtually impossible. So the task is to get some of these things down into the organization where people feel comfortable. There an organization can operate the way it's operated before, but more efficiently.

There are a lot of reports that are generated, a lot of files. Everybody's got file boxes on their desks, or a list of things to watch and do. All of that they can do now with these word-processing machines, and they'll do them informally. The centralized system person always says "I'll maintain all the files and all the reports that everyone wants in the whole organization. I've got this one data base, look how great it is. There'll never be any wrong information in there." But the problem is the timeliness of the information. Also large, central data bases are very difficult and expensive to build and maintain. Unless people are keyed in or have a terminal into that data base all the time, it's not very useful and it's generally wrong. You can't get the response you need in terms of kinds of queries and formats.

Q. Modern science fiction has utilized the computer extensively. The computer is the bad guy. Is there a danger associated with the computer?

A. It's not a bad guy. But it can be an instrument of bad guys. The notion that you can have a machine monitoring all of the communications in the world, processing all of that communication and filtering it--well, I've never tried to compute whether that's possible or not. But right now--and as far into the future as I can see--it feels impossible. And even if it weren't, there are very good security devices that we <u>do</u> have right now. You can put a personal scrambler on a telephone that you carry around with you, if you're worried about that sort of thing. Technologically we can deal with security problems. We can have secure communication channels.

Then there is this whole business of records. I don't think that presents an insurmountable problem, either, of course people have to be a lot more careful than they have been with information. The risks are no greater, however, than they have been.

Q. Does someone who aspires to running an organization have to know computers?

A. Yes. If for no other reason than to have some notion of what a process is. But whether they can really effectively understand how machines will diffuse into organizations and be used is questionable. So many mechanisms of how processes work in organizations, all the informal communications paths, how an organization performs its functions, aren't very well understood. And computers point out the lack of understanding because all activites for machines must be so explicit. Machines can force a rigor that I think is necessary in would-be, cloudy headed, future managers.

Q. Why should the average person bother to learn about computers?

A. Simply so he can get along and understand the world. You have to have some way of relating to what the world is today rather than just writing letters that say "Your computer screwed me."

It really burns me up the way people put in systems and then use the computer as a scapegoat. "My computer did it to you," they'll say. That's nonsense because the organization (usually just one person) is respnsible in any event. They'd better have a process in place to sort and cope with the input.

I get furious when I get a bill for 00 cents, or a check for 00 cents. It's simply unnecessary and at best a sloppy program which is permitted to exist by some sloppy, wasteful manager. And then sometimes people will get dunning letters and threats, and when they write or call to complain, and ask how can things be so absolutely screwed up, they'll be told laughingly "We;ve just installed a computer, and you understand what that means."

This is totally absurd. What it comes down to is that people have found a new scapegoat, something they feel everybody can relate to and understand. Somehow there is a notion that people weren't involved; it was a machine that did a dumb act. It really irks me. If you think the computer is causing the problem get it thrown out!

Q. Do you have any advice to people on what their attitude should be towards the computer revolution you predict?

A. People shouldn't worry about it. They should relax and enjoy it. Machines are (or should be) friendly, fair and basically helpful. I think it's going to be fun. It'll all come in a basically innocuous way, driven mainly from the economics of everything. It can'be stopped, especially as long as organizations are operated so much on purely economic metrics.

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* d i g i t a l *
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TO: see "TO" DISTRIBUTION DATE: SUN 18 OCT 1981
15:50 EST

FROM: GORDON BELL
cc: see "CC" DISTRIBUTION DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: CMU JOINT PROPOSAL DISCUSSION WITH DOUG VAN HOUWELLING

Just had a discussion with Doug on this. He is going to call me back on Tuesday morning.

We got into the heart of the issue: IBM has made the commitment
to the project. Doug noted that IBM moved very fast after receiving the proposal, and on the other hand we knew of the project and their desire to work with us for about a year, even
though the proposal had not been made. We're second in the pipeline to agree to do a Technical Proposal with them! CMU does
not believe that both DEC and IBM can do a Technical Study there
in parallel, hence the question:

Is there anything we can do to prevent IBM from making their
Technical Study, or should we simply agree that they should go
first and we will request a similar Technical Study period
following IBM?

WHAT IBM IS GOING TO DO
IBM has proposed to be their partner on this project, subject to
being able to reach agreement during the Technical Proposal

making phase. They are meeting for a day during the first week
of November in order to review and approve a memorandum of agreement ... for the technical study phase. They have designated a single individual to head the Technical Proposal group and have asked CMU to provide space for the 12 individuals
they want to relocate in Pittsburgh. They study is supposed to
take 3 to 6 months. Doug has worked with IBM before, and has been sceptical whether IBM can be flexible enough and understands
the importance of the area enough, but so far he has been surprised and has stated that IBM may have changed.

WHAT WE MIGHT (MUST) DO IF WE WANT TO DO THIS PROJECT
Right now, we run the risk of not being able to be asked to make
a Technical Proposal because we can not convince CMU that we can
or are willing to do the project. I don't see how we can convince them otherwise in the short period between now and when
they are meeting with IBM to make an agreement. We can not sit
by even now, otherwise, by default they might enter into a non-cancellable agreement with IBM which says the two must go ahead subject to an adequate proposal.

Therefore there are significant risks now that IBM will get the
project by default. We will be unable to convince them that we
are serious enough, hence they won't even bother to allow us to
make a Technical Proposal! We must still work during this time
to determine how to even stay in the race.

Since Doug is calling me on Tuesday morning at 9:30, I would like to get together on Monday morning to decide what we say.

"TO" DISTRIBUTION:

SAM FULLER BILL JOHNSON IKE NASSI

"CC" DISTRIBUTION:

CHUCK EICHENLAUB WIN HINDLE ANDY
KNOWLES
JOE MEANY

GB3.S1.19

PROPOSAL FOR THE JOINT DEVELOPMENT OF

PERSONAL COMPUTING

BY CARNEGIE-MELLON UNIVERSITY AND DIGITAL

G. B.

10/14/81

THE CMU PROPOSAL

- BUILD A PERVASIVE ENVIRONMENT OF PERSONAL COMPUTERS THAT

GRADUALLY EVOLVES FROM EXISTING T/S SYSTEMS IN DAILY USEBY A LARGE, DIVERSE POPULATION.

EVERY STUDENT, FACULTY, STAFF MEMBER WILL HAVE A PC. STUDENTS WILL TAKE PC WITH THEM.

-DEVELOP APPLICATIONS APPLICABLE TO A BROAD MARKET, ENCOMPASSING:

+

OPERATIONAL SUPPORT OF LARGE INTEGRATED NETWORK
(ARCHIVAL, RETRIEVAL, ETC.)

+

PRINT IMAGING, GRAPHICS, AND VOICE

+

ROBOTICS

+

MODELLING

+

KNOWLEDGE ENGINEERING

+

INFORMATION AND DOCUMENT PROCESSING

+

HUMAN INTERFACES AND SOCIAL ASPECTS OF "LIVING ON THE MACHINE"

-CREATION OF AN OFF SITE INSTITUTE FOR INFORMATION MANAGEMENT AND TECHNOLOGY TO DISSEMINATE AND TRAIN STAFF, CUSTOMERS, POTENTIAL CUSTOMERS.

G. B.

10/14/81

BENEFITS, COSTS, RISKS

BENEFITS

-OWNERSHIP OF TECHNOLOGY (FIELD PROVEN HARDWARE AND SOFTWARE DESIGNS) FOR FIXED OPTION PERIOD.

-CLOSE COLLABORATION WITH A LEADING UNIVERSITY AS A WAY TO EDUCATE, INNOVATE, VITALIZE ENGINEERING.

- REDUCE ENGINEERING ISOLATION FROM CUSTOMERS AND ACCESS APPLICATIONS

COSTS

- $6-7M PER YEAR

-REQUIRES MANAGING AN ENGINEERING SITE LOCATED IN PITTSBURGH

RISKS

- STAFFING

-TRANSFER OF DEVELOPED TECHNOLOGY INTO PRODUCTS

-UNCLEAR ASSOCIATIONS WITH OTHER CMU INDUSTRIAL AFFILIATES (WESTINGHOUSE, THREE RIVERS, IBM, HP ...)

-WE ACCELERATE THE DEVELOPMENT OF A MARKET THAT WE DON'T QUICKLY CAPITALIZE ON

- NO PRODUCTS FOR THREE-FIVE YEARS

-ADVANCED DEVELOPMENT TREND IS MOVING AWAY FROM DEC

(UNIX, XEROX, THREE RIVERS, WESTINGHOUSE)

G. B.

10/14/81

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* d i g i t a l *
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TO: see "TO" DISTRIBUTION DATE: SUN 18 OCT 1981 14:02 EST

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION

DEPT: ENG STAFF

EXT: 223-2236

LOC/MAIL STOP: ML12-1/A51

SUBJECT: CMU JOINT VENTURE DISCUSSION WITH ALLEN NEWELL

I told Allen about our basic decision to go ahead with the study phase. I tried to give an accurate presentation that our position was to approve in principle, the idea of the proposal and engineering site, but that we weren't prepared to give a carte blanche approval of this sort of expenditure at this time.

In contrast, he stated that IBM has already given such an approval... namely, they have approved the plan to do the project, subject only to a detailed proposal. This is an interesting commentary on IBM vs DEC... I doubt if we could make a decision as fast even if the magnitude was about 1/10 the

size!! Also, it indicates that IBM is really going balls out for
this area, and they already understand the need for both research
and large scale prototyping in a pilot fashion.

Given that we can not make such a strong commitment, Allen would like to get some way of testing that we are serious about
doing the project, given that a successful business plan can be worked out. This may take on the form of visits to CMU by say Ken or Win or Andy. Their view, based on a relatively long
history, is that we really budget and control very tightly and
very much in a distributed fashion, making it difficult to make
a decision of this fashion. Furthermore, we don't believe very
much in research, but instead focus on short term results. I couldn't say that he was absolutely wrong. We did agree that the
proposal several years ago to put 100 PC's in the CS Dept. was a
different, though similar case. (In that case, there was no support from either development or from research. In retrospect, that would have been a bargain in order to get the
work done. We have spent the money internally and have no output.)

I think we are ready to go ahead with the convincing them process.
It should take the form of Ike doing the convincing with van Houwelling
et all, plus getting the other person who would head up the facility there to put together the study team.

I will argue very hard to do this project if we can get a team
and very good plan together.

"TO" DISTRIBUTION:

SAM FULLER BOB GLORIOSO BILL JOHNSON
IKE NASSI

"CC" DISTRIBUTION:

CHUCK EICHENLAUB WIN HINDLE ANDY KNOWLES
JOE MEANY

GB3.S1.22

00 BURT DECGRAM ACCEPTED S 6703 O 464 13-NOV-81 16:45:23
****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION DATE: FRI 13 NOV 1981 3:38 PM EST

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: CMU JOINT VENTURE PROPOSAL.. I WOULD LIKE YOUR SUPPORT!

This is the most exciting proposal I've seen about building a computing environment that will allow us to understand computing in the explosive '80's. Everyone has a powerful computer (or access to one) in every part of his environment (home, office, classroom).

CMU is an ideal laboratory in terms of its size, attitude, determination to build the system, decision making ability to carry it out, competence (computer science and engineering), computer center support and computer use.

We would proceed with the 6 months study phase, and if successful, proceed with CMU to implement the environment. The mechanics would mean a DEC Facility there staffed with Software and Hardware Engineers, P/L Engineers, SW Support and EDUCATION Service persons. CMU (Pittsburgh) would become a key engineering site.

I'd like to discuss this on Wednesday or Thursday at the Operations Committee Woods. The purpose would be to get approval for the study phase, with a strong commitment to proceed if the study were successful. Given the tax structure, the cost is unclear. CMU believes it will cost five to seven million per year for both CMU and its partner. The duration is 5 years.

Based on the performance of the CMU Computer Science Department in implementing their SPICE (Powerful Personal Computer Network) which we rejected 2 years ago, I believe the project will be successful. Furthermore, the project is vital to our future.

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FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: CMU JOINT VENTURE INTO TOTAL ENVIRONMENT COMPUTING

I'D LIKE YOUR SUPPORT ON THIS... CMU HAS THE VISION AND TALENT.
Proposal being sent via regular mail.

This is the most exciting proposal I've seen about building a computing environment that will allow us to understand computing in the explosive '80's. Everyone has a powerful computer (or access to one) in every part of his environment (home, office, classroom).

CMU is an ideal laboratory in terms of its size, attitude, determination to build the system, decision making ability to carry it out, competence (computer science and engineering), computer center support and computer use.

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TECHNOLOGY LECTURE (CMU - FEB. 22, 1977)

books to read and I read every time I see a serious technology forecast is a thing that was done in '70 by a bunch of people who got together in a DELFI experiment and I'll show you a diagram of what a DELFI experiment is if you don't know but I was amused by Bob Sprowl saying "why did all these bright people get together and they didn't produce a really startling system?" The thing that always amazes me is that when you put that many bright people together you get anything out. A DELPHI experiment is that in the limit although I'm not sure whether they use bright people or not. A DELPHI experiment is where everybody talks about what all of the wild life is and when things are going to happen and somehow all of these people conspire to make projections about the future; for example, I think it was one of the military that did this and this was for 15 years of data processing and in fact if you looked at all the statements that were made there by 1985 or so when this 15 year period ended, virtually every science fiction thing you'd every dreamed about had concluded. Somehow they should have given themselves 50 years instead of 15 years and maybe things would have been different because a color display with a thousand bit resolution low cost was going to be available in 1971 and this was done in 1969. Wall displays, 4 feet by 12 feet with rapid resolution of 40 lines per inch and color are feasible. That was going to be in 1973 and that was really far out. Low cost graphics terminals were somehow 1974. None of the responses to all these things that were going to happen were related to one another. They all seem to be independent. Widespread use of LSI, given all of that, for computer memories fortunately didn't happen until 1976 which is in fact sort of when it's happening. Occassionally they hit a few. Semiconductor caches were available in 1971. A universal computer language will have evolved through automated communication and that occurs in 1995. So the programming problem doesn't get solved. That did go outside--they didn't define it--that's what's so wild about this whole thing--it looks like everybody put statements in there and there was no attempt to sort out the overlap or anything and they voted on it and they have all these little votes of when something is going to happen and there's a distribution of when things are going to happen. User program systems without programmers--programmers only used to program firmware. That happened in 1975. For spoken input, computer vocabulary will be many hundreds of words and the computer will interpret simple sentences. That happened in 1972. A 7200 bit modem on voice grade lines was highly feasible and was going to happen in 1970. And we still don't have any decent modems at decent prices. The problem in all my graphs--I based them all on past data and if your foolish enough to think that those lines would go out into the 80's forget the fact that these lines are always--I draw access out and this is the only safe part and anything beyond 1977 forget about--but the lines are just drawn there for your convenience. Worry about exponential projections--I do. Initially the third talk was going to be on technology and I moved it back so we're going back into this diagram because in order to get into the--I can't start the context of where we were yesterday. So using the first diagram we used yesterday, I started building these talks from top down and then when I got to the bottom up part I found that they didn't mesh and that's why I had to go back and insert the third talk in this side because essentially one of my thesis is everything is driven from this technology, from this core or from the user and talking about the marketplace until one has what's driving this system, it doesn't make a great deal of sense. Just had this one slide--I never understood this diagram but this is a modified DELFI technique. All these experts get involved and there's interaction and person to person contact--these aren't my slides--I just talked to them because there awfully complicated and all these boxes and I can't imagine the thing working--and they don't. Back to this curve which is cars, and computers. I wanted to call attention to the fact that the whole thing that drives this is purely the number of units. I'm using time because units are virtually impossible to get in terms of looking. That all comes from the notion of production learning curves--that is the efficiency of the n'th units is you take the n'th unit and that's raised to some exponential or a positive learning constant so that the efficiency improves with the number of units and a lot of that work was done here in terms of studying and getting a correlation of why, not necessarily why because I don't think people know yet why that gets better, but in fact take that these are generally intherical data and a lot of that came out of work here in studying everything from liberty ships to airplanes or jet engines in terms of finding what the efficiency of a given unit is or what the cost of a given unit was is purely based on number of units, not time. All the early technology forecasting was done in terms of an exponential to some time period. A guy by the name of Fusfeld and maybe somebody else, but he claims he made this observation came up with a technology progess function which is really a learning curve in which he finds that the technology of the n'th computer, that is some performance indicater of the n'th computer is raised to an exponential and that's 2.5 for computers and .7 for autos if you take horse powers as the measure. He made this other observation that if the number of units increases exponential with time, then one ends up with the p of the n'th unit and the technology at some other time then those two are the same and that's been the case of computing. And in fact with computing that's also if you pass these production costs savings on to the user and you have an elastic demand curve then this whole thing is an unstable situation driving all the costs to zero which is exactly where I claim we're all going. Except the thing that keeps us in these stable bands is these salespeople. These sales outlets so institutions, classes of users and salesmen keep us all in particular stable bands.

Question:?

Answer: If you strip all the components out and say "What's the labor in building liberty ships", it follows these curves and in fact I was talking to somebody who was making Bell helicopers and he said "Oh yeh, we're on an 18% curve" and when they say that it means everytime the units double then the amount of labor comes down by 18% of what it was or 15% or 10% in some number and it's usually it means given a unit doubling whats the percentage labor contents it comes out so you have to push all that back into the constituent part and you say "Well helicopter steel isn't coming down" and in fact down at the end even though labor cost is coming down or learning may be taking place the amount of the wages may be increasing. Things like automobiles--that thing is down adding a factor of two automobiles at 10 to the 8'th automobiles is a hell of a hard thing because that takes another 25 years and by that time the labor prices have gone up a great deal. You have to be very careful how the thing is constructed or how you deal with the component.

Question:?

Answer: No--I'm claiming they work clear out into large numbers. But the point is that large numbers--nothing much happens there because it's hard to get a -- with automobiles-forget it--They've learned everything there is to learn about automobiles and nothing much is going to happen. But with helicopters there's a lot to learn because there are only a few helicopters and with anything that complicated to build, there has got to be a simpler way.

Looking at software, cpu, and disk constituent technology, I've put on them taking these various time scales that we had here and looked at the amount of time that one spends in research of anywhere from 0 to 20 years here and say to 1 to 10 years in each of these areas, and advanced development says they are breadboard kinds of technologies. Software one can do in the order of a couple of years to maybe 6 months. These are typically 1 to 2 year projects. Development is 1 to 2 years in software. Cpu's about the same and disks about the same. Testing, tooling, and design maturity testing somewhere 3 and 6 months, 6 months and a year. Here you're talking about a year in a very complex electromechanical system. Shipping may be somewhere between 3 and 6 months to actually ship. At this point we've maybe done a first ship and maybe back in here the product is announced and here this is the educating used thing and one gets somewhere between 6 months and 5 years. Maybe 6 months here from an education point of view. Here in a disk we've got, because people know what it is, it's a commodity, we have no times for it to come in to the marketplace. The education and understanding sort of increases with this complexity here. I did this and looked at these constants principally to do some understanding of what kind of development process one builds and with this you can see how, by spending certain kinds of resources you can actually build the system that can keep you 4 years behind the competition. Because if one keys all development off of announcements here, you use the conventional market pull kind of way for definition. So I'm into a kind of a commodity market. Market tells me I need something, I then go back and think maybe I can develop it because the markets already defined it and then I start through this cycle. Then the time through the cycles is in the order of somewhere between 3 to 4 years so in fact with these kinds of cycles you can understand how you can reliably build obsolete parts in an environment and we've had a case where we kept wondering "Gee, why do these products appear to be obsolete" and there's no surprise once you look at it from process standpoint. So when people say "Hey, is something market driven" I say if the market is defining it or if you're looking at the competitive products there in terms of what you're going to put in yours you've pretty much guaranteed that you've got yourself a system that's going to build products that are 3 or 4 years late.

The languages is a fairly interesting one because one has an educational window there where you can begin to look at the market buildup for a particular language. One that's been particularly one which we look at all the time is the case of PL1 because another language is like being vaccinated for another disease or something--hopefully that vaccination is not going to kill you again. So one wants to minimize the products in some sense--particularly in the language area where you talk about very high education, and higher support costs.

I think in the process sense the thing that seems to come out here is looking at the various people involved in this whole structure. We have in the middle block architects and hardware implementers, programmers, parking and salespeople, salespeople and in the time horizen here I put -25 years to +10 years because I claim they ought to know everything. I don't like to see inventions that weren't in. If there is a good idea in ATLAS I expect it to go in a --ATLAS is only 17 years old so there weren't any good ideas before ATLAS. Certainly 18 year olds have some good ideas that haven't been properly implemented in machines and clearly you've got to look out 10 years because with the software investment, the thing has got to last 10 years. Hardware--I don't know what there because there's a certain amount of implementation history that's important and one had better be pretty good for the next 4 years because that's covering that technology window that's coming out. Programming--that's wrong. It's got to be something in the future and with the different kinds of computers that are being built, I think they had better go back 25 years too because you can the ? microprocessor people learning now just up to the point where the mini people were in 1962 or so and then similarly we had learned what was by about 1952. So every 10 years or every time there is one of these new names machines and these stable states I really think (I don't know how to find out how stable they are) they appear to be quite stable market states.

There appears to be a whole new set of learning that goes on and a whole activity around that and they look almost independent of one another.

Marketing and Sales

Something in the 6 month horizen. Looking at orders they are losing and then forcing back in so that we're sure to build these obsolete products.

Activities--Technology and Historical Technology Selection and Use

This is a tremendous amount of standards. Marketing and sales is really specific use.

Goals - Major

I think another thing that drives is sort the clarity with which people can operate and architectural clarity I think is a fairly hard thing because it's dealing with a large number of concepts.

Hardware implementation--One thing that gets us there is the simplicity of the goals, set of cost, speed and then if you really want to make something complicated, add in the reliability and that gets very confusing. But one has a great deal of clear tradeoffs here.

Here, programming, I'd make as the most complex subject in terms of states, programming of size and speed, and in general a fairly unclear set of goals and that's what I think is probably the hardest thing in programming.

These are all very clear cut measures and in fact people can operate very nicely within--this one is especially clear-- this one's less clear because they're sort of sitting at the end and they don't know whether these guys are screwing off or they didn't give them the right sort of things or what.

Number of interfaces, goals simplicity/complexity -- I'd say this is probably the most complex activity - this is the second most - hardware is third most and marketing/sales are in terms of this is a product of states times the information content in those states. These have to be quite right and so maybe I ought to reverse these two. It's very hard to test an architect because there are lots of states here but the fuzziness surrounding those is something else.

I also made the statement about these three designers that we had: This was in the tenth symposium, I think. This is in the performance/price theme. One starts with no design, moves out here adding cost and finally gets a minimal machine and then one can add a little bit here and get quite a game until you get to this best cost/performance point and then you move up to this point and if you lose, you come down there and it's unbuildable.

This is kind of that projectory and one can see these clear design points here. This being the hardest point because it's easy to add something to the design but it's virtually impossible to take something out and you don't really know what that marginal utility is at that point.

This is one I had that is inside of trying to understand what we did and I went back and plotted all of our computers in various lines and say why are all our computers the way they are and so those lines are people migrating around and how much clarity they have in the design. The one here and the guy went off to III and I did the four and sort of split in two or three pieces and did big machines and worked on little machines. These are easy machines--I would never try to build a mid-range machine. That's a very difficult machine to build because you never know. Little machines and big machines are sort easy to build. Big machines are a little bit hard because it can lose through that precipice there.

Here are the four lines of machines and the PDP-5 machines and really that's been implemented as a family. Here's a machine that was implemented as a lower cost version of the 8 after the 8. What I really wanted to show here was this set of machines--this is the 11 series, in fact, which one designer has sort of been responsible for. This line, one has been responsible for that line, and this basic design has been used up here and this is sort of a maximum performance design and then we've split off some people here to go after a lower cost below this because, although I say this is easy, if you straining to make this machine already for a low cost, it's hard to split. It's hard to come up and say you're failing because in fact constraints here where these are all unibus based machines and in fact that's one of the constraints of why it's hard to make a machine that's lower price. In fact we've now started managing by who does the project rather than the project goal.

This is looking at the tree of the technology that drives all of this. The plasma stuff. This is letrastatic memories which really aren't used any longer. Crt's and capacitor sort of analog and digital stores. Here are the two main branches: the electromagnetic memories which I'll talk about--principally the disks and how they go. There is moving electromagnetic memories and semiconductor memory desity because this is the one that's evolved most rapidly and for starters, the thing that differentiates these two storage media and why this one evolves roughly twice the speed that this one does goes back to that very simple

concept of learning where the computer world takes about the half of the capacity of the semiconductors and in the case of magentic media, there is virtually no media from video tape outside computing. So essentially there is no market outside computing and the evolution isn't as fast as with semiconductors.
But again without the computer and the semiconductor, it's hard to think that that would have gone anywhere because there was this perception that it was a whole market in which you made a few hi-fi sets and you find that your limited by peoples ears and the FM band. That there's really not that much incentive to make better transistors after a while whereas with computer parts, we've driven them to do better.

This is a "hot off the press" curve. The only curves I really watch very carefully are ones made by people that have a hand on the valve. One hand with the pen and one making these curves and one on the valve controlling the resources to make it happen. I copied this off a chart by Dean Toome, who is Vice President of Engineering for TI--on Monday. His model of what's going to happen purely in one dimension and I'll go back to why this is an important dimension. This is size and bits of memory chips--these are the MOS chips, either by polar chips. This is the CCD, and these are bubbles. And in fact, these lines are sort of constant time lines of when things will be available. These are 1K, 4K, note roughly every 3 years one gets a factor of 2. My curves have been more every 2 years one gets a factor of 4 so I've been more agressive here but I've got other bugger factors that I can use. He hasn't defined what he means here in '76 or '77. He says the paper that was just presented to the solid state conference is at a high volume kind of thing or not, but note the implication here is that in this time scale the '76, '77 time scale one has a 16K chip; in the '79, '80 time scale it's three years. We're sitting here with a 65,000 bit chip or 8K bytes on a single chip and if you're going to have that much memory, you might as well throw a processor in for good luck because that isn't going to cost very much. So we have our 8K byte computer before around 1980 and I think the cost will be in the order of the 5 to 10 dollar range of what we see these machines coming down to now which is really a package cost kind of a thing. So we'll have 8K byte machines by that time on single chips.

Now as a kind of technology historian I'm having trouble noting when the fourth generation comes. The fourth generation I would say historically is as basically being the time we had a single processor on a chip. I would go for perhaps a single computer on a chip as being the next significant thing although that's already happened if you talk about these small number of 1,000 bit or 8K bit kind of machines on a chip. I don't think those are significant yet and it's hard to know how to peg that in the generation sense. I think maybe somehow a significant event has to coincide with that.

The other thing that was unique here is this factor of somewhere around 3 in terms of cost for 400 microsecond CCD memory. So here by the '80, '81 time frame you have a quarter of a million bit CCD memory and bubble memory being maybe a little bit earlier but with 4 millisecond access time. An interesting sort of research program at this time is how does one really utilize these memories because it really is a painful thing to deal with. From a memory hierarchy standpoint everything works but those models are awfully continuous and if we have to do something different to the machine then we really aren't doing very much planning now. If these are mere fixed head drum disk replacements that's an easy thing to do but note this very fast access time is to exploit some of the other properties of this. The transfers are going to take place a lot faster than they did before and the question is "Do you switch context" because we've had these long terrible context switching problems. We've learned to make context switches in the order of 5 milliseconds and be happy about it and now we've got these very fast devices and I don't see that those long context switches are going to be acceptable there. Perhaps a structure like the CCD 6600 where you have multiple context and once you get a page fault you switch to another context, compute there for a while, and so you really have -- multiple processors active at the same time on one physical process.

It is really important to operate there with that kind of thing so seed out work here is important at least from that standpoint to be able to have those processes active and to not have high overhead between them.

On the memory thing, I've always been fasinated as to why Grosch's law would hold and the only thing I could find in the past of why Grosch's law would hold would be that there was an economy of scale with disks and with core. That is, you had some physical structure a coincident occurrence--Whitcore says you double the amount of coincidence circuit, then you get 4 times the amount of bits there. So that was a square law relationship. I found another one which is in fact, if you'll buy that wild statement I made about "A good work indicator"--that is how much work is a computer doing--is the memory data rate by how much memory you have to work in times the processor rate or the memory data rate. Now lets just take one of those single chips and put a processor on it, then that's a measure of performance of that particular one. Now if we say that, then the memory size is strictly proportional to price. Memory data rate is also--this is data rate in bits per second is also strictly proportional to price, then we end up with the performance in bits times bits per second as being a price squared relationship, neglecting processor costs and in fact with the dominant costs going the way they are we can neglect processor cost--we can sort of throw those in for free either on the chip or you put those in in a bigger system when you put in another disk. It clearly holds but it turns out that holds if every time you put a chip in you've got access to that chip and you are able to get the bits out that having that chip implies. If you put them all in and have only one bus, and they're all selected then that doesn't count and you're on a either constant or even a linear relationship.

The interesting thing is that it doesn't matter if by that measure then we would equally well put a processor on every one of those chips and distribute that power if there were some way to pull back together, but at least in a pure work sense you have the potential of doing more work on a square basis if one adds money on a price basis. I'm kind of intrigued that there is a relationship there although I'm hard pressed to see Grosch's law really holding very well on the various machines we've built. In fact, when I get into the marketplace thing, on the 360 and on the 11 it's hard to get more than that power constant at being around 1.5. We feel that 1.5 may even be pushing it to show. In fact, on a 360 there is a price range of a factor of 65 and the performance goes up by a factor of 300. Again you have to almost choose the right problem. That's on the scientific problem. If you put it in to a disk space problem, the performance may not go up hardly at all. If you put one disk on a 195 and one disk on a model 30 and you've got a sorting problem, the performance is going to be relatively constant.

Looking at some of these performance measures--I'm going to go over some of them quickly. This is Noyce's curves in terms of components per circuit for semiconductors. I indicated that that's gone up by 1.78 to the t minus 1960. The one I always like to use is to the t minus 62 so I can remember it.

Neusbaum, who's head of switching circuits department at Bell Labs, has a 60% improvement in gate costs and that's probably fairly close to Noyce's if you assume that the gate cost is not going to go down as fast as the gate because you get into this packaging problem where packaging is probably increasing slightly. We've learned everything we can about packaging and these are new dye that we're building and getting the learning for versus those packages which really don't look a heck of a lot different than the ones in I guess 1965.

The other thing you see here is by the MOS circuitry and the TTL circuitry in LSI then there is something on the order of 7 or 8 years difference in terms of gate cost. So in fact they parallel one another and really it's a question of "when did you get to that density with this other technology". Some specific points--this is another form of that curve done in 1972--these are very maybe later than that--here's the IBM chip which is off the curve and in fact people come to me and say "why". The impressive thing about the IBM technology is their technology and in a semiconductor that's the only point I've seen that's interesting of IBM and the only reason that stands out is that the semiconductor people sort of sat there and said "but why would anyone want a 448 K bit MOS ROM". That would have been probably before IBM did it if somebody had said "Gee we want one". We know damn well that we don't want one because our software changes too rapidly and besides, our programs are a little bit smaller than that and we don't need 48K, those kind of chips, to write a good BASIC in so this makes up for having very large slow cumbersome software packages which is the advantage you have if you have enough technology. At that core you can blast through and make up for a lot of this software fat on those inner rings. But overall this is roughly a little bit less than a factor of 2 in transistors for chips. One of the things that always comes out is that you've got to be very careful taking these curves very seriously. I always use them but not to this precision because when you get into this precision you find that dooms kind of things come out. Here's core memory there, here's n channel MOS there and this is when these guys essentially cross over and it turns out that that hasn't happened yet. Furthermore, you see how bubbles really came in like crazy since 1974 and the other day we actually got one so about three years after these projections and I think this was really in the order of a '72 2 kind of projections. It's very hard to project two years in the future with any accuracy. In fact in Turn's book on computers of the 80's is remarkably inaccurate for the time the book was published. So starting in 1974 the curves were bad and I don't know what's going to happen by 1980.

This is another one of being very careful about what happens. This shows problems in two dimensions: Here, gate delay in now seconds and relative density and they put all the technologies that they knew about. This illustrates the problem of these things. Here's I-squared L which is really the dominant technology or that's beginning to come in as a form of bipolar. Here's the SOS technology. It's low power schotkey. I don't know whether that's that or not but even two years into the future one misses major technology changes in these forecasts and that's not surprising because of the way these curves are gotten. These guys are often getting curves and data from people we and everybody else, I guess, buy them and they come to us and say "we want to go to a consortium and we won't tell who the other members of the consortium are. We want you to spend $5,000 to get you 3 pounds of information on the semiconductors of the future" and they go away and they talk to everybody and/or how typesetting is going to change in 5 years or 10 years. And they come back with 3 pounds of paper on that subject and nobody can read. And they get it by talking to a lot of our own marketing people and of course we're very tight lipped about the whole thing and we're only going to tell them all the bad ideas that we are pretty sure aren't going to happen and we really got into it to find out what everybody else was doing. So, in fact, when you buy the 3 pounds you're generally getting obsolete stuff and in fact if you got a market survey, you can be pretty sure that if it's in the survey, the market's gone because only obsolete things go on market surveys. I don't think I've gotten any hot ideas out of the market surveys. I've got the ones that I know are pretty much going to be beaten to death by everybody else. In a semiconductor world then you end up starting with this relationship, this was done for the tenth paper because I've tried to make a model there. MOS read/write is the key date. Shift back a year for bipolar ROM, shift back 2 years for bipolar read/write. Shift ahead if you want ROM. If you're talking about production add 1 to 2 years and then from that you get all these things and low and behold this happens to fall on the curves that Dean Toombe gave me Monday so I'm feeling good that for 18 months this model has held and it corresponds to somebody elses model; in fact, it's the model that we've been on in terms of when things going to happen. It's kind of important to know when things are going to happen as long as you don't take it too seriously and be prepared to change.

The other technology that dominates is the disk technology and this gets into the notion of economy of scale and there is an economy of scale with this technology. One takes a given disk platter and builds a fairly simple mechanism around that. It's got a motor, it's got cheap metal, it's got electronics. Now if you start piling some more disks on top of that and just to the point to where the whole things topples over and you don't understand it and that number is 10 it turns out. Maybe it's 9 because we're using 10 and I'm not sure we understand all of that 10th one but that one builds that particular technology and the model I have there is this economy of scale by having a little bit bigger motor one ends up getting a factor of 10 in capacity with not much more cost. It turns out more than one would expect and 10 probably now doesn't seem like the optimum anyway. But you do that first and you do it in the high end so that it's going back to the designers again, the designers work at the high end and are driving to get the lowest cost per bit and that turns out to be this 10 high technology.

Behind that technology one takes this base technology and puts it in a low cost technology and this is in fact the mini technology. This right now we're seeing separating. We're not moving as aggressively here in the low cost technology at least in cost per year as in these more aggressive 10 high technologies because there isn't as much learning and much work going on into making achieve versus making it lowest cost per bit. In terms of those two technologies, a curve I plotted a couple of years ago; this is IBM technology, this is IBM disk 62 to 74, 38% per year in terms of price, in terms of dollars per megabyte and capacity is gone up at 42%

per year so in fact the average disk price has gone up slightly because sheet metal, we've already been (?) a lot of sheet metal, we've already built billions of motors and those things aren't changing very much and the thing that is changing is the magnetic density which is going up, which is changing quite rapidly. And in fact yesterday, I had plotted some hard disks here in terms of looking for an economy of scale on those and here I've got number of bits versus price, here's accesses per second, here's the pure performance and here's this payload factor. Here's a factor of 2 so it's gone up a little bit more than a factor of 2 or at a given time when I took this snapshot then in fact using these measures it was more cost effective to buy at the high end more than the square log. Interesting observation is that on the accesses per second this doesn't have much of an effect in terms of money. That is we're talking that mechanical motion is the same thing as why a mazerotti won't go 50 times faster than a pinto because of the difference which we'd expect out of the price. Here we're back into this mechanical constraint. We just can't violate, and we're stuck with a new toy in mechanics and when it gets into the system, then you're stuck again at the system level by not having any economy of scale. You'd think when you scale the whole bloody system off, it's going to perform faster but it doesn't because this is the limiting performance factor on all of the multi programs floppy systems. So you've virtually got the ceiling there that is it's multiplier. So it's really disk access rate, this is rate, maybe you get 50 per second out of this one, here you're talking 20 per second of these and that's the thing that's dominating our performance.

From an observation the disk and semiconductor technology is one goes at 41% doubles every two years, one doubles every year and that seems to be due to a tremendous (?) in the overlap of the discipline. In the semiconductor discipline, a number of the people who work on semiconductors all come from the same basic discipline and in fact have a common vocabulary of communication. In disks one has all those technologies plus some processing, testing, plating technologies that aren't in the semiconductor, so those two industries, it turns out, I believe varied both on the basis of there is a captive market for magnetic media versus not in semiconductors where only half of the semiconductors market plus the disciplines themselves are widely separated to make disks. And then the third factor is the semiconductor industry is a very unique industry in that knowledge is broadcast very rapidly in the semiconductor industry and they do it with sort of good scientific communication. A lot of them have been trained as Phd physicits, chemists, electrical engineers, materials people so in fact there is this whole discipline of report what you've done. There is a tremendous amount of reporting and so people know what's going on and then the crowning blow of all of that if you didn't have all those factors is they used to share agressive money to buy people and so people are changing jobs all the time. So it's a very exciting and interesting; it makes computers look like pikers by comparison. It's a really exciting industry but a half life of the people are varied too by comparison. So the character of those two disciplines is different and in the case of the disks, all of that technology really came out of IBM in sort of '65 time frame and again they used this universal solvent money to pull all those people back from IBM and in fact to get those disks made in the various places. In fact, why all those law suits, is that it wasn't clear when they brought some of those people out of IBM that they didn't have a few plans with them as they came out, in fact that's the whole business of what makes the thing interesting because they sue IBM for stealing the market, and/or whatever. I don't understand what it's doing but they do all those kinds of things and then IBM counter sues saying "but the disk your making was our disk in the first place" and so we should side with the underdog. It's fair to steal the thing and take it away and make it but that's gotten resented. It looked like TELEX for example. That was being rewarded; they were able to closely covet a design and then turn around and sue IBM for not letting them market it effectively by IBM merely changed its prices to respond to the competition which is the good old practice of American business or all businesses.

This is dumb terminal prices, this is I haven't put it in to the 10 into the right exponential. This was
I haven't put it into the 10 into the right exponential. This had a lot of thoughts around it. This was a high regression, I don't remember what he got out of this but it looked like a reasonable fit in other words and that's actually t-70 and that .03t and that's e so it's about 10% per year price decline so that's .9 in terms of price so 90% 10% price reduction per year at the dumb terminals.

<u>Minis</u>
I put 31% and that's improvement, that's not really 30% reduction, that's 1 over 30% or it turns out to be about 22 or so when you do the reciprocal. So this is basic machines, what the price decline is then for small machines, the minimal machines.

Overall we get these various effects. Semiconductors then are followed maybe 60% to 80% price improvement disks, 41% in density, core 30%, tape is 23% in density. Notice that that and that are correlated, or that this your only getting a linear improvement, here your getting a square improvement because disks are packed that way. Data rate: 6% improvement in data rate or 6% change in tape speed or over the 25 years that turns out to be a factor of 4 improvement in tape speed since tapes were introduced and that's pretty good going against Newton that way.

Packaging and power per watt per cubic inch haven't changed--they're sort of holding their own.

Minis: this is too hot but I believe it's improving. Better communication capability for computers I think drives distributed processing because that has to be based on communication capabilities. Otherwise we're going to be up against the limb of the telephone operators problem here where everybody becomes a telephone operator in switching information from machine to machine. In fact as you distribute it, everybody becomes a computer operator and that'll drive us into the network stuff. The density also changes the reliability radically because there simply is less mechanical parts to fail. It adds this greater functionality in terms of basic language and operating constructs and it makes every terminal a smart terminal with some additional capability and in fact will generate an electronic typewriter from that. Smart plants, smart labs where we put in every instrument that is fundamentally electronic will have enough intelligence in there to do significant data processing.

Greater disk density is really driving us to the need to get organized in the data bases area. Higher people--people costs are going up. Paper costs are increasing. That I think drives us into basically not generating information that we don't capture so that what will drive the typewriters to all be electronic, that in fact as you get into the problem of making corrections on copy or doing typesetting or filing. The worst thing about creating memos very often is not the memo per se but it's the fact that somebody's going to read that and with electronic mail we've got the possiblity we can have computers read all that mail and answer it and we get to that happy stage: they'll create them on-line, transmit them, store them, be able to retrieve them, then we can read them and in the next stage we can write them and so I think that I'm glad Bob Sproul is here. I think getting out of the Xerox is a good idea because if there is one thing that hurts this whole paper thing, it's Xerox creating more and more paper in the world. I don't know how to get around that. I think clearly we have the opportunity but whether or not paper is the absolute drug we cannot deal with, do without, I don't know. But I'd sure like to try. That's this section on technology.

Question: (Bob)

Answer: I think better encoding is going to help. I think pictures may be a way of essentially soaking up that and basically doing some encoding. Let's gets some useful information out for a change. I mean those goddam EDP machines that generate these massive piles of paper that then--who ends up doing the processing is. I have seen more reports where people sit with a calculator trying to get stuff off of the EDP runs. I think that the processing has really has got to go into sending that information. It really should be done keeping it in the data base then going in and accessing it only transmitting the exceptional kinds of information so people can operate. Number of cards at last is not rising and that is the number of cards produced per year is sort of flattened out. I think that's one of the major breakthroughs because with for every hundred cards, one of them is in error then there is a high probability that that error's going to make that other data that gets generated from those cards useless. In these reports I see I think the people I work with are putting me on when they say "Oh the input datas got garbled and therefore all this stuff is meaningless and that's why I'm overbudgetted" and it's all because of the EDP problem. I think fundamentally a lot of the power is just going into doing useful information processing where a person is committed to making them.

Question: ?

Answer: No I think they're fairly good in terms of what they're doing. It's the DELFI techniques. I'm not worried about these people. It's the market surveys which gets the information and the DELFI is in fact one layer removed from that chain. I don't know who they asked for those things to get all the garbage that came out of that report. There is something useful about that report though. Are there any wild ideas that might be feasible now that might actually be interesting to have. Of course I'd like to have a display on a 40' wall and have it all electronically changed.

Question: ?

Answer: That's one I apologized for two years ago in that paper. Now I know. The neat thing about doing all this stuff is you clearly now know what the opportunities are going to be and I think if I had done essentially this much work. That one I knew in my gut but now I can prove it any way you want to prove it including you can even get marketing people, users to say that too. But the drive there really is a significant effect on the architect. In fact, trace that back; how much, if you also believe the constant price model, then it says every couple of years we need another bit in the memory space. The thing that holds us from that really is the ability to make machines that will go do that with those larger memories.

Question: ?

Answer: That's one piece. I see a lot more value now in looking at that base technology data than I did...now in retrospect the whole history is clear to me. Why everything is the way it was but now does that do any good in the future? I'm not sure but I'd like to at least understand why things were the way they were and I think so far its been useful to me to at least get some ideas about how long I've got to live in the future or what kind of an environment one could have sort of in 1985 time parameter. That's why I look at these in a sense I think any of these curves that would come in ? exponential limit ? I'd say great I won't have to worry about that any more. Sometimes I'd like to see some of that happen but nothing like that's happening. You can only see until 1981 in the semiconductor thing because that's really clear because that's the ? limit. But yet all the experiments are done for the x-ray and e-beam exposure of semiconductors in making a mast and so they're saying--the other day we were talking to some people and they say "Oh we're not worried about going past '80 now" so I'm feeling good up until 1985. I don't know what that means because I'm now worried more about how the hell do we use all these things. Let's take my curves, run them up to '82 say I'm wrong by 3 or 4 years and that gets us to '85. A million bit chip appears in '85. That's only 8 years. So we've really got virtually zero cost computing at that. There aren't that many people who got a million bits, an eighth of a million bytes or 128K byte chip in that time slot and that's a reasonable price. You could put a few together and in fact that's right at the limit of the programs...it's way past the limit of most of the programs that we use most of the time. All the text editing, all the interface programs and things like that. That'll all fit on a ? chip but the other programs...so these big data base systems and the other programs I think are ones that we really need to be working on now. Those are the ones I'm very concerned about.

Question: ?

Answer: But I'm making the assumption that one of the interesting things that's going to happen is when that fits on a chip, then in fact that will present a much lower cost threshold. People will do things with that as a unique device as opposed making million computers. Yesterday's talk was these computers came down and reached the stable state and I don't know to find those states but in fact we're here right now and there's a stable state beneath that...which or maybe it's this state here doing something else and there's going to be all sorts of activities around that lower cost thing and in fact building at the high end is going to be the hardest and we've got to find new organizations because we're going to keep stumbling over the complexity thing. How do you build that many machines together? How do you get them to communicate? I think it's going to be incredibly exciting in terms of what one can have in the next few years. I think by '80 we'll be at a very exciting time too. An 8K byte thing...well that's kind of interesting too because that means every typewriter can for not much money remember everything you've every typed on it and have corrected on it. It may have written it even. And I think what else do we do? So the DELFI I do read for any wild ideas that are now feasible and also useful.

Question: ?

Answer: In a way this part feels the softest to me in terms of a way of really doing a good analysis of what the structure looks like because it gets into a whole bunch of dimensions in the marketplace. The ones that are comparatively hard are that some of these use that functions structure dimensions

TO: see "TO" DISTRIBUTION DATE: MON 18 OCT 1982
10:40 PM EDT

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

MESSAGE ID:
5179038153

SUBJECT: CMU LOSS: WHY, SIGNIFICANCE AND NEXT STEP

I'm very sorry we lost the bid to do a PC with them. I think it will turn out to be an extrememly pivotal event in history.
Andy rightly fully gave me hell for losing the order, because although I felt strongly about the necessity of doing it, I didn't spend enough time, nor did I offer to really get into the design. Similarly, I didn't push to get some of the other
folks like Avram into the effort of the new machine.

The reasons why we lost: With IBM there was potentially higher
risk, but much higher payoff since if they were successful, then
IBM would leverage their work by distributing millions of them.

With us, it was a surer thing, and lower cost, but not as potentially exciting.

IBM was willing to let them manage the project. This had an incredible appeal to them. (note the potential risk/reward for an environment that is normally not used to this)

IBM was enthusiastic about using the CMU operating system and environment called SPICE, built in Computer Science.

IBM's head of the Palo Alto Scientific Center lead the effort on a full time basis, with a larger, resident full time team. IBM appeared to take the whole project much more serious.

IBM made the initial sale via Lew Branscomb and Cyert. It was
uphill for us and we never really sold Cyert.

They really liked the idea of swimming in a bigger pond, as we've not always responded to potential opportunities.

IBM's providing their scientific personal computer that was just
announced today as the first machine. The REAL machine will be
available in Summer 85. We believe this is the 801, very high performance machine driving a display.

NEXT STEP
We must continue to have a strong presence there and must continue to watch the Spice Project, learn from it. We have MANY projects going with the CS department and we can't give these up: robotics, LISP, Ethernet, SPICE, etc.

I believe we need to provide a significant computer of the kind they wanted. Whether it would have been sold in droves on colleges, remains to be seen. However, I do know that such a machine is what the professionals need.

I also think it is necessary to get another, demanding partner.
Candidates include: MIT, Stanford, Waterloo?, Harvard,, ??. We need someone who has the commitement to do it across the whole campus and someone who is very competent! Right now I don't see a single university that has both of these attributes.

IBM's POSTURE NOW
They will use this sale like crazy to say they now dominate the Computer Science and University Market! We have to down play it, as anything other than an isolated example. As I've recently pointed out, IBM is building machines according to specs now from CMU, MIT (An AI machine) and NYU (the

Ultra-Computer). This is a model that they used when they established themselves in computing in the early 50's when they worked with Columbia, Harvard, MIT (Whirlwingd). It's
also the model the Japanese use to transfer technology.

BOTTOM LINE (WITH RESPECT TO IBM)
They have many more resources, and they are being used very effectively on high quality, creative products. This is in contrast to a substantial number of evolutionary products we are
doing. Hopefully, they have some really poor products in the works too. Otherwise, it's ...

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BOB TROCCHI	BILL WISE	

GB3.S8.70
@KGF, 11/21/84

I think it is quite crucial to get the first computer into Carnegie-Mellon University.

My own ties are still strong:
.they still list me on the faculty and I still have many professional
friends that I'm close to (including Raj et al)
.I'm on the board of the Software Engineering Institute that was just
funded by DOD
.I remember putting the first VAX there, and I'm superstitious

Apart from this, CMU is:
.rated 2 or 3 (with MIT... which we really can't afford to do business
with). Furthermore, other schools follow them.
.an advant garde user and Raj is opinion leader in the DARPA

community
.DEC and IBM oriented
.tolerant and can help us get the machine up to snuff

DARPA is simply critical to Encore because:
.the early machines will not be operate efficiently enough to compete
.this community will do their parallel processing and robotics and AI
work on Hydra. These will probably end up being key to ECC's success.
.the general technical community follows DARPA
.DARPA has an incredible amount of money in the next few years to
throw at computing and parallel processing. We need to catch much
of it.

Re The Large Memory Boards
Henry will have to get an answer from Hydra. Large boards are quite impressive, and may turn out to be the best or only way to get the Mips out of Hydra by making sure we never swap. (I recall a paper in the IBM Systems Journal in which it is predicted that very large timesharing systems don't work because of the growth in various times associated with managing a large number of page tables and disks.)

Re Prices
Regarding our pricing. Our prices, whatever they are have to be our prices. We can't afford to give things away yet. Hopefully we won't need to even in the case of the Beta units. Note our mark-ups appear to still be sustantial.

Re Doing their boards
We have several choices (for each board):
1. Lock these boards into the DARPA contract! We could lock the two together and it will get CMU to put pressure back on DARPA to give us a contract.
2. Do nothing.
3. Offer some amount of consulting.
4. Do each board for a fixed fee. The video one could be done this way, but the Systolic interface could be a mess.

In short, of the friends I've introduced to Hydra (including Sperry), CMU will probably be much more lucrative, fun and helpful in both the short and long term.

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* d i g i t a l *
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TO: see "TO" DISTRIBUTION DATE: SAT 17 OCT 1981 15:16 EST

FROM: GORDON BELL

cc: WIN HINDLE
ANDY KNOWLES

DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: PROCEEDING AHEAD TO EXPLORE THE CMU/DEC RESEARCH PROPOSAL

I described the proposal and ask for an agreement in principle
to enter the study phase, and if successful, go on to fund the
proposal. The Operations Committee was reluctant to give a unilateral endoresement of the proposal without having an understanding of what the proposal would cost.

We did agree that that we must go into the study phase and that it would be ideal to have a combined R and D center in Pittsburgh, closely linked to CMU. In this way, we would not
have to have the total incremental funding, but would have to cover the project in a substantial fashion out of existing programs by correctly coupling the CMU Project with our own work.

I'd like to meet on Monday morning and discuss how to proceed.
I'll call Allen today and get a reading on where things are.

"TO" DISTRIBUTION:

SAM FULLER BOB GLORIOSO BILL
JOHNSON
JOE MEANY IKE NASSI

GB3.S1.23

PROPOSAL FOR THE JOINT DEVELOPMENT OF

PERSONAL COMPUTING

BY CARNEGIE-MELLON UNIVERSITY AND DIGITAL

G. B.
10/14/81

THE CMU PROPOSAL

- BUILD A PERVASIVE ENVIRONMENT OF PERSONAL COMPUTERS THAT GRADUALLY EVOLVES FROM EXISTING T/S SYSTEMS IN DAILY USE BY A LARGE, DIVERSE POPULATION.

EVERY STUDENT, FACULTY, STAFF MEMBER WILL HAVE A PC.
STUDENTS WILL TAKE PC WITH THEM.

-DEVELOP APPLICATIONS APPLICABLE TO A BROAD MARKET, ENCOMPASSING:

+ OPERATIONAL SUPPORT OF LARGE INTEGRATED NETWORK (ARCHIVAL, RETRIEVAL, ETC.)
+ PRINT IMAGING, GRAPHICS, AND VOICE
+ ROBOTICS
+ MODELLING
+ KNOWLEDGE ENGINEERING
+ INFORMATION AND DOCUMENT PROCESSING
+ HUMAN INTERFACES AND SOCIAL ASPECTS OF "LIVING ON THE MACHINE"

-CREATION OF AN OFF SITE INSTITUTE FOR INFORMATION MANAGEMENT AND TECHNOLOGY TO DISSEMINATE AND TRAIN STAFF, CUSTOMERS, POTENTIAL CUSTOMERS.

G. B.
10/14/81

BENEFITS, COSTS, RISKS

BENEFITS

-OWNERSHIP OF TECHNOLOGY (FIELD PROVEN HARDWARE AND SOFTWARE DESIGNS) FOR FIXED OPTION PERIOD.
-CLOSE COLLABORATION WITH A LEADING UNIVERSITY AS A WAY TO EDUCATE, INNOVATE, VITALIZE ENGINEERING.
- REDUCE ENGINEERING ISOLATION FROM CUSTOMERS AND ACCESS APPLICATIONS

COSTS

- $6-7M PER YEAR
-REQUIRES MANAGING AN ENGINEERING SITE LOCATED IN PITTSBURGH

RISKS

- STAFFING
-TRANSFER OF DEVELOPED TECHNOLOGY INTO PRODUCTS
-UNCLEAR ASSOCIATIONS WITH OTHER CMU INDUSTRIAL AFFILIATES (WESTINGHOUSE, THREE RIVERS, IBM, HP ...)
-WE ACCELERATE THE DEVELOPMENT OF A MARKET THAT WE DON'T QUICKLY CAPITALIZE ON
- NO PRODUCTS FOR THREE-FIVE YEARS
-ADVANCED DEVELOPMENT TREND IS MOVING AWAY FROM DEC (UNIX, XEROX, THREE RIVERS, WESTINGHOUSE)

G. B.
10/14/81

****

TO: see "TO" DISTRIBUTION DATE: SAT 10 OCT 1981
19:41 EST

FROM: GORDON BELL
cc: LARRY PORTNER DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: THE CMU PROPOSAL, US AND THE NEXT ENGINEERING SITE

Bottom line:
They are going out for bid on their proposal with HP, IBM and
us.
We must not only go out and get this, but it must be part of
a combined SWE, Research, P/L (EDU, Education Services,
SWS=Network
development) facility... otherwise it makes no sense to go
after
it. I want it to be our next site together with Japan and
Washington... capable of holding 500 people by 85!

The rationale: we missed an opportunity with the CSDept
personal
computing work. They have made real progress and
got their 100 systems, while we TALK. Meanwhile, they've
also
produced a PLUTO we will probably end up using. The robotics
work includes all the key problems: vision, manipulation,
applications and AI for control. The McDermott work alone is
worth a site since we must use that technology now to manage
large projects... like Venus.

I want to get together this week and plan on how we go after
this. Also, I want to get the basic approval for proceeding
to bidding on this. The approach is to go into a study phase
for the next 6 months. In doing this, I want your support.

If you want to talk about this today or tomorrow, give me a
call. Otherwise we'll wait when we can meet.

At our meeting, I'd like to find someone who might be the site
leader so that when we work, we do it in conjunction with the appropriate ultimate doer.

"TO" DISTRIBUTION:

SAM FULLER BOB GLORIOSO BILL JOHNSON

GB3.S1.28

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* d i g i t a l *
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TO: see "TO" DISTRIBUTION DATE: SUN 18 OCT 1981 15:50 EST

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION DEPT: ENG STAFF

EXT: 223-2236

LOC/MAIL STOP: ML12-1/A51

SUBJECT: CMU JOINT PROPOSAL DISCUSSION WITH DOUG VAN HOUWELLING

Just had a discussion with Doug on this. He is going to call me back on Tuesday morning.

We got into the heart of the issue: IBM has made the commitment
to the project. Doug noted that IBM moved very fast after receiving the proposal, and on the other hand we knew of the project and their desire to work with us for about a year, even
though the proposal had not been made. We're second in the pipeline to agree to do a Technical Proposal with them! CMU does
not believe that both DEC and IBM can do a Technical Study there

in parallel, hence the question:

Is there anything we can do to prevent IBM from making their Technical Study, or should we simply agree that they should go first and we will request a similar Technical Study period following IBM?

WHAT IBM IS GOING TO DO
IBM has proposed to be their partner on this project, subject to being able to reach agreement during the Technical Proposal making phase. They are meeting for a day during the first week of November in order to review and approve a memorandum of agreement ... for the technical study phase. They have designated a single individual to head the Technical Proposal group and have asked CMU to provide space for the 12 individuals they want to relocate in Pittsburgh. They study is supposed to take 3 to 6 months. Doug has worked with IBM before, and has been sceptical whether IBM can be flexible enough and understands the importance of the area enough, but so far he has been surprised and has stated that IBM may have changed.

WHAT WE MIGHT (MUST) DO IF WE WANT TO DO THIS PROJECT
Right now, we run the risk of not being able to be asked to make a Technical Proposal because we can not convince CMU that we can or are willing to do the project. I don't see how we can convince them otherwise in the short period between now and when they are meeting with IBM to make an agreement. We can not sit by even now, otherwise, by default they might enter into a non-cancellable agreement with IBM which says the two must go ahead subject to an adequate proposal.

Therefore there are significant risks now that IBM will get the
project by default. We will be unable to convince them that we
are serious enough, hence they won't even bother to allow us to
make a Technical Proposal! We must still work during this time
to determine how to even stay in the race.

Since Doug is calling me on Tuesday morning at 9:30, I would
like to get together on Monday morning to decide what we
say.

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G. B.

10/14/81

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ROBOTICS

+

MODELLING

+

KNOWLEDGE ENGINEERING

+

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+

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G. B.

10/14/81

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(UNIX, XEROX, THREE RIVERS, WESTINGHOUSE)

G. B.

10/14/81

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* d i g i t a l *
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TO: see "TO" DISTRIBUTION DATE: SUN 18 OCT 1981 14:02 EST

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION DEPT: ENG STAFF

EXT: 223-2236

LOC/MAIL STOP: ML12-1/A51

SUBJECT: CMU JOINT VENTURE DISCUSSION WITH ALLEN NEWELL

I told Allen about our basic decision to go ahead with the study phase. I tried to give an accurate presentation that our position was to approve in principle, the idea of the proposal and engineering site, but that we weren't prepared to give a carte blanche approval of this sort of expenditure at this time.

In contrast, he stated that IBM has already given such an approval... namely, they have approved the plan to do the project, subject only to a detailed proposal. This is an interesting commentary on IBM vs DEC... I doubt if we could make a decision as fast even if the magnitude was about 1/10 the

size!! Also, it indicates that IBM is really going balls out for
this area, and they already understand the need for both research
and large scale prototyping in a pilot fashion.

Given that we can not make such a strong commitment, Allen
would like to get some way of testing that we are serious about
doing the project, given that a successful business plan can
be worked out. This may take on the form of visits to CMU by
say Ken or Win or Andy. Their view, based on a relatively long
history, is that we really budget and control very tightly and
very much in a distributed fashion, making it difficult to make
a decision of this fashion. Furthermore, we don't believe very
much in research, but instead focus on short term results. I
couldn't say that he was absolutely wrong. We did agree that the
proposal several years ago to put 100 PC's in the CS Dept. was a
different, though similar case. (In that case, there was no
support from either development or from research. In
retrospect, that would have been a bargain in order to get the
work done. We have spent the money internally and have no
output.)

I think we are ready to go ahead with the convincing them process.
It should take the form of Ike doing the convincing with van Houwelling
et all, plus getting the other person who would head up the
facility there to put together the study team.

I will argue very hard to do this project if we can get a team
and very good plan together.

"TO" DISTRIBUTION:

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00 BURT DECGRAM ACCEPTED S 6703 O 464 13-NOV-81 16:45:23
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* d i g i t a l *
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TO: see "TO" DISTRIBUTION DATE: FRI 13 NOV 1981
3:38 PM EST

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: CMU JOINT VENTURE PROPOSAL.. I WOULD LIKE YOUR SUPPORT!

This is the most exciting proposal I've seen about building a computing environment that will allow us to understand computing
in the explosive '80's. Everyone has a powerful computer (or access to one) in every part of his environment (home, office,
classroom).

CMU is an ideal laboratory in terms of its size, attitude, determination to build the system, decision making ability to carry it out, competence (computer science and engineering), computer center support and computer use.

We would proceed with the 6 months study phase, and if successful, proceed with CMU to implement the environment. The mechanics would mean a DEC Facility there staffed with Software and Hardware Engineers, P/L Engineers, SW Support and EDUCATION Service persons. CMU (Pittsburgh) would become a key engineering site.

I'd like to discuss this on Wednesday or Thursday at the Operations Committee Woods. The purpose would be to get approval for the study phase, with a strong commitment to proceed if the study were successful. Given the tax structure, the cost is unclear. CMU believes it will cost five to seven million per year for both CMU and its partner. The duration is 5 years.

Based on the performance of the CMU Computer Science Department in implementing their SPICE (Powerful Personal Computer Network) which we rejected 2 years ago, I believe the project will be successful. Furthermore, the project is vital to our future.

"TO" DISTRIBUTION:

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* d i g i t a l *
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TO: see "TO" DISTRIBUTION DATE: SUN 11 OCT 1981
23:04 EST

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: CMU JOINT VENTURE INTO TOTAL ENVIRONMENT COMPUTING

I'D LIKE YOUR SUPPORT ON THIS... CMU HAS THE VISION AND TALENT.
Proposal being sent via regular mail.

This is the most exciting proposal I've seen about building a computing environment that will allow us to understand computing
in the explosive '80's. Everyone has a powerful computer (or access to one) in every part of his environment (home, office,
classroom).

CMU is an ideal laboratory in terms of its size, attitude, determination to build the system, decision making ability to carry it out, competence (computer science and engineering), computer center support and computer use.

We would proceed with the 6 months study phase, and if successful, proceed with CMU to implement the environment. The
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"TO" DISTRIBUTION:

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GB3.S1.26

TECHNOLOGY LECTURE (CMU - FEB. 22, 1977)

books to read and I read every time I see a serious technology forecast is a thing that was done in '70 by a bunch of people who got together in a DELFI experiment and I'll show you a diagram of what a DELFI experiment is if you don't know but I was amused by Bob Sprowl saying "why did all these bright people get together and they didn't produce a really startling system?" The thing that always amazes me is that when you put that many bright people together you get anything out. A DELPHI experiment is that in the limit although I'm not sure whether they use bright people or not. A DELPHI experiment is where everybody talks about what all of the wild life is and when things are going to happen and somehow all of these people conspire to make projections about the future; for example, I think it was one of the military that did this and this was for 15 years of data processing and in fact if you looked at all the statements that were made there by 1985 or so when this 15 year period ended, virtually every science fiction thing you'd every dreamed about had concluded. Somehow they should have given themselves 50 years instead of 15 years and maybe things would have been different because a color display with a thousand bit resolution low cost was going to be available in 1971 and this was done in 1969. Wall displays, 4 feet by 12 feet with rapid resolution of 40 lines per inch and color are feasible. That was going to be in 1973 and that was really far out. Low cost graphics terminals were somehow 1974. None of the responses to all these things that were going to happen were related to one another. They all seem to be independent. Widespread use of LSI, given all of that, for computer memories fortunately didn't happen until 1976 which is in fact sort of when it's happening. Occassionally they hit a few. Semiconductor caches were available in 1971. A universal computer language will have evolved through automated communication and that occurs in 1995. So the programming problem doesn't get solved. That did go outside--they didn't define it--that's what's so wild about this whole thing--it looks like everybody put statements in there and there was no attempt to sort out the overlap or anything and they voted on it and they have all these little votes of when something is going to happen and there's a distribution of when things are going to happen. User program systems without programmers--programmers only used to program firmware. That happened in 1975. For spoken input, computer vocabulary will be many hundreds of words and the computer will interpret simple sentences. That happened in 1972. A 7200 bit modem on voice grade lines was highly feasible and was going to happen in 1970. And we still don't have any decent modems at decent prices. The problem in all my graphs--I based them all on past data and if your foolish enough to think that those lines would go out into the 80's forget the fact that these lines are always--I draw access out and this is the only safe part and anything beyond 1977 forget about--but the lines are just drawn there for your convenience. Worry about exponential projections--I do. Initially the third talk was going to be on technology and I moved it back so we're going back into this diagram because in order to get into the--I can't start the context of where we were yesterday. So using the first diagram we used yesterday, I started building these talks from top down and then when I got to the bottom up part I found that they didn't mesh and that's why I had to go back and insert the third talk in this side because essentially one of my thesis is everything is driven from this technology, from this core or from the user and talking about the marketplace until one has what's driving this system, it doesn't make a great deal of sense. Just had this one slide--I never understood this diagram but this is a modified DELFI technique. All these experts get involved and there's interaction and person to person contact--these aren't my slides--I just talked to them because there awfully complicated and all these boxes and I can't imagine the thing working--and they don't. Back to this curve which is cars, and computers. I wanted to call attention to the fact that the whole thing that drives this is purely the number of units. I'm using time because units are virtually impossible to get in terms of looking. That all comes from the notion of production learning curves--that is the efficiency of the n'th units is you take the n'th unit and that's raised to some exponential or a positive learning constant so that the efficiency improves with the number of units and a lot of that work was done here in terms of studying and getting a correlation of why, not necessarily why because I don't think people know yet why that gets better, but in fact take that these are generally intherical data and a lot of that came out of work here in studying everything from liberty ships to airplanes or jet engines in terms of finding what the efficiency of a given unit is or what the cost of a given unit was is purely based on number of units, not time. All the early technology forecasting was done in terms of an exponential to some time period. A guy by the name of Fusfeld and maybe somebody else, but he claims he made this observation came up with a technology progess function which is really a learning curve in which he finds that the technology of the n'th computer, that is some performance indicater of the n'th computer is raised to an exponential and that's 2.5 for computers and .7 for autos if you take horse powers as the measure. He made this other observation that if the number of units increases exponential with time, then one ends up with the p of the n'th unit and the technology at some other time then those two are the same and that's been the case of computing. And in fact with computing that's also if you pass these production costs savings on to the user and you have an elastic demand curve then this whole thing is an unstable situation driving all the costs to zero which is exactly where I claim we're all going. Except the thing that keeps us in these stable bands is these salespeople. These sales outlets so institutions, classes of users and salesmen keep us all in particular stable bands.

Question:?

Answer: If you strip all the components out and say "What's the labor in building liberty ships", it follows these curves and in fact I was talking to somebody who was making Bell helicopers and he said "Oh yeh, we're on an 18% curve" and when they say that it means everytime the units double then the amount of labor comes down by 18% of what it was or 15% or 10% in some number and it's usually it means given a unit doubling whats the percentage labor contents it comes out so you have to push all that back into the constituent part and you say "Well helicopter steel isn't coming down" and in fact down at the end even though labor cost is coming down or learning may be taking place the amount of the wages may be increasing. Things like automobiles--that thing is down adding a factor of two automobiles at 10 to the 8'th automobiles is a hell of a hard thing because that takes another 25 years and by that time the labor prices have gone up a great deal. You have to be very careful how the thing is constructed or how you deal with the component.

Question:?

Answer: No--I'm claiming they work clear out into large numbers. But the point is that large numbers--nothing much happens there because it's hard to get a -- with automobiles- forget it--They've learned everything there is to learn about automobiles and nothing much is going to happen. But with helicopters there's a lot to learn because there are only a few helicopters and with anything that complicated to build, there has got to be a simpler way.

Looking at software, cpu, and disk constituent technology, I've put on them taking these various time scales that we had here and looked at the amount of time that one spends in research of anywhere from 0 to 20 years here and say to 1 to 10 years in each of these areas, and advanced development says they are breadboard kinds of technologies. Software one can do in the order of a couple of years to maybe 6 months. These are typically 1 to 2 year projects. Development is 1 to 2 years in software. Cpu's about the same and disks about the same. Testing, tooling, and design maturity testing somewhere 3 and 6 months, 6 months and a year. Here you're talking about a year in a very complex electromechanical system. Shipping may be somewhere between 3 and 6 months to actually ship. At this point we've maybe done a first ship and maybe back in here the product is announced and here this is the educating used thing and one gets somewhere between 6 months and 5 years. Maybe 6 months here from an education point of view. Here in a disk we've got, because people know what it is, it's a commodity, we have no times for it to come in to the marketplace. The education and understanding sort of increases with this complexity here. I did this and looked at these constants principally to do some understanding of what kind of development process one builds and with this you can see how, by spending certain kinds of resources you can actually build the system that can keep you 4 years behind the competition. Because if one keys all development off of announcements here, you use the conventional market pull kind of way for definition. So I'm into a kind of a commodity market. Market tells me I need something, I then go back and think maybe I can develop it because the markets already defined it and then I start through this cycle. Then the time through the cycles is in the order of somewhere between 3 to 4 years so in fact with these kinds of cycles you can understand how you can reliably build obsolete parts in an environment and we've had a case where we kept wondering "Gee, why do these products appear to be obsolete" and there's no surprise once you look at it from process standpoint. So when people say "Hey, is something market driven" I say if the market is defining it or if you're looking at the competitive products there in terms of what you're going to put in yours you've pretty much guaranteed that you've got yourself a system that's going to build products that are 3 or 4 years late.

The languages is a fairly interesting one because one has an educational window there where you can begin to look at the market buildup for a particular language. One that's been particularly one which we look at all the time is the case of PL1 because another language is like being vaccinated for another disease or something--hopefully that vaccination is not going to kill you again. So one wants to minimize the products in some sense--particularly in the language area where you talk about very high education, and higher support costs.

I think in the process sense the thing that seems to come out here is looking at the various people involved in this whole structure. We have in the middle block architects and hardware implementers, programmers, parking and salespeople, salespeople and in the time horizen here I put -25 years to +10 years because I claim they ought to know everything. I don't like to see inventions that weren't in. If there is a good idea in ATLAS I expect it to go in a --ATLAS is only 17 years old so there weren't any good ideas before ATLAS. Certainly 18 year olds have some good ideas that haven't been properly implemented in machines and clearly you've got to look out 10 years because with the software investment, the thing has got to last 10 years. Hardware--I don't know what there because there's a certain amount of implementation history that's important and one had better be pretty good for the next 4 years because that's covering that technology window that's coming out. Programming--that's wrong. It's got to be something in the future and with the different kinds of computers that are being built, I think they had better go back 25 years too because you can the ? microprocessor people learning now just up to the point where the mini people were in 1962 or so and then similarly we had learned what was by about 1952. So every 10 years or every time there is one of these new names machines and these stable states I really think (I don't know how to find out how stable they are) they appear to be quite stable market states.

There appears to be a whole new set of learning that goes on and a whole activity around that and they look almost independent of one another.

Marketing and Sales

Something in the 6 month horizen. Looking at orders they are losing and then forcing back in so that we're sure to build these obsolete products.

Activities--Technology and Historical Technology Selection and Use

This is a tremendous amount of standards. Marketing and sales is really specific use.

Goals - Major

I think another thing that drives is sort the clarity with which people can operate and architectural clarity I think is a fairly hard thing because it's dealing with a large number of concepts.

Hardware implementation--One thing that gets us there is the simplicity of the goals, set of cost, speed and then if you really want to make something complicated, add in the reliability and that gets very confusing. But one has a great deal of clear tradeoffs here.

Here, programming, I'd make as the most complex subject in terms of states, programming of size and speed, and in general a fairly unclear set of goals and that's what I think is probably the hardest thing in programming.

These are all very clear cut measures and in fact people can operate very nicely within--this one is especially clear--this one's less clear because they're sort of sitting at the end and they don't know whether these guys are screwing off or they didn't give them the right sort of things or what.

Number of interfaces, goals simplicity/complexity -- I'd say this is probably the most complex activity - this is the second most - hardware is third most and marketing/sales are in terms of this is a product of states times the information content in those states. These have to be quite right and so maybe I ought to reverse these two. It's very hard to test an architect because there are lots of states here but the fuzziness surrounding those is something else.

I also made the statement about these three designers that we had: This was in the tenth symposium, I think. This is in the performance/price theme. One starts with no design, moves out here adding cost and finally gets a minimal machine and then one can add a little bit here and get quite a game until you get to this best cost/performance point and then you move up to this point and if you lose, you come down there and it's unbuildable.

This is kind of that projectory and one can see these clear design points here. This being the hardest point because it's easy to add something to the design but it's virtually impossible to take something out and you don't really know what that marginal utility is at that point.

This is one I had that is inside of trying to understand what we did and I went back and plotted all of our computers in various lines and say why are all our computers the way they are and so those lines are people migrating around and how much clarity they have in the design. The one here and the guy went off to III and I did the four and sort of split in two or three pieces and did big machines and worked on little machines. These are easy machines--I would never try to build a mid-range machine. That's a very difficult machine to build because you never know. Little machines and big machines are sort easy to build. Big machines are a little bit hard because it can lose through that precipice there.

Here are the four lines of machines and the PDP-5 machines and really that's been implemented as a family. Here's a machine that was implemented as a lower cost version of the 8 after the 8. What I really wanted to show here was this set of machines--this is the 11 series, in fact, which one designer has sort of been responsible for. This line, one has been responsible for that line, and this basic design has been used up here and this is sort of a maximum performance design and then we've split off some people here to go after a lower cost below this because, although I say this is easy, if you straining to make this machine already for a low cost, it's hard to split. It's hard to come up and say you're failing because in fact constraints here where these are all unibus based machines and in fact that's one of the constraints of why it's hard to make a machine that's lower price. In fact we've now started managing by who does the project rather than the project goal.

This is looking at the tree of the technology that drives all of this. The plasma stuff. This is letrastatic memories which really aren't used any longer. Crt's and capacitor sort of analog and digital stores. Here are the two main branches: the electromagnetic memories which I'll talk about--principally the disks and how they go. There is moving electromagnetic memories and semiconductor memory desity because this is the one that's evolved most rapidly and for starters, the thing that differentiates these two storage media and why this one evolves roughly twice the speed that this one does goes back to that very simple concept of learning where the computer world takes about the half of the capacity of the semiconductors and in the case of magentic media, there is virtually no media from video tape outside computing. So essentially there is no market outside computing and the evolution isn't as fast as with semiconductors.

But again without the computer and the semiconductor, it's hard to think that that would have gone anywhere because there was this perception that it was a whole market in which you made a few hi-fi sets and you find that your limited by peoples ears and the FM band. That there's really not that much incentive to make better transistors after a while whereas with computer parts, we've driven them to do better.

This is a "hot off the press" curve. The only curves I really watch very carefully are ones made by people that have a hand on the valve. One hand with the pen and one making these curves and one on the valve controlling the resources to make it happen. I copied this off a chart by Dean Toome, who is Vice President of Engineering for TI--on Monday. His model of what's going to happen purely in one dimension and I'll go back to why this is an important dimension. This is size and bits of memory chips--these are the MOS chips, either by polar chips. This is the CCD, and these are bubbles. And in fact, these lines are sort of constant time lines of when things will be available. These are 1K, 4K, note roughly every 3 years one gets a factor of 2. My curves have been more every 2 years one gets a factor of 4 so I've been more agressive here but I've got other bugger factors that I can use. He hasn't defined what he means here in '76 or '77. He says the paper that was just presented to the solid state conference is at a high volume kind of thing or not, but note the implication here is that in this time scale the '76, '77 time scale one has a 16K chip; in the '79, '80 time scale it's three years. We're sitting here with a 65,000 bit chip or 8K bytes on a single chip and if you're going to have that much memory, you might as well throw a processor in for good luck because that isn't going to cost very much. So we have our 8K byte computer before around 1980 and I think the cost will be in the order of the 5 to 10 dollar range of what we see these machines coming down to now which is really a package cost kind of a thing. So we'll have 8K byte machines by that time on single chips.

Now as a kind of technology historian I'm having trouble noting when the fourth generation comes. The fourth generation I would say historically is as basically being the time we had a single processor on a chip. I would go for perhaps a single computer on a chip as being the next significant thing although that's already happened if you talk about these small number of 1,000 bit or 8K bit kind of machines on a chip. I don't think those are significant yet and it's hard to know how to peg that in the generation sense. I think maybe somehow a significant event has to coincide with that.

The other thing that was unique here is this factor of somewhere around 3 in terms of cost for 400 microsecond CCD memory. So here by the '80, '81 time frame you have a quarter of a million bit CCD memory and bubble memory being maybe a little bit earlier but with 4 millisecond access time. An interesting sort of research program at this time is how does one really utilize these memories because it really is a painful thing to deal with. From a memory hierarchy standpoint everything works but those models are awfully continuous and if we have to do something different to the machine then we really aren't doing very much planning now. If these are mere fixed head drum disk replacements that's an easy thing to do but note this very fast access time is to exploit some of the other properties of this. The transfers are going to take place a lot faster than they did before and the question is "Do you switch context" because we've had these long terrible context switching problems. We've learned to make context switches in the order of 5 milliseconds and be happy about it and now we've got these very fast devices and I don't see that those long context switches are going to be acceptable there. Perhaps a structure like the CCD 6600 where you have multiple context and once you get a page fault you switch to another context, compute there for a while, and so you really have -- multiple processors active at the same time on one physical process.

It is really important to operate there with that kind of thing so seed out work here is important at least from that standpoint to be able to have those processes active and to not have high overhead between them.

On the memory thing, I've always been fasinated as to why Grosch's law would hold and the only thing I could find in the past of why Grosch's law would hold would be that there was an economy of scale with disks and with core. That is, you had some physical structure a coincident occurrence--Whitcore says you double the amount of coincidence circuit, then you get 4 times the amount of bits there. So that was a square law relationship. I found another one which is in fact, if you'll buy that wild statement I made about "A good work indicator"--that is how much work is a computer doing--is the memory data rate by how much memory you have to work in times the processor rate or the memory data rate. Now lets just take one of those single chips and put a processor on it, then that's a measure of performance of that particular one. Now if we say that, then the memory size is strictly proportional to price. Memory data rate is also--this is data rate in bits per second is also strictly proportional to price, then we end up with the performance in bits times bits per second as being a price squared relationship, neglecting processor costs and in fact with the dominant costs going the way they are we can neglect processor cost--we can sort of throw those in for free either on the chip or you put those in in a bigger system when you put in another disk. It clearly holds but it turns out that holds if every time you put a chip in you've got access to that chip and you are able to get the bits out that having that chip implies. If you put them all in and have only one bus, and they're all selected then that doesn't count and you're on a either constant or even a linear relationship.

The interesting thing is that it doesn't matter if by that measure then we would equally well put a processor on every one of those chips and distribute that power if there were some way to pull back together, but at least in a pure work sense you have the potential of doing more work on a square basis if one adds money on a price basis. I'm kind of intrigued that there is a relationship there although I'm hard pressed to see Grosch's law really holding very well on the various machines we've built. In fact, when I get into the marketplace thing, on the 360 and on the 11 it's hard to get more than that power constant at being around 1.5. We feel that 1.5 may even be pushing it to show. In fact, on a 360 there is a price range of a factor of 65 and the performance goes up by a factor of 300. Again you have to almost choose the right problem. That's on the scientific problem. If you put it in to a disk space problem, the performance may not go up hardly at all. If you put one disk on a 195 and one disk on a model 30 and you've got a sorting problem, the performance is going to be relatively constant.

Looking at some of these performance measures--I'm going to go over some of them quickly. This is Noyce's curves in terms of components per circuit for semiconductors. I indicated that that's gone up by 1.78 to the t minus 1960. The one I always like to use is to the t minus 62 so I can remember it.

Neusbaum, who's head of switching circuits department at Bell Labs, has a 60% improvement in gate costs and that's probably fairly close to Noyce's if you assume that the gate cost is not going to go down as fast as the gate because you get into this packaging problem where packaging is probably increasing slightly. We've learned everything we can about packaging and these are new dye that we're building and getting the learning for versus those packages which really don't look a heck of a lot different than the ones in I guess 1965.

The other thing you see here is by the MOS circuitry and the TTL circuitry in LSI then there is something on the order of 7 or 8 years difference in terms of gate cost. So in fact they parallel one another and really it's a question of "when did you get to that density with this other technology". Some specific points--this is another form of that curve done in 1972--these are very maybe later than that--here's the IBM chip which is off the curve and in fact people come to me and say "why". The impressive thing about the IBM technology is their technology and in a semiconductor that's the only point I've seen that's interesting of IBM and the only reason that stands out is that the semiconductor people sort of sat there and said "but why would anyone want a 448 K bit MOS ROM". That would have been probably before IBM did it if somebody had said "Gee we want one". We know damn well that we don't want one because our software changes too rapidly and besides, our programs are a little bit smaller than that and we don't need 48K, those kind of chips, to write a good BASIC in so this makes up for having very large slow cumbersome software packages which is the advantage you have if you have enough technology. At that core you can blast through and make up for a lot of this software fat on those inner rings. But overall this is roughly a little bit less than a factor of 2 in transistors for chips. One of the things that always comes out is that you've got to be very careful taking these curves very seriously. I always use them but not to this precision because when you get into this precision you find that dooms kind of things come out. Here's core memory there, here's n channel MOS there and this is when these guys essentially cross over and it turns out that that hasn't happened yet. Furthermore, you see how bubbles really came in like crazy since 1974 and the other day we actually got one so about three years after these projections and I think this was really in the order of a '72 2 kind of projections. It's very hard to project two years in the future with any accuracy. In fact in Turn's book on computers of the 80's is remarkably inaccurate for the time the book was published. So starting in 1974 the curves were bad and I don't know what's going to happen by 1980.

This is another one of being very careful about what happens. This shows problems in two dimensions: Here, gate delay in now seconds and relative density and they put all the technologies that they knew about. This illustrates the problem of these things. Here's I-squared L which is really the dominant technology or that's beginning to come in as a form of bipolar. Here's the SOS technology. It's low power schotkey. I don't know whether that's that or not but even two years into the future one misses major technology changes in these forecasts and that's not surprising because of the way these curves are gotten. These guys are often getting curves and data from people we and everybody else, I guess, buy them and they come to us and say "we want to go to a consortium and we won't tell who the other members of the consortium are. We want you to spend $5,000 to get you 3 pounds of information on the semiconductors of the future" and they go away and they talk to everybody and/or how typesetting is going to change in 5 years or 10 years. And they come back with 3 pounds of paper on that subject and nobody can read. And they get it by talking to a lot of our own marketing people and of course we're very tight lipped about the whole thing and we're only going to tell them all the bad ideas that we are pretty sure aren't going to happen and we really got into it to find out what everybody else was doing. So, in fact, when you buy the 3 pounds you're generally getting obsolete stuff and in fact if you got a market survey, you can be pretty sure that if it's in the survey, the market's gone because only obsolete things go on market surveys. I don't think I've gotten any hot ideas out of the market surveys. I've got the ones that I know are pretty much going to be beaten to death by everybody else. In a semiconductor world then you end up starting with this relationship, this was done for the tenth paper because I've tried to make a model there. MOS read/write is the key date. Shift back a year for bipolar ROM, shift back 2 years for bipolar read/write. Shift ahead if you want ROM. If you're talking about production add 1 to 2 years and then from that you get all these things and low and behold this happens to fall on the curves that Dean Toombe gave me Monday so I'm feeling good that for 18 months this model has held and it corresponds to somebody elses model; in fact, it's the model that we've been on in terms of when things going to happen. It's kind of important to know when things are going to happen as long as you don't take it too seriously and be prepared to change.

The other technology that dominates is the disk technology and this gets into the notion of economy of scale and there is an economy of scale with this technology. One takes a given disk platter and builds a fairly simple mechanism around that. It's got a motor, it's got cheap metal, it's got electronics. Now if you start piling some more disks on top of that and just to the point to where the whole things topples over and you don't understand it and that number is 10 it turns out. Maybe it's 9 because we're using 10 and I'm not sure we understand all of that 10th one but that one builds that particular technology and the model I have there is this economy of scale by having a little bit bigger motor one ends up getting a factor of 10 in capacity with not much more cost. It turns out more than one would expect and 10 probably now doesn't seem like the optimum anyway. But you do that first and you do it in the high end so that it's going back to the designers again, the designers work at the high end and are driving to get the lowest cost per bit and that turns out to be this 10 high technology.

Behind that technology one takes this base technology and puts it in a low cost technology and this is in fact the mini technology. This right now we're seeing separating. We're not moving as aggressively here in the low cost technology at least in cost per year as in these more aggressive 10 high technologies because there isn't as much learning and much work going on into making achieve versus making it lowest cost per bit. In terms of those two technologies, a curve I plotted a couple of years ago; this is IBM technology, this is IBM disk 62 to 74, 38% per year in terms of price, in terms of dollars per megabyte and capacity is gone up at 42%

per year so in fact the average disk price has gone up slightly because sheet metal, we've already been (?) a lot of sheet metal, we've already built billions of motors and those things aren't changing very much and the thing that is changing is the magnetic density which is going up, which is changing quite rapidly. And in fact yesterday, I had plotted some hard disks here in terms of looking for an economy of scale on those and here I've got number of bits versus price, here's accesses per second, here's the pure performance and here's this payload factor. Here's a factor of 2 so it's gone up a little bit more than a factor of 2 or at a given time when I took this snapshot then in fact using these measures it was more cost effective to buy at the high end more than the square log. Interesting observation is that on the accesses per second this doesn't have much of an effect in terms of money. That is we're talking that mechanical motion is the same thing as why a mazerotti won't go 50 times faster than a pinto because of the difference which we'd expect out of the price. Here we're back into this mechanical constraint. We just can't violate, and we're stuck with a new toy in mechanics and when it gets into the system, then you're stuck again at the system level by not having any economy of scale. You'd think when you scale the whole bloody system off, it's going to perform faster but it doesn't because this is the limiting performance factor on all of the multi programs floppy systems. So you've virtually got the ceiling there that is it's multiplier. So it's really disk access rate, this is rate, maybe you get 50 per second out of this one, here you're talking 20 per second of these and that's the thing that's dominating our performance.

From an observation the disk and semiconductor technology is one goes at 41% doubles every two years, one doubles every year and that seems to be due to a tremendous (?) in the overlap of the discipline. In the semiconductor discipline, a number of the people who work on semiconductors all come from the same basic discipline and in fact have a common vocabulary of communication. In disks one has all those technologies plus some processing, testing, plating technologies that aren't in the semiconductor, so those two industries, it turns out, I believe varied both on the basis of there is a captive market for magnetic media versus not in semiconductors where only half of the semiconductors market plus the disciplines themselves are widely separated to make disks. And then the third factor is the semiconductor industry is a very unique industry in that knowledge is broadcast very rapidly in the semiconductor industry and they do it with sort of good scientific communication. A lot of them have been trained as Phd physicits, chemists, electrical engineers, materials people so in fact there is this whole discipline of report what you've done. There is a tremendous amount of reporting and so people know what's going on and then the crowning blow of all of that if you didn't have all those factors is they used to share agressive money to buy people and so people are changing jobs all the time. So it's a very exciting and interesting; it makes computers look like pikers by comparison. It's a really exciting industry but a half life of the people are varied too by comparison. So the character of those two disciplines is different and in the case of the disks, all of that technology really came out of IBM in sort of '65 time frame and again they used this universal solvent money to pull all those people back from IBM and in fact to get those disks made in the various places. In fact, why all those law suits, is that it wasn't clear when they brought some of those people out of IBM that they didn't have a few plans with them as they came out, in fact that's the whole business of what makes the thing interesting because they sue IBM for stealing the market, and/or whatever. I don't understand what it's doing but they do all those kinds of things and then IBM counter sues saying "but the disk your making was our disk in the first place" and so we should side with the underdog. It's fair to steal the thing and take it away and make it but that's gotten resented. It looked like TELEX for example. That was being rewarded; they were able to closely covet a design and then turn around and sue IBM for not letting them market it effectively by IBM merely changed its prices to respond to the competition which is the good old practice of American business or all businesses.

This is dumb terminal prices, this is I haven't put it in to

the 10 into the right exponential. This was
I haven't put it into the 10 into the right exponential.
This had a lot of thoughts around it. This was a high regression, I don't remember what he got out of this but it looked like a reasonable fit in other words and that's actually t-70 and that .03t and that's e so it's about 10% per year price decline so that's .9 in terms of price so 90% 10% price reduction per year at the dumb terminals.

Minis
I put 31% and that's improvement, that's not really 30% reduction, that's 1 over 30% or it turns out to be about 22 or so when you do the reciprocal. So this is basic machines, what the price decline is then for small machines, the minimal machines.

Overall we get these various effects. Semiconductors then are followed maybe 60% to 80% price improvement disks, 41% in density, core 30%, tape is 23% in density. Notice that that and that are correlated, or that this your only getting a linear improvement, here your getting a square improvement because disks are packed that way. Data rate: 6% improvement in data rate or 6% change in tape speed or over the 25 years that turns out to be a factor of 4 improvement in tape speed since tapes were introduced and that's pretty good going against Newton that way.

Packaging and power per watt per cubic inch haven't changed--they're sort of holding their own.

Minis: this is too hot but I believe it's improving. Better communication capability for computers I think drives distributed processing because that has to be based on communication capabilities. Otherwise we're going to be up against the limb of the telephone operators problem here where everybody becomes a telephone operator in switching information from machine to machine. In fact as you distribute it, everybody becomes a computer operator and that'll drive us into the network stuff. The density also changes the reliability radically because there simply is less mechanical parts to fail. It adds this greater functionality in terms of basic language and operating constructs and it makes every terminal a smart terminal with some additional capability and in fact will generate an electronic typewriter from that. Smart plants, smart labs where we put in every instrument that is fundamentally electronic will have enough intelligence in there to do significant data processing.

Greater disk density is really driving us to the need to get organized in the data bases area. Higher people--people costs are going up. Paper costs are increasing. That I think drives us into basically not generating information that we don't capture so that what will drive the typewriters to all be electronic, that in fact as you get into the problem of making corrections on copy or doing typesetting or filing. The worst thing about creating memos very often is not the memo per se but it's the fact that somebody's going to read that and with electronic mail we've got the possiblity we can have computers read all that mail and answer it and we get to that happy stage: they'll create them on-line, transmit them, store them, be able to retrieve them, then we can read them and in the next stage we can write them and so I think that I'm glad Bob Sproul is here. I think getting out of the Xerox is a good idea because if there is one thing that hurts this whole paper thing, it's Xerox creating more and more paper in the world. I don't know how to get around that. I think clearly we have the opportunity but whether or not paper is the absolute drug we cannot deal with, do without, I don't know. But I'd sure like to try. That's this section on technology.

Question: (Bob)

Answer: I think better encoding is going to help. I think pictures may be a way of essentially soaking up that and basically doing some encoding. Let's gets some useful information out for a change. I mean those goddam EDP machines that generate these massive piles of paper that then--who ends up doing the processing is. I have seen more reports where people sit with a calculator trying to get stuff off of the EDP runs. I think that the processing has really has got to go into sending that information. It really should be done keeping it in the data base then going in and accessing it only transmitting the exceptional kinds of information so people can operate. Number of cards at last is not rising and that is the number of cards produced per year is sort of flattened out. I think that's one of the major breakthroughs because with for every hundred cards, one of them is in error then there is a high probability that that error's going to make that other data that gets generated from those cards useless. In these reports I see I think the people I work with are putting me on when they say "Oh the input datas got garbled and therefore all this stuff is meaningless and that's why I'm overbudgetted" and it's all because of the EDP problem. I think fundamentally a lot of the power is just going into doing useful information processing where a person is committed to making them.

Question: ?

Answer: No I think they're fairly good in terms of what they're doing. It's the DELFI techniques. I'm not worried about these people. It's the market surveys which gets the information and the DELFI is in fact one layer removed from that chain. I don't know who they asked for those things to get all the garbage that came out of that report. There is something useful about that report though. Are there any wild ideas that might be feasible now that might actually be interesting to have. Of course I'd like to have a display on a 40' wall and have it all electronically changed.

Question: ?

Answer: That's one I apologized for two years ago in that paper. Now I know. The neat thing about doing all this stuff is you clearly now know what the opportunities are going to be and I think if I had done essentially this much work. That one I knew in my gut but now I can prove it any way you want to prove it including you can even get marketing people, users to say that too. But the drive there really is a significant effect on the architect. In fact, trace that back; how much, if you also believe the constant price model, then it says every couple of years we need another bit in the memory space. The thing that holds us from that really is the ability to make machines that will go do that with those larger memories.

Question: ?

Answer: That's one piece. I see a lot more value now in looking at that base technology data than I did...now in retrospect the whole history is clear to me. Why everything is the way it was but now does that do any good in the future? I'm not sure but I'd like to at least understand why things were the way they were and I think so far its been useful to me to at least get some ideas about how long I've got to live in the future or what kind of an environment one could have sort of in 1985 time parameter. That's why I look at these in a sense I think any of these curves that would come in ? exponential limit ? I'd say great I won't have to worry about that any more. Sometimes I'd like to see some of that happen but nothing like that's happening. You can only see until 1981 in the semiconductor thing because that's really clear because that's the ? limit. But yet all the experiments are done for the x-ray and e-beam exposure of semiconductors in making a mast and so they're saying--the other day we were talking to some people and they say "Oh we're not worried about going past '80 now" so I'm feeling good up until 1985. I don't know what that means because I'm now worried more about how the hell do we use all these things. Let's take my curves, run them up to '82 say I'm wrong by 3 or 4 years and that gets us to '85. A million bit chip appears in '85. That's only 8 years. So we've really got virtually zero cost computing at that. There aren't that many people who got a million bits, an eighth of a million bytes or 128K byte chip in that time slot and that's a reasonable price. You could put a few together and in fact that's right at the limit of the programs...it's way past the limit of most of the programs that we use most of the time. All the text editing, all the interface programs and things like that. That'll all fit on a ? chip but the other programs...so these big data base systems and the other programs I think are ones that we really need to be working on now. Those are the ones I'm very concerned about.

Question: ?

Answer: But I'm making the assumption that one of the interesting things that's going to happen is when that fits on a chip, then in fact that will present a much lower cost threshold. People will do things with that as a unique device as opposed making million computers. Yesterday's talk was these computers came down and reached the stable state and I don't know to find those states but in fact we're here right now and there's a stable state beneath that...which or maybe it's this state here doing something else and there's going to be all sorts of activities around that lower cost thing and in fact building at the high end is going to be the hardest and we've got to find new organizations because we're going to keep stumbling over the complexity thing. How do you build that many machines together? How do you get them to communicate? I think it's going to be incredibly exciting in terms of what one can have in the next few years. I think by '80 we'll be at a very exciting time too. An 8K byte thing...well that's kind of interesting too because that means every typewriter can for not much money remember everything you've every typed on it and have corrected on it. It may have written it even. And I think what else do we do? So the DELFI I do read for any wild ideas that are now feasible and also useful.

Question: ?

Answer: In a way this part feels the softest to me in terms of a way of really doing a good analysis of what the structure looks like because it gets into a whole bunch of dimensions in the marketplace. The ones that are comparatively hard are that some of these use that functions structure dimensions

TO: see "TO" DISTRIBUTION DATE: MON 18 OCT 1982
10:40 PM EDT

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5179038153

SUBJECT: CMU LOSS: WHY, SIGNIFICANCE AND NEXT STEP

I'm very sorry we lost the bid to do a PC with them. I think it will turn out to be an extrememly pivotal event in history.
Andy rightly fully gave me hell for losing the order, because although I felt strongly about the necessity of doing it, I didn't spend enough time, nor did I offer to really get into the design. Similarly, I didn't push to get some of the other
folks like Avram into the effort of the new machine.

The reasons why we lost: With IBM there was potentially higher
risk, but much higher payoff since if they were successful, then
IBM would leverage their work by distributing millions of them.

With us, it was a surer thing, and lower cost, but not as potentially exciting.

IBM was willing to let them manage the project. This had an incredible appeal to them. (note the potential risk/reward for an environment that is normally not used to this)

IBM was enthusiastic about using the CMU operating system and environment called SPICE, built in Computer Science.

IBM's head of the Palo Alto Scientific Center lead the effort on a full time basis, with a larger, resident full time team. IBM appeared to take the whole project much more serious.

IBM made the initial sale via Lew Branscomb and Cyert. It was
uphill for us and we never really sold Cyert.

They really liked the idea of swimming in a bigger pond, as we've not always responded to potential opportunities.

IBM's providing their scientific personal computer that was just
announced today as the first machine. The REAL machine will be
available in Summer 85. We believe this is the 801, very high performance machine driving a display.

NEXT STEP

We must continue to have a strong presence there and must continue to watch the Spice Project, learn from it. We have MANY projects going with the CS department and we can't give these up: robotics, LISP, Ethernet, SPICE, etc.

I believe we need to provide a significant computer of the kind they wanted. Whether it would have been sold in droves on colleges, remains to be seen. However, I do know that such a machine is what the professionals need.

I also think it is necessary to get another, demanding partner.
Candidates include: MIT, Stanford, Waterloo?, Harvard,, ??. We need someone who has the commitement to do it across the whole campus and someone who is very competent! Right now I don't see a single university that has both of these attributes.

IBM's POSTURE NOW

They will use this sale like crazy to say they now dominate the Computer Science and University Market! We have to down play it, as anything other than an isolated example. As I've recently pointed out, IBM is building machines according to specs now from CMU, MIT (An AI machine) and NYU (the

Ultra-Computer). This is a model that they used when they established themselves in computing in the early 50's when they worked with Columbia, Harvard, MIT (Whirlwingd). It's also the model the Japanese use to transfer technology.

BOTTOM LINE (WITH RESPECT TO IBM)
They have many more resources, and they are being used very effectively on high quality, creative products. This is in contrast to a substantial number of evolutionary products we are doing. Hopefully, they have some really poor products in the works too. Otherwise, it's ...

"TO" DISTRIBUTION:

BILL AVERY	CHUCK EICHENLAUB	EMC:
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BOB TROCCHI	BILL WISE	

GB3.S8.70
@KGF, 11/21/84

I think it is quite crucial to get the first computer into Carnegie-Mellon University.

My own ties are still strong:
.they still list me on the faculty and I still have many professional friends that I'm close to (including Raj et al)
.I'm on the board of the Software Engineering Institute that was just funded by DOD
.I remember putting the first VAX there, and I'm superstitious

Apart from this, CMU is:
.rated 2 or 3 (with MIT... which we really can't afford to do business with). Furthermore, other schools follow them.
.an advant garde user and Raj is opinion leader in the DARPA

community
.DEC and IBM oriented
.tolerant and can help us get the machine up to snuff

DARPA is simply critical to Encore because:
.the early machines will not be operate efficiently enough to compete
.this community will do their parallel processing and robotics and AI
work on Hydra. These will probably end up being key to ECC's success.
.the general technical community follows DARPA
.DARPA has an incredible amount of money in the next few years to
throw at computing and parallel processing. We need to catch much
of it.

Re The Large Memory Boards
Henry will have to get an answer from Hydra. Large boards are quite impressive, and may turn out to be the best or only way to get the Mips out of Hydra by making sure we never swap. (I recall a paper in the IBM Systems Journal in which it is predicted that very large timesharing systems don't work because of the growth in various times associated with managing a large number of page tables and disks.)

Re Prices
Regarding our pricing. Our prices, whatever they are have to be our prices. We can't afford to give things away yet. Hopefully we won't need to even in the case of the Beta units. Note our mark-ups appear to still be sustantial.

Re Doing their boards
We have several choices (for each board):
1. Lock these boards into the DARPA contract! We could lock the two together and it will get CMU to put pressure back on DARPA to give us a contract.
2. Do nothing.
3. Offer some amount of consulting.
4. Do each board for a fixed fee. The video one could be done this way, but the Systolic interface could be a mess.

In short, of the friends I've introduced to Hydra (including Sperry), CMU will probably be much more lucrative, fun and helpful in both the short and long term.

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* d i g i t a l *
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TO: see "TO" DISTRIBUTION DATE: SAT 17 OCT 1981 15:16 EST

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

cc: WIN HINDLE
ANDY KNOWLES

SUBJECT: PROCEEDING AHEAD TO EXPLORE THE CMU/DEC RESEARCH PROPOSAL

I described the proposal and ask for an agreement in principle to enter the study phase, and if successful, go on to fund the proposal. The Operations Committee was reluctant to give a unilateral endoresement of the proposal without having an understanding of what the proposal would cost.

We did agree that that we must go into the study phase and that it would be ideal to have a combined R and D center in Pittsburgh, closely linked to CMU. In this way, we would not have to have the total incremental funding, but would have to cover the project in a substantial fashion out of existing programs by correctly coupling the CMU Project with our own work.

I'd like to meet on Monday morning and discuss how to proceed.
I'll call Allen today and get a reading on where things are.

"TO" DISTRIBUTION:

SAM FULLER BOB GLORIOSO BILL JOHNSON
JOE MEANY IKE NASSI

GB3.S1.23

PROPOSAL FOR THE JOINT DEVELOPMENT OF

PERSONAL COMPUTING

BY CARNEGIE-MELLON UNIVERSITY AND DIGITAL

G. B.
10/14/81

THE CMU PROPOSAL

- BUILD A PERVASIVE ENVIRONMENT OF PERSONAL COMPUTERS THAT GRADUALLY EVOLVES FROM EXISTING T/S SYSTEMS IN DAILY USE BY A LARGE, DIVERSE POPULATION.

EVERY STUDENT, FACULTY, STAFF MEMBER WILL HAVE A PC. STUDENTS WILL TAKE PC WITH THEM.

-DEVELOP APPLICATIONS APPLICABLE TO A BROAD MARKET, ENCOMPASSING:

+ OPERATIONAL SUPPORT OF LARGE INTEGRATED NETWORK (ARCHIVAL, RETRIEVAL, ETC.)
+ PRINT IMAGING, GRAPHICS, AND VOICE
+ ROBOTICS
+ MODELLING
+ KNOWLEDGE ENGINEERING
+ INFORMATION AND DOCUMENT PROCESSING
+ HUMAN INTERFACES AND SOCIAL ASPECTS OF "LIVING ON THE MACHINE"

-CREATION OF AN OFF SITE INSTITUTE FOR INFORMATION MANAGEMENT AND TECHNOLOGY TO DISSEMINATE AND TRAIN STAFF, CUSTOMERS, POTENTIAL CUSTOMERS.

G. B.
10/14/81

BENEFITS, COSTS, RISKS

BENEFITS

-OWNERSHIP OF TECHNOLOGY (FIELD PROVEN HARDWARE AND SOFTWARE DESIGNS) FOR FIXED OPTION PERIOD.
-CLOSE COLLABORATION WITH A LEADING UNIVERSITY AS A WAY TO EDUCATE, INNOVATE, VITALIZE ENGINEERING.
- REDUCE ENGINEERING ISOLATION FROM CUSTOMERS AND ACCESS APPLICATIONS

COSTS

- $6-7M PER YEAR
-REQUIRES MANAGING AN ENGINEERING SITE LOCATED IN PITTSBURGH

RISKS

- STAFFING
-TRANSFER OF DEVELOPED TECHNOLOGY INTO PRODUCTS
-UNCLEAR ASSOCIATIONS WITH OTHER CMU INDUSTRIAL AFFILIATES (WESTINGHOUSE, THREE RIVERS, IBM, HP ...)
-WE ACCELERATE THE DEVELOPMENT OF A MARKET THAT WE DON'T QUICKLY CAPITALIZE ON
- NO PRODUCTS FOR THREE-FIVE YEARS
-ADVANCED DEVELOPMENT TREND IS MOVING AWAY FROM DEC (UNIX, XEROX, THREE RIVERS, WESTINGHOUSE)

G. B.
10/14/81

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TO: see "TO" DISTRIBUTION DATE: SAT 10 OCT 1981
19:41 EST

FROM: GORDON BELL

cc: LARRY PORTNER DEPT: ENG STAFF

EXT: 223-2236

LOC/MAIL STOP: ML12-
1/A51

SUBJECT: THE CMU PROPOSAL, US AND THE NEXT ENGINEERING SITE

Bottom line:
They are going out for bid on their proposal with HP, IBM and us.
We must not only go out and get this, but it must be part of a combined SWE, Research, P/L (EDU, Education Services, SWS=Network development) facility... otherwise it makes no sense to go after it. I want it to be our next site together with Japan and Washington... capable of holding 500 people by 85!

The rationale: we missed an opportunity with the CSDept personal computing work. They have made real progress and got their 100 systems, while we TALK. Meanwhile, they've also produced a PLUTO we will probably end up using. The robotics work includes all the key problems: vision, manipulation, applications and AI for control. The McDermott work alone is worth a site since we must use that technology now to manage large projects... like Venus.

I want to get together this week and plan on how we go after this. Also, I want to get the basic approval for proceeding to bidding on this. The approach is to go into a study phase for the next 6 months. In doing this, I want your support.

If you want to talk about this today or tomorrow, give me a call. Otherwise we'll wait when we can meet.

At our meeting, I'd like to find someone who might be the site
leader so that when we work, we do it in conjunction with the appropriate ultimate doer.

"TO" DISTRIBUTION:

SAM FULLER BOB GLORIOSO BILL JOHNSON

GB3.S1.28

April 26, 1982

Dean A. G. Jordan
Carnegie-Mellon University
Office of the Dean
Carnegie Institute of Technology
Schenley Park
Pittsburgh, Pennsylvania 15213

Dear Angel and Granger Morgan:

I will read your plan and send it around for review.

My first reaction is negative, based on watching public policy groups at Harvard and MIT. In fact, I believe strong scientific and engineering institutions have been weakened by the management and resources defocus that such a department represents. It seems to be extremely difficult to manage and participate in the technical change and simultaneously engage in the management and rhetoric that departments like this often represent.

Somehow the work needs to be done that's characterized by the goals in your letter, but I don't see how we can contribute, nor do I think CMU needs a whole department to address them.

While these are my own views, I'm sure others here will disagree, hence I'll send your proposal around for comment and review. Hopefully there are people here you might want to talk with when you make your study.

Sincerely,

Gordon Bell
Vice President, Engineering
Professor, Computer Science and Electrical Engineering
Carnegie-Mellon University, on leave

GB:mal
ID GB3.S4.2

11 April 1979

Dr. Richard Cyert
President
Carnegie Mellon University
Pittsburgh, Pennsylvania

Dear Dr. Cyert:

As you may be aware, a number of individuals from our respective organizations have been discussing the possibility of Digital's participation in CMU's ambitious program for distributed computing in the 1980's.

Although our discussions have been preliminary, with a number of important issues yet to be addressed, we are optimistic that it will be possible for Digital to provide CMU with concrete financial assistance in implementing its vision. Specifically, we would like to consider the possibility of

Digital's providing a substantial research grant toward the purchase of computing equipment needed by CMU to implement its plans.

I would like to extend a personal invitation to you to visit us to discuss this matter further. Please feel free to bring with you any colleagues whom you feel would be helpful in our discussions.

I am looking forward to meeting with you.

Yours very truly,

Gordon Bell
Vice President, Engineering

GB:swh
GB0002/24
In CMU:

```
  1   3-MAR-79  To: Fuller                     VAX's at CMU
  2  17-FEB-79  To: Bell                       CMU
  3  16-FEB-79      Fuller                     CMU's Department of
Computer Science Computing Needs
  4  13-MAR-79      Jorgensen                  CMU Visit on 8 MAR
79
      5  22-APR-79  TO: BELL                   CMU MEETING
      6  23-APR-79     FULLER                  CMU PROPOSAL
      7  23-apr-79     SECATORE                CMU PROPOSAL (FROM
SAM FULLER)
```

EMS 3-MAR-79
17:26:49 200 1
To: Sam Fuller, Bill Johnson, Jim Bell, Ulf Fagerquist
CC: Craig Mudge, Mary Jane Forbes, Robert Kusik, Dileep Bhandarkar
From: Gordon Bell
Date: SAT 3-MAR-79 17:26:49 EST
Subject: VAX's at CMU

MJ Please send copy of this to Nat Parke and J Burness. It is imperative that
we get back to Al Newell by Monday evening in regard to the CMU proposal....ie
how to fix it, what to say so things can get strted through the sales office.
Jim can you read it on Monday? I'll brinng a draft in.

Allen called me on Friday evening with their dilema: several groups are
wanting to now purchase a VAX, and they don't want to predjudice the proposal.
I also taold him about the possibility that we were considering building an
LSI design console... and would like input from Bob Sproul. He also said that
Ivan Sutherland was spending the summer at CMU working with Sproul on the LSI
effort. We ought to get this console definition cleared up soon.

The groups who want a machine include : Raj for speech and image; Sproul for
VLSi (note CMU is probably going to get a big slug of $'s soon from ARPA on
this); and Robertson who works with Allen on Zog, etc.

Is there a way we cold loan them a VAX? I need to get back on this especially
so they can get started.

Command:

EMS 17-FEB-79
14:59:46 150 1
To: Jim Bell, Bernie Lacroute, Ulf Fagerquist
From: Gordon Bell
Date: SAT 17-FEB-79 14:59:46 EST
Subject: CMU

I believe we ought to head this way and encourage them, there is more to come.
Here's the prelude.

Forwarded message:
EMS 16-FEB-79
14:07:50 260 1
To: Bill Johnson
CC: Gordon Bell
From: Sam Fuller
Date: FRI 16-FEB-79 14:07:50 EST
Subject: CMU's Department of Computer Science Computing Needs
----
This statement of CMU's computing needs is the result of a discussion Bill
Johnson and I had with a number of the faculty at CMU (Newell, Reddy,,
Sproull, Fayman, etc.) on February 7, 1979.

This is only a characterization of the Department of Computer Science, and
related activities, at CMU, and not the entire university. The assumption
here is that the Computer Science Department at CMU is an innteresting
example of an R&D organization with some vision of the computing needs of
productive R&D groups in the 1980's.

1. CHARACTERIZATION OF THE COMPUTING COMMUNITY AT CMU:

- About 300 to 500 accounts on the existing PDP-10's. - About 150 "real
users". In other words, 150 of the 500 accounts
represent people who use the computers one or more times

a week. - There
are a set of heavily used application programs used by most
of the 150 active users. Specifically: SOS, Mail
Systems, and
document preparation systems (RUNOFF, PUB, SCRIBE). -
About 60 users
make significant computational and disk storage loads
on the system. - On a typical afternoon, about 60
persons are logged in
at any
moment. - For short one or two weeks bursts, single
users will use up to
20%
of the machine. - Users can be roughly clustered into 5 or
6 distinct
research areas.

2. PRESENT COMPUTER SYSTEM AT CMU:

- Three PDP-10's; 2 KA10's; and 1 KL10. - Half a dozen PDP-11's directily
support the PDP-10's as comm. front
end, high-quality printer controller, graphics
processors, etc. -
Slightly over one Gigabyte of online disk storage. -
Magtapes used primarily
for failsafing disks.

The above computing system is viewed as severely underpowered for CMU's
current needs. The 50-odd PDP-11's acattered about CMU s
part of C.mmp, Cm*,
IUS machine, etc. are serving dedicated, systems research
investigations and
are of no real hlep in serving the general computing needs.

3. CMU'S VISION OF ITS NEXT GENERATION COMPUTER SYSTEM

A- Based on a machine architecture with a much larger
address space
than the PDP-11 or PDP-10. (The one Megabyte virtual
address space

of the PDP-10 is already a serious problem in the image processing application. CMU sees its other applications growing well beyond a Megabyte in the near future. - Main need is for "Interaactive MIPS".1979 needs is estimated at about 5 MIPS (say 3KL10's or 6 VAX-11/780'). Derivative of needs seems to track technology, i.e., about 30% per year.

- Want some guarantee on responsiveness of computing system. I.e., the current situation of teh PDP-10's bogging down to a slow crawl in the afternoon and evening is considered a serious hindrance. - Central, MultiGigabyte file system. Concept of personal libraries of floppy disks or TU58 cassettes seen as a step backwards. Very high data integrity required of this logically central fiel system. Assume such techniques as journalling and/or shadowing will be used to guarantee integrity of data. - General consensus that next generation systems ill provide its interactive MIPS, as opposed to file storage, via "personal computers" distributed around the organization. 40 to 60 of these personal computers needed, assuming that of teh 150 people in the department, 60 of them make significant use of computing power. - Whatever the distributed/centralized organization of the system, the user should see a consistent niterfact. I.e., editing with a VT100 on a central machine should not look any different than editing on a personal computer (aside from the response to some of the editing commands.) - Department makes extensive use

of home terminals
and would like to
continue to do so. Unclear how this dimension of needs flow into
the scheme of things until personal computers are really cheap enougoh
to be home computers. I.e., two personal computers per researcher

- Ultimate value of system to CMU is in the software systems it suppoprts.
Raw compute compute and disk storage without software systems
of no use. This translates into conclusion thatmovement off of
the PDP-10's will cause a major glitch in productivity and will entail
several years of software systems building rather than basic research. -
Graphics seem as critical to future applications at CMU. Areas already
seen: CAD, more powerful editors, image processing ressearch.
2500 characters, 30 times a second seen as the scope of the graphics
performance needs. - Candidate machines: VAX, Prime 500's, Z8000's, Lisp Machines
(from MIT).

* At another time it might be interesting to look at the entire CMU
computing environment; it might provide a good example of a mid-sized
university committed to teaching computing concepts across many of its
education programs.

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university committed to teaching computing concepts across many of its
education programs.

Command:

EMS 13-MAR-79 11:37:41 420 1

To: Per Hjerppe, Gordon Bell, Ulf Fagerquist
From: John Jorgensen
Date: TUE 13-MAR-79 11:37:41 EST
Subject: CMU Visit on 8 MAR 79

The purpose of the visit was to join Pete Smith in reviewing 4300 Series
presentations recently made to CMU.

1. IBM is aggressively targeting Education with their 4300 series. CMU
is apparently on a list of 25 universities IBM is

committed to
capture. Cary's review of a 2050 proposal to Stanford in his role
on their BOD apparently triggered this new thrust.

2. CMU believes IBM has targeted DEC time-sharing as what they must
have to succeed in interactive computing. Their current half-duplex
approach still falls far short of TOPS-10/20 for program development
problem solving, and the novice user. Tom Boardman's recent visit
to Waterloo revealed that IBM is aggressively pursuing series one to both
compete directly with VAX in cost performance (Tom saw actual IBM charts
with their products positioned relative to VAX) and as high performance
communication/network front-end for the 4300 series. Tom believes these
front-ends will be the key to IBM's improved interactive capabilities
which are targeted to compete with TOPS-10/20.

3. We should investigate how UNIVAC took over the RCA base and lost so few
customers as a possible model for retaining our TOPS-10/20 base
through the move to VAX.

4. CMU is having aggravating intermittant problems with our 2050 series
since last November.

5. Dick Van Horn is eager to re-new our three year working agreement with
CMU. He felt the focus should be through Jack McCredie for both the
compu
ter center and the computer science research. As an aside, he noted that

system availability was top priority for them. VAX perceived as very reliable.

6. I had an unscheduled discussion with H. Wachler on the subject of Allan Newell's recent proposal. The distributed multi-processing work they are doing with 11's is extremely interesting, in particular, I was very pleased to learn that they are dealing with:

A. How the system manages itself for the achieving of transparency to the user.

B. How to interconnect a homogeneous complex with a non-homogeneous complex. OF PARTICULAR INTEREST IS HOWARD'S INTENT TO QUICKLY INTERFACE THEIR KL TO THE VAX NETWORK VIA A ETHERNET TYPE INTER-CONNECT AT ABOUT 5 MEGABAUD. This implementation could be very key to providing "add-on technology" to move our installed base to providing VAX products for their future computing.

C. Howard also is prepared to look at the language compiler issues relate to making a VAX network look like a much bigger machine through the use of parallel processing single programs. I believe this is also critical to our ability to provide growth for our customers through distributed processing.

In conclusion, CMU made it clear that IBM is targeting DEC's interactive capabilities and our low end cost performance. They

indicated it was 2-3
years before IBM had what we have today in TOPS-10/20 and VAX. We must get
our key developers in tune with CMU distributed processing research and
immediately lay out very aggressive plans to have competitive leadership in
this area and provide the facilities to move our high-end customers to this
technology i in the 1980's.

Command: REA

EMS 22-APR-79
18:55:39 520 1
To: Jim Bell, Sam Fuller
CC: Mary Jane Forbes
From: Gordon Bell
Date: SUN 22-APR-79 18:55:39 EST
Subject: cmu meeting

Jim call Pete Smith of edu so as to co-ordinate.

I am going to cmu next monday to work with dan. At that time, it would be
worth having a first meeting with cyert, mccredie, newell and csd dept so as
to get on with the possible project. Can you, someone from edu, the sales
person, and possibly sam (or however will be the offical liason) come with
me?

I communicated the notion that the 2m was for cmu, not cds, and it didn't go
down well. I want to understand this better too as to just what you and
witmo
and puffer and sam had in mind. We should meet before we go in there.

Let's really start writing this down, as Allen is talking to both me and to
sam, and we can get awfully confused if we get out of sync. I had said the 2m
was for csd, and independent of any other deals that we might make, etc. Also,
the deal was with engineering. Tonite, we talked about the attitudes of
 sw prices and I would believe we don't want to include sw in the allowances,
since we don't want them writing sw that we have because the price is too
high. In this regard, they are part of engineering, and get sw licenses free
so as to base future programs on what we have. From an IRS standpoint, I
would hope we could deduct any expenses we incur due to this.

Allen would like a look into our futures so as to know what to buy. I think
f

now, we simply confine it to 780's and other standard parts that are known by
them. This is somethting we ought to work out on next monday there.

They want to go with us, but are looking at ibm (given they ordered the 100
4331's...and ibm is selling and finding out how badly they need cmu to work on
the interactive computing environment for them. Prim and Pascaltos are the 2
other alternatives.

Command: REA

EMS   23-APR-79
09:03:31 000 1
To: Gordon Bell
CC: Jim Bell
From: Sam Fuller

Date: MON 23-APR-79 09:03:31 EST
Subject: cmu proposal

Gordon: Would the meeting at CMU be in place ofthe meeting we have been
trying to have here before May 5th?? One of the necessary discussions early
on is an interaction between CMU and DEC on the contents of the proposal. If
we do this at CMU, we will need to send a number of techn ical people from
DEC to CMU.

You are right we need to write stuff down. I will write a memo this morning.
With Mike Campbell, local DEC salesman in Pgh, leaving DEC, for Harris, the
person I had been counting on to coordinate things is now out ofthe picture.

It seems to me we are already beginning to reap some benefits from the CMU
proposal. Howard Wactlar gave a presentation at DECUS on what he saw the
future of computing to be: i.e. $10,000 personal VAXes. There was alot of
interaction with other DEC customers and I think a number of ideas were
planted/re-enforced in some of DEC's larger customers.

Sam

Command: REA

EMS   23-APR-79 12:13:29 320 1
To: Gordon Bell, Jim Bell, Bill Johnson, Bob Puffer
From: Diane Secatore
Date: MON 23-APR-79 12:13:29 EST
Subject: CMU Proposal (From Sam Fuller)

Gordon, in his EMS note of April 22nd, asked someone to write

down what is
happening on the CMU proposal. Here is a quick dump from my perspective.

February 7, 1979.

Bill Johnson and Sam Fuller visit CMU and discuss the future computing needed
of the computer science dpartment.

March 12, 1979.

CMU, and more specifically, the computer science department at CMU,
submitted a proposal to DEC via Mike Campbell, the local DEC salesman. Bottom
line: CMU is asking for 112 VAXes over a 5 year period to construct a
distributed system of personal computers.

April 11, 1979

CMU is getting nervous about proposal (it needs more machines soon and if DEC
is negative it wants to get serious with some other vendor)

and Gordon Bell calls a meeting with : Jerry Whitmore, Bob Puffer, Jim Bell
and Sam Fuller. The outcome of this meeting was the following::

1. In principal, DEC likes CMU proposal and wants to "do something". 2. The
proposal has to be scaled down. On the order of 15 to 18 months,
$2,000,000 of MLP equipment at a 50% discount. 3. The equipment is limited to
"32-bit systems". 4. President Cyert should coordinate

between the two
prinicipal computing groups at CMU: the computer science department (which
submitted the proposal) and the computation center (I.e., McCredie). 5. DEC
should not send DEC software engineers to CMU, but rather DEC should set up a
software adv. development group in-house that will work to complement and
monitor the CMU work. Undecided where and who this group should be. Might be
the R&D group, might be somewhere in software engineering. 6. Witmore
effectively argued CMU should separate its immediate need for 2
VAX-11/780's from this proposal. If it really wants the 780's, it should
order them now. Whatever the agreement turns out to be, these 780's will be
part of the agreement. If the agreement dies, then CMU will pay full MLP for
the 780's. 7. This should be a contract, not a grant to CMU.

April 16, 1979

Mike Campbell delivers a letter from Gordon Bell, inviting Cyert and DEC to
discuss details of the agreement. Mike was unable to see Cyert at the time
and so could not deliver the verbal messages we needed delivered:

1. Scale of contract: 18 months, 50% off on $2M of MLP. 2. Regret if
DEC-imposed time crunch in March caused disruption at CMU.

April 23, 1979

Mike Campbell has now left DEC. Rich Pearlman and Bob Bonecourt (salesman)
visit CMU. General coordination vist to keep ball rolling following

departure of Mike Campbell.

April 30, 1979

Gordon Bell plans to visit CMU. Opportunity for some yet unplanned meeting.

May 5, 1979

On this date the semester at CMU ends and a number of key faculty and staff
members leave for several weeks to a month. CMU hopes we can tie down the
major points of agreement prior to this date.

CC: Jerry Witmore, Barbara Farquar, Peter Smith, Rich Pearlman, Bob
Bonecourt, Bob Russel, Peter Jenson

Command:
October 10, 1981

Professor A. N. Habermann
Department of Computer Science
Carnegie Mellon University
Pittsburgh, Pennsylvania 15213

Dear Nico:

I would strongly support Mario's promotion to Senior Research Computer Scientist. He has constantly produced important results since he has been at Carnegie Mellon. Although a substantial amount of the work has been surrounding the ISPS language, there has been a diversity of activity from automatic design to computer verification and evaluation. The work has also been very deep since ISPS has been used externally for specification and simulation at several sites and for different purposes. This demonstrates both a breadth and depth. Furthermore, I believe the work on automatic design will become important in the next few years. I am deeply indebted to Mario for making ISP into a diverse, working tool used rather than just another notation or poor register transfer language. Without this work, there would not be the acceptance of this style of description and design.

Quite apart from the ISPS work, Mario has earned a great deal of respect in other phases of Computer Architecture including MCF evaluation and specification, and Conlan.

I can't speak to his work on ADA, but his other work on SPICE and networks is very solid.

I hope you can keep Mario there and provide an environment for him to continue to be productive.

Sincerely,

Gordon Bell
Vice President, Engineering Digital Equipment Corporation
Professor, on leave, Carnegie Mellon University

GB3.S1.25

<u>Customer Segment Letter</u> - <u>Sample Only</u>

Professor Jack McCredie
Vice Provost for Computing
Carnegie-Mellon University
Schenley Park
Pittsburgh, PA 15213

Dear Jack:

This note is to confirm my comments on your future direction as we discussed on the sixth. In essence the situation at

CMU is:

1. The computation center has: three TOPS 20 Systems for administration, educational computing and research; two RSTS Systems for Business School computing and document preparation; and two VMS Systems for physics and chemistry research computing. You also have a very high performance, high quality printer and plotting facility. Also, there are three billion bytes on line.

2. There are many distributed, departmental mini and micro computers, some of which are timeshared. There are floppies galore too on all systems.

3. There are administrative data entry and word processing systems.

4. The Computer Science department has: three TOPS 10 machines, two experimental PDP-11 multiprocessors (16 and 50 each) and there are various minis for dedicated functions (e.g., terminals, speech i/o). An ARPA Tip interconnects the 10's to ARPA-net and the department would like a better interconnection scheme.

I was impressed with the arguments you gave me on how, by incremental purchasing, you acquired resources as needed such that the University has the most cost-effective system (as compared with various sister institutions and compared with a single large machine purchase). It's now clear our recommendation to replace the 360/67 with one or two TOPS 10's, in 1971, would have saved several million dollars had the University acted on it!

Now to confirm our discussion about the future:

1. It's imperative that the network get installed so that the many mini and other users (e.g., word processing, data entry) are able to take advantage of the impressive central filing, printing, plotting and processing facility. Furthermore, this will

allow various work to be migrated among the machines at the center over a longer term on the basis of economics, performance, data base location etc.

----

2. I agree that you need not install any more TOPS 20 Systems, although the existing ones should be upgraded to be most cost-effective. This is not meant to imply that we won't be building 20's, but rather the VAX-11 line will be implemented as various sizes (including 11's), in higher volume, and should generally be more cost-effective than the 10/20 line.

3. VAX's of varying sizes should be added to the "center" and new applications would be placed on them. Here, users could be assigned to machines in any way you decide. You might decide to distribute the center out to your users along the following work assignments for "off loading" the currently more general 20 Systems:

a. computational, FORTRAN production work in science and engineering

b. COBOL production for the administrative work

c. student environment, especially that involved in teaching PASCAL, FORTRAN, BASIC, and COBOL.

In this way the 20's can be run fully general purpose using the large language and application software base (e.g., APL, BCPL, COGO, CPL, GPSS, Simula SPSS,...,ZOG) that is not now available on VMS.

4. You might choose to move one of the 11/45's somewhere else (e.g., a department) and migrate their workload under the VMS/RSTS emulator. This will be more cost-effective and it will have more language and array size capability for the MIS programs.

This approach, I believe, will continue to give CMU the most cost-effective computing well into the mid 80's, and for now, it's hard to see beyond this time frame.

Sincerely,

Gordon Bell
Vice President,
Engineering
Professor, Computer
Science and
Electrical Engineering
Carnegie-Mellon
University, on leave

GB:ljp
GB0001/6
September 22, 1980

Dan Siewiorek
Carnegie-Mellon University
Computer Center
Schenley Park
Pittsburgh, PA 15213

Dear Dan:

We are trying to locate some books from Gordon's personal collection.

The following were checked out to you:

1. Microprocessors & Microcomputers, Branko Soucek
2. Multiprocessors & Parallel Processing, Enslow
3. Folder on Capability Machines (Fabry + Plessey) articles

Please let me know if you have the above.

Thanks.

Sincerely yours,

Mary Jane Forbes

GB1.S6.48
****
* d i g i t a l *
****

TO: SAM FULLER   DATE: THU 9 OCT 1980
11:35 PM EDT
    BILL KEATING   FROM: GORDON BELL
                                                  DEPT: OOD
                                                  EXT: 223-2236
                                                  LOC/MAIL STOP: ML12-
1/A51

SUBJECT: PLEASE HELP BILL WULF AT CMU... TODAY!

Allen Newell just got a call from Bill for me to read my
mail.
I did. A copy follows. In order to get them out of the
woods,
would you get the person who is maintining Bliss to call Bill
and to take the Source down to him this weekend and to stay
there untile the first level modifications get put in?

I assume there is some sort of clause that says they will not
use the source code on any other machine. I'm sure Bill will
sign whatever you think is needed for our protection. Please
call me in the morning on this at once.

The note from Bill:

type mail.box
?^Q?
.type mail.box

Date: 5 October 1980 1122-EDT
From: Bill.Wulf at CMU-10A (X390WW17)
To: Gordon.Bell at CMU-10A
Subject: Bliss
CC: Allen.Newell at CMU-10A
Message-Id: <05Oct80 112242 WW17@CMU-10A>
Origin: X390WW17 at CMU-10A; 5 Oct 1980 1124-EDT

Gordon,

Tonight I spoke to Allen about our continuing and severe
problems
with Bliss. He said that he plans to call you, and I
volunteered to
write down some things about the factual side side of things.
You may
read this either before or after Al gets you on the phone; if
its
after you'll already have the context -- if before, well,
maybe you
should try calling him.

First, some generalities:

I decided a coupl?{?years ago to use Bliss/36 for PQCC
rather
than Bliss/10, SAIL, LISP, etc. I was motivated by a desire
to not be involved in compiler maintenance as well as the
main
line research -- and I wanted an acceptably efficient
product
(thus eliminating LISP, for example).

That decision has been a disaster!   CMU is a "field test
site"
for Bliss/36 because of Mario's work on ISP. The people
responsible
for Bliss at DEC had no contact with us during the original

development of Bliss and have no interest in PQCC. Although I suspect that we are treated no worse than other field test sites, we are definitely third priority -- behind any internal DEC problem as well as behind anything, such as ISP, for which the field test site agreement was granted.

Over the past 18 months, I have lost at least 6 to Bliss problems. I will give a few examples below, but the frustration here is monumental. We devote endless hours to working around problems, trying to explain/justify our requests, and just plain sitting on our hands because we are blocked. Fixes come, if at all, in the "next release" -- typically months apart. Frankly, I will never again use Bliss -- or any DEC product -- for a research project. I will never again allow the progress of my research to be controlled by morons who see no need to fix our problems because "that feature isn't used at DEC" (the most common reason for not fixing problems).

I want to repeat what I said to you as well as to any number of people at DEC to whom I have spoken before. I want to do my research. Nothing more. Bliss is a tool to that end. I need a tool that works. From time to time we have problems with Bliss; to get my work done I need those problems fixed. I do not care whether you do it or we do -- in fact I have a preference for your doing it. BUT, I need some sort of guarantee that problems WILL be fixed. Promptly! In the past, at least, no one has been willing to give me that

guarantee. In fact, all the evidence is to the contrary. We have
problems, serious problems, that are well over a year old and are
unfixed. The most common reaction is a rquest is to tell us that
whatever-it-is can't be done.

Given that you are unable/unwilling to fix our problems, I need to
be able to fix them myself -- that is, I need the sources for Bliss.
Frankly, given that they are largely cribbed from Bliss/11, I think
you should have given them to us in a spirit of cooperation several
years ago. I consider it something of an affront that Bliss
is here only because ofMario's ISP. (I was denied it, by the way,
when I asked for it.) But "ought to have been" is not the issue. I
am faced with practical problems and a lot of pressure. Many of the
problems we have been working around are ones that cannot even be
tested at DEC (see CMU-PPNs below). If you would prefer putting
someone here to fix the problems (without the endless arguments about
whether in DEC's view they are problems), and not give us the sources
-- that's fine. But I need solutions NOW.

I have about eight weeks to a major demo?? do not have time for weeks
of promises, arguments, and no-action.

OK, so much for the plea. Let me try to capture some of the kinds
of problems we've faced.

1. CMU PPNs. As you know, we use these strange non-DEC PPNs.
You may also know that Bliss has a "require" declaration --
it snarfs in a file into the source stream and is an
invaluable
aid in structuring large systems. Bliss, of course, vomits on
a
CMU-PPN in the require fil?pecification. Since we have done
it
in Bliss/10 and Bliss/11, we know this involves a one line
change
to correct. It has been outstanding since we first got the
compiler.
To patch around the problem I have spent a couple of man
months and
a kludge int the TOPS-10 monitor.

But, alas, the compiler is not the only place where Bliss has
fixations
about PPNs. They appear in the EXPORT package (i/o routines
and the like)
and in library requests. We have completely rewritten the
low-level
i/o routines and no longer use EXPORT; had we had the
sources, it would have
been a one-line change and we would still be compatible with
DEC.
To solve the library problem took more creativity (??). We
now have
a program that scans over REL files and patches over the
erroneous
PPNs placed there by the compiler. Total effort involved,
around a
man-month. It would have taken 10 minutes of someone's here,
either
here or a DEC to do it right.

2. Empty blocks. In its wisdom, the Bliss group decided that
 begin end
that is, an empty block, must be a mistake on the part of the
programmer.
I agree. Alas, much of our Bliss code is written by programs,
not by people.

The programs are emitting a regular structure that is very hard to
"turn off" if the actions involved happen to be nill -- so lots of
empty blocks get generated. So, fine; the compiler gives us only
warnings -- not errors -- and we proceed. Alas, the number of warnings
per PQCC phase is several hundred. Real errors are lost in the trash
floating across the screen. Each of us has wasted days searching
for bugs that were really caught at compilation time -- but were
hidden from us. So, we asked for a way to turn off the warning
message. NO, is the answer. The manual says its an error, says the
answer. Live with the problem, says the answer.

3. Bad code with debugging enabled. The compiler generates incorrect
code for SIGNALs when debugging is enabled. We have had no response on this
one -- but we have on similar ones in the past -- "no one at DEC uses
the SIX12 debugger and therefore we won't fix bugs having to
do with its linkages". Actually this is typical of a couple of things.
First, we can expect two weeks before getting a preliminary answer to
anything. Second, the 80% probable answer is that its not really
a problem (for DEC) and hence won't be fixed. Sometimes with long
discussions we can convince someone that there really is a legit
issue. Sometimes. [Sorry, but I'm gonna be a snob for a minute.
The guys maintaining Bliss are reasonable enough. I kinda like
Lupton, for example. They are not super bright, however. They

have very
little perspective. They know relatively little about modern notions
of software engineering, and they know zip about what we are
doing. They are not qualified to tell us how we should design/code
our system. I have had my gut full of pious crap about why they
can't do something or another because of thier miscomprehension
of software engineering. If it weren't so frustrating, it would be
funny to observe how often a misunderstood version of my own
design principles have been used to justify why I can't be allowed
to do something.]

4. Wrong code for timing package. We have a performance analysis tool
called the "timing package". It used almost?ut not quite the same
linkage as the debugger. We asked for a change to support it, and
offered to help make the timer available at DEC in return.
The answer was NO. No need/use/demand for such a thing in DEC
(after all, who would want to find out how well their program
performs?). I had an undergraduate spend the entire summer trying
to adapt the timer to the only linkage available. He failed.
Faced with a demo last week at which we had promised performance data,
I had to divert Newcomer from the main line research to the timer.
He managed to kludge around the problem eventually, but as a result,
although we had performance data, one of the major modules of the PQC
was not functional.

5. Various "out of storage"?roblems. I have not tracked down all

the details on this one -- but a number of our modules have been
switched into assembly language because of storage limitations in
the Bliss compiler. I believe only recompilation of the compiler
is necessary with some bounds increased -- but ....

6. Use of LINKAGE declarations with various optimization levels.
Some of our automatically generated phases must be compiled with
optimization-level zero (no optimization) becuase of obscure
interactions with the LINKAGE declarations. Unfortunately, the
LINKAGEs were installed precisely to improve performance.
We are allowed our choice of ways to lose. This one has been on the
list for at least 9 months; I don't know why it hasn't been fixed --
except of course, we are very low priority.

7. Manuals. I'll mention this one, not because it something that matters
in the next 3 month time frame, but only because it is SO typical of every
aspect of interaction with DEC wrt Bliss. It is only within the last
couple of months that everyone on the project has gotten his/her
very own Bliss manual. Many of us, however, still don't have language
guides for B/36, including me. Below is a note that Joe sent me before our
last infusion of manuals ...

" We are in worse shape now for Bliss manuals than we were way
back. Because Bliss is now a product, distribution is handled
via the standard DEC distribution center. When I called and

ordered manuals, and gave the manual number, a VERY offensive person told me that I didn't have a copy of that manual, couldn't have a copy of that manual, it was illegal for me to have a copy of that manual, and that I had better destroy it before somebody at DEC caught me with it. I tried to explain about being a field test site, and she informed me that this was irrelevant, that the manual number clearly indicated it was DEC internal only. I explained that the software was now a product, and the product manager (Glenn Lupton) had told me that morning that he had an order on his desk for the manual release dated something like a month before. No luck; I was clearly trying to do something evil and disgusting. What she did not have the creativity to suggest is that the manual would have everything the same except the letter suffix (and she could have checked on this letter suffix). I had to call Glenn back, he had to spend time to find out what the manual number was (just the suf???change) and I called back to order them. No luck, not in stock. Back order? Obviously I was kidding. I can say a lot about the customer service at DEC, but none of it is very complimentary, let me tell you right now!"

N. Vax? Of course, the granddaddy of them all is why we aren't
running on a VAX. One of the original reasons for using Bliss/36
was so that we would be able to move to a VAX. Well, IUS, etc.,
decided to use UNIX; clearly, by implication we are dangerous.
And ISP, the rationale for any sort of Bliss being
at CMU, was on a /10. PQCC?, who/what's that?

It goes on and on and on and on ......

Please don't think this is the whole list or the source of all the
frustrations. I picked a few that were at the top of my stack. As I
recall, there is a 9 or 10 page list of outstanding items; this list
does not include the requests that were rejected out of hand, only
those that are "open". I would guess that for each item on that
list, 2-3 have been summarily rejected (mostly, in my view, for
blatently stupid reasons).

Let me repeat my basic plea. I have a major demo in 3 months. I am
wedged into using Bliss/36; a wiser manager would have reverted to
Bliss/10 a long time ago, but I believed the promises and now its
too late. A subset of the problems MUST be fixed if I am to make the
demo date. Nothing will recover the time already lost, but I cannot
lose ANY more. And I need control. I can no longer have the

progress
of the whole PQCC project depend on the whims of some low-level
managers within DEC. I would have preferred a cooperative relation.
Its too late.

Finally, this is REALLY urgent. I want some sort of solution this week!
It all seems like a very simle decision to me, so give it to us quickly.
I need to make plans. If the answer is NO, fine. I would rather have
that answer this week than "yes" in a month. And if its yes, then for
God's sake, let's get the files down here this week too. I just can't
overstate how tight we are running or how high the frustration level is.
Everything about the research looks SO good, and we can't demo it because
of the damn Bliss system (compiler and people). Delay has been so characteristic
of our experience; I can't recall when the v.125 compiler was promised
to us -- sometime in the summer -- and it is other places, but not here.
PLEASE hear.

Bill

GB1.S7.45
April 27, 1981

Professor Nico Habermann
Carnegie-Mellon University
Department Head, Computer Science Dept.
Schenley Park
Pittsburgh, PA 15213

Dear Nico:

I'd like to present the enclosed honorarium to the department for some worthy cause.

As a co-author, albeit not a very energetic one of the forthcoming Siewiorek, Bell, and Newell book, Computer Structures, I would like to have the royalties go to some appropriate CSD fund.

I'd hope this would amount to $10K over a 10 year period. Please suggest something, and I'll sign the papers.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:swh
GB2.S5.42

Enclosure (1)

EMS 9-MAY-79 23:13:33 410 1

To: Richard Peebles, Dick Snyder, Jim Bell, Sam Fuller, Ken King
CC: Mary Jane Forbes, Bernie Lacroute, Bill Demmer, Ulf Fagerquist
CC: Per Hjerppe
From: Gordon Bell
Date: WED 9-MAY-79 23:13:33 EDT
Subject: cmu..talk with allen newell tonite

MJ please send a copy to dick echouse and j witmore.

Allen is impressed with the interaction with rich. The

interaction with our
salesperson is down in quality and quantity. Is there an alternative?

Allen described the dilema..good for them that assumes vax's of price and
performance rations of 1 (for 780), 1/2, 1/4, 1/8, 1/16 (and assuming a base
of 240k, gives 120, 60, 30 and 15K for the personal machine in 6 years. This
means that a reasonable mix for them might be 8, 8, 16, 16, and 64. This says
they have little to buy in the final years, or we put up lots in the front
end. Allen also pointed out the reasonable price of doing r and d there at
less cost per person.

He described the meeting on the 22 and since I'll be out of the coutry until
the 28 and then at stratton, I hope things will go well. Although he wants
out, sam can be useful at getting this sort of information via informal
channels, provided all gets co-ordingated. (he's better here than I am,
because my phone nods often get taken as commits.) If there is a sticky
problem, then it might best wait until I can help (hopefully).

When we visit there on the 22, it seems we have to get off to a start where
there is involvement with 2 critical groups of development. The LCG Eng will
be doing much of the co-existence, networking and compatibility. Tewksbury
should be there because there will be concerns about VMS, and we need a rep
there... has anyone been appointed yet?

They are counting on the two machines and are pleased that they are coming.

Al believes that if we get the first machines in there, then the course will
in fact be set so there will be no way out.

I am still enthusiastic about the project, particularly after getting around
to reading about web and knowing we want to get it in place and that it will
take a lot of work. This insite/pressure on the timing and need to plan
machine sizes, performance and configuration can really help our planning

Thanks for the machines Jerry.

Good luck.

Command:

GB3.S10.9

00 CORE DECGRAM ACCEPTED S 003014 O 130 03-NOV-82 15:25:40

```
.___.___.___.___.___.___.___.
!   !   !   !   !   !   !   !
! d ! i ! g ! i ! t ! a ! l !        I n t e r o f f i c e  M e m o
!___!___!___!___!___!___!___!
```

TO: see "TO" DISTRIBUTION   DATE: WED 3 NOV 1982 9:55 AM

FROM: GORDON BELL

cc: EMC: DEPT: ENG STAFF

EXT: 223-2236

LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5180664662

SUBJECT: CMU SPICE AND YALE AND PPA

Professor Raj Reddy wants to jointly do a Cm* or c.mmP with ARPA. I say absolutely yes! Let's get ARPA to pay for PPA! We all want big address multiprocessors. As a side effect, "leaking" microVAX in this way is going to have an incredible effect on slowing down the 68,000 landslide. Let's go do PPA this way with a very aggressive schedule . . . and get CMU and other universities to do software for us. What you say?

We've got to have a DEC effort at CMU simply to monitor IBM work and to search out new opportunities.

Forest points out that we must get CMU the microcode for the 750 so they can put Spice on VAX. This is essential for tracking the IBM work and operating system. This will also aid the LISP work. They want to provide portability with Spice . . . let's constantly test this.

It would seem to make sense to have a full time DEC Scholar there plus a small engineering group doing LISP, etc.

At Yale, I found much interesting work, especially in compilers for parallelism. They're working at building a very parallel machine with one, very long instruction and multiple data ops.

I see this computer as great for data flow and for multiprocessors. They'd be an ideal test site for 784, and alternatively the PPA.

"TO" DISTRIBUTION:

BILL DEMMER SAM FULLER BILL JOHNSON
MAHENDRA PATEL BILL STRECKER

September 26, 1979

Howard Wactlar
Computer Science Department
Carnegie-Mellon University
Pittsburgh, Pennsylvania

Dear Howard:

Thanks for the update on SPICE. I enjoyed reading the proposal, but will refrain from giving the numerous comments that it evoked. I hope that we will be able to somehow work things out so that the goals of the proposal can be realized, because I view we are one of the very few organizations that can engage in the partnership and provide the results you are proposing. It is probably good to take the next six months to a year implied in the proposal to interact because it will get everyone further along in their thinking. We have made amazing progress toward the proposal already because of the interaction.

Attached is a copy of the note announcing our museum for internal use. The purpose in informing you of this is two fold: visit it; and I would like to have parts from C.mmp and possibly Cm* and C.vmp for inclusion in an exhibit area called the Computer Classics Gallery. I would especially like a bit slice of the 16 x 16 switch, a photograph of C.mmp, an original reprint of the paper by Bill and I a diagram of the configuration, a copy of the book draft and a bibliography on it. This would be put in a 2' x 3' collage frame or some other structure to describe it. As you look at the 16 boards that form the switch, they could probably be replaced by dummy boards and then given to the various people and institutions (eg. ARPA, NSF, DEC (I hope), Bill Broadley, Bill Wulf, Sam Fuller, etc.) I also need other information like dates (when operational goals achieved), significant events (firsts), costs, performance levels, etc. I would make up a description and layout a collage exhibit for CMU like the one for us, if you send me all the poop and artifacts...provided you can live with Digital Computer Museum format.

I believe it is also important to decide on what part of C.mmp you are going to preserve, and then keep the machine intact in a roped off area in something of a secure fashion. Similarly, the C.vmp, and Cm* breadboards should also be kept in this form, perhaps along with the first Graphic Wonder. As I get involved in building this museum, it seems important to somehow keep artifacts.

It was good to interact again, and I hope I can visit in the Spring, but for longer.

Sincerely,

Gordon Bell
Vice President, Engineering
Professor, Computer Science
and
Electrical Engineering
Carnegie-Mellon University,
on leave

GB:swh
GB0004/59
Attachment

CC: Sam Fuller, Digital
Dick Eckhouse, Digital
Professor Habermann, CMU
Professor Newell, CMU
Professor Reddy, CMU
Professor Sproull, CMU
Professor Wulf, CMU

****
* d i g i t a l *
****

TO: SAM FULLER
BILL KEATING
cc: BOB GLORIOSO

DATE: SUN 19 OCT 1980 9:22 PM EDT
FROM: GORDON BELL
DEPT: OOD

EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: CMU. THANKS BILL KEATING ET AL. LET'S KEEP IT UP.

Am glad to forward the attached from Bill Wulf. Thanks Bill Keating and your Bliss crew. I want us to really get a better
relationship going there in the next year so we can interact with them for languages, personal computers (they have perqs0,
etc. Also, we should send someones to the Cm* review on Nov. 7
and I'm sorry I can't go.

Note the attached form Bill and Anita:
Date: 16 Oct 1980 0909-EDT
From: ANITA.JONES at CMU-10B
Subject: An Invitation to the Cm* Review
To: bell at CMU-10A, fuller at CMU-10A, dickman at CMU-10A
cc: jones at CMU-10A
Origin: QNET at CMU-10B; 16 Oct 1980 1828-EDT
Via: CMU-10B; 16 Oct 1980 1856-EDT

Gordon, Sam, and Lloyd,

I am planning to have a review of the Cm* project.
I would like to invite each of you to attend. If you want to bring a couple more DEC people, they are likewise invited. Tentatively,
the review is scheduled for 7 November. The date may change to
accommodate people's schedules.

As of 1 January 80, Cm* joins the roster of "CMU facilities".
I have continued along the path of developing it as an experimental
laboratory. We have been relatively successful. Experimentation,

such as that reflected in Jarek Deminet"s chapter of the comprehensive technical report, continues.
?jo, pausing to review the project at this point is just right.

I very much hope that each of you can attend.

Please let me know whether or not you can attend, and whether
the 7th presents any scheduling problem for you.

Regards, Anita
- - - - End forwarded message - - - -

Date: 17 October 1980 1529-EDT
From: Bill.Wulf at CMU-10A (X390WW17)
To: Gordon.Bell at CMU-10A
Subject: status
CC: Allen.Newell at CMU-10A
Message-Id: <17Oct80 152912 WW17@CMU-10A>
Origin: X390WW17 at CMU-10A; 17 Oct 1980 1544-EDT

Gordon,
I just sent the attached message to Glenn Lupton; I think it captures
pretty well where we are on the Bliss issue. I deeply appreciate
your
part in helping us to dig out of the hole we were/are in.

Bill

Date: 18 October 1980 0707-EDT (Saturday)
From: Bill.Wulf at CMU-10A
To: Gordon.Bell at CMU-10A
Subject: status
CC: Allen.Newell at CMU-10A
Message-Id: <18Oct80 070738 WW17@CMU-10A>
Origin: X390WW17 at CMU-10A; 18 Oct 1980 0709-EDT

Gordon,

I just got a message from Al saying that the "attached message"
wasn't.
Seems to have been a glitch of some sort in the readmail program
... because
now my mail file is trompled-upon and under the tender care of
the wizards
who attend to such things. Fortunately, I have a file with a slightly
earlier version of the note; except for fixing a couple of typo's
what
I sent was ----

Glenn and/or Al,

As you probably know by now, the Bliss sources arrived, Topher
came
down and helped us build both /10 and /20 versions, and the new
compiler has already solved some of our problems (like a module
that
wouldn't compile before). Also, Bill Keating was here yesterday,
and
he and I spent the???W??part of the day discussing the issues on
both sides. I consider the meeting was a good one, and I am hoping it
is the beginning of an improved relation on many fronts.
I am aware that you were not in favor of our getting the sources,
and
I believe I appreciate your reasons. I also fully realize

that
the
manner in which I precipitated getting them has the potential
to
increase the tensions in an already strained relation. If I
had
not
believed that the situation here was critical, I would have
preferred
an approach that did not have that potentially harmful side
effect.

My purpose in sending you this note is not to explain, or
apoligize
for, my method. I do believe the situation is critical, and I
did
not
percieve another way to resolve it. Rather, my purpose is to
see
whether we can now proceed to generate a constructive
relation
that
is beneficial to both parties. There is, of course, now the
opportunity for us to go our separate ways -- for the Blisses
to
diverge in unnecessary ways and for there to be suspicion and
antagonism between us. That need not be, however. We could
also
try
to forget the past, to try to recognize and respect our
different
needs and goals, and to collaborate where it is mutually
beneficial.

I would much prefer the second possibility. I will try to do
my
part
to make that happen. I deeply believe that closer ties
between
universities and industry in general, and between CMU and DEC
in
particular, works to the benefit of both. Beyond generalities

like
that, however, I have no desire to become a Bliss maintainer.
For
the
most part Blis36, Bliss16 and Bliss32 are improvements on
Bliss11;
you have done a good job, and, frankly, I want to ride on
your
coat?x??. At the same time, I think we have things that we
can
contribute to your efforts. Sometimes our contributions may
just
be
ideas -- often having nothing to do with Bliss. Other times
we
may be
able to implement things in and around Bliss that are
difficult
for
you to justify doing, but represent positive contributions to
the
overall Bliss effort.

As I said, I want to do my part in trying to resetablish a
good
relation. I have some specific things in mind; you may have
other
suggestions.

First, security. The Bliss sources will be protected as well
as
is
possible on TOPS/20. Only a few people from PQCC will be
authorized
to touch them. Among other things, it is strongly in my
interest
to
have minimal deviations from DEC's Bliss (see below), so I do
not
intend to allow random hacking.

Second, bug reports. We will continue to send you bug

reports,
but we
will filter them first to be sure that they are present in
your
version too. We will also try to attach a meaningful
indication
of
their severity; if we can 'code around' them, we will -- and
will
tell you so. If, in the process we happen across the
(likely)
cause,
we'll tell you that too.

Third, accessibility. We will make all of our changes,
whatever
the
purpose, available to you. You may not want to use them --
that
is
your choice -- but they will be available.

Fourth, "enhancements': It is strongly in my interest from
several
perspectives, to make our 'enhancements' both as compatible
as
possible and as few in number as possible. I plan to put a
strong
filter on proposals for changes. If we deem a change is
sufficiently
important, we'll go through a design review process before
implementing anything. The design (or at least sketches of
them)
will
be sent to you by net mail. We would appreciate your
comments
and
suggestions. I can imagine that some of them will have no
interest
for you (eg, CMU PPNs). Others, however, may be of interest
in
various ways. Where at all possible, I want to be consistent

with
DEC's philosophy and conventions -- both for the language and its
implemtation. I can well imagine that various functionality
requirements we have could be implemented in ways that are
inconsistent -- while another approach would be consistent or would
make it possible for you to utilize our change. Tell us! Its usually
the funtionality we're after -- not the details of its realization.

Back to my theme. I regret that an adversary relation has been
building between us; in times long past we had a 'special' relation
with DEC that, I think, was beneficial to both. I would like to
see
whether we can reestablish such a relation. I will do what I can.

Bill.

GB1.S7.41

ID#0264

d i g i t a l   **i n t e r o f f i c e   m e m o r a n d u m**

Subject: **COBOL Specification**

To: Ulf Fagerquist, Bill Johnson,
    Larry Portner, Dick Snyder

CC: Norma Abel, Jim Bell,
    Bill Keating, George Plowman

Date: 8 SEP 78
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

follow up 9/22/78

I just got a glimpse of the massive spec on the PDP-10 COBOL 79. It's hard to believe this approach to design specification is useful since the spec can't be further decomposed to code and because it sits away from the code (and will become obsolete) and because it's too big to verify or work with. (There's already progress on the VAX COBOL without such a document.)

Could we get a project review, maybe by the supervisor and chief architect (programmer)?

Why can't we have a combined COBOL language group? (I would believe we need some compatibility among our COBOLS and this is the only way I know, based on the BASIC +2 experience to do it.)

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST:	Norma Abel	MR1-2/E37	Jim Bell	ML3-2/E41
	Ulf Fagerquist	MR1-2/E78	Bill Johnson	ML21-3/E87
	Bill Keating	ML12-3/A62	George Plowman	ML5-5/E97
	Larry Portner	ML12-3/A62	Dick Snyder	MR1-2/E37

Group Codes

Name **Code**

Gordon Bell's Staff---------------------------------------OOD

Bob Puffer (Engineering Operations)

Staff-- EOS
Managers--- EOM

Larry Portner (Software Development)

Staff-- SDSTF
Managers--- SDM
Product Managers------------------------------------- SDPM

Dick Clayton (Systems Development)

Staff-- SYS
Managers--- SDE
Product Managers------------------------------------- SYPM

Bill Johnson (Technical Director)

Staff-- WJS
Managers--- WJM

John Kevill (Mass Storage)
Staff-- MDS
Managers--- MDM
Product Managers-------------------------------------
MSPM

Bill Demmer (Medium Systems)
Staff-- BDS
Managers--- BDM
Product Managers-------------------------------------
BDPM

Jim Cudmore (Corporate Process Manufacturing)
Staff-- MSM

Ulf Fagerquist (LCG Development & R&D Group)
Staff-- 10S
Product Managers------------------------------------- D10

Jim Bell (R&D) Staff--------------------------------- RDS

Corporate Committees

Product/Pricing Committee------------------------- PLM

Operations Committee------------------------------ OPC

Operations Committee Rotating Members------------ OPR

Finance & Administration Committee--------------- F&A

Marketing Committee------------------------------- MKT

GB3.S10.22

00 CORE DECGRAM ACCEPTED S 003711 O 312 19-NOV-82
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TO: BOB NOLIN DATE: FRI 19 NOV 1982
2:05
BRUCE PARKER FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

MESSAGE ID:
5182294832

SUBJECT: REGARDING ROGER SHANK'

I spent the day in New Haven and found interesting work.
Also, they'd
like to interact with us.

PARALLEL COMPUTATION

Prof. Josh Fisher is heading this. They have three
interesting
activities:

1. A compiler for building dataflow graphs that can be
executed
in parallel. I see this as an interesting program
for our
own PPA. They are currently using it to compile
fast
microcode for the FPS 164 (see below). The source
is T(iny)
Lisp, and eventually Fortran. Also, they compile
ELI as it's
designed.

2. The ELI (Extra Long Instructions) machine is being
designed.
Consider it as either an ILLIAC IV-like machine with
control

of all units or a microprogrammed machine. A long, 500 bits or so, instruction controls several (say 20) arithmetic/primary memory units. They want to finish the design and then get someone to build it. I said we might want to build it if someone would pay us to do it, providing it looks good.
(Incidentally, we need to build much, much more hardware to get the experience and learning curves!)

3. CAD is exciting, different but similar to our work on the 2080. It's written in LISP and starts as a data-structure. They're doing display programs that "view" and operate on this structure as needed. This is totally different than our CAD which starts with a display input. Also, they're working on automatic design across levels.

LISP

John O'Donnell (203-432-4666) heads their center and is remarkable in his understanding of hardware and software. His group is doing T-LISP, and they are quite concerned about a really good LISP on VAX.

They may be a resource.

PROF. MARTIN SCHULTZE (APPLICATIONS)

Is doing programs for Numerical Analysis of Scientific problems (CAD, CAM, Scientific Dataprocessing) including VLSI. ESG's supporting his work. They're building a large memory for the FPS 164 and it also attaches to VAX simply. He said the problem with a Cray is simply not enough memory. He thinks an FPS (or even a VAX) with 100 Mbytes will outperform it due to I/O limitations. This means PPA should have 128 Mbytes! (Only a $128K at current prices.)

He's like to work with us on microcode for the 780. Their compiler really addresses the difficulty in programming the 164. Shouldn't we simply build the large primary memory for the system, and market: a 780, large memory, the FPS 164, and their compiler?

ROGER SCHANK, DEPT. HEAD (436-0606) AND AI RESEARCHED

ROGER SCHANK, PRESIDENT, COGNITIVE SYSTEMS INC. (203-773-0726)

They have 15 or so programmers and want to build and sell an AI-based Small Business System. They're leaning toward Appollo. Julius had better get Bob Daley, Bill Noyce, Norma Abel, John O'Keefe et al there to persuade them to use our VAX (LISP) since he wants to decide within a month. The goal is a less than $50K system for 6 users and LISP and a good database system. The Appollo will be down to $20K in a year. Let's sell VAX!

The breadboard of this system is quite impressive and convincing!

ATTACHED MEMO

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION
1:05 PM EST

cc: see "CC" DISTRIBUTION

DATE: TUE 16 NOV 1982

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5181987944

SUBJECT: YALE CS DEPT. VISIT:SEVERAL OPPORTUNITIES TO LEARN/INTERACT

I spent the day in New Haven and found interesting work. Also, they'd like to interact with us.

PARALLEL COMPUTATION

Prof. Josh Fisher is heading this. They have three interesting activities:

1. A compiler for building dataflow graphs that can be executed in parallel. I see this as an interesting program for our own PPA. They are currently using it to compile fast microcode for the FPS 164 (see below). The source is T(iny) Lisp, and eventually Fortran. Also, they compile ELI as it's designed.

2. The ELI (Extra Long Instructions) machine is being designed.

Consider it as either an ILLIAC IV-like machine with control of all units or a microprogrammed machine. A long, 500 bits or so, instruction controls several (say 20) arithmetic/primary memory units. They want to finish the design and then get someone to build it. I said we might want to build it if someone would pay us to do it, providing it looks good.
(Incidentally, we need to build much, much more hardware to get the experience and learning curves!)

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The breadboard of this system is quite impressive and convincing!

"TO" DISTRIBUTION:

NORMA ABEL	SAM FULLER	TOM GANNON
ARNY GOLDFEIN	BILL KEATING	ALAN KOTOK
JESSE LIPCON	BILL LONG	JOHN MANZO
JULIUS MARCUS	MAHENDRA PATEL	PETER SMITH
BILL STRECKER	BOB TROCCHI	

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ULF FAGERQUIST	BOB GLORIOSO	WIN HINDLE
BILL JOHNSON		

GB3.S10.6

00 CORE DECGRAM ACCEPTED S 000077 O 6 03-NOV-82 3:37:56

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TO: see "TO" DISTRIBUTION DATE: TUE 2 NOV 1982
10:57 PM

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION DEPT: ENG STAFF

EXT: 223-2236

LOC/MAIL STOP: ML12-
1/A51

MESSAGE ID:
5180564403

SUBJECT: A UNIQUE OPPORTUNITY TO USE AI AND GET A JUMP ON SM
BUS COMPUTER

Roger Schank, head of the CS dept at Yale and President of Cognitive Systems Inc, 234 Church St., New Haven, 06510 203 773 0726 (Yale= 203 436 0606), is one of the major developers of natural language programming and has a company with 15 people who are dedicated to producing and marketing an AI program to help the small business by allowing the people to interact in english.

They have an incredibly impressive breadboard that runs in Maclisp and are moving it into the development environment on the 750, and then on to a particular computer for sale. They have to make a choice in the next month because they need to select the bread and butter database etc so as to finish the application.

Roger believes that 50K for a 6 user system is the outside price, and we can do this with a 730, even though his technical
folks are worried about the performance.

Currently, he's tending toward Appollo because they'll have a 20K system in July.

I said, no way, we have a super system with a big disk (which they need), plus we have a commitment to get LISP running competitively, plus we will market the hell out of their great, unique product. All they have to do is to write the program and to stay out of the marketing and distribution nightmare.

Here's a group that has much very good technology, and would like to show the world. They want the product out in droves. Let's help them (and us). This could really establish a high water mark(et), if we do the right thing.

Could you guys go visit them and look at it and see how we might interact?

(PS.
I'm a raving advocate for using AI to solve some of these really messy heretofore intractable problems.)

"TO" DISTRIBUTION:

BOB HUGHES JULIUS MARCUS JOHN O'KEEFE

"CC" DISTRIBUTION:

BOB DALEY SAM FULLER KEN OLSEN
MAHENDRA PATEL

July 12, 1978

Harold Cohen
University of California, San Diago
LaJolla, California 92093

Dear Harold Cohen:

I was happy to receive your letter; in particular, the piece with your wife began to give me an idea of this work. The drawings just came and I'm really grateful for them. One will be hung in a prominent place in my office.

I'd like to explore the possibility of adding your work as a panel in what we call the DEC Distributed Museum. Here, we'd have a short (about 10 minute) recording together with slides. A brochure would include some of the slides together with the text of the voice. How much would you charge to make such a tape, with a few slides?

As to whether we had any quid pro quo, either explicit or implied: we clearly did not. I expected nothing, aside from some good will, from the venture...I don't want to jeopardize that by my actions now. The misunderstanding is two way: I was recently reprimanded by our Contributions Committee because you had implied that I had offered to continue support. To this I said: 1. We had one satisfactory deal, 2. I would hope that you would get the money to buy a computer from us somehow. (I had forgotten how badly universitites administer themselves in regard to capital equipment and salaries. This is probably compounded by proposition 13.) I didn't comment on whether we should support you or not, only that I would hope you would try to buy a DEC machine.

To: Harold Cohen July 12, 1978

Let me urge you to go through Ron Masulla, and get Dave Williams and Noordhuisen to write letters of support for a contribution. Ron should propose to help you as he sees fit. I know we support the Boston Museum of Fine Arts, and I believe your work is a lot more relevant to art and us. The work is really great and I support it too.

I hope this clears things up a bit and that we can find a way to help you.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:ljp
ID#0167

CC: Ron Masulla
Dave Williams
Contribution Committee
Jos Noordhuisen, Utrecht

April 10, 1984

Professor I. Bernard Cohen
History of Science
Science Center, Room 235
Harvard University
1 Oxford Street
Cambridge, MA 02138

Dear Bernard,

re: The Computer Comes of Age

Not being an historian, but being an engineer, the number of errors in this book were extremely troublesome. However, the biasses and lack of a very wide view of computing were even more annoying, and the end, made me very unhappy. Errors and biasses of this kind only compound the problem of history. I feel further at a loss for not reading French so that I don't know if the errors crept into the translation or were present in the original work.

The work does provide some source material and information on French computing that is not otherwise easily available, but because of the incredible inaccuracies and biasses, one would be foolish to trust it for anything other than a rough guide to references. This is the strongest positive statement anyone could make about this book!

The troubles started at the first sentence of the preface. Most American's think the "Mark I" and the "Harvard-IBM machine" are the same thing, when from the later context one learns that the author must be referring to the Manchester University Mark I.

Then on the first page of the introduction, the last sentence of the second paragraph is misleading. The term "computer science" had yet to be coined by Perlis and Newell in the letter in Science where it was first argued in 1967.

Now, let me just take a few instances at random.

Page 20. Most authorities use 1887 the year of the patent for the date of the Felt Comptometer (not 1885). And Burrough's patent was 1888, although The Science Museum catalog notes that he was working on a machine as early as 1880.

Page 61. Engineering Research Associates, ERA (not Electronics)

Page 65. The first "ideas" (not use) of "magnetic" cores was made by Forrester for Whirlwind in 1949. In fact, these were a Deltamax material, not the ceramic derivative from Philips that was ultimately used.

On the same page, "But RCA was never able to make this work". If "this" refers to the Selectron it is incorrect. If "this" refers to the Selectron for the IAS machine it is correct. Either way the translator has created confusion. Since translator's note were included about random ideas, then one on An Wang's contribution would have been appropriate.

Page 91. First paragraph is full of mis-information. It is probably very dangerous to call the SEAC the first computer to use transistors. While it may have had a few transistors, it had no effect (that anyone can trace) on the full-scale use of transistors in computers. Were the transistors in the SEAC from the beginning? added later? What were they used for? The debate that we have on the "firsts" of the transistor machines are (1) Bell Lab's Leprachaun, 1956, (2) Lincoln Lab's TX-0 (project start in 1955 and operational in 1956) to test the Philco SBT100 surface barrier transistor (costing $80 each).

The Philco story itself is not told well: What is the project start and delivery of the TRANSAC S-1000? The Philco 210 (predecessor of the 212) and delivered in 1958 is omitted. Also there's Cray's first machine at Univac that he designed for the Navy which was operational in 57. Who built the Atlas Guidance Computer Model 1? Another claimant is the Siemens 2002 and the transistorized machine built by Ziemanek. The final sentence about CDC discounting and delivering product in 1958 is unbelievable. Somehow, about 1957, the summer in which both CDC and DEC were incorporated, it became clear that transistors were the next technology for computers and then the question was designing, retooling, and getting to the market with a product.

The next paragraph is again confusing. "the design of the CDC 1604 was the work of the founding members, Seymour Cray." (The word "one" must have been left out.) Should the appropriate company name be Sperry Univac rather than Remington Rand? The evolution of company names is important too. The CDC 1604 was not available until late 1959 or early 1960, not 1958. It could more logically be added to the listing at the end of the second paragraph on page 92.

p 92-102 is poorly organized for what should just be a description and commentary on three interesting machines. I would hardly put the Gamma 60 in the same class as the Stretch or LARC in terms of either power or influence. It was an interesting machine, but virtually unknown to everyone from engineers to historians. In writing Computer Structures, I looked at it carefully and could find no real influence on any successors. It was clearly sort of interesting, but naive.

Pages 104-105. The section about DEC probably has the most errors. This is doubly embarrassing since the source is given as The Computer Museum, but Gwen can find nothing in writing. Usually The Museum refers such authors to the book, Computer Engineering, a history of DEC's computers that I compiled in August 1978.

The names of the machines are PDP-1, PDP-4, etc., always with a hyphen. The company was incorporated in 1957 (this mistake does not fit with his data on the second page.) The D in PDP is Data, not Digital. I was the project engineer of the PDP-4, not, Gordon Hall. The memory capacity of the PDP-4 was not the same as the PDP-1. 45 PDP-4's were built, not 65. Ken Olsen's name is spelled with an e.

His brother is Stanley. Harlan Anderson was a co-worker at Lincoln Laboratory. (There is no d in Harlan.) John McCarthy did not design the PDP-1. The first one was sold to Bolt, Beranek & Newman (not company), not built for them. John McCarthy was consulting for BBN at the time, and developed his ideas for time sharing from working on the PDP-1 (and I'll be happy to tell you that anecdote some day.) One of the first papers on time sharing lists McCarthy, Boileu, Fredlein and Licklider. (It was Boilen, and Fredkin, which was misspelled several times and ways.)

I would have happily checked the data on DEC, and Fredkin is an MIT professor, so there are probably people there to check MIT facts. There are errors surrounding the MIT people and work.

Page 106. Title The CAB 500. (No dates of project start or first delivery so it is hard to argue.) "These were the minicomputers, so named to contrast them with the top-of-the-line machines." The word was coined and used in the mid-sixties to denote a very specialized kind of machine, not to contrast them to large machines in the same line. The whole issue of upward compatibility is quite different. Ralston's Encyclopedia has several pages defining the characteristics of minicomputers and this is totally a misuse of the word. The IBM 1620 along with the G-15 and LGP-30 while small do not fit the definition of minicomputers.

Page 132-3. Under memory it is confusing to use the word "ferrite" to mean core. Drums are also coated with a "ferrite."

Outside of the errors, a basic problem of the book that makes it useless for any historical work is summed up on page 166:

"PAF vanished with the CAB 500, but it had a famous descendant,
BASIC, produced in 1965. Even if the authors of this language did
not know of PAF, BASIC had the majority of its features."

The facts here might be correct, the intrepretation I give is: "let's rewrite history as it might have been" is inexcusable, especially by anyone who has a title of

Scientific Director. BASIC had characteristics that were taken from a variety of languages, including Algol, Fortran and JOSS -- people were working on the same problems at the time. But Kemeny and crew made BASIC work. If they had stolen the whole language of PAF without reference, then the story is different. The section on PAF as a descendent of Fortran does grate on the reader, in light of the lack of data. The two source books I use, Sammet (Programming Languages) and Wexelblat (History of Programming Languages) don't mention PAF.

All of this may be excused, providing good clean fun for the nitpickers of this world to correct, but the conclusion on p 196 is the most offensive statements I've read in a long time:

"It is no exaggeration to say that there has been no fundamental development in computer science since 1963." (p. 196)

As an official Computer Pioneer, this would be nice to believe, however, since that time, I count fundamental developments in timesharing, packet-switching, artificial intelligence, distributed computer systems, algorithms and high level languages. For example, MIT and Harvard spend a lot of money trying to advance computer science. Moreau's statement says they've failed. This statement, which the book fails to either posit or communicate, shows the author's ignorance is only exceeded by his arrogance.

The standards for a history series cannot allow so many spurious errors and misinterpretations, especially published under MIT's label.

A recall is in order -- the book is filled with defective parts and harmful to our health.

Cordially,

Gordon Bell
Chief Technical Officer
Professor, Computer Science and Electrical Engineering (on leave)
Carnegie-Mellon University

cc: Bill Asprey, Paul Ceruzzi, Bernie Galler, Jean Sammet, Frank Satlow

ps. Bernie and Jean, I hope that The Annals and Computing Reviews won't review it until these errors are corrected because I don't think anyone needs misinformation and to have their attention called to such.

Bill Asprey
Charles Babbage Institute
104 Walther Library
University of Minnesota
Minneapolis, MN 55455

Paul Ceruzzi
Clemson University
Clemson, South Carolina

Bernie Galler
Computing Center
University of Michigan
1075 Beal Street
Ann Arbor, MI 48109

Miss Jean E. Sammet
Division Software Technology Manager
IBM Federal Systems Division
6600 Rockledge Drive
Bethesda, Maryland 20817

Frank Satlow
MIT Press
Building E32
28 Carleton Street
Cambridge, MA 02142

+---------------+ ID#: 0150
| **d i g i t a l** | **I N T E R O F F I C E M E M O**
+---------------+

SUBJ: The Colorado/Disk Issues

To: Phil Arnold, Bob Jack, John Kevill, Demetrios Lignos, John Meyer, Bob Puffer, Mike Riggle, Grant Saviers

Date: 5 JULY 78
From: Gordon Bell
Dept: Office of Development
MS: ML12/A51 Ext: 2236

I wouldn't have believed there could have been such a change in attitude by such a separation so quickly, but there is and we have to work hard to avoid it affecting us. The Colorado Engineering team is very good, and with the close coupling to manufacturing, we should produce some great products. The issues:

1. The Mass Storage Strategy-It's good to get Grant back here in working the strategy. This has to include an overall idea how/why more should go for more Mass Store. IF we can get the NDS thing together, that's an avenue, because it'll relieve some funds that would have been spent on handlers. This is going to be even more difficult in the event of any further downturn of sales or the economy.

2. Tape Problem-This belongs to us all. What is the right strategy in light of increasing costs in field service, the Springfield plant, and the engineering budget? When I look at the reliability figures for TU 10,16 and 45 I shudder; however, is the TS04 going to be any better? We have to get a reasonable fix through DMT. Given the TU77/78 fiasco, we have to have something. Somehow cutting a project that could potentially produce revenue seems bad...on the other hand cutting a project that could be a continual engineering drain if the mechanics are fundamentally poor is smart. This will have to wait until we have DMT, design and TU77/78 licensing

etc. information.

3. RL Futures. This one is clearly Phil's to drive. Mike has some independent funds to do things he feels are necessary, plus any support from Phil. It is up to Phil to get a plan in place that makes sense with the resources (including Mike and Fred). I'm leary about already deciding what the product should be at this time. I would like to see the space of alternatives and see them plotted on a 3 dimensional surface (you have the equipment there to do this). The things I'd like to see include time plots of development cost (including the cost to get the unit into production), product cost, number of bytes, cost/byte. The plots would be for a number of alternatives, not just the ones the customers think they want today. Phil, when can we have a look at the alternatives? Wouldn't a cursory view like this be the basis of an advanced development plan since each of the alternatives would have a set of components on which the alternatives were based?

4. AZTEC. I'd sure like to understand it as an advanced development project as it relates to the possible various alternative projects. Mike, is this plan available?

5. R81. The same is true for the R81 as for the RL04, but with one major exception...we don't have an R80 yet. This work has to be coupled even more gingerly so that the R80 is not disturbed. Demetrios has the driving responsibility, when he is ready. Until then it is clearly Mike"s.

6. Overall location of Mass Storage engineering. This is something we all have to work. Given the large number of engineers who are working in the mill and who don't want to go to Colorado, I don't want to force this. We are going to have to have meaningful work in both locations. I've been disturbed at the rate things have moved contrary to what I believed was right or what I thought I agreed to. The R80 was one case, and more recently there has been the case of the NDS.

7. NDS. At least at this point it appears to have a user. There are no agreed on specs, and at this time, the concept hasn't yet been made to work and still deliver the performance. I thought I said no movement of people until a prototype and till the specs which could be built exist. Neither of these conditions exist. Furthermore, the architectural team has only produced what seems like a rat's nest of components interconnected in an ad hoc fashion. The current approach to architecture (adding more people) will only result in higher costs and more kludginess. Therefore let me reiterate:

> No one is to move to Colorado on the NDS team until there is a spec, a working breadboard at the necessary performance level, and an architecture (interconnection of components) that I consider reasonable.

We have the potential for great products now. Let's not blow it by bickering. There's more work to do than any/all of us can do. Let's focus on this, not the charters!

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST: Phil Arnold CX Bob Jack ML1-3/E58
John Kevill ML1-3/E58 Demetrios Lignos ML3-6/E94
John Meyer ML12-1/A11 Bob Puffer ML12-2/E38
Mike Riggle ML4-1/B32 Grant Saviers CX

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! ! ! ! ! ! ! !

!d!i!g!i!t!a!!! Interoffice Memo

!___!___!___!___!___!___!___!

TO: TOM BURNIECE DATE: MON 6 JUN 1983

MIKE RIGGLE FROM: GORDON BELL

cc: see "CC" DISTRIBUTION DEPT: ENG STAFF

EXT: 223-2236

LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5202114236

SUBJECT: COLORADO VISIT (AND SOME COMMENTS)

GB5.54

Thanks for the hospitality and lively interaction on Tuesday. I promise it won't be so long till the next visit, which will hopefully be on a scheduled review. It should be more lively after I recover more and get back into the product contest.

Some comments:

1. You folks sure have a full plate and exciting time ahead with the aggressive product plan.

2. The 4-HSC/12-780 Cluster under test was really impressive. The team is to be congratulated for getting this all to work. Two of Bean's observations should be acted on immediately: special training is required to install and operate a cluster; and diagnostic hardware of some kind is required to monitor transactions in order that complex system faults can be located. (These predominantly software problems almost require a time stamped log of CI messages. Maybe this could be a special microcode package in one of the 780's.)

3. I hope you'll declare the HSC a combined hardware/software system and start following Software Engineering design, releases and support procedures -- which are well documented. Unless this is done, there'll be no one field trained and capable of solving HSC problems. It's clear the HSC is a major, evolving software system that is only slightly smaller than VMS and TOPS. Also, this would mean that project management is software and systems-based rather than what appears to be part hardware with lots of "microcode".

4. I would like to see the latest articles you're submitting or planning for the HSC. Bill Strecker, Sam Fuller and I are writing a book on the overall architecture. The HSC is a key chapter. Can you send us the articles? (We may want more written on it.)

Could you also send the Hughes slides which show the number of processors, programs and speeds of the various parts of a cluster -- together with measurement data that reflects various loads?

5. QDA is critical to both Seahorse I and II (MicroVAX version) I believe. Unlike Gutman, I don't think we can wait 3 years! (We really do need it within a year -- and that's 6 mos. after Seahorse starts shipping.)

6. I strongly support the plan for an early ship of a combined file/database server based on Seahorse, Seaboard, and JRD. Why can't you declare that you're building this server? The only weakness is there's no disk (QDA) for it!

"CC" DISTRIBUTION:

JIM CUDMORE	DAVE CUTLER	MIKE GUTMAN
BILL JOHNSON	ROY MOFFA	GRANT SAVIERS
JACK SMITH		

-2-

CHALLENGES IN GENERATING THE NEXT COMPUTER GENERATION

Even before the Japanese told us about the Fifth Generation, Computer Generations have been of interest--what they are, why they happen and especially the next one. This fascination surrounds a computer structures taxonomy essential for The Computer Museum and understanding computer evolution. The Museum must have a way to contain and segment ideas: by generations and by information processing structures. Observations from our past and present will help in creating our future.

WHAT IS A GENERATION, now that we need one?

A generation is simply the convergence of:
need (in this case--threat of military and industrial annihilation) which frees resources;
technology, science and ideas to build from; and
organizations to build
new computing structures.

Finally use will confirm a generation after the fact.

The whole process is like a cyclotron and a generation is one or more trips around. The concept to "do a machine" is injected into the accelerator at some stage... I'd like this to be needs driven to a large extent. Technology is the first stage, architecture and design are down stream, followed by the actual construction and manufacture. System software further accelerates the electron. Algorithms and use with critical evaluation, which we often ignore, provide the final stages... and of course by now, the particle has gone around once. And now it is ready to be accelerated again and attain the critical energy level necessary for real use or for going around again. For many generations, going around twice constitutes a new generation. The first time around a new structure is formed, and the second time around it is made more useful and gains market acceptance. Clearly the Personal Computer (PC) was like this: the very first PC, the LINC, now in the Computer Museum, cost about $40K in 1965 but not until 1975 with the microprocessor was it viable from a market perspective. The PC actually took about three trips around to reach the high energy level characteristic of a Generation. The Apple and IBM PC characterize the second and third times around the ring. Now a trip around takes less than 2 years. This process is highly evolutionary with all parts of an industry acceleration.

Richard DeLauer, of DARPA, claims the U.S. is working on the Nth generation, and I believe that the Fifth Generation is already cast, even though the Japanese are laying claim to it.

WHAT IS THE NEXT GENERATION?

Last week Alan Perlis spoke at The Computer Museum, and in passing gave a number of his pearls:
"If a computer understands English, it must be Japanese."

My concern is that the Japanese have already won the race to the next generation. In the past, no one was interested in a race, contest or game. In fact our strength was the independent, uncoordinated inventors of board games, physical skill games, simple intellectual games like Chess or complex ones like Go. Now as a guerilla warfare army, we've been drawn into a contest where we seem to be forced to compete and where we have no knowledge of the rules. We have no notion of how to pick teams or whether the game is played with teams or individuals, and whether more or less resources count. In the midst of all this, many forces are moving people among institutions.

The Japanese evolutionary approach to engineering and their leverage of the world's research has been impressive. They understand the notion of long term processes and learning from the past. We also can learn from the past.

Observe how the Japanese understand this notion of generations and evolution. The concepts of AI and AI workstations have existed for years in the lab. They started with a DECsystem 10 and are making the very best workstation hardware they can to execute LISP and Prolog at a factor of 10-20 times the large system! In parallel, they're working on significant real applications and trying to develop the engineering discipline. Finally, they'll use and evaluate their applications and workstations in order to go around again at a much higher performance level. They plan about two more evolutionary cycles by 1990: use with critical evaluation, re-architect, build, deploy, then repeat the use and evaluation stage to start around again. The important thing is to start with use NOT revolutionary new structures!

In a recent talk, Mike Dertouzos of M.I.T. says there are 4 ways to beat the Japanese in the forthcoming race:

1. $100-200M to develop high speed computers with AI functions
2. an open policy toward foreign workers in industry and academe
3. tax credit for long range and in accord with national policy
4. careful re-exmination of antitrusts to permit consortia

He also argues for foregoing the traditional short term gain at the expense of long term R and D.

The above 4 points do raise questions:

1. Where's a reasonable plan that would spend $100M in a coordinated fashion? Won't a large budget just serve to swap a fixed set of people from place to place? Postwar university research has been run as independent, decoupled projects. Can we change to a more coordinated, directed approach that a new generation requires?
2. Although we have been successful and probably need an open door policy, is this really a relevant success factor?
3. Where is a national policy or plan? R and D credit may just go right to the bottom line of a corporation to increase earnings. Similarly, few corporations are equipped to do either credible or useful research. Even Advanced Development can be a conflict because few managers understand the differences between product development and product enhancement, let alone concepts of basic and applied research. There is poor understanding of these activities and we clearly can't manage the flow of ideas through the stages. The Japanese are masters at moving world research into products.
4. We have several consortia but they have taken a long time to establish; antitrusts may not be the issue.

Now, we must learn from Japan about how to define, establish and then execute projects. The Japanese Fifth Generation effort appears to be 3-5 years ahead of us because they understand large scale, long term interacting processes and they have a plan that started in 1980 and based on the world's research.

For example, in contrast to the Japanese directed and evolutionary approach, we have many projects aimed at designing and building revolutionary machines at various universities to exploit fine-grain parallelism. All, violate the historical notion of evolution since they start with a structure that looks interesting to build with new technology and not science, programming technology or a problem.

They all involve incredible personal commitments. How many revolutionary computers can we really afford to build to completion with analytical use? Are we prepared to run these 10 year, very high risk experiments?

WHAT IS THE FIFTH GENERATION WE'RE ENTERING?

The need is intercommunication.
The technology is VLSI which permits powerful microprocessors and Local Area Network interconnection.
The technology permits building: Personal Computers, powerful personal workstations, multiple processors for fault tolerance and performance.

WHAT IS THE NEXT GENERATION?

The emphasis is on Artificial Intelligence applications with voice and natural language communication, built with VLSI and ULSI and predicated on a high degree of parallelism. Furthermore, the new structures will supposedly be revolutionary!

For any generation, we need a clear view of the target and the problems standing in the way. Although fuzzy, the Japanese appear to have a view and an approach. Finally, the notion of revolution is not consistent with a next generation.

Only a handful of real AI applications, including "expert systems" are in operation. A future predicated on parallelism is equally risky based on past results. Thus, a computer can't be evolved unless a model of use exists. Revolutionary machines usually fail even though they often provide useful by-products. Breadboard of the real structure usually operate in a previous generation. Do these structures now exist?

THE PLAYERS

Even with all the caveats participation is required by everyone provided we can have a more focussed approach. Even a guerilla army needs some leadership. In the past, DARPA has indirectly provided this leadership and science for industry in the form of timesharing, speech understanding, graphics, packet switching, and most recently VLSI.

Universities played the key training and scientific discovery roles in the past. The university role is vital because the science of parallelism is underdeveloped, ULSI is too hard and we have little understanding about communication with people.

Jay Forrester, who headed MIT's Whirlwind and invented the core memory, made several comments on building machines in Universities that still hold today:

"Experimental equipment merely for demonstration of principle and without inherent possibility of transformation to designs of value to others does not meet the principle of systems engineering".

This lesson should govern building new experimental machines: Unless a machine provides about an order of magnitude more power to the individuals who may use it than is available to them, there will be insufficient pull to attract users and test the basic idea. In other words, don't build toys. However, building experimental systems today appears to be even more difficult than in the past.

WHAT CAN BE LEARNED FROM PAST EXPERIMENTAL MACHINES?

Table I shows several university-based computers in the first-fourth generations. Nearly all were useful in training engineers and scientists. Some machine not only were especially useful, but in addition trained users and provided insight into various algorithms.

Harvard's Mark I played a role in the search for the computer. The main architect, Howard Aiken was not particularly gracious in acknowledging IBM who actually designed and built the Mark I, which might be considered an impossible to build machine were it not for IBM's impressive engineering. The later Marks weren't near the state of the art, and none were as influential. However the most important by-product was to train individuals who have influenced computing.

Columbia was influential when Wallace J. Eckert got IBM to build the SSEC computer, a first, pre-computer generation machine composed of relays and vacuum tubes and using many of the techniques derived from the Mark I.

At the University of Pennsylvania, ENIAC was the truly revolutionary machine because it provided several orders of magnitude more performance than the Marks or the Bell Labs relay machines! The stored programs concept came from the ENIAC. The work lead to EDVAC, IAS, the University of Illinois' ILLIAC I, and then indirectly to the computer industry.

MIT's machines were evolutionary in structure, but revolutionary in technology with Whirlwind. Later on the TX-0 and LINC were also successful and influential. TX-0 took about a year to design and then was in use over 10 years. The well engineered, state of the art circuits were the basis of starting Digital Equipment

Corporation.

A machine rarely pioneers more than one aspect of computing: current technology, architecture, on application (use).

UNIVERSITY OF ILLINOIS

Illiac I was built in the IAS and von Neuman architecture. The real contribution was the detailed circuitry and logic that permitted copies to be made at various laboratories. The machines had a long life resulting in contributions to knowledge and use about software and applications.

Illiac II, a transistor circuit-based machine, operated three years after the start of the second generation.

With a new architecture, new circuits and logic, the machine, was completed three years after significantly better industrial machines, e.g IBM 1401, 7090, CDC 160/1604 and DEC PDP-1, were available.

Because there were so many new, risky parts, conservative and obsolete technologies were selected (i.e. germanium versus silicon transistors, discrete wiring versus printed circuits), creating an unwieldy machine. Furthermore, asynchronous logic and a small memory were used to further slow down the system. Although the machine was designed to be a very high performance computer, the industry moved past Illiac II and hence the notion of building experimental machines at universities was squelched for sometime.

Illiac IV came out of the Solomon project described in 1962. Illiac IV, a truly revolutionary machine, was put in service in 1975 and operated at 250 million operations/sec. with a total of 64 parallel processing elements controlled by a single instruction stream. A memory hierarchy for the processing elements of 1 Mbyte (RAM), 2 Mbyte (core), and 139 Mbyte (fixed head disk)--clearly violate Amdahl's constant of 1 byte of memory for each instruction per second.

Dan Slotnick, the designer of the Illiac IV commented:
"Most machines come about through evolution and that's counter to the notion of original research which is supposedly the basis of

university rewards." The activity of building a machine for study entails major engineering; this too can conflict with the emphasis on science.

"I'm convinced that universities can't and shouldn't build machines. There are too many ideas, too much democracy and too little discipline. I used to have to stop the flow of ideas on interconnection every week when we were designing Illiac IV. There is also too much bureaucracy. In a state university it takes 90 days to get an IC."

Larry Roberts, who headed DARPA then, claimed that it was absolutely clear that the machine should have been done with TTL and not ECL technology. "People complain bitterly, but in the end, conservative technology seems to work out better." (This is what I like to define as a tradeoff of instructions per second versus instructions per month. Not getting an operational machine limits its life and delays the essential purpose of the original design--which should be to understand if the structure can be useful!

The contributions of Illiac IV were mostly as by-products even though it did operate as the world's fastest machine for some problems until the Cray 1 came into production. A number of people began working on parallelism at Illinois and elsewhere. The fast semiconductor memories that resulted from the effort were essential for all machines including the Cray 1. Illiac IV may have stimulated TI's ASC, CDC's STAR and the CRAY 1.

CARNEGIE-MELLON UNIVERSITY'S MULTIPROCESSOR

CMU's machines, designed to obtain experimental results about parallelism were more evolutionary and had more side-effects for a smaller cost than Illiac IV.

Multiprocessors are intriguing to an engineer because performance is obtained by replicating a simple design instead of massive design. We must understand them so they can be applied to real use. Furthermore, multiprocessors represent another form of parallelism whereby multiple instruction streams operate on multiple data streams.

Multiprocessors were studied at CMU in the late 60's, and Bill

Strecker's 1970 thesis computed the performance for p processors accessing a common memory of m modules. This main reference work for multiprocessors was rejected as the first paper on these structures because it wasn't relevant at the time. There have been dozens of subsequent theses and papers during the last 10 years which embellish the model, and all reference the Strecker thesis.

Today's research on switching structures which focuses on thousands of processors and memories seems to be completely irrelevant because we have no evidence that over a few processors can operate in parallel on a single problem. In fact, in a recent visit to the University of Illinois one researcher stated to me that he wouldn't work on a project of only 32 processors if it couldn't be extended to 1000! This prevailing attitude which focuses on the exotic completely masks the more difficult job of building and what may be the impossible job of using such a machine. Thus we have a paradox: we have no real demonstration or understanding that more than 10 processors can be used effectively; on the other hand, the researchers who must provide this fundamental understanding have no interest in developing an understanding because of the focus on finding switches for several thousand processors.

The issue is not the switch performance, nor finding exotic switching structures, but simply: getting on with finding out whether multiprocessors can work together on a single problem. This is a combination of architecture, system software, language and algorithm design. I believe that if anyone can demonstrate that a small scale multiprocessor of say 10 can work routinely in production, we can extend this to a large scale multiprocessor of 100 and then to 1000. Note, the Japanese Fifth Generation project is predicated on parallelism.

<u>C.ai</u>, a multiprocessor with 16 processors for AI research which had a one gigabyte, very high bandwidth memory called C.ai was proposed in May 1971. <u>C.mmp</u>, a much simpler design, was in place using 16 PDP-11 processor modules in August 1971.

The project had two goals: a capability based Operating System based on changing the PDP-11 and to examine the use of multiprocessing. The addressing problem using the PDP-11 became a major issue and problem.

The project is well documented including what was learned in Wulf's book on Hydra. Maximum speedups were hard to obtain. It is unclear why C.mmp wasn't used enough for applications, but on the other hand we know that any machine must provide more computation than is available by other means in order to be attractive for users. By 1978, the CMU computing environment had more machines which were easier to use. Ironically, not everyone on the project learned about the small address problem when they went on to design the Intel 432.

Cm* is a set of computer modules which permit building a medium scale multiprocessor of 50 processors in an open-ended fashion.

Cm* was an evolution of C.mmp, and foresaw the notion of functional multiprocessors that is used in Intel's Multibus. Cm* used the same C.mmp operating system concepts. Even though any processor could access any memory, there was a preference to a local memory, or to other processors within a cluster of 10, and finally to memory outside the cluster. Thus, the machine is problem idiosyncratic because the access time varies whether data is in local, in the cluster or external to the clusters. The structure of computation and data with respect to particular physical structures is being understood using Cm*.

Significant work is needed before these machines can work together harmoniously without extensive hand tuning of programs. The evolution of Cm* from C.mmp paid off.

For Multiprocessors, the progress has been slow. In each generation, there is renewed optimism in the concept. In the mid 60's with large computers and mid 70's with minicomputers, I felt multiprocessors were the best way to provide more computation. Now since the smallest unit is the very high performance processor with the characteristic that the smaller it becomes, the faster it goes, multiprocessors must be an important way to increase performance. Also note that many companies are finally offering multiprocessors in all product ranges: supercomputers (Cray X-mP, Dennelcor), superminicomputers (ELEXSI), and micros (Synapse).

Maybe there are reasons why multiprocessors have not been used

appreciably:
. we always find a simpler way using technology or instruction set (e.g. vectors) to provide high performance
. engineering has been too conservative
. operating systems and languages haven't supported or encouraged them
. too many other ideas are present and in use

no market because users may not be able to program them/no product to test a market

With the advent of several commercial multiprocessors, it is critical for universities to become involved in use and providing understanding.
Human organization theory doesn't seem to help the work on parallelism except in an anecdotal fashion. More than a decade ago, Melvin Conway wrote that people build computer structures like the human organizations they know. This explains why n people build n-pass compilers; IBM build hierarchically structured protocols like SNA; ARPA has to have a store and forward net independent of its users; Digital builds democratic (anarchic) structures like Unibus, Ethernet, DECnet and multiprocessors.

If we could use human organization theory it might shed light on parallelism from structures that are connected together in particular ways. It might also explain, like humans, why its difficult to get more than six processors to work together--unless totally top down directed with clear goals (like, capturing a beach or hill). For now we need to concentrate on the general case of multiprocessors because it has the ultimate in connectivity via the memory. Slow or restricted networks such as LANs, trees, hypercubes, etc. can come later after we understand the general case.

Some general observations about the experimental machines:

1. nearly all the machines were useful in training computer engineers and scientists

2. early machines tended to be built for use, not understanding and hence had longer lives.

3. machines with long gestation risk a long life or being useful

due to obsolescence from competitive approaches

4. later machines tend not to be used because other production machines are available as such their contribution has to be to science

5. unless a machine is used, its contributions to understanding algorithms won't happen

6. a single machine is unlikely to pioneer more than one aspect of architecture, technology

7. revolutionary machines such as Eniac, Illiac IV and C.mmp provide understanding and by-products that are more important than the use.

Given the concerns, but yet the need for research, there are several ways to do this work:

1. cheap labor of graduate students... brilliant, but unpredictable. Not recommended unless the machine is easily assembled from well-defined industry standard modules or computers!

2. professionals within the university which create a second culture. This structure is somewhat difficult to manage and unstable, but essential to building a system within a university. This is what has been done at the CMU projects.

3. jointly with a company. A hardware/software split may be the right division of labor whereby universities do software. This was used in the PC generations. Why not do it again? It's being used at CMU with IBM for products. The Japanese companies build machines for the various universities, especially at the University of Tokyo.

4. as a separate company outside the university and fueled by venture capital.

Contrary to popular opinion, I believe large amounts of money will cause excessive swapping of people and further perpetuate the erroneous economy-based notion that money can be traded off for science ideas, and talent! The money comes from two sources:

1. The government. This acts to simply churn the small number researchers moving them from place to place. The nice effect is to raise everyone's salary.

Since these research projects are large, they require professors to be good project managers in a university environment designed for teaching. Large projects diminish freedom. By becoming managers, the reaction after a few years may be: why work at sometimes lower pay, lack of freedom and without adequate engineering resources. This provides a target for industry to scoop up kernels of the nation's "seed corn."

2. The Venture Capital world which draws people from established industries and academe into often mundane and low tech products because of the risk. For example, one high tech company started up in March and were shipping your generic 68,000-based UNIX product in 9 months, the standard gestation time. A company of 4 recently, built one board and assembled a UNIX product. Others build NOTHING but merely assemble.

Many believe that entrepreneurism is the way to beat the Japanese because it unleashes such an incredible amount of focussed energy--but I wonder if the Japanese are going to feel threatened by 123 different kinds of 68,000 based workstations! On the other hand this system has funded really creative technology, e.g. Amdahl's Trilogy Corporation.

Today the result of several recent dissertations at Stanford has been a chip, program, algorithm or system capable of starting a company. Recent examples at Stanford include Clarke's Geometry Engine the basis for Silicon Graphics; the Timing Verify of Widdoes/McWilliams, the basis of the Valid Logic Company; and the SUN terminal, the basis of SUN Microsystems. So finally people can rapidly progress through the cycle from freedom to fame to riches.

I don't know what the final answer to the question of how do we continue to generate interesting generations. But it is clear we've got to get organized. Or in the words of Pogo, "we have met the enemy and he is us."

GB8.14 - 11/29/83 Tue 15:33:49
GB8.22 - 12/19/83 Mon 17:21:19
12/20/83 Tue 11:03:16

****
* d i g i t a l *
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TO: BILL DEMMER
ULF FAGERQUIST
BILL JOHNSON

DATE: THU 22 APR 1982
6:14 PM EST
FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: COMET MCA

Sounds like we might get somewhere.

A crew of Rothman, Armstrong and Melanson and possibly Hanneman if we need to push the packaging density very high could get us the information quickly as to whether this is a crazy idea or not. The back of the envelope notion of scaling says: Comet has a 2 ph clock of 140ns each. If we scale by a factor of 5, then each phase is 28 ns across 5 boards for the cpu. The roms are about 60 ns, and when scaled to ecl gets us 12 ns (which is also available).

Maybe it's all crazy. All I know is that Venus looks very good as a design right now. The numbers of bugs to be found looks real according to Ulf's model... and we aren't yet in a mode of finding them with the simulator very well yet. Competitors are coming out of the woods daily for the Venus and we need a product bad. Bob and Ulf have managed to get a design without the continued slip (only a month is 6 months, versus 6 months in 6 months). The machine still looks 27 months away.

LSG has a factory to design pcb's, backplanes, and mca's.

Surely that could be used to get a machine quickly if this turns out to be a reasonable approach.

ATTACHED: MEMO;32

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* d i g i t a l *
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TO: GORDON BELL
    SAM FULLER

DATE: THU 22 APR 1982
1:06 PM EST

FROM: BOB ARMSTRONG
DEPT: CADSE AUTO TOOLS
EXT: 227-0685
LOC/MAIL STOP: ML3-5/T28

SUBJECT: MCA750

I've just released the new version of our router and am now between projects. (except for bug fixes that may be be needed).

What's happening on the exercise to put comet into MCA technology?? I got a note from you about a month ago to convene
a group to look at this, haven't heard anything since. Rothman
called me the other day to find out what's happening. I haven't started
doing anything yet.

I"ve recieved an analysis done by Steve Jenkins/Don McInnis last
August that proposes an MCA Comet design and makes it look very unattractive.
How is this different from what your exercise is aimed at??

I've tried to call a couple of times, no luck. Let me know what
you'ld like to do.

bob

GB3.S4.28

ID#384

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Subject: **COMET Review**

To: Brian Croxon, TW/C04
Bill Demmer, TW/D19
Bernie Lacroute, TW/A08
Don McInnis, TW/A08
Steve Rothman, TW/D06

Date: 8 DEC 78
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

CC: OOD, Marketing Committee

The review was to the point. Please convey my congratulations to the presenters and groups who are doing a really fine job with COMET so far.

As I tried to point out in the review:

1. We intend to ship at least 50 COMETS/week at $80K/machine over a 50 month period.

2. The product has a fixed end of life, hence any slip, cuts the NOR by the amount slipped.

A one-week slip causes $4M loss in NOR.

Let's keep the schedule!

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Dick Clayton	ML12-2/E71	Jim Cudmore	ML1-5/E30
Bill Demmer	TW/D19	Ulf Fagerquist	MR1-2/E78
Win Hindle	ML10-2/A53	Bill Johnson	ML21-3/E87
Ted Johnson	PK3-2/A55	John Kevill	ML3-6/E94
Andy Knowles	ML10-2/A52	John Meyer	ML12-1/A11
Stan Olsen	MK1-2/A57	Larry Portner	ML12-3/A62
Bob Puffer	ML12-2/E38	Bill Thompson	ML12-1/F41
Brian Croxon	TW/C04	Bernie Lacroute	TW/A08
Don McInnis	TW/A08	Steve Rothman	TW/D06

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION

DATE: TUE 19 MAY 1981 8:26 EST

FROM: GORDON BELL

cc: ULF FAGERQUIST
GEORGE HOFF

DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: UNDERSTANDING COMET TO HELP VENUS AND NAUTILUS

Was rearranging my files and happened on to Steve Rothman's

May
16, 1977 Comet Project Plan and other Comet documents. As we
move forward with great speed on both the Venus and Nautilus,
I
would like a series of essays by Steve which describe what we
learned from the Comet project. It would cover the product
cost,
schedule, development, mtbf, size etc. parameters versus
time.
Also, there should be a section dealing giving heuristics of
what
we must do different next time.

Can we get this started today and start feeding insight to
these
critical projects that lie ahead?

GB2.S5.56

"TO" DISTRIBUTION:

BRIAN CROXON   BILL DEMMER   DON MCINNIS
STEVE ROTHMAN
****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION   DATE: TUE 19 MAY 1981
8:26 EST
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cc: ULF FAGERQUIST   DEPT: ENG STAFF
    GEORGE HOFF   EXT: 223-2236
                                             LOC/MAIL STOP: ML12-
1/A51

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GB2.S5.56

"TO" DISTRIBUTION:

BRIAN CROXON BILL DEMMER DON MCINNIS STEVE ROTHMAN

ID#425

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i n t e r o f f i c e   m e m o r a n d u m

Subject: **Solving the Communications Protocol and Option Handler Design, Implementation and Test Problem**

To: George Plowman, ML5-5/E97

Date: 19 JAN 79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

follow up 2/7/79

I just saw the list of features that were requested in VMS release two and find that most of them were of the above type. I'm sure every operating system has the same list! We have really failed in our design technology and now have to rely on hand-crafting components. In reality, no real intellectual talent has been applied to automate this. Although we do have other parts of engineering that are as art-based, let us move immediately to understand what the task is involved in these designs so that we can move to a more engineering oriented endeavor. In fact, given that ATT is offering to support 500 terminals in ACS, they must know something we don't.

It seems to me that design of a communications line handler (complete with tests and diagnostics) ought to be fully automatable from the specification in much the same way a compiler front end is generated from the syntax spec. Failing this, we have to find some other way to get out of this abysmal hole we've dug. (In the case of VAX, I would assume there is some method to put it fully in the user space so it doesn't have to be done in such a hand-crafted fashion requiring stand alone time.)

Would you first meet and figure this out, and then get me together with some of the right, bright people that are responsible for and rely on this work and propose what you are going to do?

GB:ljp

CC:	Jim Bell	ML3-2/E41	Joe Carchidi	TW/D08
	Peter Christy	ML12-3/A62	Ulf Fagerquist	MR1-2/E78
	Sam Fuller	TW/A08	Bill Heffner	TW/C10
	Bill Johnson	ML3-5/H33	Bill Keating	ML12-3/A62
	Tony Lauck	ML5-5/E97	Larry Portner	ML12-3/A62
	Chuck Stein	ML5-5/E97	Bill Strecker	TW/A08
	Pete vanRoekens	TW/B10		

D I G I T A L INTEROFFICE MEMORANDUM

DIST:	George Plowman	ML5-5/E97		
	Jim Bell	ML3-2/E41	Joe Carchidi	TW/D08
	Peter Christy	ML12-3/A62	Ulf Fagerquist	MR1-2/E78
	Sam Fuller	TW/A08	Bill Heffner	TW/C10
	Bill Johnson	ML3-5/H33	Bill Keating	ML12-3/A62
	Tony Lauck	ML5-5/E97	Larry Portner	ML12-3/A62
	Chuck Stein	ML5-5/E97	Bill Strecker	TW/A08
	Pete vanRoekens	TW/B10		

Digital **Interoffice Memo**

Subject: **The Comm. Products and Chips: Who's Minding the Store?**

To: Roger Cady/Julius Marcus

CC: OOD, Vince Bastiani,
Rick Corben, Tony Lauck,
Stan Olsen Steve Teicher,
Nat Teichholtz

Date: 20 SEP 76
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

F/U 9/28

Now that you're taking on a focus by business, who's looking after the DDP-type product sales channel?

Are you depending on the OOD process to do most of the product definitions in this area?

There seem to me to be countless product opportunities...like we never had before, and I feel we're going to really blow them without this market focus. To name a few:

1. Products that support DECNET in a very low cost way. Shouldn't we have made DECNET versus SDLC chips?

2. Significant Comm. products based on fewer chips like the 8080 microprocessor based products that are LSI-11 based? (These might flush the LSI-11 package?)

   a. Time division multiplexors (i.e., concentrators).

   b. RJE terminals (DECOPS? front end).

   c. Store and forward networks such as the one we need and are planning internally. (Our customers are asking if they too, can easily build their own ARPA nets.)

   d. Protocol changers. Dedicated hardware may get us around some of the complex software.

Based on our latest product pricing approvals, I don't believe we're leading here.

Can we answer some of these questions this Red Book?

Our customers appear to be using DECNET. Rather than taking the laissez-faire attitude toward it, could we really aim toward it being the standard?

GB:ljp

Attachment

ID#407

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| d | i | g | i | t | a | l |   interoffice memorandum
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```

Subject: **Some Comments on AT and T's ACS and Us**

To: Don Alusic, MK1-2/K34
Roger Cady, MK1-2/E25
George Plowman, ML5-5/E97

Date: 8 JAN 79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

CC: Marketing Committee, OOD
Peter Christy, ML12-3/A62
John Holman, PK3-1/P84

follow up 1/22/79

Having spent time plowing through the MDC morass of crappy, information polluting market surveys on ACS, and getting some idea about it:

1. We ought to assume ACS is going to happen, even though the development appears large and the demand (hence installation delay) is enormous. (However, they aren't spending that much on development.)

2. Given the demand, we could/must provide back-fill and compatible products. Here, our ACS-watchers aren't doing an adequate job! George, will you:

   a. Really tell us what ACS is and the penetration vs. time.

   b. What products built by us, our OEMs and users does it impact.

   c. Propose what ACS-compatible products for the large, in-house use market would look like. (This is equivalent to ACS-PBX.)

3. The impact on us of ACS, etc. could be large because:

a. IBM will do the job through the 8100's with AT and T providing copper.

b. AT and T doesn't do it and creates demands and standards.

c. AT and T does it and much business goes away.

4. For now, I don't classify ACS as having significant data processing even though it does have memory and data-conversion (transduction). Because it just:

a. converts from any character - oriented through batch terminal to any other terminal format for entry into a computer including time multiplexing of multiple lines. (Note how much of our business is in front-ends for this purpose?);

b. stores and forwards messages from terminals to other terminals and/or computers (how much business is in message switching?);

c. interconnects computers for message switching.

Only b provides more than Telenet, even though a is more extensive.

5. AT and T has an abysmal record with providing cost-effective communications for computers! They'll probably screw this up too. Can't we win in its wake, chest thumping and promises by offering a working, ACS compatible alternative?

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Dick Clayton	ML12-2/E71	Jim Cudmore	ML1-

5/E30

Bill Demmer	TW/D19	Ulf Fagerquist	MR1-

2/E78

Win Hindle	ML10-2/A53	Bill Johnson	ML21-

3/E87

Ted Johnson	PK3-2/A55	John Kevill	ML3-

6/E94

Andy Knowles	ML10-2/A52	John Meyer	ML12-

1/A11

Stan Olsen	MK1-2/A57	Larry Portner	ML12-

3/A62

Bob Puffer	ML12-2/E38	Bill Thompson	ML12-

1/F41

Don Alusic	MK1-2/K34	Roger Cady	MK1-

2/E25

Peter Christy	ML12-3/A62	John Holman	PK3-

1/P84

George Plowman	ML5-5/E97		

7 January 1985

Mr. Jonathan W. Baker
Acquisitions Editor
Digital Press
Digital Equipment Corporation
30 North Avenue
Burlington Massachusetts 01803

Dear Jon:

I have not made detailed comments, but here are my impressions after reading it a couple of times.

Overall, the book needs to be published very rapidly. The situation is that a number of universities and companies are building multiprocessors and there is no theory, experimental data or framework to support the efforts. This book provides real data from one of the three, large working multiprocessors -- so it's badly needed. Also, the classification (taxonomy) of parallel processing is quite good.

I see it as a book that a number of people will want in their libraries because of the myriad of experimental data, the framework and definitions. It is clearly an advanced treatment and would be either the main text or the principle reference text for a course on parallel processsing (pp). The figures, equations et al are fine. I see need for all kinds of courses to support the multiprocessors that are beginning to emerge in droves. It would be used within DEC for their parallel processing, by professional seminars (several should soon be devoted to the topic... this is an idea for DEC Educational Services), and graduate courses or seminars.

Right now, I see it as a 6, but it could get to 8 or 9 with some work. What I want is a little more concreteness: I would like to see the syntax/semantics of what the user actually programs in either the text or an appendix. Also, it is necessary to show the time for the various operations like send / receive, statements, floating point, etc. There should be a chapter on a real live example (one that was highly successful) which gives the code, measurement, comparison with say a VAX, etc. The process of breaking the code down for parallel processing would also be useful and covered in the example chapter.

I'll be happy to write a jacket statement on the next revision.

Sincerely,

Gordon Bell
Vice Chairman, Technology

GB14.20

cc: Dan Siewiorek
Thoughts stimulated by the Poduska/Apollo 13 December 1983 talk:
Apollo... has gone for quality people who have a very good understanding of the industry. The only thing to stop them in getting to $1B by 88 is IBM, when it gets the workstation... it seems determined to get. DEC is clearly no threat even though there are a few tiny islands of competence in a sea of incompetence.   DEC is the source of people... just as Honeywell staffed DEC in the 70's.

This is another clear indication of a generation: the new structure surpasses the old, a new industrial layer is formed and the high output people leave an organization to build a new one. Honeywell folks left to come to DEC. The good folks of Prime, DG and DEC now leave to form the next generation based on Micros: Masscomp, Apollo, Sun, Sequent, Dataflow, etc.

IBM... which I believe was based on the OEM market models of the old DEC. IBM also learned about university interaction from DEC. IBM is fundamentally structured around Independent Business Units which are entrepreneurial centers. IBM has quality folks who can manage.

PRIME... all fouled up and probably irrecoverable until it gets a new head. Options are to be a marketing company. It's technology is nil. Henson's experience of service was wholly inadequate for running a company. Prime's success came from unique products in the early days which allowed building a total oranization. Finally, its success was its sales force being incentivised and in effect being the entrepreneurs of the company.

DG... looks quite good! The new IBMers, Chapman and Miller are impressive and have brought in a deeper understanding of the industry, management, computers, quality, manufacturing, and technology. The power has been distributed in an entrepreneurial fashion. DG will grow at a substantially higher rate than DEC or Prime, but not at Apollo's.

DEC... is unworkable and headed nowhere. There's no overall control system given the destruction of the Product Line structure which, in the past, provided a product check on engineering AND MANAGED the field (because sales was not incentivized). Now, no one manages the field sales. The company lacks entrepreneurs, and top management lacks basic understanding of products, industry, and quality (as say compared to DG). The large functional organizations (sales, engineering, manufacturing and marketing... whatever that is now) place responsiblity squarely and solely at the top! It can now only prosper by divisionalization of some sort. It is too large to be a functional organization like it prospered on. Lack of checks on Ken as President, CEO and COB together with a nil board means more stockholder suits... I'll bet Caldwell will leave the board soon. There is clearly no successor to Ken.

ID#410

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+---------------------------+
|   |   |   |   |   |   |   |
| d | i | g | i | t | a | l |   i n t e r o f f i c e   m e m o r a n d u m
|   |   |   |   |   |   |   |
+---------------------------+
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Subject: Attached Memo -- **DEC Contribution to Cornell VLSI Facility**

To: Paul Kampas, ML3-3/H24
Joe Zeh, WZ2

Date: 9 JAN 79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

CC: Jim Bell, ML3-2/E41
Dick Clayton, ML12-2/E71
Bill Green, ML1-4/B34
Bob Kusik, ML21-4/E20
Bob Puffer, ML12-2/E38
Jerry Witmore, PK3-1/M40

I agree and support this, in principle. Right now we have made deals with: Cal Tech Craig Mudge is there and we give ~ 100K/year in equipment discounts; Stanford discount (mainly for CS work); MIT (wants some LSI-11's); and now Cornell.

These 4+ CMU and Cincinatti are the only schools I know of doing anything in LSI. We Need them. I only worry about the interface, priorities of which to use and the value received.

For Cornell and others, the important output has to be getting graduates.

The sources of funds are: microproducts, other development groups, a product line and a corporate contribution.

Dick Clayton, Bill Green, Bob Puffer, can you get a policy/plan together here to address the problem?

It's up to you to get the money for Cornell, although I can't see giving them money unless:

1. we get something in return;

2. someone interacts with them; and

3. they put up half the money!

GB:ljp

Attachment

D I G I T A L INTEROFFICE MEMORANDUM

DIST:	Jim Bell	ML3-2/E41	Dick Clayton	ML12-2/E71
	Bill Green	ML1-4/E34	Paul Kampas	ML3-3/H24
	Bob Kusik	ML21-4/E20	Bob Puffer	ML12-2/E38
	Jerry Witmore	PK3-1/M40	Joe Zeh	WZ2

GB0003/42

| d | i | g | i | t | a | l | **i n t e r o f f i c e m e m o r a n d u m**

Subject: **Comments on Our Discussion**

To: Peggy Wesley, WZ-2

CC: Jim Cudmore, ML1-5/E30
Joe Zeh, WZ-2

Date: 6/2/79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

I hope you took from the Stratton Mountain meeting the fact that we really need LSI for this product strategy. Also, let me encourage you to get the tapes and show them to the LSI group because there is a strong dependence on LSI for the interconnect structure. The backplane interface can not be done without it and if we don't have this, then we get a whole bunch of non-compatible computers all done in an ad hoc way.

Regarding our Tiny versus Pusart discussion. Since I didn't especially favor doing either of them, I can be neutral. However, independent of the outcome which I trust you will measure, there is a significant difference in the two. Tiny, is an 11 and it interfaces to a well-defined industry standard bus and it will let us build systems we could not otherwise build. Pusart, is a cost reduction and we can get similar and probably even better parts outside. In no way do I believe there will be any products built with it that could not have been done with off-the-shelf parts. Thus, it violates the first law of make versus buy for DEC: We make what we sell, not what we buy...or don't make it if we can buy it.

In contrast, doing the Squid interface would have gotten us higher payoff in terms of use, allowed us to build systems that could not otherwise have been built by getting rid of lots of parts, and it would have been just as challenging. Alternatively, getting an interface to the industry standard chips that a version of Squid might have been would have had still higher payoff.

Somehow having gone over our discussion and thought about it some, I believe our thinking is at odds and I believe, because you have some power and influence in what we are LSIing we had better get together. I have some direction in mind for the parts we need, and your logic is such that these parts will be precluded. Maybe Jim and Joe should join us, or I'd be happy to come to WZ and discuss viewpoint with rest of the group too. This might be worthwhile because I'd like to congratulate the group on the Fonz and the Comet and encourage them to lobby to get us into the high volume business by having us get 23's out in the volumes that Intel and Motorola does on their 16-bit chips.

Your move.

GB:swh

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Jim Cudmore	ML1-5/E30	Peggy Wesley	WZ-2
Joe Zeh	WZ-2		

EMS 19-JAN-79 14:35:42 420 1

To: Roger Cady
From: Gordon Bell
Date: FRI 19-JAN-79 14:35:42 EDT
Re: INFORMATION FOR STRATEGIC PLANNING IN COMMERCIAL GROUP
From: Roger Cady Date: TUE 16-JAN-79 19:50:30 EST
Message ID: EMS 16-JAN-79 19:50:30 190 1

THE AVAILABILITY OF ONE OR FEW CHIP MICROPROCESSORS WILL CAUSE TMR SYSTEMS TO BE BUILT AS THE STANDARD. THE LARGE ADDRESS SPACE OF THE 38 WILL (COULD) HAVE SOME BIG EFFECT ON PRODUCTIVITY. THIS REALLY SHOULD EFFECT OUR DATABASE WORK.

STANDARDS COULD REALLY BE IMPORTANT, AND THIS WOULD BE A BIG CHANGE (NON-EVOLUTIONARY).

THE VOICE I/O COULD REALLY HELP IN THE DOCUMENT PREPARATION (LETTERS, MEMOS) AND HIGH VOLUME TRANSACTION PROCESSING (BILLING, WAREHOUSING, ORDER PROCESSING). IT WILL COME IN TO A LARGER DEGREE.

THE AUTOMATED OFFICE IS GOING TO NEED A STANDARD INTERCONNECT SO VARIOUS
PARTS CAN COMMUNICATE. WITHOUT THIS STANDARD, A REVOLUTION WON'T TAKE PLACE.

Command:

EMS 16-JAN-79 19:50:30 190 1
To: Gordon Bell
From: Roger Cady
Date: TUE 16-JAN-79 19:50:30 EDT
Re: INFORMATION FOR STRATEGIC PLANNING IN COMMERCIAL GROUP
From: Gordon Bell Date: TUE 16-JAN-79 18:09:54 EST
Message ID: EMS 16-JAN-79 18:09:54 500 1

THANKS, GORDON FOR THE IDEA. IF YOU HAVE MORE, PLEASE KEEP THEM COMING. I AM
VERY CONCERNED THAT WE ARE FAR TOO INTROSPECCTIVE IN OUR PLANNING, AND THAT WE
FAIL TO LOOK AT ALL THE THINGS THAT COULD HAPPEN FROM COMPETITORS AND NEW
PEOPLE ENTERING THE MARKET. FIVE YEARS AGO YOU WOULDN'T HAVE FORCASTED THE
AVAILABILITY PUSH THAT TANDEM REPRESENTS ... AND THAT IS MINOR COMPARED WITH
SOME OF THE POTENTIAL FROM THE JAPANEESE.

DO YOU HAVE ANY FEELINGS ABOUT THE ROLE OF VOICE REPRODUCTION AND VOICE
RECOGNITION THAT MAY EXIST EITHER NOW OR IN FUTURE. I AM CONCERNED THAT
T.I. IS DOING FAR MORE IN THIS AREA THAN WE ARE, AND I AM SURE THAT IBM HAS
STUFF ALREADY DESIGNED. THIS MIGHT BE A MAJOR CHANGE IN THE USE AND
APPLICATION OF SYSTEMS THAT COULD MATERIALLY CHANGE OUR CONCEPT OF THE
AUTOMATED OFFICE.

I WOULD LOVE TO HAVE YOUR VIEWS ON THE AUTOMATED OFFICE CONCEPT ALSO, IF AND
WHEN YOU HAVE THE TIME.

THANKS.

Command:

EMS 16-JAN-79 18:09:54 500 1
To: Roger Cady
From: Gordon Bell
Date: TUE 16-JAN-79 18:09:54 EDT
Re: INFORMATION FOR STRATEGIC PLANNING IN COMMERCIAL GROUP
From: Roger Cady Date: SUN 14-JAN-79 20:35:32 EST
Message ID: EMS 14-JAN-79 20:35:32 560 1

THE ONLY THINK I CAN THINK OF IS GETTING TOGETHER A VERY HIGH VOLUME, HIGH
QUALITY TERMINAL COMPUTER AND MUCH FORWARD PRICING! A JAPANESE CONSORTIUM
WITH TV PRODUCTION COULD DO IT, BUT I DON'T THINK THE JAPANESE ARE THAT SMART
YET. ALSO VIDEO DISK AND LOW COST, LARGE DISKS WOULD BE USED FOR READ-ONLY
AND READ-WRITE DATA BASES. POSSIBLY TI'S LOW OST THRUSTS WILL TAKE AWAY SOME
OF OUR MARKET.

THUS, WITHIN 5 YEARS, IT COULD BE VERY HIGH VOLUME EVOLUTION (INCLUDING
DISKS) FORWARD PRICING AND GOING AFTER FULLY DISTRIBUTED SMALL RELATIVELY
PERSONAL MACHINES. SOFTWARE WOULD BE DONE THROUGH A MASS PUBLICATION
ENVIRONMENT TO REDUCE COSTS. FIVE YEARS SEEM TOO SHORT TO SOLVE THE PROGRAM
PROBLEM EXCPET IN THIS FASHION.

Command:

EMS 14-JAN-79
20:35:32 560 1
To: Gordon Bell
From: Roger Cady
Date: SUN 14-JAN-79 20:35:32 EDT
Subject: INFORMATION FOR STRATEGIC PLANNING IN COMMERCIAL GROUP

I AM SPENDING THE NEXT TWO WEEKS DRIVING OUT THE COMMERCIAL STRATEGY MUCH THE SAME WAY YOU DID WITH THE ENGINEERING/PRODUCT STRATEGY -- TAKING THE BULL BY THE HORNS.

I NEED ANY IDEAS YOU MIGHT HAVE ON MAJOR REVOLUTIONARY TECHNOLOGICAL DEVELOPMENTS THAT MIGHT HAPPEN IN THE NEXT FIVE YEARS. MY FIRST TASK (NEXT TWO DAYS) IS TO PUT TOGETHER IDEAS OF POSSIBLE EVENTS AND TRENDS IN ORDER TO PRODUCE A FEW "SNAPSHOTS" OF THE ENVIRONMENT AND COMPETITIVE AND TECHNOLOGICAL SITUATIONS THAT MIGHT EXIST IN 3-5 YEARS. I AM OBVIOUSLY INTERESTED IN THE CHANGES YOU MIGHT SEE IN THE USAGE OF COMPUTER SYSTEMS.

PLEASE BEAR IN MIND WHAT I AM LOOKING FOR IS NOT EVOLUTIONARY EXTENSIONS OF WHERE WE ARE TODAY, BUT RATHER REVOLUTIONS THAT MAY OCCUR WHICH ARE NOT PREDICTABLE HISTORICALLY.

THANKS FOR YOUR TIME.

Command:

COMMERCIAL PRODUCT PHILOSOPHY

*LAYERED FUNCTIONALITY ON A COMMON BASE

* EASE OF USE

* PROGRAMMERLESS PROGRAMMING

* HIGH AVAILABILITY

* INTEGRATED W.P., AS WELL AS STANDALONE W.P.

* APPLICATIONS

REFERENCE TODAY

PRODUCTS, SUPPORT, TOMORROW

*SERVICE/SUPPORT MAJOR FACTORS IN OUR OFFERING

COMMERCIAL PRODUCT PHILOSOPHY

WHEN DONE, APPLICATIONS ON 8, 10/20, 11 AND VAX-11 IN VAX COMPATIBLE LANGUAGES

ENHANCE OPERATING SYSTEM FUNCTIONALITY ON VAX; AND ON 20 AS REQUIRED TO MEET EXISTING MARKETS

DIRECT CUSTOMERS ON HOW TO PROGRAM THEIR 11 AND 20 IN VAX COMPATIBILITY FASHION

ENCOURAGE THIRD PARTY SOFTWARE VENDORS TO MOVE TOWARD VAX

SELL 20'S TO EXISTING CUSTOMERS AND ACCOUNTS WHERE 20 FUNCTIONALITY, SIZE OR 20 BASED APPLICATIONS ARE NEEDED AND AVAILABLE

COMMERCIAL PRODUCT PHILOSOPHY

PRODUCT SELECTION IS BASED ON MANY FACTORS
INCLUDING

HISTORICAL CUSTOMER USE, FUNCTIONALITY,
PERFORMANCE,

ABILITY TO HELP GUIDE OUR CUSTOMERS.

SELL 11/VAX SYSTEMS TODAY AS BROADEST,
MOST

PRIMARILY COMPATIBLE FAMILY IN THE INDUSTRY WITH
WIDEST

DISTRIBUTED FUNCTIONALITY. WE ARE INCREASING OUR
INVESTMENT

PROCESSING IN COMMERCIAL VAX SOFTWARE AND OVER
TIME IT WILL

BE A CLEAR COMMERCIAL LEADERSHIP
PRODUCT.

WE WILL CONTINUE TO SELL THE 20 FAMILY
TO THE

PRIMARILY EXISTING CUSTOMER BASE AND TO NEW
CUSTOMERS

MAINFRAME WHERE THERE IS A CLEAR PRODUCT
ADVANTAGE TO

PRESENTLY AVAILABLE FUNCTIONALITY OR

APPLICATION

SOFTWARE.

EXAMPLES: IN-HOUSE TIMESHARING

FINANCIAL MODELING

SOFTWARE

APL EMPHASIS

LARGE MAINFRAME

PERFORMANCE

IN GENERAL PURPOSE

ENVIRONMENT

ID#0159

+---------------+
| **d i g i t a l** | **I N T E R O F F I C E M E M O**
+---------------+

SUBJ: DEC then and now; Should we have a commission plan?

TO: Al Bertocchi, Win Hindle, Ted Johnson, Andy Knowles

Date: 7/10/78
From: Gordon Bell
Dept: Office of Development
MS: ML12/A51 Ext: 2236

I just talked with a friend of about 16 years and who has supplied DEC a service primarily to the sales organization for the last ten. One of his relatives has just reapplied to work in the sales force here and is now deciding whether to work at DEC or Prime. As a salesperson who sold several 10s he is heavily biassed toward Prime because:

1. He believes life at DEC is too soft and there is no real incentive to make the numbers. He thinks a commission plan feels better.

2. Prime sold themselves and moved fast and is confident. In contrast, it took three weeks for us to return a call, and even longer to make up our mind...even

though the credentials were in order.

3. He viewed the internal structure as political versus results oriented.

4. As a former salesperson, he disagreed with whether they should go after a sale. His management tended to not go after sales unless they were really easy. (Don't go after it if it looks like too much work.)

5. We have this really long (years and years) backlog, and DEC is soft because of it, and there's really no big challenge to bring in the sales. (Ted this must be the supreme sand bag...cause I sure don't know about the backlog. Do you?)

My friend apologized because their relative was awfully hard-driving and probably wouldn't fit in anymore.

As a separate issue, he was asked to bid on a service (through Al's organization) and never heard back. I told him that's the way big companies operate and you don't have to be polite. We were really doing him a favor by asking for bids. The issue was whether an outside company could supply for $8/unit what it costs DEC internal $10.50 to supply and he had bid $8.50 on.
I said we found someone for under $8 (I assume), and we'd be back next year after they went out of business.

Overall, he felt the quality of people and the esprit de corps had declined, but was resigned to it because that's what all big companies are like. He has been impressed with the people overall and believes we should do well because of the people in the management structure. Still has the euphoria that DEC is great, though mature now.

gb

+---------------+ ID#0180

! d i g i t a l ! i n t e r o f f i c e m e m o r a n d u m

+---------------+

Subject: **Our Commitment to NEC; Future Dealings with them as an OEM**

To: Don Frost, Yu Hata, Carl Jansen, Ted Johnson, Julius Marcus

Date: July 28, 1978
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

CC: Ron Smart

We had cordial meetings with NEC regarding our supply of 11/70's for what seems like a joint venture into minis into the NTAA (IRS). As an Operations Committee member I voted to support this. Now, I hear us weaseling out of this and it seems like we can jeopardize the success of the system because they can easily misapply IAS, DBMS and DECnet. We have to keep close enough to know when this is happening and we must inform their management too!

I invited Dr. Ishii, the head of this group, to visit Carl and Julius and Ken in Maynard to confirm the support and reaffirm/clarify the commitment we have. We also have to discuss any concerns vis a vis their plan to take our technology (DECnet, IAS, the 11/70). I suspect their only interest is in DECnet...and that should be copyable from the published documents.

I also suggested they simply buy 11's (for their mini) and backward integrate using the 11 by making memory, attaching their peripherals, etc. This gets them a full mini line quickly without the expense of manufacture. Currently they build Level 6, and this seems like a waste of resources when they could buy cpu's from us. It's possible this could be another Plessey, but I doubt it. Instead, we get a supplier of 11s in end use.

As an aside, I suggested we tell MITI to adopt the 11 as a standard, just as they have with the 320 for minis. This is clearly intriguing.

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST: Don Frost PK3-2/S50 Yu Hata TK
Carl Janzen AK Ted Johnson PK3-2/A55
Julius Marcus MK1-2/C37 Ron Smart AK

28 February 1982

Dr. Peter Friedland
Dept of Computer Science
Stanford University
Stanford Ca. 94305

Dear Dr. Friedland,

Sorry we've had so much trouble communicating. Here's some information that will be called to you. Some people/places:

Companies:
Appollo, Bill Poduska;
Three Rivers, Brian Rosen or Ed Fredkin;
Ungermann- Bass, Charlie Bass;
Xerox Dave Liddle, Burt Sutherland, Adele Goldberg, Bob Spinrad, Butler Lampson (really interesting);
IBM, Lewis Branscomb, B O Evans, Herb Shorr;
Intel- Noyce or Gordon Moore (maybe preferable) on semiconductors, also Ted Hoff (one of micros people who is now working on speech;
Dupont, very good use of graphics and computation for chemical synthesis, Dave Pensak;

DEC:
Bell, Sam Fuller on LAN's and perceived impact;
George Champine, Graphics and large personal computers in science Avram Miller, low cost personal computers;
Jack Gilmore or Bob Travis, Office Automation (word

processing, typesetting, electronic mail);
? or me, LAN's to distribute processing to control and accumulate data -- here we have a breadboard system that I might talk about or it could be a seperate session (I can get a good speaker); Maurice Wilkes, a computer pioneer is with DEC now and responsible for building the Cambridge ring system;

Univerities:
NY Institute of Technology has by far the most impressive graphics, their head of CS Dept. (who I can't remember) might be a great keynoter or graphics Dave Denniston can find out;
U of Rochester on LAN's good on theory, Jerry Feldman;
Stanford has an impressive lan plan and some good work;
MIT has the largest operational network;
CMU is building the Spice network in CS, and Al Newell can point to the right person or give the talk

Government labs:
I've been impressed with the work at Los Alamos and Livermore vis a vis their extensive local networking, graphics, and functional computing. These are probably the lead institutions. George Michaels at Livermore and Dale Sparks, head of LASL would probably do a good job. Alternatively they can point to someone.

One of our persons in marketing, Dave Denniston, 617-467-6960, has agreed to be available with ideas to talk with you. Here, he's suggested people at Dupont (Dave Pensak, above), CMU Brookhaven, Chemical abstracts for data base, Yale, and Washington U for lab automation. I recommend working through him to get ideas for some of the more advanced systems.

I believe Meade has the best overview about VLSI and its impact. He is also stimulating and imaginative. Could be a keynoter.

I'd be happy to give an overview talk on LANs as the pivotal emerging computer structure of the 80's. This would be as a computer architect, computer scientist interested in computer structures and computer historian (I'm the curator of the Digital Computer Museum).

I'll be back in town on Monday 8 March.

Sincerely,

Gordon Bell
Vice President of Engineering

CC: Ed Feigenbaum

GB3.S2.64

+---------------+
! d i g i t a l ! i n t e r o f f i c e m e m o r a n d u m
+---------------+

Subject: **Communications and Networks Product Line Reorganization and/or Field Focus**

To: Operations Committee, OOD,
Bruno Durr, John Holman,
George Plowman

Date: 2 MAY 78
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

Summary

We have the basic communications and network products, but there has to be a way to get them to the customers, and currently there is a very noisy, high impedance, low bandwidth path. Our future of Distributed Processing depends on the expertise we have to help design (in the field), install and support these products. Let's really clean this one up now as it represents a true product and set of people resources that we need and can capitalize on!

In our deliberations about P/L reorganization, as I visit the field, and as I listen to our own internal development group, I would like to plead that we must have a field-oriented organizational entity that worries about the development, marketing, manufacture and support of communications and network products.

I can restructure the development to focus the hardware, software, and terminal support aspects even though there are many interfaces within engineering, but I am concerned about our lack of field focus. For example, building a simple network requires a highly intelligent customer to be highly dedicated and take a high risk! There's no one there to help him very much. We have people internally, who if organized could provide a unique sales opportunity.

History

In the past we have vacillated about whether there is any such thing as a communications market because so much of our equipment has communications options on it. Now with networks, nearly all products connect to existing computers or to systems through communications equipment. The old DDP product line started out this way, but got attached to selling some equipment to bankers for funds exchange and suddenly they thought they were in the financial marketplace, knowing essentially nothing about banking except that they used computers to transfer information. At this point they stopped selling products that were strictly communications and we have lost much of the field expertise to understand and sell communications.

What a Communications Market Looks Like

Technically, a communications product is only concerned with the transmission and switching of information, and possibly only a minimum amount of information storage of information. That is, products do not look at what they transmit except to route it in rudimentary ways.

The Customers

There are many OEMs who buy equipment for this purpose, including our largest, TELCO, who is devoted mainly to this use. Others include Rockwell who builds message switching, time division multiplex voice switching, and call unit trunk switching. Others make central office and PBX equipment. The unique aspects of this market are RAM parameters (reliability, availability maintainability) plus expandability because all systems are built to cover a wide range of applications, and occasionally there are some interfaces to terminate digital or analog communications lines, although most of the OEMs do this themselves.

This market also includes the OEMs who will sell either software or services for electronic mail (e.g., Computer Corporation of America). There are also OEMs such as Telenet that might buy our machines to provide a communications message switching service or function.

Finally there are all of our end users who must solve complex communications problems (e.g., terminals multiplexing) or who are now building DECnet systems to interconnect their computers. With a really great DECnet, this market is now ripe! We somehow have to have the people in place who can most often add the necessary interfaces, install the software and add the message switching hardware to allow our computers to communicate with one another in the way they should. In some cases, we don't have equipment -- and this has to be factored in!

Alternative Organizations

0. Make it part of TELCO.

1. A separate product line could be put in place which would couple with engineering to really focus products (and the interface with other P/Ls would have to be carefully spelled out to stay away from hassles...I think it could be).

2. We could put the strength

into software support. They have this now for DECnet, but there are lots of hardware issues too, and I don't see this happening very well. Also, I believe there are so many sales/field organizational and inefficiency problems that work probably has to be taken out of these organizations, rather than increasing their size.

3. CSS is already in the field and could get a group that helps design and install these systems.

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Jim Bell	ML3-2/E41	Al Bertocchi	PK3-2/A56
Dick Clayton	ML12-2/E71	Jim Cudmore	ML1-4/E30
Sheldon Davis	PK3-1/C16	Bill Demmer	TW/D19
Ulf Fagerquist	MR1-2/E78	Win Hindle	ML5-2/A53
Ted Johnson	PK3-2/A55	John Kevill	ML1-3/E58
Andy Knowles	MR2-2/A52	Julius Marcus	MK2/C37
John Meyer	ML12-1/A11	Ken Olsen	ML12-1/A50
Stan Olsen	MK	Larry Portner	ML12-3/A62
Bob Puffer	ML12-2/E38	Jack Smith	ML1-4/F31
Bill Thompson	ML12-1/F41		
Bruno Durr	PK3-2/S56	John Holman	PK3-1/P84
George Plowman	ML5-5/E97		

ID#342

| d | i | g | i | t | a | l | i n t e r o f f i c e m e m o r a n d u m

Subject: **Common BLISS**

To: Bill Johnson, ML21-3/E87

Date: 13 NOV 78
From: Gordon Bell
Dept: OOD

Loc: ML12-1/A51 Ext: 223-2236

follow up 11/27/78

I think it's essential to use common BLISS for our systems programming now and eliminate BLISS 36 ASAP! This especially includes new CAD work (e.g., SAGE and VOTE) where we want to use these applications on all machines.

Any problems?

GB:ljp

CC: Bert Bruce, ML1-1/E24
Ulf Fagerquist, MR1-2/E78
Ed Fauvre, MK1-2/E06
Marv Horovitz, ML21-4/E10
Bill Keating, ML12-3/A62
Bob Kusik, ML21-4
George Plowman, ML5-5/E97
Larry Portner, ML12-3/A62
Dick Snyder, MR1-2/E37

D I G I T A L INTEROFFICE MEMORANDUM

DIST:	Bert Bruce	ML1-1/E24	Ulf Fagerquist	MR1-2/E78
	Ed Fauvre	MK1-2/E06	Marv Horovitz	ML21-4/E10
	Bill Johnson	ML21-3/E87	Bill Keating	ML12-3/A62
	Bob Kusik	ML21-4	George Plowman	ML5-5/E97
	Larry Portner	ML12-3/A62	Dick Snyder	MR1-2/E37

<u>COMMUNICATIONS COSTS</u>

VAGUE, ALTHOUGH FORECASTS INDICATE COSTS HALVING BY 1985.

(THE NUMBER OF LINES IS NOT INCREASING AS RAPIDLY AS TOTAL OPERATING

COMPANY REVENUES. THEREFORE, THE COST/LINE IS INCREASING!)

<u>MODEM COSTS</u>

1973 - 9.6 KB MODEM COST $9.6K

12%/YEAR REDUCTION

1979 - 9.6 KB MODEM COST $4.5K

YEAR	DATA-RATE (KBIT)	COST/MBIT
1960	2.4	$1.00
1963	40.3	.42
1964	50	.33
1976	56 (DDS)	.11

13%/YEAR REDUCTION

00 BURT DECGRAM ACCEPTED S 005883 O 590 14-JUN-83 17:15:21

```
.___.___.___.___.___.___.___.
!   !   !   !   !   !   !   !
! d ! i ! g ! i ! t ! a ! l !         I n t e r o f f i c e  M e m o
!___!___!___!___!___!___!___!
```

TO: BOB HUETTNER

DATE: TUE 14 JUN 1983 4:24 PM DST

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

cc: see "CC" DISTRIBUTION

MESSAGE ID: 5202930672

SUBJECT: RE: NEW COMMUNICATIONS PRODUCTS

GB6.5

I'd be happy to discuss the products--will you set up. I'll send some memos of about 3 years ago when I was trying to figure

out what a VT-phone should be. As I recall, it needs a plugable rom--to add functions,
battery backup, ability to be a speakerphone. The functions it
needs to carry out to unclutter the desk are: VT (1 or more virtual ones), phone, clock, alarm clock (with lots of stops/ messages, phone directory and calculator.

In addition a user should be able to instantly switch contexts.

Haven't thought about the switches for awhile, but wouldn't mind.

"CC" DISTRIBUTION:

FU 6/24	BILL AVERY	JIM CUDMORE
KEN OLSEN		

GB3.S1.4

Just read the Distributed System plan for the 80's and don't believe we have competitive communication options when one considers the cost per line and the processing overhead associated with communication handlers. For example, combo cost/line = $150 in .1hex, and PLUTOS = $300 in .5 hex/line. Furthermore, we have no understanding of whether PLUTO will increase or decrease communication overhead in VMS. Also, we are really spending a disproportionately large amount for dist.sys., getting further behind, and losing people. Do we have adequate understanding about our position?

Note that many COMM options including the CT (regular COMM and TMS), VAX combo, modems are either done or funded outside the Distributed System group. What is the interia and push for good COMM?

Reading has to take a short term view of providing gateways within VMS, since we can't build our longer term gateways because we have no low cost 11's. Also CSS builds cost effective options for lots of applications. Since the schedule on this software is also so far out, it would seem like CSS, UK Reading, MK or TW hardware groups could get us suitable hardware for making cost effective gateways. Why not move aggressively to get good low cost QBus options so that we can build gateways? Note that there are a substantial number of chips that provide for levels 1 and 2 in hardware. With the new 64K chips, one gets an 11/23 processor and 128 Kbytes on a dual! Thus with two duals, we could build most gateways as standalone products. Furthermore, they could even be mounted in a VT100 as the box, console, and power supply. Bernie, I think you have to get with Bill and Mike (and then CSS) and address our whole Distributed Systems needs and then parcel out clean charters so we can start winning.

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION   DATE: MON 29 SEP 1980 10:05 AM EDT

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION   DEPT: OOD

EXT: 223-2236

LOC/MAIL STOP: ML12-1/A51

SUBJECT: EXECUTING THE COMM., NETWORKS & INTERCONNECT STRATEGY

BACKGROUND

It's clear we have to change our plans for communications, networks and interconnects, as several of us (VMS, Comm./Nets,
Small Systems, and Interconnect) discussed.

The combinatorials are getting us and are going to get worse:

8 operating systems (vms, 10, 20, m, m+, rsts, rt, ssc) x

4 types of hardware (programmed or dma) on Q and U busses x

2-4 line types (asynchronous, synchronous) x

(DEC + IBM + 7 x X.25 + ?) Protocols where
 DEC= versions of DECnet + various terminal protocols + NI
 IBM= terminal + bisync + impending versions of SNA
 7 X.25 dialects, all of which will evolve
 ? = other vendor interfaces

If there were only 1 protocol, this would get us only 64 different versions or variants of software! However, protocols are emerging as we sit here.

To make matters worse, we have declared to the world that we are going to build Ethernet networks for local interconnect, yet we have no really significant product plans. Too little, too late.

PROPOSAL

Stop all hardware options for Unibus, and build options that can be used on Qbus systems and as a Qbus Concentrator/Gateway, QCG's

Don't do Mercury on CI, as it is not part of the eventual plan to distribute communications on the NI. Build Mercury ASAP as the higher end, reliable QCG. In some way get a QCG now, using a 23.

Accelerate NI interconnects to all machines > 44's, such that QCG's will be used for all comm., terminal, and gateway support for all systems. Introduce no new support on these systems.

Begin to cost reduce the QCG's when the software requirements are adequately known to address the systems on the 44 and

smaller.
... in short, INTRODUCE, THEN COST REDUCE! .....

On very small systems, support only a limited set of direct terminals, and protocols and rely on the NI as the world gateway.

ACTION

I want to get a task force together now, to explore this rough plan...or another one that is in line with the strategy we put forth 2 years ago. We are doing so many interim products that we never get to execute the basic strategy.

Bill should get us together to see how we might proceed.

What you think?

GB1.S6.40

"TO" DISTRIBUTION:

JOE CARCHIDI	BILL DEMMER	BILL HEFFNER
STAN PEARSON	GEORGE PLOWMAN	DAVE RODGERS
HERB SHANZER		

"CC" DISTRIBUTION:

DICK CLAYTON	DAVE CUTLER	DICK HUSTVEDT
ULF FAGERQUIST	SAM FULLER	FRANK HASSETT
BILL JOHNSON	BILL KEATING	BERNIE LACROUTE
TOMAS LOFGREN	SI LYLE	JIM MARSHALL

BILL MCBRIDE LARRY PORTNER WAYNE
ROSING
BILL STRECKER

COMPARATIVE MUSEUM STATISTICS

	Budget(1)	Attendance	Employees(2)		Space - sq.ft.	
	000	000	Prof	Total	Exhibit	Total
Museum of Science, Boston (est 1830)	3,067	285		135	117	292
Corning Glass Museum (est 1951)	2,335 (3)	600	41		40	x
Natl Mus Science & Technology, Ottawa (est 1966)	2,358	653		136	120	234
Lawrence Hall of Science, Berkeley (est 1968)	3,000	285		104	30	117
MIT Museum (est 1980)	210 (3)	4	8		6	17
Digital Computer Museum FY 81	130 (3)	4	2		2	4
FY 82	250 (3)	10	4		5	8

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(1) Operating figures, exclusive of acquisition funds or capital funds.
(2) Exclusive of student interns, part time employees

and volunteers.
(3) Exclusive of a number of overhead expenses given "in kind", including rent and maintenance.

Digital Computer Museum

	funding			Attendance	Employees(2)		Space - sq.ft.	
	Capital	Other	DEC	000	Prof	Total	Exhibit	Total
FY 81			130	4	2		2	4
FY 82		5	250 (4)	10	4		5	8
FY 83	100	20	325	20	6		6	12
FY 84	500	30	400	30	8		8	14
FY 85	3,000	40	400	30	12		8	14
FY 86	5,000	40	400	30	12		8	14
Dedicated Museum Building	1,000	150	1,000	100	20	50	50	120

<>slide of product segmented/level of integration stratified
This generation is based on a large set of product segmented industries that are organized by levels of integration strata. Entrepreneurial energy fuels the individual companies of the product industries.

<>Venture_Entrepreneur_Cycle
Using the basic instincts of fear and greed, entreprenurial energy and venture capital greed and fear drive the company formations... these supply the critical needs that free resources in what now appears to be a never ending cycle like

a perpetual motion machine. The release of this energy and capital can only come about if the basic technology supports new products. This generation has been on a long, steady role since the development of the microprocessor and may continue for awhile as long as technology progresses.

<>Slide of 4G
This generation, which is called the fourth, independent of whether we call the next one the fifth, sixth or simply the next one is based on standards. Note it is an evolutionary one based on evolutionary semiconductors especially the microprocessor and large semiconductor memories, magnetics and communication technology. Use is evolutionary too, providing much more access to interactive computing by using Personal Computers instead of shared systems. This wide use creates a a massive interconnection problem which the generation must solve. This in turn demands the use of all kinds of Local Area Networks and the necessity of standards. Like other generations, we won't understand the real nature of generations as measured by useage until 10-20 years from now.

Previous products provide the critical goals for what are mostly evolutionary products at lower cost and much higher demand. Demand for minicomputers doubled each time the cost was reduced by 20%. Occasionally, revolutionary products emerge based on new technology, but these are surprisingly rare. Though semiconductor technology evolves rapidly, measured by speed and density, it is evolutionary.

<>2 slides of structures made possible by the micro (AEA/Rodgers)
Unlike the previous generations where the processing element and memories constituted a large fraction of the size and cost, with the microprocessor, these parts are a comparatively small part of a system. Thus, many more structures are possible.

Previous generation products are the goals. For example, most business plans start with the goal of building a better VAX at a lower price using one of the three microprocessors or they combine micros to build a higher performance or higher availability machine at the same price. The final section of the plan lists a VAX 750 as capital equipment. This is the ultimate form of capitalism. I feel like the capitalist who sold the rope to hang himself. As a startup now, my PC at Encore Computer is a VAX 730 and most of the Encore companies have 750's.

To beat the VAX is an important goal, but constraints are also important because they help focus. Standards are the constraints for finding the target or at least defining the class of games or race courses we run. Defacto and industry standards allow the statification by permitting incredible parallelism in the development of products. In this way one can build new systems quickly by assembling lower level standard components quickly.

I intend to explore, in a somewhat rambling fashion, the nature of standards, and ask that the next COMPCON be completely devoted to standards because they form the constraints necessary for both evolutionary and revolutionary technology, processes and products. The conference would ask

- what kinds of standard and what are needed for the future -- without constrating creativity
- what are the goals and constraints for various standards
- what are the responsiblities and behaviors of various organizations, manufacturers, professional organizations, governments, academe
- how do standards form, ie timing
- when do you leave things alone, when do you evolve, and when do you throw out and start a new path

My obsession about standards lies in a belief that the lack of standards at various levels of integration has been both costly, is simply non-productive and impedes technological progress more than any other factor. At least 50% of our efforts seem to go into supporting redundant work. One of the questions such a conference might examine is the economics of supporting multiple standards.

We can observe the effect of having a good standard in the case of the IBM PC. It came at a propitious time-- concurrent with a processor capable of accessing a megabyte of memory, the 64K chip, widescale availability of 5" floppies, and just prior to the availability of 5" winchesters. The great progress or rather explosion in software came about because people could work on applications instead of reinventing and porting operating systems for various hardware idiosyncratic PCs.

A guiding principle should be:
either make the standard or follow the standard!

On the other hand, a caveat about following de facto standards:
be prepared to react quickly and follow!

Those who follow the IBM standards might observe that IBM does change as in the 360/370 transition... ask the Amdahl corporation about this. We will soon see a repeat of this as the next IBM PC obsoletes a current product by providing a fully upward compatible product, but offering more capability. One can fairly accurately guess about the characteristics by looking at the 286 architecture.

Setting de facto standards such as the Unibus are important, because they are first and establish the way for succeeding product generations. To form an officially approved standard in 1970 for interconnecting computer components to form minicomputers just wouldn't have had any takers. Today, everyone recognizes the importance of the bus in building computer systems. Every company, consortia and many academics try to get one more standard bus or feature to ride the bus specification. Having too many alternatives such as the set forming 802 simply delays work on building networks and distributed computing systems.

<>Guidelines for standards
Given the desirability of standards, let's look at some heuristics governing them.

The first rule is to have someone (person, persons, a company, several companies) responsible for defining, implementing and caring for the standard. This is called responsiblity. Preferably the standard has to work in order for the individuals to be successful. Let me cite Ethernet as an example of this. All of the companies needed it: Xerox and DEC as the backbone of their produt strategies, Intel to sell chips. Rarely will we see such an important interconect need as the LAN. How it is implemented is moot-- the modulation and topology whether busses, rings, trees, or centralized switching is quite irrelevant except that it completely consumes us and hence we can't work on building the systems.

An equally important part of making a standard based on existence proofs is the ability to test conformance. This is another responsibility of the sponsor.

A standard must be real. The best way to insure reality is that it has been implemented before designing it with a committee who are sure to make it unimplementable. Unfortunately, when engineers get hold of a particular implementation, the temptation is to look at the implementation as a template, throw out the old, and extend it... not just use it in an upward compatible fashion.

Again, Ethernet is a good example. It took almost ten years to get a standard called 802.3 after the original Ethernet operated. The upgrade provided almost a factor of 4 performance improvement, but the delay in starting the understanding as to what is really wanted in Local Area Network was quite long. We should have simply used the old one to get more real experience. Here, a guiding heuristic:

> if you haven't lived with a new computing structure, use an
> arbitrary structure in order to get the experience before trying
> to design the ultimate system or standard-- the standard is much
> less important than its existance (will return

to this on UNIX)

While we're on the notion of reality, it is occasionally useful to have models by which new standards may fit such as the 7 layer open systems interconnect model. Here, again we might invoke the rule that implementation is a necessity. Had this happened, there might only have been 4, 5 or 6 layers.... or even 8. Unfortunately, every real implementation that says it uses the 7 levels uses the levels like one uses a metric ruler to draw on 1/4" squared quadrille graph paper. The lines on the graph paper serve only as reference lines for the infinity of figures that one can draw using the ruler. About every 2.5 inches the two scales line up pretty well.

This brings up the notion of the necessity for having a sparse set of standards for two reasons: First having too many standards is like having NO standards at all. The current plethora of LAN standards, including various digital PBXen, which I also call a LAN, is a good example of too many, with no basis of experimentaion. Second, a standard is hard to specify it every detail: I consider the Unibus to be a good standard. It specified a way of interconnecting a whole set of different kinds of parts, not just a pair; furthermore it showed the way for this generation of buses and the future generation of micros. Yet, it took about 8 years after the bus was in operation to have a really complete Unibus specification... even though hundreds of engineers had designed hardware to attach to Unibuses. In this regard, the standard should be understandable in various levels of precision.

A finally role of the responsible organization is evolution. With expoential change in virtually every dimension of computing, changes are necessary. Ideally, the domain of a standard is specified a priori so that one knows when it should be extended. Many standards, such as Fortran, live longer than the sponsor thought or intended them to. As a result, ad hoc extensions occur because everyone makes extensions and no one is responsible. It was felt that Fortran, now about 25 years old was dead, so why evolve it or work on compilers for it? It turns out that many use it and it does pay to really work on it, but that's the final line in this talk.

Finally, standards should be timeless, and failing the test of time should simply remain static and hopefully then disappear. But they rarely can or do.

<>Levels of integration in this generation
Let's get specific by looking at critical standards associated with various strata and product segments. About eight levels of integration form the strata, half of which are hardware. A given level has many product segments, with a given organization ususally excelling in only a few groups. That is an organization has culture and cost structure that constrains its behaviour. Contrast this with the complete vertical integration in the first generation where a computer company designed and manufactured circuits, peripherals, systems, operating systems, languages and applications. Standards provide clear constraints for building products within a given strata and segment such as the Spread Sheet Industry. For example, it is enlightening that data format standards have evolved for these various packages built by different software companies.

SILICON WAFER LEVEL
Rarely do we think of the Silicon Wafer as a level of integration. It is certainly not a well publicized or documented level since processes have been tradtionally been the jewels of a semiconductor company. It is realitively safe to predict that in our fairly near future, perhaps even the real next generation, many of the systems will be a single chip with up to 1 or 10 million thousand transistors. Of course many or even most chips will continue to be "standard" or combinations of "standards" such as microcomputers, peripherals and memories all integrated on a chip or even a large chip.

The creative products will come from the use of silicon using the so called silicon foundry industry that Carver Mead advocates. A good example is a product like the Silicon Graphics IRIS, which uses a ___________dozen? 40,000 transistor chips which Jim Clark calls the Geometry Engine and computes at the rate of ________ Megaflops, which is roughly equivalent to the power of a _______________ computer. One can invision hundreds of these sorts of systems which operate on all kinks of pictures, voice, and mechanisms.

We are nowhere near being able to realize such a scenario with today's state of the silicon foundry, mainly due to lack of standards in foundries and CAD systems. Standards are needed for the various approaches whether gate arrays, standard cell or fully custom chips are used. Let me list a few interfaces:

high level system descriptions
specifications of structure and behaviour, including
simulation at all levels
physical information for processing wafer masks (such as CIF)
control for foundry processes, especially if processing steps
become optional
chip test, including automatic generation of test data
chip assembly including bonding and multi-chip bonding

We must target the development of standard interfaces to languages and datbases that are communicable via networks. Agreeing on these interfaces doesn't limit the competitiveness or creativity of a given company or product, it simply means that users don't have to spend all their resources in converting among different formats or worry about being locked into a corner. Standards would let users mix and match different CAD systems in a completely flexible fashion. This would still let every vendor build their own editors, timing verifiers, simultators, design rule checkers, etc. but a user could interchange data among the various systems. The market would expand much more rapidly because users could buy without fear of being trapped into a particular system or format. This is completely analogous to the pre-Cobol / pre-Fortran where every manufacturer was pushing different languages. Everyone got sick of the situation and rebelled by designing COBOL.

When going to the foundry and testing folks, the user is faced with an equally fuzzy and perplexing situation regarding the characterization of a process including testing.

To clarify: this is a message to the foundries, CAD companies and failing that to the users to specify what they should be demanding.

STANDARD CHIP: MICROS, MICRO-PERIPHERALS, MEMORIES
The first rule of standards, having a responsible organization is critical and not well understood by all semicomputer manufacturers. Since the Instruction Set Architecture is the bottom level of integration that includes substantially more hardware in the form of busses, boards and systems and goes on to include operating systems and languages, the responsiblity of the semicomputer manufacturer is quite large! I'd like them to acknowledge this responsibility.

The microprocessor is at the root of most of our redundant efforts. A micro's life seems so incredibly predictable, following a time worn path with respect to its ability to accesses memory. A recent article in Computer Architecture News suggested that there are about 20 measures of word length. Only one counts-- the amount of directly addressable memory. Of course there are a few embellishments like data-types when considering performance. In 1976, having lived through a moderate amount of hell in terms of trying to extend the 11 and well along on VAX, it was safe to warn future designers of microprocessors. I certainly did in two papers. They didn't listen.

Unlike semiconductor process evolution, all users are dragged along as one evolves a simple stack idea that started out in a Datapoint terminal, went on to become the 8008, the 8080, the Z80 (by another company), the 8086, 186, 286 and more. As someone who has sponsored using many of these parts, I have been able to relive computer evolution for a third time... and frankly, this is boring as hell!
In the late 50's the folks at the University of Manchester, using Mercury, Ferranti's version of their second machine, developed a system that allowed users to

treat both primary and secondary memory as one. By 1962, the University had a breadboard for Atlas operating with a 27 bit virtual address. Atlas also had a number of other ideas that people continually rediscover, for example, in the last issue of CAN someone reinvented Atlas' Extracodes. Let's call Atlas the 0th time through because it was a university machine and there were only a dozen papers written on it, the critical one was repubished in 1971 in Bell and Newell but it was in the UK, and Ferranti only sold a few.

Having erred in a similar fashion on DEC's early minicomputers by designing two computers which had only 12 bit addresses that immediately had to be extended to 16 bits, I architected the PDP-6, the forerunner of DECsystem 10, with a 20 bit address in 1964. This was concurrent with the 360, which though having a larger physical address, only really implemented a small address... that's why the two versions of the 370 came into existence 10 years later with 24 and eventually 32 bits of address. The DECsystem 10/20 and the 370 eventually ended up with 32 bits of address, complete with paging, just like ATLAS, but about 15 years later. The mainframe was the first time through.

As the PDP-11 came out in 1970 with the goal of solving the minicomputer addressing problem by having a 16 bit address, the first customer demanded a physical address extension to 18 bits. Eventually, the virtual address got to 17 and the physical address to 22. For many years DECs engineering spent thousands of hours trying to figure out how to address more memory. Users spent much more time encoding programs in small memories. In 1975, we finally gave up and built the VAX 32 bit architecture with an embedded PDP-11. Other minis followed essentially the same path for the second time around, but most were on the east coast.

The micro was born on the west coast with the 4004 and 8008 concurrent with the extensions to the 11. These had 12 and 14 bits of address, hence why I wrote the paper on the 11 about addressing in 1975. The leverage of doing it right the first time was very high. Subsequently, the 8086 was extended to 20 bits and most recently to 24 bits of physical and 30 bits of virtual address. It is ironic that information on addressing didn't travel from California to Oregon where the 432 was developed, but then again Oregon didn't become a state until 9 years after California.

Motorola's saga is similar. National took the high road and simply copied VAX without violating the patents. Another tragedy. If an exact copy could have been made several billion dollars worth of software could have been made available! And many resources could have been freed for doing something creative or otherwise productive. Finally, with the micro we have everyone going around three times. The saga is not yet ended as we understand the ramifications of greater than 32 bit address spaces.

There is an equally tragic story about an architecture called CFA, for Computer Family Architecture, which is the defense department's version of VAX. This time, they could have used an exact copy of VAX. Won't our enemies just use US standard micros, and get the parts and software at least 5 years earlier?

With shifts in relative speed and sizes of on chip registers, cache memory and control memory, it looks like a return to simple, CRAY type load/store architectures which are implemented without microcode may perform much faster than architectures oriented to processing the data-types of high level languages such as the 360. Since these so called reduced instruction set architectures trade off microprogram control complexity for compiler technology, it would be well to find and use a single one rather than continual evolution.

New architectures, especially those which have gone along well travelled evolution paths, have cost computing at least half of our resources. The glib answer of using C and UNIX to obtain machine inddependence is deceptively simple and errorneous. A compiler for C or a compiler written in C is only a starting point for a product...

not the end. An architecture pervades virtually every part of a system and database.

When an architectue should be copied, evolved or thrown out and started over is fundamental to the notion of standards because of the tremendous user program and database investments. Let's understand it.

BOARD: BUSES FOR VARIOUS PERFORMANCE, APPLICATIONS, ETC.

The board level is similar to the Instruction Set Architecture story, except that busses have longer lives than specific instances along the evolutionary life of an architecture. For example, the various species of the IBM channel buses are now 20 years old and will no doubt continue for another 20 years in their current forms, even though many of the functions that a peripheral might perform could be handled in the same amount of hardware as that required to interface the bus. The Unibus is almost 15 years old.

The IEEE is in the business of blessing these buses and I don't understand the politics of this process. One manufacturer already has an adequate unibus-type standard to build multiprocessor and multicomputer structures. Does the IEEE support a bus indpendent of whether there are any riders? How many more do we need or can we afford?

LANs and LANCs ANOTHER KIND OF SWITCH

<>Ethernet, the Unibus of the Fifth Generation

While on the issue of busses, this is a fine place to discuss another important switch, we now call a LAN which is used for interconnecting computers and terminals in a local area. This slide is one I used exactly three years ago. Several of us from Intel, Xerox and Digital including Bob Noyce, Dave Liddle and myself presented the case for Ethernet as a standard and to show that we were committed to use it. It was useful because I wanted to convince all of the engineers working on the project of its importance. I attempted to show the need for the bus for building new, distributed computer structures or clusters of computer. Let's call these structures LANCs.

<>Unibus,
Note that this computer structure and the LAN/LANC are nearly identical except they are seperated by 15 years. The unibus is used to build a single computer from constituent information processing components such as processors, memory, communications equipment and terminals. It was designed to travel about 15 meters. Ethernet, or rather IEEE 802.3 allows a user to build LANs and LANCs. It was designed to travel several kilometers.

Digital needed a LAN to interconnect computers into a network and to be able to interconnect terminals to computers in an open ended fashion. I was receptive to using Ethernet as the wheelbase when Bob Metcalfe, its inventor, proposed the standard and consortia to built it. At the time, two experimental LANs were operating within DEC. While Ethernet was proposed as simply a network interconnect the main motivation was a bus for the evolution of two types of clusters: first, a single shared mini or large computer would gradually be decomposed into functional server components; and the proliferation of PCs would require intercommunication into a cluster formed by aggragation.

The key reason for the standard was to allow us to get on with building LANCs, which only a few organizations understand experientially. To reitierate, to propose a standard, one should have lived with it for awhile and really understand it.

In retrospect, getting anyone outside of the three organizations involved may have been a mistake... had we simply built the bus, and offered it as a LAN standard, the process would have been done quickly. Furthermore, instead of engaging in debate about something we knew little about experientially, we could have simply designed and implemented it 2 years earlier. What appeared to happen was that no one knew they needed a LAN, but when they found out one was being proposed as a standard, then everyone had a design to try.

The IEEE tried to help with inventing 802 and now have .3, .4, .5 and .8.   .9 is needed for PABXen and we'll soon need a second digit to add to the new proposals--still LANs and LANCs don't exist to any degree.

802.3 was allocated for the CSMA/CD type, or Ethernet. Since others would like lower cost LANs of this flavor, then several folks took the basic idea and built fully incompatible versions. Alternatively, the same energy applied to cost reducing Ethernet would have made everyone win.

Of course, one would like to have some sort of LAN on broadband, using a token bus technique, so 802.4 was assigned with only 3 incompatible versions.

Another early kind of switch, the ring came out of early work at Bell Labs, Cambridge and other places. Prime built such a ring, and when these folks formed Apollo, took this basic religion with them when they moved 15 miles north. Because rings usually require some form of central controller, IBM grabbed the ring, hence 802.5.

Since one can obviously use fiber optics for building LANs we require a fiber standard, 802.8.

802.3 can be transmitted on standard orange or yellow Ethernet cable; for others who like a simpler installation and will give up distance, RGU 58 can be used if you call it cheapernet Bob Metcalfe calls it thin Ethernet; Codenol has a fiber optic system using the same scheme; for those who like broadband there is a modem. The purpose of all these media is to be able to get users to build LANs and not to wait for what is really quite an arbitrary choice of media, and one which only delays the critical use. Surely someone could take the controller / transceiver interconnect and build a transceiver to operate on a ring structure. I hope this could also be used to adapt to high speed digital PABXen as they become available.

While we're on switching, the forthcoming high speed PABXen will permit the same function as the LAN, and hence should come under the 802 perview. It is imperative to have conformance at the higher levels. Can I suggest 802.9?

These alternatives for standards to switch information at a modern, computer data rate versus a scheme that evolved from the Morse code allows everyone to avoid working on the essential problem of building networks and evolving into clusters. Again, the multiplicity of standards delays the introduction of structures at least five years!

The glib answer to multiple or no standards is gateways. However building gateways is often about as easy as having a single train that can travel on different gauge tracks. It's fine when you reach steady state, it's the transition among track sizes that kills you.

ELECTROMECHANICAL ASSEMBLY: DISKS, I/O, POWER, ENCLOSURES
The evolution of small disks and tapes has been very impressive. I remember meeting Al Shughart at the start of Seagate when his greatest concern was making sure of a competitive second source with the same interface and form factor, which in effect creates a complete industry. This is the same formula that he used in creating the floppy form factors, standards and industries. The standardization process might be understood by these examples.

We also see the effect of edicted, blind standards when looking at the issue of keyboard thickness. The IBM PC's keyboard is designed to pass a particular national standard, but has little legs that are raised that make it comfortable to use. I've never seen one in use without the legs.

OPERATING SYSTEM: COMMUNICATIONS (eg. WAN, LAN), DATABASE, SCREEN
In 1966, a user could have a 300 baud Teletype using a phone line. By 1980 the speed of the common dial-up line

had been raised to 1200 baud. This amounts to a a performance improvement of less than 10% per year, and I believe the connect cost rose. This is not the kind of improvement we're used to in computing.

During this period, through computer controlled switching, telephones have gained improved functionality. All of the telephones systems are incompatible with one another at the user level beyond the plain old telephone. All have a relatively large manual and training to get back to the capabilities we had with multiple button phones. The new phones are not user friendly nor do they pass the ease of use test nor are they particularly helpful about adding or deleting the appropriate one except to say that what you've just dialed in is wrong. If a system is knowledgeable enough to always give you the same error message, then it should simply always fix the error.

We have turned a large part of our future systems development over to AT&T for one of the key interfaces by adopting UNIX. In fact, it is the kernel of the system, just above the hardware. When the Justice Department was playing God, why wasn't UNIXCO separated? Maybe it's the only money making part, especially at the price AT&T charges for royalties. Given the simplicity of UNIX, it would seem completely appropriate to install a venture capital offices around the various Bell Labs in order to extricate and form an independent, responsive company to evolve UNIX. Are all you San Francisco based venture folks listening?

The UNIX phenomenon illustrates some principles of standardization and I'm sure we can learn from it. Like all operating systems, the only people who really love UNIX are its parents and those who only grew up with it. This is a large set. It also illustrates a recurring theme of standards:

in order to make forward progress, one has to regress for awhile

UNIX evolved along these lines:

. UNIX came from a reaction by Thompson and Ritchie to MULTICS, the large, joint MIT Bell Labs project of the late 60's. It was written for a DEC mini and evolved to the PDP-11 in the early 70's.

. DEC didn't give away operating systems to universities-- especially the source code; UNIX was essentially free.

. UNIX is by most measures a very simple operating system, to do anything useful requires other programs such as database access, special communications, programming, etc. Students and faculty could understand all facets of its internals and use. It was written in a high level assembly language, C, and as such could be modified. It was an excellent pedagogical tool. Universities embraced it and trained many students with it. A built-in market.

. UNIX evolved to be used on other computers by being transportable. A team of people could carry it to another computer system, provided a C language compiler was available. This was something that early high level languages were supposed to do, but never quite succeeded with due to extensions for calling the operating system. In turn, this created the notion that it might someday be possible to have a complete system that was machine and manufacturer independent. Users like this idea.

. Chip makers and system builders who had no means of building software were able to get a system relatively cheaply. Thus, we have more support and the beginning of a standard. The semiconductor industry knows about standards.

. Much work is required to have a system that supports 80's computing concepts. This is why I worry about the control in a bureaucracy. The extensions include:

.virtual memory. This function was worked out about 5 years ago and has been in operation for at least 4 years in the verion of UNIX for VAX called 4.1! Recall the notion of virtual memory was only invented 20 years ago.

. special functions for real time and transaction

processing. UNIX is being extended and adapted in incompatible ways by diverse organizations.
.human interfaces that are competitive with the PC. UNIX grew up in a timesharing world using dumb terminals. Windowing and fast interaction are critical.
.multiprocessing. With the micro, many companies started up to extend UNIX for multiprocessing.
. networks. Given the origin of UNIX in a communications, we should demand modern communications capabilities.
.fully distributed processing across a LAN to form LANCs. The Universisty of Newcastle, Berkeley and several companies have all implemented incompatible systems for fully distributed processing. Berkely 4.2, which is being distributed is a good starting point.

UNIXco must take the responsibility commensurate with their selling of UNIX as a standard operating system. The notion of a standard is good. But it must be evolved more rapidly than any single manufacturer. It can provided there is parallelism in the development using multiple organizations. If UNIXco is the single company doing and blessing all the extensions, we have simply subsituted multiple competitive companies with a single, behmouth! The system has to be evolved in a reasonable, not ad hoc fashion. I think this is the most serious problem we have in extending computing today.

LANGUAGE: INCLUDING EXTENSIONS TO APPLICATION LANGUAGES
With the very strong concern regarding UNIX, C is a weaker concern. C is at the heart of applications portability. It's time that C be treated like a serious language, complete with standard.

<>picture of ACM september with Japanese and US going toward 5g
All the languages could be enumerated with concerns especially ADA, are important for this next generation. LISP has been proven to be useful for Artificial Intelligence applications. Like the Japanese, I believe

these applications may be the basis of the next generation.

LISP was defined about 25 years ago by John McCarthy while at MIT. I was so enamoured by LISP 20 years ago that I put the critical primitives into the hardware that ultimately became the DECsystem 10... still about the fastest LISP computer. LISP branched and created many dialects. One path went west via BBand N to Xerox, creating INTERLISP. Many dialects evolved from the original MIT LISP: MACLISP, Zetalisp, NIL, SCHEME, TLISP, Portable Standard LISP and now Common LISP the later two are vying for standards status. Virtually everyone who gets inside a LISP compiler or interpreter creates a new language. These languages are incompatible with one another and thus one can't benchmark, or use common techniques to bootstrap extend the language in a compatible fashion. Much work surrounding LISP is to make applications development easier. But given the number of dialects and the number of extensions to make development easier, I wonder if anyone is working on applications. The effeciency for normal development is 0.5 due to redundancy. This is high for AI applications because there is no standard base.

To reiterate, in order to get on with the business of applying AI, we need some way of sharing information across the various different languages called LISP. A serious standards activity is long overdue.

In fact, the Japanese were so confused about LISP that they totally gave up and went to Prolog.

Having extolled standards now for sometime, there's a downside. A standard provides an interface or target by which systems can be compared. Recently, the Livermore Laboratory kernel becnhmark codes expressed in 25 year old Fortran, were run in Japan on the Fujitsu VT100, VT200 and Hitachi 810/820. Using very good vectorizing compilers, all machines ran at a rate of over 2 times a Cray XMP. There is virtue of understanding the old and evolving it.

A PRODUCT SEGMENTED INDUSTRY, ORGANIZED BY LEVELS OF INTEGRATION WHICH FORM STRATA*, FUELED BY ENTREPRENEURIAL ENERGY

SOFTWARE FORMS NEW PRODUCTS AND USES
SYSTEMS ARE DELIVERED IN MANY DIFFERENT WAYS

*STANDARDS DEFINE THE STRATA

GUIDELINES FOR STANDARDS*

BE SPONSORED... NOT JUST A COMMITTEE
BE REAL (IMPLEMENTABLE AND TESTABLE)
BE PRECISE, UNDERSTANDABLE AND APPLICABLE
BE FEW
BE TIMELESS, AND
BE EXTENDABLE IN A RESPONSIVE FASHION

*SPECIFIES THE INTERCONNECTION OF TWO (OR MORE) PARTS

LEVELS OF INTEGRATION: THE STRATA

SILICON WAFER:
STANDARD CHIP: MICROS, MICRO-PERIPHERALS, MEMORIES
BOARD: BUSES FOR PERFORMANCE, APPLICATIONS...
ELECTROMECHANICAL: DISKS, I/O, POWER, ENCLOSURES...

OPERATING SYSTEM: COMMUNICATIONS, DATABASES, I/O...
LANGUAGE: INCLUDING APPLICATION LANGUAGES
GENERIC APPLICATION: WORD PROCESSING...
DISCIPLINE/PROFESSION SPECIFIC APPLICATION:

```
procedure VENTURE_ENTREPRENEUR_CYCLE
        begin
        while greed and not fear do
        write (business_plan);
        get (venture_funds);
        exit {job} ; start (new_company);
        build (product); sell (product);
```

```
        sell (company); {for 100 times sales}
        venture_funds := sale_liquidity;
        end
```

<>slide of product segmented/level of integration stratified
This generation is based on a large set of product segmented industries that are organized by levels of integration strata. Entrepreneurial energy fuels the individual companies of the product industries.

<>Venture_Entrepreneur_Cycle
Using the basic instincts of fear and greed, entreprenurial energy and venture capital greed and fear drive the company formations... these supply the critical needs that free resources in what now appears to be a never ending cycle like a perpetual motion machine. The release of this energy and capital can only come about if the basic technology supports new products. This generation has been on a long, steady role since the development of the microprocessor and may continue for awhile as long as technology progresses.

<>Slide of 4G
This generation, which is called the fourth, independent of whether we call the next one the fifth, sixth or simply the next one is based on standards. Note it is an evolutionary one based on evolutionary semiconductors especially the microprocessor and large semiconductor memories, magnetics and communication technology. Use is evolutionary too, providing much more access to interactive computing by using Personal Computers instead of shared systems. This wide use creates a a massive interconnection problem which the generation must solve. This in turn demands the use of all kinds of Local Area Networks and the necessity of standards. Like other generations, we won't understand the real nature of generations as measured by useage until 10-20 years from now.

Previous products provide the critical goals for what are mostly evolutionary products at lower cost and much higher demand. Demand for minicomputers doubled each time the cost was reduced by 20%. Occasionally, revolutionary products emerge based on new technology, but these are surprisingly rare. Though semiconductor technology evolves rapidly, measured by speed and density, it is evolutionary.

<>2 slides of structures made possible by the micro (AEA/Rodgers)
Unlike the previous generations where the processing element and memories constituted a large fraction of the size and cost, with the microprocessor, these parts are a comparatively small part of a system. Thus, many more structures are possible.

Previous generation products are the goals. For example, most business plans start with the goal of building a better VAX at a lower price using one of the three microprocessors or they combine micros to build a higher performance or higher availability machine at the same price. The final section of the plan lists a VAX 750 as capital equipment. This is the ultimate form of capitalism. I feel like the capitalist who sold the rope to hang himself. As a startup now, my PC at Encore Computer is a VAX 730 and most of the Encore companies have 750's.

To beat the VAX is an important goal, but constraints are also important because they help focus. Standards are the constraints for finding the target or at least defining the class of games or race courses we run. Defacto and industry standards allow the statification by permitting incredible parallelism in the development of products. In this way one can build new systems quickly by assembling lower level standard components quickly.

I intend to explore, in a somewhat rambling fashion, the nature of standards, and ask that the next COMPCON be completely devoted to standards because they form the constraints necessary for both evolutionary and revolutionary technology, processes and products. The conference would ask

- what kinds of standard and what are needed for the future -- without constrating creativity
- what are the goals and constraints for various standards
- what are the responsiblities and behaviors of various

organizations, manufacturers, professional organizations, governments, academe

. how do standards form, ie timing

. when do you leave things alone, when do you evolve, and when do you throw out and start a new path

My obsession about standards lies in a belief that the lack of standards at various levels of integration has been both costly, is simply non-productive and impedes technological progress more than any other factor. At least 50% of our efforts seem to go into supporting redundant work. One of the questions such a conference might examine is the economics of supporting multiple standards.

We can observe the effect of having a good standard in the case of the IBM PC. It came at a propitious time--concurrent with a processor capable of accessing a megabyte of memory, the 64K chip, widescale availability of 5" floppies, and just prior to the availability of 5" winchesters. The great progress or rather explosion in software came about because people could work on applications instead of reinventing and porting operating systems for various hardware idiosyncratic PCs.

A guiding principle should be:

either make the standard or follow the standard!

On the other hand, a caveat about following de facto standards:

be prepared to react quickly and follow!

Those who follow the IBM standards might observe that IBM does change as in the 360/370 transition... ask the Amdahl corporation about this. We will soon see a repeat of this as the next IBM PC obsoletes a current product by providing a fully upward compatible product, but offering more capability. One can fairly accurately guess about the characteristics by looking at the 286 architecture.

Setting de facto standards such as the Unibus are important, because they are first and establish the way for succeeding product generations. To form an officially approved standard in 1970 for interconnecting computer components to form minicomputers just wouldn't have had any takers. Today, everyone recognizes the importance of the bus in building computer systems. Every company, consortia and many academics try to get one more standard bus or feature to ride the bus specification. Having too many alternatives such as the set forming 802 simply delays work on building networks and distributed computing systems.

<>Guidelines for standards
Given the desirability of standards, let's look at some heuristics governing them.

The first rule is to have someone (person, persons, a company, several companies) responsible for defining, implementing and caring for the standard. This is called responsiblity. Preferably the standard has to work in order for the individuals to be successful. Let me cite Ethernet as an example of this. All of the companies needed it: Xerox and DEC as the backbone of their produt strategies, Intel to sell chips. Rarely will we see such an important interconect need as the LAN. How it is implemented is moot-- the modulation and topology whether busses, rings, trees, or centralized switching is quite irrelevant except that it completely consumes us and hence we can't work on building the systems.

An equally important part of making a standard based on existence proofs is the ability to test conformance. This is another responsibility of the sponsor.

A standard must be real. The best way to insure reality is that it has been implemented before designing it with a committee who are sure to make it unimplementable. Unfortunately, when engineers get hold of a particular implementation, the temptation is to look at the implementation as a template, throw out the old, and extend it... not just use it in an upward compatible fashion.

Again, Ethernet is a good example. It took almost ten years to get a standard called 802.3 after the original Ethernet operated. The upgrade provided almost a factor of 4 performance improvement, but the delay in starting the understanding as to what is really wanted in Local Area Network was quite long. We should have simply used the old one to get more real experience. Here, a guiding heuristic:

> if you haven't lived with a new computing structure, use an
> arbitrary structure in order to get the experience before trying
> to design the ultimate system or standard-- the standard is much
> less important than its existance (will return to this on UNIX)

While we're on the notion of reality, it is occasionally useful to have models by which new standards may fit such as the 7 layer open systems interconnect model. Here, again we might invoke the rule that implementation is a necessity. Had this happened, there might only have been 4, 5 or 6 layers.... or even 8. Unfortunately, every real implementation that says it uses the 7 levels uses the levels like one uses a metric ruler to draw on 1/4" squared quadrille graph paper. The lines on the graph paper serve only as reference lines for the infinity of figures that one can draw using the ruler. About every 2.5 inches the two scales line up pretty well.

This brings up the notion of the necessity for having a sparse set of standards for two reasons: First having too many standards is like having NO standards at all. The current plethora of LAN standards, including various digital PBXen, which I also call a LAN, is a good example of too many, with no basis of experimentaion. Second, a standard is hard to specify it every detail: I consider the Unibus to be a good standard. It specified a way of interconnecting a whole set of different kinds of parts, not just a pair; furthermore it showed the way for this generation of buses and the future generation of micros.

Yet, it took about 8 years after the bus was in operation to have a really complete Unibus specification... even though hundreds of engineers had designed hardware to attach to Unibuses. In this regard, the standard should be understandable in various levels of precision.

A finally role of the responsible organization is evolution. With expoential change in virtually every dimension of computing, changes are necessary. Ideally, the domain of a standard is specified a priori so that one knows when it should be extended. Many standards, such as Fortran, live longer than the sponsor thought or intended them to. As a result, ad hoc extensions occur because everyone makes extensions and no one is responsible. It was felt that Fortran, now about 25 years old was dead, so why evolve it or work on compilers for it? It turns out that many use it and it does pay to really work on it, but that's the final line in this talk.

Finally, standards should be timeless, and failing the test of time should simply remain static and hopefully then disappear. But they rarely can or do.

<>Levels of integration in this generation
Let's get specific by looking at critical standards associated with various strata and product segments. About eight levels of integration form the strata, half of which are hardware. A given level has many product segments, with a given organization ususally excelling in only a few groups. That is an organization has culture and cost structure that constrains its behaviour. Contrast this with the complete vertical integration in the first generation where a computer company designed and manufactured circuits, peripherals, systems, operating systems, languages and applications. Standards provide clear constraints for building products within a given strata and segment such as the Spread Sheet Industry. For example, it is enlightening that data format standards have evolved for these various packages built by different software companies.

SILICON WAFER LEVEL
Rarely do we think of the Silicon Wafer as a level of integration. It is certainly not a well publicized or documented level since processes have been tradtionally been the jewels of a semiconductor company. It is realitively safe to predict that in our fairly near future, perhaps even the real next generation, many of the systems will be a single chip with up to 1 or 10 million thousand transistors. Of course many or even most chips will continue to be "standard" or combinations of "standards" such as microcomputers, peripherals and memories all integrated on a chip or even a large chip.

The creative products will come from the use of silicon using the so called silicon foundry industry that Carver Mead advocates. A good example is a product like the Silicon Graphics IRIS, which uses a ___________dozen? 40,000 transistor chips which Jim Clark calls the Geometry Engine and computes at the rate of ________ Megaflops, which is roughly equivalent to the power of a _______________ computer. One can invision hundreds of these sorts of systems which operate on all kinks of pictures, voice, and mechanisms.

We are nowhere near being able to realize such a scenario with today's state of the silicon foundry, mainly due to lack of standards in foundries and CAD systems. Standards are needed for the various approaches whether gate arrays, standard cell or fully custom chips are used. Let me list a few interfaces:

high level system descriptions
specifications of structure and behaviour, including
simulation at all levels
physical information for processing wafer masks (such as CIF)
control for foundry processes, especially if processing steps
become optional
chip test, including automatic generation of test data
chip assembly including bonding and multi-chip bonding

We must target the development of standard interfaces to languages and datbases that are communicable via networks. Agreeing on these interfaces doesn't limit the competitiveness or creativity of a given company or product, it simply means that users don't have to spend all their resources in converting among different formats or worry about being locked into a corner. Standards would let users mix and match different CAD systems in a completely flexible fashion. This would still let every vendor build their own editors, timing verifiers, simultators, design rule checkers, etc. but a user could interchange data among the various systems. The market would expand much more rapidly because users could buy without fear of being trapped into a particular system or format. This is completely analogous to the pre-Cobol / pre-Fortran where every manufacturer was pushing different languages. Everyone got sick of the situation and rebelled by designing COBOL.

When going to the foundry and testing folks, the user is faced with an equally fuzzy and perplexing situation regarding the characterization of a process including testing.

To clarify: this is a message to the foundries, CAD companies and failing that to the users to specify what they should be demanding.

STANDARD CHIP: MICROS, MICRO-PERIPHERALS, MEMORIES
The first rule of standards, having a responsible organization is critical and not well understood by all semicomputer manufacturers. Since the Instruction Set Architecture is the bottom level of integration that includes substantially more hardware in the form of busses, boards and systems and goes on to include operating systems and languages, the responsiblity of the semicomputer manufacturer is quite large! I'd like them to acknowledge this responsibility.

The microprocessor is at the root of most of our redundant efforts. A micro's life seems so incredibly predictable, following a time worn path with respect to its ability to accesses memory. A recent article in Computer Architecture News suggested that there are about 20 measures of word length. Only one counts-- the amount of directly addressable memory. Of course there are a few embellishments like data-types when considering performance. In 1976, having lived through a moderate amount of hell in terms of trying to extend the 11 and well along on VAX, it was safe to warn future designers of microprocessors. I certainly did in two papers. They didn't listen.

Unlike semiconductor process evolution, all users are dragged along as one evolves a simple stack idea that started out in a Datapoint terminal, went on to become the 8008, the 8080, the Z80 (by another company), the 8086, 186, 286 and more. As someone who has sponsored using many of these parts, I have been able to relive computer evolution for a third time... and frankly, this is boring as hell!
In the late 50's the folks at the University of Manchester, using Mercury, Ferranti's version of their second machine, developed a system that allowed users to

treat both primary and secondary memory as one. By 1962, the University had a breadboard for Atlas operating with a 27 bit virtual address. Atlas also had a number of other ideas that people continually rediscover, for example, in the last issue of CAN someone reinvented Atlas' Extracodes. Let's call Atlas the 0th time through because it was a university machine and there were only a dozen papers written on it, the critical one was repubished in 1971 in Bell and Newell but it was in the UK, and Ferranti only sold a few.

Having erred in a similar fashion on DEC's early minicomputers by designing two computers which had only 12 bit addresses that immediately had to be extended to 16 bits, I architected the PDP-6, the forerunner of DECsystem 10, with a 20 bit address in 1964. This was concurrent with the 360, which though having a larger physical address, only really implemented a small address... that's why the two versions of the 370 came into existence 10 years later with 24 and eventually 32 bits of address. The DECsystem 10/20 and the 370 eventually ended up with 32 bits of address, complete with paging, just like ATLAS, but about 15 years later. The mainframe was the first time through.

As the PDP-11 came out in 1970 with the goal of solving the minicomputer addressing problem by having a 16 bit address, the first customer demanded a physical address extension to 18 bits. Eventually, the virtual address got to 17 and the physical address to 22. For many years DECs engineering spent thousands of hours trying to figure out how to address more memory. Users spent much more time encoding programs in small memories. In 1975, we finally gave up and built the VAX 32 bit architecture with an embedded PDP-11. Other minis followed essentially the same path for the second time around, but most were on the east coast.

The micro was born on the west coast with the 4004 and 8008 concurrent with the extensions to the 11. These had 12 and 14 bits of address, hence why I wrote the paper on the 11 about addressing in 1975. The leverage of doing it right the first time was very high. Subsequently, the 8086 was extended to 20 bits and most recently to 24 bits of physical and 30 bits of virtual address. It is ironic that information on addressing didn't travel from California to Oregon where the 432 was developed, but then again Oregon didn't become a state until 9 years after California.

Motorola's saga is similar. National took the high road and simply copied VAX without violating the patents. Another tragedy. If an exact copy could have been made several billion dollars worth of software could have been made available! And many resources could have been freed for doing something creative or otherwise productive. Finally, with the micro we have everyone going around three times. The saga is not yet ended as we understand the ramifications of greater than 32 bit address spaces.

There is an equally tragic story about an architecture called CFA, for Computer Family Architecture, which is the defense department's version of VAX. This time, they could have used an exact copy of VAX. Won't our enemies just use US standard micros, and get the parts and software at least 5 years earlier?

With shifts in relative speed and sizes of on chip registers, cache memory and control memory, it looks like a return to simple, CRAY type load/store architectures which are implemented without microcode may perform much faster than architectures oriented to processing the data-types of high level languages such as the 360. Since these so called reduced instruction set architectures trade off microprogram control complexity for compiler technology, it would be well to find and use a single one rather than continual evolution.

New architectures, especially those which have gone along well travelled evolution paths, have cost computing at least half of our resources. The glib answer of using C and UNIX to obtain machine inddependence is deceptively simple and errorneous. A compiler for C or a compiler written in C is only a starting point for a product...

not the end. An architecture pervades virtually every part of a system and database.

When an architectue should be copied, evolved or thrown out and started over is fundamental to the notion of standards because of the tremendous user program and database investments. Let's understand it.

BOARD: BUSES FOR VARIOUS PERFORMANCE, APPLICATIONS, ETC.
The board level is similar to the Instruction Set Architecture story, except that busses have longer lives than specific instances along the evolutionary life of an architecture. For example, the various species of the IBM channel buses are now 20 years old and will no doubt continue for another 20 years in their current forms, even though many of the functions that a peripheral might perform could be handled in the same amount of hardware as that required to interface the bus. The Unibus is almost 15 years old.

The IEEE is in the business of blessing these buses and I don't understand the politics of this process. One manufacturer already has an adequate unibus-type standard to build multiprocessor and multicomputer structures. Does the IEEE support a bus indpendent of whether there are any riders? How many more do we need or can we afford?

LANs and LANCs ANOTHER KIND OF SWITCH
<>Ethernet, the Unibus of the Fifth Generation
While on the issue of busses, this is a fine place to discuss another important switch, we now call a LAN which is used for interconnecting computers and terminals in a local area. This slide is one I used exactly three years ago. Several of us from Intel, Xerox and Digital including Bob Noyce, Dave Liddle and myself presented the case for Ethernet as a standard and to show that we were committed to use it. It was useful because I wanted to convince all of the engineers working on the project of its importance. I attempted to show the need for the bus for building new, distributed computer structures or clusters of computer. Let's call these structures LANCs.

<>Unibus,

Note that this computer structure and the LAN/LANC are nearly identical except they are seperated by 15 years. The unibus is used to build a single computer from constituent information processing components such as processors, memory, communications equipment and terminals. It was designed to travel about 15 meters. Ethernet, or rather IEEE 802.3 allows a user to build LANs and LANCs. It was designed to travel several kilometers.

Digital needed a LAN to interconnect computers into a network and to be able to interconnect terminals to computers in an open ended fashion. I was receptive to using Ethernet as the wheelbase when Bob Metcalfe, its inventor, proposed the standard and consortia to built it. At the time, two experimental LANs were operating within DEC. While Ethernet was proposed as simply a network interconnect the main motivation was a bus for the evolution of two types of clusters: first, a single shared mini or large computer would gradually be decomposed into functional server components; and the proliferation of PCs would require intercommunication into a cluster formed by aggragation.

The key reason for the standard was to allow us to get on with building LANCs, which only a few organizations understand experientially. To reitierate, to propose a standard, one should have lived with it for awhile and really understand it.

In retrospect, getting anyone outside of the three organizations involved may have been a mistake... had we simply built the bus, and offered it as a LAN standard, the process would have been done quickly. Furthermore, instead of engaging in debate about something we knew little about experientially, we could have simply designed and implemented it 2 years earlier. What appeared to happen was that no one knew they needed a LAN, but when they found out one was being proposed as a standard, then everyone had a design to try.

The IEEE tried to help with inventing 802 and now have .3, .4, .5 and .8.   .9 is needed for PABXen and we'll soon need a second digit to add to the new proposals--still LANs and LANCs don't exist to any degree.

802.3 was allocated for the CSMA/CD type, or Ethernet. Since others would like lower cost LANs of this flavor, then several folks took the basic idea and built fully incompatible versions. Alternatively, the same energy applied to cost reducing Ethernet would have made everyone win.

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Another early kind of switch, the ring came out of early work at Bell Labs, Cambridge and other places. Prime built such a ring, and when these folks formed Apollo, took this basic religion with them when they moved 15 miles north. Because rings usually require some form of central controller, IBM grabbed the ring, hence 802.5.

Since one can obviously use fiber optics for building LANs we require a fiber standard, 802.8.

802.3 can be transmitted on standard orange or yellow Ethernet cable; for others who like a simpler installation and will give up distance, RGU 58 can be used if you call it cheapernet Bob Metcalfe calls it thin Ethernet; Codenol has a fiber optic system using the same scheme; for those who like broadband there is a modem. The purpose of all these media is to be able to get users to build LANs and not to wait for what is really quite an arbitrary choice of media, and one which only delays the critical use. Surely someone could take the controller / transceiver interconnect and build a transceiver to operate on a ring structure. I hope this could also be used to adapt to high speed digital PABXen as they become available.

While we're on switching, the forthcoming high speed PABXen will permit the same function as the LAN, and hence should come under the 802 perview. It is imperative to have conformance at the higher levels. Can I suggest 802.9?

These alternatives for standards to switch information at a modern, computer data rate versus a scheme that evolved from the Morse code allows everyone to avoid working on the essential problem of building networks and evolving into clusters. Again, the multiplicity of standards delays the introduction of structures at least five years!

The glib answer to multiple or no standards is gateways. However building gateways is often about as easy as having a single train that can travel on different gauge tracks. It's fine when you reach steady state, it's the transition among track sizes that kills you.

ELECTROMECHANICAL ASSEMBLY: DISKS, I/O, POWER, ENCLOSURES
The evolution of small disks and tapes has been very impressive. I remember meeting Al Shughart at the start of Seagate when his greatest concern was making sure of a competitive second source with the same interface and form factor, which in effect creates a complete industry. This is the same formula that he used in creating the floppy form factors, standards and industries. The standardization process might be understood by these examples.

We also see the effect of edicted, blind standards when looking at the issue of keyboard thickness. The IBM PC's keyboard is designed to pass a particular national standard, but has little legs that are raised that make it comfortable to use. I've never seen one in use without the legs.

OPERATING SYSTEM: COMMUNICATIONS (eg. WAN, LAN), DATABASE, SCREEN
In 1966, a user could have a 300 baud Teletype using a phone line. By 1980 the speed of the common dial-up line

had been raised to 1200 baud. This amounts to a a performance improvement of less than 10% per year, and I believe the connect cost rose. This is not the kind of improvement we're used to in computing.

During this period, through computer controlled switching, telephones have gained improved functionality. All of the telephones systems are incompatible with one another at the user level beyond the plain old telephone. All have a relatively large manual and training to get back to the capabilities we had with multiple button phones. The new phones are not user friendly nor do they pass the ease of use test nor are they particularly helpful about adding or deleting the appropriate one except to say that what you've just dialed in is wrong. If a system is knowledgeable enough to always give you the same error message, then it should simply always fix the error.

We have turned a large part of our future systems development over to AT&T for one of the key interfaces by adopting UNIX. In fact, it is the kernel of the system, just above the hardware. When the Justice Department was playing God, why wasn't UNIXCO separated? Maybe it's the only money making part, especially at the price AT&T charges for royalties. Given the simplicity of UNIX, it would seem completely appropriate to install a venture capital offices around the various Bell Labs in order to extricate and form an independent, responsive company to evolve UNIX. Are all you San Francisco based venture folks listening?

The UNIX phenomenon illustrates some principles of standardization and I'm sure we can learn from it. Like all operating systems, the only people who really love UNIX are its parents and those who only grew up with it. This is a large set. It also illustrates a recurring theme of standards:

in order to make forward progress, one has to regress for awhile

UNIX evolved along these lines:

. UNIX came from a reaction by Thompson and Ritchie to MULTICS, the large, joint MIT Bell Labs project of the late 60's. It was written for a DEC mini and evolved to the PDP-11 in the early 70's.

. DEC didn't give away operating systems to universities-- especially the source code; UNIX was essentially free.

. UNIX is by most measures a very simple operating system, to do anything useful requires other programs such as database access, special communications, programming, etc. Students and faculty could understand all facets of its internals and use. It was written in a high level assembly language, C, and as such could be modified. It was an excellent pedagogical tool. Universities embraced it and trained many students with it. A built-in market.

. UNIX evolved to be used on other computers by being transportable. A team of people could carry it to another computer system, provided a C language compiler was available. This was something that early high level languages were supposed to do, but never quite succeeded with due to extensions for calling the operating system. In turn, this created the notion that it might someday be possible to have a complete system that was machine and manufacturer independent. Users like this idea.

. Chip makers and system builders who had no means of building software were able to get a system relatively cheaply. Thus, we have more support and the beginning of a standard. The semiconductor industry knows about standards.

. Much work is required to have a system that supports 80's computing concepts. This is why I worry about the control in a bureaucracy. The extensions include:

- .virtual memory. This function was worked out about 5 years ago and has been in operation for at least 4 years in the verion of UNIX for VAX called 4.1! Recall the notion of virtual memory was only invented 20 years ago.
- . special functions for real time and transaction

processing. UNIX is being extended and adapted in incompatible ways by diverse organizations.
.human interfaces that are competitive with the PC. UNIX grew up in a timesharing world using dumb terminals. Windowing and fast interaction are critical.
.multiprocessing. With the micro, many companies started up to extend UNIX for multiprocessing.
.   networks. Given the origin of UNIX in a communications, we should demand modern communications capabilities.
.fully distributed processing across a LAN to form LANCs. The Universisty of Newcastle, Berkeley and several companies have all implemented incompatible systems for fully distributed processing. Berkely 4.2, which is being distributed is a good starting point.

UNIXco must take the responsibility commensurate with their selling of UNIX as a standard operating system. The notion of a standard is good. But it must be evolved more rapidly than any single manufacturer. It can provided there is parallelism in the development using multiple organizations. If UNIXco is the single company doing and blessing all the extensions, we have simply subsituted multiple competitive companies with a single, behmouth! The system has to be evolved in a reasonable, not ad hoc fashion. I think this is the most serious problem we have in extending computing today.

LANGUAGE: INCLUDING EXTENSIONS TO APPLICATION LANGUAGES
With the very strong concern regarding UNIX, C is a weaker concern. C is at the heart of applications portability. It's time that C be treated like a serious language, complete with standard.

<>picture of ACM september with Japanese and US going toward 5g
All the languages could be enumerated with concerns especially ADA, are important for this next generation. LISP has been proven to be useful for Artificial Intelligence applications. Like the Japanese, I believe

these applications may be the basis of the next generation.

LISP was defined about 25 years ago by John McCarthy while at MIT. I was so enamoured by LISP 20 years ago that I put the critical primitives into the hardware that ultimately became the DECsystem 10... still about the fastest LISP computer. LISP branched and created many dialects. One path went west via BBand N to Xerox, creating INTERLISP. Many dialects evolved from the original MIT LISP: MACLISP, Zetalisp, NIL, SCHEME, TLISP, Portable Standard LISP and now Common LISP the later two are vying for standards status. Virtually everyone who gets inside a LISP compiler or interpreter creates a new language. These languages are incompatible with one another and thus one can't benchmark, or use common techniques to bootstrap extend the language in a compatible fashion. Much work surrounding LISP is to make applications development easier. But given the number of dialects and the number of extensions to make development easier, I wonder if anyone is working on applications. The effeciency for normal development is 0.5 due to redundancy. This is high for AI applications because there is no standard base.

To reiterate, in order to get on with the business of applying AI, we need some way of sharing information across the various different languages called LISP. A serious standards activity is long overdue.

In fact, the Japanese were so confused about LISP that they totally gave up and went to Prolog.

Having extolled standards now for sometime, there's a downside. A standard provides an interface or target by which systems can be compared. Recently, the Livermore Laboratory kernel becnhmark codes expressed in 25 year old Fortran, were run in Japan on the Fujitsu VT100, VT200 and Hitachi 810/820. Using very good vectorizing compilers, all machines ran at a rate of over 2 times a Cray XMP. There is virtue of understanding the old and evolving it.

STANDARDS

SPECIFIES INTERCONNECTION OF TWO (OR MORE) MORE PARTS

VANITY: EXISTS WITHIN A SINGLE COMPANY

DE FACTO: ORIGIN IS A SINGLE COMPANY, EVERYONE FOLLOWS

...SOME STANDARDS ORGANIZATION MAY BLESS IT

INDUSTRY: EXISTS WITHIN A SINGLE COMPANY (IBM)

NATIONAL: (EG. ANSI, JSA)

GOVERNMENT BUREAUS: (EG. NBS VDE)

INTERNATIONAL: (EG. ISO, IFIP, ECMA, CCITT)

PROFESSIONAL ORGANIZATION: (EG. IEEE, ASME)

CONSIDERATIONS FOR FUTURE COMPCON ON STANDARDS

. STANDARDS ESSENTIAL TO PROVIDE A PATHWAY FOR THE FUTURE BUT DON'T CONSTRAIN CREATIVITY,

. NATURE OF GOALS AND CONSTRAINTS FOR FUTURE STANDARDS

. ROLES OF VARIOUS ORGANIZATIONS: MANUFACTURERS, USERS, STANDARDS BODIES, PROFESSIONAL ORGS., ACADEMIA

. TIMING IN RESEARCH, PRODUCT, AND USE LIFE CYCLE

. MAININTAINING, EVOLVING AND DISCARDING STANDARDS

. ECONOMICS OF SINGLE AND MULTIPLE STANDARDS

A PRODUCT SEGMENTED INDUSTRY,
ORGANIZED BY LEVELS OF INTEGRATION
WHICH FORM STRATA DEFINED BY STANDARDS

- FUELED BY ENTREPRENEURIAL ENERGY RELEASED BY VENTURE CAPITAL FUNDS

- SOFTWARE FORMS NEW PRODUCTS AND USES

- SYSTEMS ARE DISTRIBUTED IN MANY DIFFERENT WAYS

GUIDELINES FOR STANDARDS

. SPONSORED... NOT JUST A COMMITTEE OR COMMITTEES

. REAL (IMPLEMENTABLE AND TESTABLE)

. UNIFIED NOT ALL POSSIBLE SOLUTIONS FOR ONE FUNCTION

. PRECISE, UNDERSTANDABLE AND APPLICABLE

. TIMELESS, AND

EXTENDABLE IN A RESPONSIVE FASHION

CRITICAL EXTENSIONS TO UNIX

. VIRTUAL MEMORY

. APPLICATIONS: REAL TIME, TRANSACTION PROCESSING, ETC.

. MODERN HUMAN INTERFACE FOR WINDOWING, GRAPHICS

. MULTIPROCESSING

. WIDE AREA NETWORKS

. LOCAL AREA NETWORKS (LAN) AND CLUSTERS (LANC)

HEURISTICS FOR STANDARDS

. EITHER MAKE THE STARNDARD OR FOLLOW THE STANDARD

. BUT, BE PREPARED TO REACT QUICKLY AND FOLLOW WHEN THE DE FACTO STANDARD CHANGES

. SET NEW STANDARDS AT YOUR OWN PERIL, AND ONLY IF YOUR NEW ONE IS <u>MUCH</u> BETTER

. CHANGE WHEN IT'S CLEAR YOU'VE GONE DOWN A RAT HOLE

LEVELS-OF-INTEGRATION: THE STRATA

SILICON WAFER:

STANDARD CHIP: MICROS, MICRO-PERIPHERALS, MEMORIES

BOARD: BUSES FOR PERFORMANCE, APPLICATIONS...

ELECTROMECHANICAL: DISKS, I/O, POWER, ENCLOSURES...

OPERATING SYSTEM: COMMUNICATIONS, DATABASES, I/O...

LANGUAGE: INCLUDING APPLICATION LANGUAGES

GENERIC APPLICATION: WORD PROCESSING...

DISCIPLINE/PROFESSION SPECIFIC APPLICATION:

```
procedure
VENTURE_CAPITAL_ENTREPRENEURIAL_ENERGY_CYCLE

 begin

 while greed and not fear do

 write (business_plan);

 get (venture_MONEY);

 exit {job} ; start (new_company);

 build (product); sell (product);

 sell (new_company); {for 100 times sales}

 venture_funds := venture_funds + sale_liquidity;

 end
```

UNDERSTANDING EVOLUTION TO LEVERAGE THE LEVERAGE

Civilization has always been concerned with building tools to leverage intellectual processes. Although a few tools are revolutionary, most are evolutionary. Virtually all revolutionary tools (machines) fail, usually for simple reasons. What are the heuristics for success and failure avoidance?

INTELLECTUAL LERAGE: THE DRIVING TECHNOLOGIES

Hope of conference: point out symbiotic relationship between new technology, and applications made possible by new tools and applications made possible by new technology, and the advances in in technology made possible by ever more powerful tools.

The notion of intellectual leverage also conjures up the notion of working smarter and not harder. I fear we don't always do this, also it seems to me one of our greates frailties is reinventing while not learning. In one of the Turing lectures, Hamming pointed out: we have to stand on each others shoulders instead of each others feet.

WHAT ARE TOOLS?

.machines ala VAX 780 that are the basis of all startups... all of which aim to replace the 780 the good news is that most of them will fail and hence the competition won't materialize. I feel like someone who has just equipped an army to shoot me. A capitalist is a person who'll sell you the rope to hang him.

.machines such as DA that do work, where we always seem to need the next one to design what we are designing

.networks, (Conway cited ARPAnet for multichip project last year)

.mail nets

.organizations

.mathmatics, notations, ways of communicating, note slang that allow the bright students to communicate (rent,dren or ren)

.a methodology and training

.goals and constraints: eg Supercomputers, targets and standards

TARGETS ARE KEY

Generations are now the target. Two scenarios.

This generation is different for what is a new industrial structure.

STANDARDS ARE THE LEVERAGE BECAUSE THEY HELP DEFINE THE TARGET

This generation is different. It is based on standards. Instead of a completely proprietary vertically integrated industry, it is a product fragmented, strateified by level of integration.

Driven by entrepreneurial Energy.

We have a very good example in the PC. Doesn't have to be the best. It was though. It was easy and strictly evolutionary. It came about by being an open architecture.

I would like to see truth in labeling as part of product description. If an interface will be kept proprietary or not. If not, what is the policy for evolution.

WHAT SHOULD STANDARDS DO?

play together

be easy to use and understandable

be around for awhile (ren retyped logo for prefix to infix

be evolvable: note Datpoint>8008>8080>Z80>8086>186>286>386(Copy: national did, a good idea)

be real. ISO model is a model and not real. It's like quadrille graph paper with 1/4 squares and giving them a ruler marked in 0.1"... but at least it's in the same basic system.

be responsible and responsive

be few so designers know what to shoot at. Can't have 8 LANs or a new battery, every time a watch is built

be at right price

RESPONSIBLITY OF THE ORGANIZATIONS

Make them open by definition

Sponsor their evolution

Be able to test whether they adhere

Clear organization (name) in charge. with schedule.

No standard without an implementation

Standards meetings should contain implementers

CHIP-level... inability of foundry standards, communication of masks, etc. CIF established one.

Responsiblity of the foundries. Absolutely chaotic.

ISPA- is by definition a major standard and this goes even lower vis a vis access to bit maps. Responsiblity of the provider

Responsiblity for at least assemblers and mnemonics

What happened to CFA? DEC offered to give DOD the VAX. Didn't like it because they didn't control it. I'd rather have someone responsible controlling something than a committee anyday

We have a disturbing phenomenon around evolution to VM! Show the evolution of VA bits.

OS- UNIX now, with a new player that's hardly used to computer standards

Would like to have standards on my telephone so I can use they across different vendors. Telephones aren't standard!

Maybe UNIXco should be a seperate company, but may be the only profitable part of AT&T, given the price of royalties. I hope AT&T realizes the major lesson from UNIX: the reason it exists as a standard was that the price was right to universities: namely 0! The other reason was that it was small and simple enough for pedagogy, yet useful enough to attract and train students. Finally, it evolved to be somewhat transportable and that was due to C.

Progress has been slow 300 b in 65, 1200 in 80.

issues: V.2 + 4.2 with incompatiblities between 4.1 to 4.2.

shouldn't UNIXco have been split off... maybe the only money maker in AT&T.

VENCO may get the UNIX crew out of AT&T

Crucial to have networking, VM, file, tp, multiprocessing, window

Would like a body for defining and then testing adherence to standards!

Misunderstanding that if one simply has a Unix port to a given machine, this is an acceptable system. NO. Much to do in compilers

LANGUAGES- It is critical that we start to address parallelism!

C- just another version of an assembler, after BCPL and before D

LISP- an absolute zoo. Keeps AI back. The Japanese were so confused they went to Prolog

DATABASES-

Spreadsheets

LANs

A paradox: they can't exist until they exist

When is it appropriate to simply acknowledge a de facto and move on? or to approve a new ad hoc one (eg. 1 Mhz PCnet)

We need a set of high level protocols. Gateways are too glib... can they be done? 12 protocols within HP, hence a committee to standardize and then you have 13.

802.3 CSMA/CD most developed with base, broad, thin and fiber media; Omninet is 1 Mhz, PC net is 1 Mhz

.4 Token Bus, especially on cable TV; committee has 3

.5 Token Ring- Apollo, Primenet, Cambridge Ring, IBM/TI why is this man smiling?

.8 Fiber

802.n = PBXen... most folks believe this is WAN. Wrong.

MAIL
    3 standards plus lots of company ones

NOW THE BAD NEWS:
the US computer inustry structure will be overturned

Compcon: 70% Bay, 7% Japanese, 95% practitioners, 1.2Kp
committee wanted a discussion of Mail to improve technical excellence

---

ZINGERS
    JAPANESE have won S/C race with x2 Cray xmP
    Glamorous professions: science, business, engineering, not mfg eng
    Glamorous businesses: systems not components, materials, products
        or processes (eg robots)

SLIDES (*to do)
    Ethernet and Unibus
    Idea of decomposing (fision) from minis and mainframes
    Idea of aggragation (fusion) from PCs and minis to build mainframe
    *Evolution of address space
    diversity of new machine structures
    Generations, this generation, evolution to next, revolution to next
    Correlate machine intros with memory intros
    table of standards vs time

BELL DATE: WED 31 OCT 1979 11:36 AM EST
DEPT: OOD
EXT: 223-2236
TO: BARRY BURNS
    OPERATIONS COMMITTEE:
    OPERATIONS COMMITTEE: @CLEM

SUBJECT: MONOTONICITY OF PAY - A PROBLEM?

Nowhere is there a policy that says a person's pay is to be monotonically increasing. However, I've heard from several colleagues they're worried about the pay derivative changing sign because they were granted generous options under the 68 plan, and finally these options have or are just about to have all lapsed.

My guess is this is one of three factors behind Leng's resignation. Shel, could you plot say x's total compensation (salary + stock) over the last ten years and see just what the story is?

I think we have a potential major total compensation problem in either the decline (phasing from stock/salary to salary) or setting people's expectation back to the market (where we've had policy to not use stock as compensation.) Our long term plan has come due - let's look at the issue.

GB:swh

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION
DATE: MON 25 AUG 1980
8:30 AM EDT

FROM: GORDON BELL
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

cc: CHERNOFF VIA FORBES
MARY JANE FORBES

SUBJECT: BEING A SUBJECT FOR XEROX ON SMALLTALK

You guys decide!
If you do, then the best way is to have whoever is going to run our project to write a confirmation letter to Bert Sutherland.
What you say?
(My feeling is that we should do it.)

When are you going to decide?

(I assume you are going to interface/tell Adele Goldberg, but with letter to Bert... or perhaps I should do this.)

As a seperate question, I think we ought to consider building it around a VT125 too on some system... perhaps write the interpreter in Bliss and try it on several of our systems. For this, we need a commitment from one of our small systems persons... but don't worry about it for this go around.

"TO" DISTRIBUTION:

HURLEY AND SNYDER BILL KEATING SAMBERG AND SNYDER
DICK SNYDER SPIER VIA KEATING ZIMMER VIA FORBES

GB1.S6.41
****
* d i g i t a l *
****

TO: BUZZ BROOKS DATE: TUE 15 JUL 1980 10:07 PM EDT
FROM: GORDON BELL
cc: see "CC" DISTRIBUTION DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: COMPETITIVE COMPARISON OF DEC AND WANG WPS BY BETH ROSE

Had an enjoyable 2 hours with Beth talking about WPS. Looking at the Wang, certainly reinforced lots of beliefs about how we get better wps. Generally we're right. There is a problem which we ought to address: do we want to try and simplify the keyboard and interface design a lot? (I think we can, yet not change the semantics very much.) This would get a

cleaner,
less overbearing look that wouldn't frighten new users. Am already at work on it. Eg. dedicating more than 1 key for the whole search
seems like a waste and being overly complex. Making a character for
the marker and then having it ask which one seems right. Getting
rid of swayp also seems right. Some way to select the character
font from bold, underline, super, sup, seems like elimnating 4
keys. Menus associated with the ruler would be nice too, and for
the multi terminal, Beth raves about the operator statistics and
all the sort allowing here to do dp work.

Got a new perspective on full page! Have full page, but allow
a mode where BIG CHARACTERS are used so as to make it easier on
operators for other tasks (and especially older operators)!

All, in all, in prepartation for our meeting, I
am asking MJ to have Rose spend 4 days comparing the 78 with the
Wang stand alone; and comparing the DPD Text 11 with the
Wang shared system. Please welcome her. If you have a problem
with this, please contact me tomorrow (MJ has the number at
the OC Woods Meeting place).

g

"CC" DISTRIBUTION:

MARY JANE FORBES STAN OLSEN BOB TRAVIS
TOM VLACH

GB1.S5.56
****

* d i g i t a l *
****

TO: DICK CLAYTON
TED JOHNSON
MFG STAFF:
OOD:
JACK SMITH

DATE: THU 11 DEC 1980 10:16
FROM: GORDON BELL
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: GETTING ORGANIZED IN ENGINEERING AND MANUFACTURING LIMITS TO FACE OUR FUTURE COMPETITORS [UPDATED FROM 10/26/79]

I'm still feeling good about our current and next few years of products; but I'm terrified about '83-'90 because I think we'll enter a more cost sensitive, commodity oriented market where emphasis is simultaneously cost AND quality. The challenge will be great in products-, process-, and manufacturing-engineering.

The four competitors of concern are IBM (everywhere), TI (only at low end and as a supplier), Intel (typifying the semiconductor revolution implicit in fifth and sixth generation computers of the early and late 80s) and the Japanese (Hitachi, Fujitsu, and NEC; also maybe others). Although each have some unique strengths and weaknesses, they have the following ordered strengths in common [our position is given []]:

1. Strong discipline in their engineering and manufacturing processes with relatively few, and aimed at volume. [Poor, lots with incremental evolution and freedom to define alternatives vs. use standard.]

2. High degree of plant automation. IBM may have the best understanding of robots and Japan is clearly the supplier! Also increased focus on productivity. Intel may not have this. [Poor, no activity outside of test. No automated material flow. Lower productivity per person.]

2a. Focussed factories with combined manufacturing and engineering industry process engineering [good in semis, part of disks. Poor in terminals, systems, cabinets, and power supplies.]

3. Very good internal source of semiconductors; all but IBM supply externally. [We only make a few of our needs.]

4. Very good disks (except TI who's now trying). Not Intel! [Need better mid/high end.]

5. Basic understanding of all kinds of materials. [Little or no work.]

6. Very large research groups, except Intel. All receive government grants for research! [Weak. External R+D to couple to.]

7. Aggressive engineering and product positioning. [Ok; many products.]

8. Strong emphasis on quality (here, I exlcude TI). [Ok; improving.]

9. Willingness to change and move rapidly whether it be product, pricing, or market method (e.g. channel of distribution) and manufacturing. [We're strong; getting older and conservative?]

10. Understanding of learning curves, market share and use of forward pricing (including IBM). [Ok; except too many products?]

11. Low inventories and willingness to drop products at end of life.

12. Significant worldwide engineering and manufacturing, especially Japan.

There are selective strengths and weaknesses(-) no particular order:

IBM

1. Very strong CAD/CAM tools and effort.

2. Disciplined processes and engineers who use a small number of PCB, Backplane, and common semiprocesses rather than evolving every possibility to get slight gains.

3. An incredible customer base and sales force capable of devouring most of any product.

4. Highly automated assembly lines with independent test and production flow controls.

5. (-)Many competing architectures and problems to

evolve networks.

6. Applicators programming knowledge.

Japan

0. Best overall technology understanding of semis, magnetics, speech, video, robotics, and comm.

1. Ability to quickly assimulate products or processes from others.

2. Experience with low cost products like TV sets that will be model for terminals, small business system, etc.

3. Strong concern for standards as a way to the market.

4. Large population of engineers, including manufacturing engineers.

5. (-)Channel of distribution.

6. (-)Programming. This is immaterial since software will be done by U.S. SW engineers in U.S.!

TI

1. Semiconductor strength.

2. Good terminal and low cost product base.

3. (-)Programming.

Our Strengths

1. The best general architecture/product position potential.

2.Product lines to focus on various users and channels of distribution.

3. Rapid turn-around, dedication of individuals to their plans. (Are we getting older and more lithargic?)

4. Strong Systems Programming to orient to generic, profession and other applications.

GB:swh
GB0005/24 (12/11/80)
GB2.S4.4 (3/17/81)

Mr. John E. Tyson, President
Compression Labs, Incorporated
2305 Bering Drive
San Jose, CA 95131

Dear John:

I enjoyed our meeting last week and hope we can get together to follow-up on some of the opportunities.

I am asking for a report on our current video teleconferencing, and how we might expand this network to cover all of engineering, with links to our manufacturing sites and to Reading, England. When we get this data, then I'd like to get someone from CLI to discuss your products with us.

We would like to discuss two other matters when you visit:

1. how our Personal Computers might interface to your system for transmitting and presentation of data

2. how we might build VLSI to implement your compression algorithm. These chips could be used in your equipment and by us for Personal Computer video input.

I'll send data as soon as possible.

Sincerely,

Gordon Bell
Vice President
Engineering

GB4.S1.39

.___.___.___.___.___.___.___.

!   !   !   !   !   !   !   !
! d ! i ! g ! i ! t ! a ! l !   I n t e r o f f i c e
M e m o
!___!___!___!___!___!___!___!

TO: see "TO" DISTRIBUTION   DATE: WED 16 FEB 1983
8:45 AM EST

FROM: GORDON BELL
cc: FU 2/25
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

MESSAGE ID: 5191131320

SUBJECT: COMPRESSION LABS, INC.

GB4.S1.37

I met with John Tyson and Paul DeBaldo, President and V.P. of Marketing of CLI, San Jose.

They build an interesting video compressor that takes color video and
reduces it to 1.5 Mb/s (<T1), and they have an algorithm that gets
down to .75 Mb/s. Their product compresses and multiplexes video +
digital channels onto a digital channel.

They are also designing a unit (instrument) so that a room can be
converted to teleconferencing for a few users.

I'd like to invite them here and discuss:

1. their product futures and our use of them

2. how we can interface a PC to it for slide presentation

3. how we might be an experimental site for video

teleconferencing
between NH and Reading via satellite

4. how we might use their algorithms for compressing video for storage in our PC's. They also believe this should be useful for educational teleconferencing

5. Vlsization of the compressor for our PCs

Before they come, I'd like to send them:

0. A report on the current Teleconferencing

1. Plans (traffic matrix) for teleconferencing in the corporation, and special situations. What would a network look like for engineering? manufacturing? engineering and manufacturing?

I'd like to see a hardwired backbone net of MK - ZK - LT - HU - MR - FR. With these spurs: ZK-TW-Andover-Salem and Hudson-Maynard and MR-Shrewsbury. There might be special links: ZK-Reading, Maynard-CX, Maynard-Westfield, ZK-Seattle, TW-Augusta.

Comments please !

Are you interested in attending?

Could I get someone in telecommunications to organize information? .

"TO" DISTRIBUTION:

AL CRAWFORD	DICK DAVIES	EMC:
DEL LIPPERT	JULIUS MARCUS	RICHARD KALIN
@MKO1		
JOHN ROSE		

WPS USERS - Leave HP mode and type <CR>

January 30, 1980

Elmer B. Staats
U.S. Comptroller General
441 G Street
North West, Washington 20548

Dear Mr. Staats:

I read your report 10-79-53 of September 21, 1979 and would like to commend you for recognizing the problem of United States - Japan Trade. The report definitely shows some understanding, more so than by any other individual in government.

It stimulated me to make the following comments, which I hope will add even more insight for you:

1. The fact that we spend twice as much on R and D is <u>very</u>, <u>very misleading</u> (and even wrong!) because:

   a. <u>The Wrong Direction</u> - most of our funding goes into military and health. These are fundamentally irrelevant to the trade problem. Rarely does a relevant idea get developed in these areas, and the chance is even smaller of it getting into the private sector for trade which your report addresses.

   b. <u>Efficiency</u> - we aren't terribly efficient, i.e. there's lots of overhead that the funding doesn't show. These include the funding agents (buyers), and checkers such as auditors, plus administrators on both sides that don't do R and D. Measure people <u>doing work</u>, not funds and I'll bet the picture changes! Also note R and D per capital and per GNP is higher in Japan.

c. R and D is World-oriented - much of our R and D goes directly to Japan - how many scientists have you ever met that aren't basically open, world citizens, and feel knowledge should be broadcast without restrictions? Hence, much of our R and D funding is "world public". So take much of the R and D and mark it for the world. Japan has an open, but closed society due to language barriers.

d. <u>Poor Process Management</u> - Japan does a really top job of managing the R and D flow of results from basic research, to product. We lose our results due to having a non-existent management process for this flow. Scientists, engineers, and product designers are all different and don't communicate very well.

e. <u>We don't understand effect of public vs. private R and D funding on trade!</u> A recent announcement by Frank Press to the members of the National Academy of Engineering noted an increase in govenment spending here of 3% (real growth). This basically should disturb us because we are constrained by people to spend it.

Money will not make researchers materialize. I trust that you never believe that money and people aren't instantaneously interchangeable like our culture, particularly sophomore economics, teaches. Therefore, an increased R and D budget will only raise salaries, which in 10 years might increase the supply.

In the short term, I believe it is safe to predict that increased federal R and D means: increased salaries; more attention to the irrelevant areas already over funded described above; <u>less</u> <u>development</u> <u>to</u> <u>address</u> <u>trade</u>; and finally decreased coupling between industry and academia. For example, the recent ARPA VLSI funding is likely to make it unnecessary for the current researchers to seek any industry funding when they can get completely on the government dole. Hence, they'll have one shop funding versus the two now--government <u>AND</u> industry!

2. The computer section requires beefing up to:

a. include semiconductors, the key primary industry for computers.

b. show that the future is bleak as projected, from any market survey.

3. Similarly, the auto section didn't address steel. Note the Japanese have the most efficient, and the most computer control in steel making. Again, this is not just capital, but lack of trained manpower and little investment in R and D in this industry! The steel industry isn't making it and I don't think it will without a major revolution in thinking, supported by trained engineers in process control. Maybe you can help.

Things are getting worse fast, especially in computers, because:

a. The Bureau of Standards is getting into the act to specify how to build products. Do you recall hearing about the forced use of the IBM I/O Channel within the Government? Isn't your organization behind this move: to limit our innovation, our ability to compute, to force some of the marginal mainframers out of the market? Note, this is a key standard for Japan to help them become a major supplier to the U.S. and the world. I find this report and <u>your</u> action on the I/O Standard mutually exclusive and contradictory!

b. We have become a stifling/control society versus an innovative/building society! For example, net output of lawyers versus electrical and computer engineers has recently changed.

Graduates/year

	<u>Lawyers</u>	<u>Engineer's</u>
1971	17.4K	17.4K
1979	34K	16.9K

Observe the high cost, both direct and in terms of using up our finite fuel supply, of a bunch of lawyers in Congress designing automobile catalytic converters. The Japanese have 15K lawyers versus our 450K, or 15 times the number per capital! Can we get our lawyers to sue the Japanese?

c. The situation of MBA's is about the same. These people are potentially more harmful than the lawyers in some sense because they mainly turn-on by return on investment and marketing. Manufacturing is a dirty word, a hard business, requires long term plans, people and real work, in short, money and a personal intellectual investment. Buying manufactured goods from Japan is appealing: look at some of this year's top roi performers: Subaru (U.S.), Tandy, and Amdahl.

Both of the disciplines further decrease output by controlling, finding (or tricky accounting) additional ways to spend when they enter politics, and merely promoting versus producing.

These professions (basically real or semantic accountants) detract from workers who could enter R and D and engineering and when could address our trade deficit at a fundamental level. As our Comptroller, I urge you to <u>audit</u> our pool of technical talent. This is the crux of the matter, I believe.

Enclosed is a paper by me on the Japanese situation which has other points you omit - especially the management of R and D to aid the flow of ideas (lacking in DOD, Commerce Department, NSF, etc. thinking). Hopefully, there are some actions to take, but if the past is any predictor. I'm sceptical.

I look forward to a helpful prescription. When?

Sincerely yours,

Gordon Bell
Vice President, Engineering
Professor, Computer Science and Electrical Engineering
Carnegie-Mellon University, on leave
Member of National Academy of Engineering
Fellow of the IEEE

GB:swh
GB1.S1.45
Enclosure

December 8, 1978

Computer Business News
797 Washington Street
Newton, MA 02160

Dear Sir:

Please check your distribution list. Gordon Bell received four copies of this -- all different addresses.

The correct <u>one</u> is:

Gordon Bell
VP, Engineering
146 Main Street
Maynard, MA 01754

ML12-1/A51

Sincerely,

Mary Jane Forbes
secretary to Gordon Bell

Enclosures

Digital **Interoffice Memo**

Subject: **Computer Conferencing (or How We Connect N.H. and Maynard without Helicopters)**

To: Distribution

Date: 1 NOV 76
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

F/U 11/8

I talked briefly with a group at SRI doing computer conferencing (person-person). It's been based on the 10, and is now ready to apply using LSI-11's...but with different emphasis.

We want to get a system to use, but have someone else develop it so that it can be available to others. I asked them to look for an OEM, and failing that would get them to develop the software. Meanwhile I asked Doug Englebart to come here so we could exchange views (and we tell them about new products)...the base for the terminal. They can almost use the 11V03 now. Bell Labs conceivably might want to develop this [Jim/Roger, can we approach them?]

Jim, let's get a small group (you, I, Stan, Ken King plus?) to write down a spec and a design for a conference room terminal. Have someone who'll write the product spec/brochure and send us background reading first (e.g., Scientific American articles, papers). Although I don't know what's in it precisely, I'd like to see the terminal be the following ($20K) of equipment:

1. Full duplex data/voice links between the two rooms with voice and 9600 baud.

2. High quality voice, possibly stereo,...we can start with a conventional speaker phone.

3. LSI-11's with video at both ends.

4. Large TV monitors so everyone can see the screen.

5. Tablets and possibly the SRI mouse (Made by Cybernex in Menlo Park) so it is easy for participants to make sketches, yet not require full video transmission.

6. Hardcopy to get pages printed right there...typewriters with plotting will be superb! (A Versetec might be better.)

7. A CCD low resolution, camera with:

100 x 100 x 4 bits = 40K bits = 4 sec.; versus

500 x 500 x 8 bits = 200 sec.

(Used for Fax and for making slides of participants.)

8. Possibly a Fax, but the CCD camera with the proper lens would do the job.

9. Several keyboards to switch information and possibly each user might have a keyboard.

10. Tape recorder to allow non-attendees to watch later.

A conference would consist of 1 to N/2 people at each end (where N is smaller than our current meetings).

Any text or charts (e.g., schedules for schedule review, budget data, budget graphs) would be entered as text on floppies ahead of time. This would use standard WP or Editor SW. The overhead projector slides would be drawn such that the low resolution camera could transmit them easily. They should be entered ahead of time too.

The meeting would be conducted by a chairman/presentor who controlled the voice and displays. Note with 100 x 100, 4 pictures could simultaneously be displayed.

GB:ljp

<u>Distribution</u>

Jim Bell	Sam Bosch
Roger Cady	Murray Copp
Ed Corell	George Friend
Jack Gilmore	Bob Glorioso
Len Halio	Ken King
Alan Kotok	Herve Lavoie

Stan Olsen Mark Sebern
Steve Teicher
February 27, 1980

Herman A. Affel, Jr.
Director-Computer Consoles Inc.
President and Treasurer
Computer Consoles Inc.
Rochester, New York 14600

Jeffrey Tai
Director-Computer Consoles Inc.
Senior Vice President-Operations
Computer Consoles Inc.
Rochester, New York 14600

Dear Messrs. Affel and Tai:

Let me thank you and your engineers for taking the time from your busy schedules to discuss and demonstrate the CCI products. It was really enjoyable to see your high growth company in action and interact with you. I hope the discussion was of benefit to you; it certainly was useful for me to learn more about transaction processing applications.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:swh
GB1.S2.36

CC: Marvin Cothran, DEC
    Jack MacKeen, DEC

+---------------+
! **d i g i t a l !   i n t e r o f f i c e   m e m o r a n d u m**
+---------------+

Subject: **A First Course Started That Uses Computer Engineering**

To: Bob Clark, Del Lippert

CC: Heidi Baldus, Marcie Kenah, John McNamara, Craig Mudge

Date: 28 JUNE 78
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

follow up 7/12/78

As you know, Digital Press is publishing the book, Computer Engineering, this fall (by me, John and Craig).

Craig may teach it at Cal Tech with the goal of developing a course study guide (with problems).

I believe we also have the opportunity of making companion video tapes -- where many of the authors would be the performers! (E.g., Alan Kotok has already delivered the PDP-10 paper.) I'd be glad to video tape some lectures too sometime, and I'd like to convince other authors to do the same.

How can we get one of the local universities to get a course started using it this fall?

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST: Heidi Baldus BY Bob Clark PK3-1/A32
Marcie Kenah BY Del Lippert BU
John McNamara ML3-2/E41 Craig Mudge Cal Tech

June 19, 1979

Montgomery Phister, Jr.
Systems Consulting
307 12th Street
Santa Monica, California 90402

Dear Monty:

Thanks for the questions and errata. They came in useful as we're just reprinting the book. Right now I can't help you with the requests, but hope to eventually. Some of the questions may be answered - see the attached notes on your question sheet.

How's the second edition of DPT&E coming? Is there some possibility that you'd want Digital Press to publish it? Are you writing anything else that they might be interested in? If you're interested, you might contact Heidi Baldus, acquisition's editor.

Again, thanks for the errata. I'm sorry I can't get more information to you just at this time.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:swh
GB0003/57

CC: Heidi Baldus

SECTION I OVERVIEW AND GENERAL INFORMATION

The Computer Museum activities are divided into several major areas: Director's Office, Archives and Exhibits, Programs and Functions, Administration, and Store. This manual describes the functions of each area and gives information to accomplish the tasks asssociated with those functions.

The staff presently includes:

	Director	467-5004
Coordinator	Exhibits/Archives 4743	
Coordinator	Programs/Functions 7570	
Coordinator	Administration 4443	
	Business Manager 4084	
	Store Manager 7331	
	Archivist/Registrar 7076	
	Exhibits Assistant	
	Secretary 4036	

Store Assistants
Museum Technician

The collections are located in the Museum proper, the Twilight Zone, and Building WZ1 at DEC, Westborough.

SECTION II DIRECTOR

The Director is responsive to the Board of Directors following through on its requests and policies with the assistance of the personnel at the Museum.

The Director directly oversees the work of the Exhibits and Archives Coordinator, the Programs Coordinator, and the Store Manager. Much interaction is required in the programs area as new events and programs evolve requiring decisions unique to each.

A large portion of time is needed in the area of fundraising, writing letters and proposals and generally creating goodwill for the Museum.

The Director also oversees the publicaton of four reports annually. An assistant for Publications and Photographs will aid in the tasks of running down details, layout, proof-reading, and editing.

Approximately one day a week must be spent in preparing for the monthly meeting with the Executive Committee of the Board of Directors. The Director is a member of this committee which sets policy, watches the budget and generally keeps the museum on track in matters legal and financial.

The Director may assist in other projects as needed, give tours, and must be available to settle personnel problems as they arise.

SECTION III EXHIBITS AND ARCHIVES

The Exhibit and Archives Coordinator reports to the Director. Reporting to the Coordinator are the Archivist/Registrar, Exhibits Assistant and Museum Technician.

The Exhibit Coordinator is responsible for all areas of the museum collection.

A. Preliminary contact work for new acquisitions

1. Follow up with telephone calls to check out potential acquisition
2. Document in pending acquisition file
3. When piece is received, remove from pending file and add to new acquisitions list (B, D, or X)

B. Registration of new acquisitions (see page 30 for detailed accessioning procedure)

1. three seqential lists - B, D,, or X
    a. B= owned by Bells
    b. D= Digital Equipment Corporation artifacts only - gift of DEC
    c. X= free and clear gift from others (XB= moved out of B list for tax purposes; XD= pieces once held on D list which were not DEC equipment
2. Form letter sent acknowledging acquisition
3. Check accuracy of information on each new piece

C. Decisions on exhibits (in conjunction with Director)

1. Conceptual planning (2 major exhibits are Timeline and 4 Generations
2. Budget Planning
3. Long range planning

D. Design of exhibit and vendor contact

1. Specifying design work

2. Contacting and arranging for work to be done with typesetters, photographers, photo reproduction, exhibit builders, lighting consultants, lighting manufacturers, plastic and metal fabricators, and others.

3. Installation of exhibit

- supervise construction
- decide where things will go
- supervise installation by Museum Technician, DEC, interns
- write text for exhibits in conjunction with Director, others
- check accuracy of information for each exhibit

E. Supervision of Archives/Library and Video Tape/Photo Collection

Work with Archivist/Registrar to

1. agree on format
2. coordinate archival material with the museum artifacts on X, D, or B lists

F. Quarterly Report

Exhibit Coordinator is responsible for the content of the Summer Report which has mainly to do with the collection, listing new acquisitions and donors. The report must be ready for the annual meeting of the Board of Directors in May.

G. Public Relations

1. Solicit artifacts
2. Show appreciation to donors of artifacts or money

H. Supervision of Museum Technician

The Museum Technician reports to the Exhibit Coordinator. The main duties of this part-time job are:

1. assist in display setup
2. dust, clean, polish all displays
3. make minor repairs
4. general maintenance
5. asist in bulk mailings
6. run errands (to post offfice, etc.)
7. rearrange furniture for lectures
8. other

I. General management of the museum with the Director and in the Director's absence.

J. Floppies used:

1. Jamie P - mostly correspondence and forms to acknowledge a donation or loan, to thank for such, and for contracts
2. DCM006.12 - contains policy, collection, receipt for donors
3. X, D, B (3 separate) - listings of collection (kept in back pocket of Blue Book.
4. Typeset - text for present and future exhibits

ARCHIVIST/REGISTRAR

The Archivist/Registrar processes, files and documents all papers, manuals, books, audio and video tapes, photographs and other artifactual materials.

Archives

(See page 30 for detailed archival procedures.)

The collections are processed according to computer company and are then separated into series based on the individual computers produced and then by the manuals, prospecti. These materials are stored in acid-free folders, obtained from either Conservation Resources International, Inc. in Alexandria, VA or University Products in Holyoke, MA. If the volume is too thick for one folder they are divided at a convenient point into two or three or more folders. The folders are labeled as follows:

Company name/computer name or number/any subdivision within the company/title of the material in the folder, volume # (folder number if the material is in more than one folder, e.g. I or II/ year

If the year, month, and day are needed or the material covers a span of time the date is as follows: year, month, day - month, day, year.

The box and folder numbers are not on each folder because these collections may not be complete and should be kept fluid. Having the box listings on a floppy permits the archivist to move the box number along the list to match any additions to or deletions from the collections. Keeping the box list up to date will insure the materials being in their proper location.

The folders are stored in acid-free boxes. The contents of each box (and folders within) are listed on floppy ARCBOX.

At the beginning of each list is the following information which is listed in the abbreviation library <ar>:

COLLECTION NAME (in caps)

<id> AR + number
<na> Company name and collection name
<so> Source (if applicable)
<hw> How acquired (if applicable)
<lo> Location (range/section/shelf e.g. I/A/1)
<rf> Reference - X, XD, D, and B list numbers
<ph> Photograph catalog numbers
<at> Audio tape catalog numbers
< >

The box number is at the left margin. The first tab is the computer name
or number. A new line is begun at a different tab for each of the categories listed between //'s above. Therefore, the whole box list is in outline form. Each collection is a distinct document on the floppy. In this way anyone can access any collection directly.

The catalog numbers from X, XD, D, and B lists which applied to the Archives collections are entered in the <rf> field. The Archives catalog numbers are entered under <rf> on the above lists. These cross references will eventually allow retrieval of all information in the Museum on a given artifact.

Indexes have been developed for the current box list. One is an alphabetical list by company or collection name which includes the catalog number, the location, and the number of boxes in the collection. The other index is a numerical list by the catalog number which includes the company or collection number, the location, and the number of boxes.

In the storage room, the collections are located by Range (wall location), Section (within Range) and Shelf (e.g. I/A/1)

Periodicals are stored in acid-free boxes by Name and Volume # or Date.

Audio and Video Tapes

The audio tape catalog file is on the AUDTAP floppy. The fields in the catalog form can be called up with GOLD, Abbrev. AT and include:

<id> AT + # + year
<na> Name of speaker
<ti> Title of the talk
<da> Date the talk was given
<se> Series (i.e. Pioneer Lecture, Bits & Bites)
<cp> Number of copies of the

tape

<tr> Transcript status

<rs> What restrictions exist if any

<lo> Location

<rf> References (to other collections in the Museum)

<lt> Length of the tape or the talk

<bl> Blurb

The AT refers to Audio Tape, and VT refers to Video Tape. Nothing has been done yet with video tapes.

Future projects include transcribing all audio tapes.

In connection with tapes are two forms sent to speakers at the Museum once the transcript has been completed:

1. Letter to the speaker with which is enclosed a transcript of the talk

2. Permission form for the use of material in the talk in Museum publications.

Accessions

(See page 30 for detailed procedures.)

A system has been set up for keeping track of the incoming non-artifactual (three-dimensional) materials. Each group of materials from a donor or lender is accessioned as a separate abbreviation library on the ACCLOG floppy.

Once the accession has been entered into the accession list, an acknowledgment letter is sent and two copies of either a donation contract or a loan contract are sent. One copy is for the donor or lender and the other is to be returned to the Museum for our records. When the contract is returned to the Museum. it is placed in a file folder with the accession number on it. All other materials referring to that accession except the correspondence will be kept in this file. The correspondence is kept in the Correspondence File. Copies of these letters and forms follow:

<<lci>>

The Computer Museum
One Iron Way
Marlboro, MA 01752

Loan Contract

The Computer Museum has received on loan the following item(s) from <>.

Description

This loan is made with the following understandings:

1. That The Computer Museum will give this(these) item(s) every reasonable care using standard museum practices to protect and preserve it(them). The Museum does not assume responsibility for insuring the item(s) against loss through theft, damage, or destruction.

2. That is the responsibility of the lender to make arrangements to have the item(s) removed from the collection or renewed at the end of the loan period. In lieu of this the lender may turn the loan into an unrestricted gift to The Computer Museum, a non-profit organization under the Internal Revenue code 501(c)3.

3. That this loan shall be for <>days, months, or years and shall terminate on <>(in the case of years the loan shall terminate on December 31 of the last year). The loan may be renewed for a similar period with the consent of both parties and subject to a statement on the condition of the article by The

Computer Museum.

Name and Address of Lender

Gwen K. Bell, Director
The Computer Museum

Date
<>

<<dc>>

The Computer Museum
One Iron Way
Marlboro, MA 01752

Donation Contract

I(we) hereby give and donate, without limiting conditions (and including copyright interest*,) the following article(s), to which I(we) have clear title as shown by the accompanying documentation, to be the absolute property of The Computer Museum.

Description

Donor's Name and Address

Gwen K. Bell, Director
The Computer Museum

Date

The Computer Museum is chartered as a non-profit institution under the Internal Revenue code 501(c) 3. The value of gifts is deductible for tax purposes within the limit of the law.

*Copyright interest applies to donations including manuscript materials, books, photographs, documents, art works, video tapes, slides, movies, original

movie scores, phonograph records,, dramatic works
etc.

<>

<<lco>>

The Computer Museum
One Iron Way
Marlboro, MA 01752

Loan Contract

I, <>, have borrowed from The Computer Museum the following item(s):

Description

This loan is made with the following understandings:

1. That <> will give this(these) item(s) every reasonable care and be responsible for it(them), its(their) replacement, or its(their) value in case of loss, theft, damage, or destruction.

2. That the loan will be for the term of _<>, to terminate on <>.

Name and Address of Borrower

Gwen K. Bell
Director
The Computer Museum

Date
<>

<<al>>

Dear <>:

The Computer Museum is grateful for your donation of the <>. As stated in our Accession Policy, the <>will become part of the Study Collections, significant historical source material.

The <>is an outright, unconditional gift to The Computer Museum, a non-profit, publicly supported organization under section 501(c)(3) of the Internal Revenue Code. You may take a tax deduction to the extent allowable under the law.

I am enclosing two copies of our Donation Contract and an addressed return envelope. Please sign both copies of the Contract and return one to the Computer Museum. The second copy is for your records.

You will be listed as a donor to our Study Collections in the Spring issue of the Computer Museum Report. If you are not currently a member of the Museum, and would like to receive the quarterly issues of the Report and learn of our activities, now is the time to join the Museum membership program. Your membership fee is important in developing the public support we need.

Thank you for your recent gift and your support of the Computer Museum.

Cordially,

Gwen Bell
Director

The Computer Museum

<date>
<>

SECTION IV PROGRAMS AND FUNCTIONS

The Programs Coordinator reports to the Director and supervises the organization of programs, dinner functions, excursions and special events. The Programs Coordinator is also responsible for a large portion of public relations for the Museum.

I. Programs include:

A. Pioneer Lecture Series

1. 6 annually - 3 in Spring, 3 in Fall
2. held in Lecture Hall of cafeteria
3. for members or by special invitation
4. content of talks generally deals with pioneering developments in the field of computing and/or major contributions to the industry
5. checksheet for procedures has been developed to make sure everything gets done
6. most scholarly (and often technical) of all museum lecture programs and always archived for scholarly use.

B. Gallery Talks

1. usually held Wednesdays at 4 p.m. during summer months
2. one hour talks by local speakers or others who are in the area
3. talks relate to speakers' area of expertise, usually as it relates to a particular museum exhibit
4. Museum visitors, DEC employees and/or customers, interns and staff attend
5. talks are audio-taped
6. less technical and scholarly than Pioneer lectures but still for those relatively "initiated" into the world of computing

C. Bits and Bites

1. Sunday series of one hour talks by local speakers
2. Spring and Fall series with an average of 8 speakers each
3. free to the public; refreshments sold at modest prices
4. not too technical in approach; the lighter side of the computing world with a historical or artistic bent

D. Dinner Functions

1. held in museum galleries outside function spaces or lecture hall following lectures
2. by request for outside groups (connected to the computer field)
3. in connection with lectures or special events

E. Excursions

Trips to significant computer installations, or exhibits relating thereto, access to which might normally be difficult for general visitors

F. All Special Events

Past events include Babbage Play. Future event will be Archiving Conference in May 1983.

II. Another major area of responsibility for the Programs Coordinator is publicity and promotion through:

A. computer conferences both locally and nationwide--making all exhibit arrangements and occasionaly representing the Museum at conferences

B. developing press releases and acting as Museum liason for general level promotion (e.g. Boston Globe Calendar, Middelesex News)

C. liason to the membership association which functions as a resource pool for volunteers, to provide suggestions, and to act as a sounding board for prospective programs

III. Other Responsibility

A. Tours

1. Docent training - tour guides come mostly from the staff or DEC
2. Scheduling of tour guides

B. Other

1. Request donations for special events (e.g. champagne for play)
2. Some solicitation letters sent for fundraising when Program Coordinator is the

primary contact

IV. Documentation used in Programs Area

A. Floppy - Chris R. (correspondence, etc.)

B. Chronological list of major publicity since 6/10/82

C. Chronological list of programs since 6/10/82

SECTION V ADMINISTRATION

Part 1

COORDINATOR OF ADMINISTRATION

The Coordinator of Administration reports to the Director, to the secretary to the DEC Operations Committee and to a DEC Supervisor. Reporting to the Coordinator of Administration are the Secretary and Business Manager.

A. Management of office
   1. Supervise secretary
   2. Supervise Business Manager
   3. To ensure smoothly-running operations, act as interface to Digital service organizations such as Facilities, Field Service, Payroll, Personnel

B. Assist Director with Fundraising

   1. Goal - coordinate 100 solicitation letters per month (over $100)
      a. Director provides lists of persons/groups to whom letters will go
      b. edit Director's letters for format, accuracy, style
      c. input list into list processing
      d. mail letters
      e. copy to correspondence file
      f. copy to Office Manager's Monthly Solicitation file (green folder in O.M.'s desk by month)
   2. Month-end Membership Report
      a. for Executive Committee
      b. shows how many new members in each category
      c. includes list of all current solicitations
      d. who responded
      e. what results
      f. filed in Executive Committee Book (white book in Business Manager's Office)

C. Manage Annual Cost Center Budget
   1. WHAT -- $60,000 from DEC

a. includes O.M.'s salary
b. aviation expenses
c. supplies from Stationery
d. miscellaneous shipping
e. other

2. HOW --

a. make up budget
b. track it monthly
c. keep Director aware of status

3. Budget overrun -

new process to be worked out with Director to voluntarily reduce contribution from DEC to commpensate

D. General Assistance
1. mailings
2. travel arrangement
3. museum events and functions
4. others

E. Special Projects

Proposed installation and management of 11/45 computer connected to all museum users.

Floppies used:

A. GERI - correspondence and other
l. filed in O.M.'s office (2 drawer file, under Floppies)

B. BUDGET - Director's floppy
1. updated monthly
2. filed in Executive Committee Book (white) in Business Manager's office
3. contains Monthly Membership Report

C. SOLCI
1. filed in O.M.'s desk in "solicitation" folder
2. contains Update Form
a. updated monthly solicitation lists
b. positive or negative responses recorded
c. paper file - left desk drawer under "Project - Solicitations over $100

Part 2

SECRETARY

The Secretary reports to the Coordinator of Administration and spends most of the time in tasks related to the calendar, telephone, memberships and correspondence.

Calendar

- Daily updates the calendar which includes staff meetings, appointments, events, store personnel schedule, etc.

- One copy is posted, one copy each to Director and Store, and one copy is kept by the Secretary.

- Staff makes additions, deletions, corrections each day to posted calendar.

- Current calendar is kept on floppy SUESYS, document 0.5 and archive is on 0.10.

Telephone

- Museum's main numbers are answered by the Secretary

- Most calls are requests for information, for literature, or to schedule tours.

- A listing of all literature sent out is kept.

- Tour Information Sheet is filled out for tours and this information is added to the calendar.

Memberships

- All memberships are

processed by the Secretary.

- A monthly running total of members and money is kept. (See Secretary's Office Procedures Manual for details.)

- Floppy MBR00l contains information about memberships.

- Rolodex cards for all members contains work and home addresses, telephone numbers, and effective date of membership.

- Book called "Membership Lists" includes alphabetical and zip code lists, Founders and Corporate Founders.

Correspondence

- Processes most outgoing correspondence
- Kept on floppies CM001, CM002, CM003 in chronological order and a copy is also kept in correspondence file.
- See Secretary's Manual for detailed procedures.

Secretary's Office Procedures Manual

- New Members Procedures
- How To run labels, Rolodex cards, pull a founders list, do a member list, and procedures for correspondence file headings.
- Disk Index of floppies used by Secretary

Floppies

- SUESYS -- DECMATE System disk
- DEBBIE
- SYSMBR -- System disk for memberships
- MBR001 -- Membership List
- C001, C002, C003 -- Chronological correspondence

Part 3

BUSINESS MANAGER

The Business Manager reports to the Administration Coordinator.

The main function of the Business Manager is to free the Director, Exhibit
Programs and Administration Coordinators from bookkeeping and other money related chores.

From the Business Manager's viewpoint the Museum is divided into the Director's Office, Exhibit Center and Archives, Program Center, and the Resource Center.

The Business Manager performs tasks in the following areas: payroll, insurance, bank accounts, bookkeeping and accounting, budget, taxes, state and federal reporting, store management, bill paying, invoicing, money handling, preparing for audit, relations with vendors, petty cash, and fundraising. Also photography, report editing, and tasks for special events.

Payroll

o Shawmut Automated Payroll Service -- Contact is Thomas Chatelier, 292-2197.

o In Payroll File see sample forms for: New Employee Setup for both salaried and hourly employees; Employee Revision Form for any change e.g. salary change, tax status; Employee Prelist (comes from Bank each payday, to be filled in with hourly employees' hours listed.)

o Time cards are collected every 2 weeks. Employee Prelist Total is stapled to Prelist and must be into Bank by 2 p.m. on Monday following the end of pay period. Pay period is

Sunday through Friday, biweekly. Checks are processed on Tuesday and can be picked up at the bank on Wednesday a.m.

- All employees must fill out a W4 Form for Federal withholding tax and a M4 Form for State withholding tax. These forms may be obtained from the IRS Center in Holyoke.

- Other forms: Employee Reference Card from bank will verify pay status of a new employee or that revisions have been made to the pay status of an existing employee.

Insurance. Two areas--Museum Insurance and Health Insurance.

Museum Insurance includes: 3 polices with Johnson & Higgins, 3 Center Plaza, Boston -- Joan Goldberg 742-5300

- o Director's and Officers' Liability

  - Underwritten by Chubb: includes areas of Embezzlement, Limits on Personal Liability, and others.

- o Blanket Excess Liability Policy

  - Underwritten by Fireman's Fund: includes areas of Bodily Injury, Automobile Liability, Workman's Compensation, and others.

- o Commercial Insurance Program (biggest area)

  - Underwritten by Federal Insurance Co. (Chubb): includes areas of Property and Building Losses, Bodily Injury (visitors, accidents), Employee Dishonesty, Personal Property.

Health Insurance or more correctly called Small Group Insurance Plan includes: accident, hospital, dental, mental, surgical, $10,000 Term Life, long term disability, $10,000 accidental death and dismemberment.

- o Group # (or Employer #) is 26232.

o Plan Administrator is MSP (Multiple Security Program)

o Claim Office is John Hancock Mutual Life Insurance Co, St. Louis Group Claim Office, 13523 Barrett Parkway Drive, Building #2, Suite 250, Ballwin, MO 630ll, Telephone # 314/821/3002.

o Claim forms include: Statement of Claim (to Dr. or hospital)
Dental Claim Form
Group Hospital Insurance Form (to hospital)

o Contact at MSP (Plan Administrator) is Vivien A. Benning, Contracts Service Coordinator at MSP Insurance Trust, P.O. Box 786, Boston, MA 02117, Tel. No. 421-5000.

o To enroll new employee in plan, <u>two forms</u> must be filled out and mailed to Vivien Benning: John Hancock/ MSP Group Insurance <u>Enrollment Car</u>d and John Hancock/MSP <u>Statement of Health</u>.

Bank Accounts

The Business Manager maintains 3 accounts, writing checks, keeping registers , and reconciling bank statements for each.

- All are at the Shawmut Community Bank, Marlboro West Branch; Manager, Susan Smith 485-6697.

- A deposit account for VISA and Mastercharge sales. Account #294-4146.

- A membership account (checking) formally called Non-DEC Contributions;an interest bearing account; the general operating fund (the largest acct.) Account # 275-959-4

- Store and Events (checking) account; deposits from store, play, etc. Account # 275-960-8. Out of this account comes money for store inventory, food for special events, expenses for any money-making event.

For Investment Information the contact is Gail Chadwick at the Framingham Office, 620-1100 X362--info on IRAs, CDs, etc.

Bookkeeping and Accounting For each of four areas of museum there are income and expense records in file folders.

Budget Income and expenditures for all four areas.

- Monthly Budget Report shows Projected, Year to Date, For Current Month, Total, Deviation.

- Fiscal Year runs July 1 through June 30.

Taxes

- Federal ID # is 042-747-017 (also called Employer ID # and Tax ID #.)

- The most important filing is Tax Exempt Filings for Federal Form 990 and Schedule A; and for State Form PC. These are filed after close of Fiscal Year and a period of 5 months is allowed for filing. (The due date for the Museum is November 15.)

- Quarterly Sales Tax Form ST9Q (State form)

- Withholding Taxes: Federal--Form 941E--Quarterly Return of Withheld Federal Income Tax. (Museum has not yet filed with State in regard to withholding income taxes.)

- Museum is in an Advanced Ruling Period with the IRS until June 1984. The IRS will give permanent tax exempt status to the Museum at that time if in the probationary period it maintains a 2-l ratio (For every $2 that is contributed by corporations, there is $1 from the public).

Accounts Payable

Invoices come in and are

- grouped by when they are to be paid,
- o.k.'d by person initiating the expense securing as much info about it as possible
- paid out of correct account.

Accounts Receivable

- Use invoice form.
- Mostly for dinners done for groups.
- Copy goes in Receivables folder.
- When paid goes in account folders.

Petty Cash

- Taken out of membership account when needed.

o See Petty Cash file folder.

o Usually an expense voucher is filled out and must be ok'd.

Audit

o Coopers and Lybrand do the auditing (gratis) after the FY is over.

o The Business Manager supplies the raw data from the income and expense files.

o Contacts at C&L are Scott Eston and Ed Gillis, 1 Post Office Square, Boston (574-5000).

o All information should be given to C&L in September so that tax forms will be ready by the November deadline for filing.

Relations with Vendors

The policy of the Museum is to pay bills promptly when due. They may be potential members of the museum or possible contributors of money or goods for special events.

Keep track of fundraising

Important to watch the income and to go slow on outgo, keep expenses down, and process deposits quickly when income is less.

FLOPPIES

Floppies are stored in "Software" file folder and are as follows:

Budget — Monthly budgets.

TWIT — Archives expense voucher, purchase order forms, invoice forms, list processing, etc.

DHB 001 — Notes to financial reports (taxes), other tax information, receipt form, information about Report.

Procedures

File Folders contain procedures for payroll, preparing taxes according to printed instructions, accounting system, and charts showing:

- Processing Museum Store Sales
- Handling Money Given to Museum

- Museum Store Purchasing of Inventory and Supplies
- Handling Accounting for Functions
- Store Mail-Order Sales

Legal Advice

- Jim Davis at Bingham, Dana, and Gould, 100 Federal Street, Boston, specializing in legal affairs for non-profit organizations. (Expensive) Clerk of our Board of Directors. Send copies of any legal or tax filing to Davis for locating potential problems.
- Darman Wing, DEC Legal Department, Secretary to Executive Committee; also gives general advice
- Legal information is filed in bottom drawer of file cabinet.

Digital **Interoffice Memo**

Subject: **Computer Names Problem: Care in Using Mini and Micro**

To: OOD	Operations Comm.	Date: 6 JAN 77
PLM's	Dick Berube	From: Gordon Bell
Bruce Delagi	Del Lippert	Dept: OOD
Jack MacKeen	Allen Michels	Loc.: ML12-1 Ext.: 2236
Steve Teicher	Mike Tomasic	
		F/U 1/24

Background

Andy proposed some names and definitions which would be used. We need names/definitions for effective communication and identity! We must evolve the mini name/definition so that it doesn't limit us. E.g., IBM has been known as a large mainframe maker; CDC a super computer maker, even though it had minis; and we've done well by defining the minicomputer (it may have hurt the 10's by being between an 8 and 11...possibly 14-bits.)

I worked hard to keep the mini definition loose:

a low cost computer, between 50K and 10K for a system, usually employed for fixed tasks (even though it can be reloaded) and whose builders agressively employed technology to supply:

a. machines at constant cost and increasing performance.
b. machines at decreasing cost and constant performance.

Hence, mini also meant, by clause b, the mini(mal) machine that one could build at any time with the available technology. Alas, I lost the battle to include in the mini definition:

<u>microprocessors</u>* - the processor-on-a-chip that comes from LSI (i.e., > 1,000 bits/chip) technology from which one builds <u>microcomputers</u>** - the complete system built from a microprocessor, memory, and interfaces. It is most always employed as a fixed application (in read only memory), and costing $100 - $1,000.

The LSI-11 is a (high end) microcomputer that is implemented with a 4 6 chips processor (not 1). This is fine because we use LSI technology.

<u>The Problem</u>

Internally we think of ourselves as a (the?) leading mini maker. We have aspirations of being a leading micro maker too. Somehow we must establish an identity to include both mini and micro without losing mini. This would help our attitudes toward design and sales.

This is an internal/external issue. Who addressing it? Who should?

GB:ljp

April 12, 1979

George Karoly
c/o Mr. David Karoly
Sibly Hall,
Red Hatch Drive,
Earley,
READING RG6 2QW
ENGLAND

Dear George,

In response to your letter of March 26, the week of July 23, as of now, would work out well. I will tentatively hold some time on July 25.

Hope you have a nice holiday, and I am looking forward to seeing you.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:swh
GB0002/23
00 BURT DECGRAM ACCEPTED S 24774 O 43 02-MAR-81 17:25:06

****
* d i g i t a l *
****

TO: TED JOHNSON
DATE: SAT 28 FEB 1981
15:17 EST

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

cc: see "CC" DISTRIBUTION

SUBJECT: RE: THE PROFESSIONAL MANAGERS DESK-TOP COMPUTER

I think the basic work is being done in the ofis program for this system. That program has a significant coupling already.

We can have all these people meet, frankly, I don't think it's worth doing. If we have the kind of resources to engage in this sort of bullshit, then I would rather take a few of them and put them to work implementing! I really don't think
the developers need any more of this content-free, marketing/user input. Peebles has a research program that we need results from to base some of our future work on. I don't want
him doing this.

The experiment you saw in ZR tells me that we are going to have the product base we need. The folks building it should go ahead, they should not be spending their time in educator mode.

I want the developers to work! They've got far more ideas on needs and what various persons want or think they need than we can ever implement or that can be humanly implemented because of the constraints (make it big versus make it little).

If I thought you were serious about this I would recommend that several professional managers got themselves a decent wps system, say like the shared one we are going to market with. Tie it directly into ems, and to one of our big shared systems. They would then start using it to find out what they really need and do: wps, ems, ability to typeset easily, a programming language or ttwo to do fancy desk calculating, a visicalc (there are several around), and then some programming help so as to be able to run experiments when there are things they want to do that they can't program (use) in these other programming/use styles.

Our developers, and development managers are flat out implementing what I think are the right set of products, based
on our knowledge of the market and how to build them. The thinking is sound, the ideas are ahead of the market as we see it now. We do have some dpeople running around trying to market the existing products: I WANT THEM TO GO INTO THE PRODUCT LINES, CAUSE I WANT OUR PRODUCT MONEY AT THIS STAGE TO GO INTO PRODUCTS AND NOT INTO MARKETING PRODUCTS WE AIN"T GOT!

I don't want our product people talking to dreamers who are basically non-computer users and who may never be about vacuuous ideas. If these people have ideas, then let them work them out at the terminal and then let's put em in. Si has the right approach toward identifying the product components in terms of sets of users. (We can all read the Apple brochures, and I don't think a group convened to read and extrapolate is what we need.)

Let's build breadboards not bullshit!

"CC" DISTRIBUTION:

STEVE COLEMAN BOB GLORIOSO SI LYLE
JULIUS MARCUS RON SMART BRUCE
STEWART

GB2.S4.39

00 CORE DECGRAM ACCEPTED S 000280 O 49 21-AUG-82 11:35:43

****

* d i g i t a l *
****

TO: ROGER CADY DATE: SAT 21 AUG 1982
11:33 AM EDT

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

cc: JULIUS MARCUS
KEN OLSEN

MESSAGE ID: 5173246132

SUBJECT: COMPUTERS FOR MANUFACTURING

Apparently their program called Mapper is spectacular and the main reason they are selling in the factory. What about getting someone to write one on VAX?

Surely we could beat HP and Univac in this market. The key is buyout software though and knowing what to do.

Peter Christy has just installed a system to control our semiconductor manufacturing with a 780 .
The manufacturing people are quite enthusiastic about it as a next generation CAM. Also, I recently saw a whole 10M company running cam, mail, cad on a 780. They also had the underground version of Visicalc (Digicalc) that we all use internally.

I can't understand why we aren't the hottest in manufacturing, just like we are in ESG.

Ken has ask me to review your proposal on the new PDP-14 controller with him. My first reaction was quite negative because I think the world will be completely in a different place when you get there with it and I can't understand why you folks don't just put a compiler on your current system to do control (eg. booleans, ladder diagrams) and repackage as necessary? I also don't believe you understand that all the machine control will be integrated into the machines by 85 and the job is really a systems integration and networking job instead of letting old style engineers fiddle with relay controllers.   These industries who'll be automating the past will not have the bucks to spend because they are going the wrong way.

Bottom line:
The industries and machines that form them are shifting radically.
The old ones won't attract the capital and be competitive anyway.
The proposal was clearly the warmed over PDP-14 only 10 years too late. The big budget to get the vanishing market really looks flaky to me. I don't want to invest there.

Why not be the supplier for the factory of the 80's and 90's?

WPS USERS - Leave HP mode and type <CR>

THEME

COMPUTERS <u>ONLY</u> SUPPLEMENT (AND SUPPLANT)

OTHER INFORMATION PROCESSING* SYSTEMS

***<u>INCLUDING</u> TRANSMISSION, TRANSDUCTION, STORAGE, SWICHING AND PROCESSING (CONTROL)**

THE POSSIBILITIES ARE NEARLY LIMITLESS

<u>BUT</u>

SYSTEMS CHANGE MORE SLOWLY THAN WE THINK (PREDICT)

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*****************
* d i g i t a l *
*****************
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TO: see "TO" DISTRIBUTION
DATE: SUN 22 FEB 1981 10:54 EST

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

cc: AL CRAWFORD

SUBJECT: OUR COMPUTING AND COMMUNICATIONS

In discussing this with Al, I came across several facts of interest, that you folks there in the hub of the mill might (re)consider:

Why Move the Maynard Datacenter (PK1)?
Al has been "ordered" out of PK1. This seems incredibly crazy, every way you look at it. Cost, having to do "make work" to move everyone/every machine, high risk in losing ability to perform (to be made up by even incredibly higher cost). It gets us nothing, except higher traffic density in Maynard because of the relatively low density of Al's operation. We are already distributing much of our computing, but there will always be some corporate piece like RCS, a few EMS nodes, Corporate Acct/Control/MIS, the Maynard support for groups like personnel, there and putting them somewhere else will merely further increase our costs. The 2080 should give Al enough capability to stem the tide while we distribute computation throught the other parts (which may turn out to be in PK2,3, PMR, ML, etc. ... which would be bad, as Al has the space).
As an officer, stockholder and person concerned with our computational ability, please let me implore you to rescend your edict ... or help me understand the decision criteria so I can defend the fact that we do try to manage in a rational fashion? In other word, HELP!

Teleconferencing Is Still Needed
I seperately came across some information that says IBM has teleconferencing links of various types between about 8 of its facilities. Furthermore, these rooms are reported to be in use from 7am to 6pm and they are building more. I had hoped we would have teleconferencing going between ML and MK so we could go into the design of a full scale network. We are still building the link, ever so slowly, but I'm equally confident that it will turn out to be an important capability. Can we get these folks on a more aggressive planning track, assuming that it will work?

Telecommunications Backbone Network Needs
A seperate, but related part of teleconferencing is

to get a substantially more aggressive plan for communications
among our NE facilities. The links needed for teleconferencing
also give us decent data communications and more voice traffic.
There is clear evidence that with distributed processing
we will need more bandwidth here. Here, I'd like to ask Al to
have us go for a first class interconnect that would be
substantially cheaper to operate AND it would give us the
experience we need to make products for what I think customers
are going to want in the pre-dawn of the 21st century?
We have the laboratory, which ma bell is well on her way to
forcing us to finance. Let's take advantage of her.

Hub, how about better direction rather than just going around?

"TO" DISTRIBUTION:

A. M. BERTOCCHI   WIN HINDLE   KEN OLSEN

GB2.S4.35
****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION   DATE: SUN 29 JUN 1980 2:14 PM EDT

FROM: GORDON BELL
cc: see "CC" DISTRIBUTION   DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: CONGRATULATIONS AND WHAT IS THE CHARTER HERE?

Am delighted to see that Jim Milton has joined Brian as
Systems Engineering Manager.

Do have some concerns about whether we are going to get more systems than we want or need that are specific to the Commercial group, and hence segmented from the Technical group.

I am deathly afraid of where we are in the systems domain now because of the situation in Manufacturing where everything is put together on an ala carte basis in FAT. I don't want to perpetuate this, and I'm afraid it will. We have to have as a goal Customer Mergability where more than one entity forms the system!

By seperate memo, Mary Jane will send you a note which I want to use to segment the systems classes.

Could you folks get together and segment who is doing what and in what class system?

"TO" DISTRIBUTION:

B FITZGERALD VIA DALEY   BRIAN CROXON   HERB SHANZER

"CC" DISTRIBUTION:

DICK CLAYTON   BOB DALEY   BILL DEMMER
J MILTON VIA DALEY   BERNIE LACROUTE   SI LYLE
LARRY PORTNER

GB1.S5.40
****
* d i g i t a l *
****

TO: ULF FAGERQUIST   DATE: MON 12 JAN 1981 12:02 PM EST

FROM: GORDON BELL

cc: GEORGE HOFF   DEPT: OOD

BILL MCBRIDE EXT: 223-2236
HENK SCHALKE LOC/MAIL STOP: ML12-1/A51

SUBJECT: CONSOLE COMPUTERS IN VENUS & JUPITER

I suggested several times that we use the same control computer for these two systems. With a module costing something like .25-.5M per crack, this would seem to make sense. Also, I tried to no avail to get you to use a standard computer like the 11/23 which had all the engineering done. Frankly, I can't see how you can afford to engineer two special computers, complete with RLV11 controllers. Traditionally, everyone who has copied the RLV has gotten nailed, since it is a very tricky circuit.

What I'd like to see:

Use a standard computer for both. On the interface into the rest of the machine, use the IEEE 488 interface, especially that one to the MPS. We should use industry standards where possible.

In this way, when CT comes out, you can simply replace the cabinet with a table top box and to the IEEE bus, and get a size and cost reduction.

What you say? Why not save a megabuck in the project?

GB2.S1.12

January 24, 1979

T. S. Hermann, Ph.D.
President and
Chief Executive Officer
Carnegie-Mellon Institute of Research
4400 Fifth Avenue
Pittsburgh, PA 15213

Dear Ted:

I talked with various people who you talked with in regard to possible consulting and couldn't find anything at this time.

We don't hire many consultants and those we do are for detailed technology. If you or Mellon Institute have specific technology or product ideas you want to explore, perhaps we should talk.

I'm sorry it took so long to respond to your November 21 letter.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:ljp
ID#432

EMS 5-MAR-79

17:12:14 190 1
To: Bob Puffer
CC: Gordon Bell, Al Bertocchi
From: Al Crawford

Date: MON 5-MAR-79 17:12:14 EDT
Re: Hendricks Analysis - Your Message 3-5-79
         From: Bob Puffer   Date: MON 5-MAR-79 12:59:41
EST
         Message ID: EMS   5-MAR-79 12:59:41 330 1

Maybe I was at a different meeting. I do recall Jack Smith saying that he
thought the technique had more payoff possibly in other than Central Engring.
I also recall a vote out of which came direction for me to go negotiate with
Hendricks a deal wherein he would be providing us the consulting services in
analyzing Central Engring in trade, more or less, for some standard DEC
hardware. To preclude any embarassment or wasted motion, we obviously need
confirmation of what is expected to happen.

Command:

EMS 5-MAR-79
17:40:57 420 1
To: Al Crawford
From: Gordon Bell
Date: MON 5-MAR-79 17:40:57 EDT
Re: Hendricks Analysis - Your Message 3-5-79
         From: Al Crawford   Date: MON 5-MAR-79 17:12:14
EST
         Message ID: EMS   5-MAR-79 17:12:14 190 1

I believe I agreed that we would use the Hendrick study for Central
Engineering.   I don't expect a fantastically big payoff, but I do excpect
that we will get a good insite into the organzation and some analysis, that
wouldn't otherwise be done by doing this. I'm sorry for the extra heat at
this time, but we can post pone the start probably till summer to get teh

thing done after the Redbook cycle....Somehow, there are a bunch of people in
engineering that could do this that aren't tied up in the planning now.

Command:

EMS 5-MAR-79
12:59:41 330 1
To: Al Crawford
CC: Gordon Bell, Al Bertocchi
From: Bob Puffer
Date: MON 5-MAR-79 12:59:41 EDT
Subject: Hendricks Analysis - Your Message 3-5-79

No, nothing now. I haven't had a chance to even read info.

I talked to Gordon who believes he made a commitment to LOOK AT it for
Engineering, but not necessarily DO it. I also talked to Jack Smith who says
he heard Gordon say the above and that he (Jack) DOESN'T feel it would best be
used in Engineering but would be much more applicable to Manufacturing.

I'll let you know more when we've discussed.

Command:

EMS 17-MAR-79
12:07:10 200 1
To: Al Crawford, Al Bertocchi
CC: Ann Jenkins, OOD
From: Gordon Bell
Date: SAT 17-MAR-79 12:07:10 EDT
Subject: The Hendricks Study

I wasn't aware that we (engineering) were obligated to spend $93K for this
study. I feel it is quite a lot in time...which I believe will be beneficial.
However, given money, I ain't so sure.

Can we have a new organizational principal within DEC? Engineering is willing
and able to stand any study and scrutiny by whatever, whoever (but not
necessarily whenever) people want it. However, in these proctoscopical
examinations the examiner must:

1. supply there own proctoscope (funding); and

2. wait till the examinee has the time

3. wait till there is room for the next proctoscope.

Command:

Digital **Interoffice Memo**

Subject: **Consultants and Other Outsiders We Can Work with on Miscellaneous Problems**

To: Distribution

Date: 1 NOV 76
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

F/U 11/8

This is a list of consultants and cooperative R/D efforts who we might utilize effectively on some problems. Can we try to start in the near future (next week or two)?

Secure (Protected) Operating Systems

Peter Neumann, Larry Robinson at SRI - Secure Operating Systems. They would look at STAR in these terms. Roger Gourd, what do you think?

Clark Weisman at SDC has done similar, but more empirical work.

Bisby at USC/ISI is also a system breaker (the group may not be secure).

Bob Abbett at LLL would probably do it free.

Performance Monitoring, Analysis, Understanding

Ed McCluskey pointed out that one of his better students, Liba Syovadoba, is an MIT Assistant Professor. Let's get her at DEC one day a week. Rollins, will you do this to help Ralph and Ulf?

This area is especially frustrating to me as the list of questions I think we ought to answer about systems (11/70, System 20) is growing faster than our ability to do anything but babble...which seems constant or declining. Let's assume the worst...our customers and engineers really would like to understand their systems, and there will be vendors who can satisfy this need (e.g., H.P.). Furthermore, someone may even sue us for false advertising when we say that an 11/70 can be used by 64 users!!

Fonz 11 (and other MOS) Chip Designs

Carver Mead at Cal. Tech. is doing some excellent work on MOS chip layout. Furthermore he has taste in design. While he consults at Intel and uses their furnaces, he's a professional, and any design critique would be secure. Conceivably anything we have in our design would ultimately get taught and used elsewhere.

I believe he could teach us (and possibly even Bill Roberts) some MOS techniques. We could learn this partially by going there and having him explain his design to us. On the other hand, I'd like him to review Fonz. Steve will you and/or one or two drop by there and see whether you believe he has something to add?

Reliability Modeling Program

We tried to get this done this summer with a CMU student (Kini) and failed. Ed McCluskey has a research associate who would be interested in working on it. Dick, can you get a users manual so that we could see whether he would want to work on this?

Memory Chip Evaluation

Harold Shattuck, V.P. of Engineering, Amdahl Corporation would be interested in exchanging reliability, performance, etc. data on memory. They've evaluated ECL and MOS RAMS. If interested in exchange, call Harold, or Lin Wu at 408-735-4011.

GB:ljp

Distribution

Jim Bell	Dick Clayton
Brian Croxon	Bill Demmer
Ulf Fagerquist	Lorrin Gale
Roger Gourd	Bill Green
Mike Gutman	Bob Kusik
Henry Lemaire	Ralph Platz
Jeff Singer	Steve Teicher
Rollins Turner	

00 BURT DECGRAM ACCEPTED S 17425 O 54 21-FEB-81 14:41:54

****
* d i g i t a l *
****

TO: BRUCE DELAGI DATE: SAT 21 FEB 1981
14:41 EST

FROM: GORDON BELL
cc: ENG STAFF: DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: BOOZ ALLEN; BUYING (AND GIVING) COMPETITVE INFORMATION

We undoubtedly got lots of useful stuff from them and I hope we got farther along on the issue of what to make vs what to buy. I learned a new word, virtual integration of a connection
that I already understood. I may have learned a couple of more tidbits about IBM. It seems to me we are in real trouble
if we get a big response that says the lectures were worthwhile.

Ken recently did a neat thing by asking various persons to present topics like these as lectures at a full day meeting. In general, they were very, very good. The presenter learned a lot, and the audience got about the same amount as with a professional presenter.

The real thing that bothers me about Booz, Allen Barf is that I consider them to be basically unethical. I would bet they have consulted to IBM, and the mapping of the IBM strategy and
organization is fundamentally a form of paid, industrial espionage they do for bucks. They probably already sold this pitch to the Japanese and to everyone else in this industry.

Fortunately, they have us down in the bottom 25 with the also rans somewhere near GE, and hopefully won't both getting the same kind of shit together to present to IBM. Their concept of thinking they are building advanced systems when they do anything for the govt in comm or computing, means they don't really understand the whole thing. (I'm on an NRC panel that's looked at the govt use of computing).

Frankly, I'm confident we gave them more than we got by

our questions, attitudes about who are the real competitors, who is quality, etc. We should have been able to get the same poop from a book or DEC lecture.
I'd propose that we interact with them via closed ckt video as a way to limit information flow. No way should they have been party to any of our thoughts on strategy.

As for the espionage, I found it as unsavory as the characters
who presented it. Maybe we are at war and I don't recognized we have to employ spys by the hour. Clearly this is kind of presentation is not new to us, Gideon Gartner's Garbage presentations on IBM (and I understand he has a DEC presentation that he gives to IBM) are another type. Somehow, I
have trouble adapting to the style. I know Japan works this way, and at one level, mapping an organization and their direction is a lot of fun. Clearly we do a lot of this with our
competitive analysts. Walking inside and talking to the folks
is like shooting fish in a barrel though. Can we get a set of
the slides they are presenting to the outside about us?

Can you all tell me this is the way the world is? That it is something (like having the responsibility for the mill) that's basically ok and builds character?

GB2.S4.32

GB0002/16

| d | i | g | i | t | a | l | i n t e r o f f i c e   m e m o r a n d u m

Subject: **Working Out a Consulting Arrangement with Paul Penfield, MIT**

To: Jim Bell, ML3-2/E41   Date: 4/11/79

Jim Cudmore, ML1-5/E30
Don Nelsen, WZ-2
Val Patel, WZ-2
Mike Titelbaum, ML1-2/E65
Joe Zeh, WZ-2

From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

follow up 4/23/79

I talked to Paul at the MIT Visiting Committee meeting last week. He seems enthusiastic about consulting for us and getting a good linkage between here and MIT. One of the issues was getting APL there so he could use it for developing design aids. Since he will be working for us in this regard, lets get the program there with the provision that it either be for his exclusive use and his group in this area, or if it is used widely, then let's treat it as a gift. In this later regard, I only see giving it, if it is not going to be used widely within the department for other purposes outside this work. On the other hand, it may be possible to give it and deduct the cost. Note, the cost is the amount to produce it, plus the residual amount to maintain it. Let's do this quick, so we can get the group committed to working with us and getting Paul focussed here this last part of spring and summer!

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST:	Jim Bell	ML3-2/E41	Jim Cudmore	ML1-5/E30
	Don Nelsen	WZ-2	Val Patel	WZ-2
	Mike Titelbaum	ML1-2/E65	Joe Zeh	WZ-2

9/7/81 - Draft

DIGITAL COMPUTER MUSEUM CATALOG

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GB2.S6.73

RESPONSIBILITY CONTRACT - BELL AND PORTNER
This contract will be the basis of an ongoing agreement with Larry updating semiannually.

____________________ ____________________

Gordon Bell (date) Larry Portner (date)

DOMAIN: JOINT RESPONSIBILITY

Bell	Portner

GENERAL: ORGANIZATION, CHARTER DEFINITION, CONTRACTS & MEASUREMENTS

Technology & products coaching & leadership	Resources, processes & control tutorials & mgmnt

PRODUCT, STANDARDS, PROJECTS: PROVIDE ENGINEERING LRP (RB) AND PRODUCT PLAQUES FOR OPERATIONS COMMITTEE

Provide integrated overview and review of ELRP	Manage ELRP Process
Review all projects at "critical" times	Establish & monitor proj control and reporting via line groups (YB)
Manage Tech Director	Manage Strateg Plan Mgr

RESOURCES: REVIEW YEARLY GROUP OPERATING PLAN (BB) FOR PEOPLE, PROJECTS, SPACE, BUDGETS, ETC.

	Manage BB process

WHOLE ORGANIZATION: DESIGN AND CONTRACT CLEAR CHARTERS

DIRECT REPORTS: ESTABLISH CONTRACTS AND MEASURE OUTPUT
Manage tech output,   Manage administration,
Be technical coach   Be managment coach

PERSONNEL: PROVIDE COMPENSATION & WORK CONDUCIVE TO ENGINEERING
Technical coach   Mgmnt training & coach
BUDGET: Via controller
CAPITAL EQUIPMENT: Via controller & admin.
SPACE/FACILITIES: Via Admin Mgr
MGMT TOOLS/SYSTEMS: Via Admin Mgr
TECH OPERATIONS: Via TOPS Mgr.

<u>PROGRAMS</u>
Q & P: SET GOALS AND REVIEW RESULTS
Manage Q & P Mgr
HELP ENG T/F ?
HRP, ORG DEV ?
TECH TRAIN ?
MGMT TRAIN ?
<u>INTERFACES</u>
CORP: OC & Group VP   F & A
PPC/CORP MKT   Manage via Corp PM
MANUFACTURING ?
ENG COMM ?
CUSTOMER SVCS ?

EMS   11-APR-79
14:53:33 500 1
To: Al Crawford, Leo Bennett, Jim Bell, Bob Puffer, George Chamberlain
To: Ann Jenkins
From: Gordon Bell

Date: WED 11-APR-79 14:53:33 EST
Subject: Corporate Contribution of Computer Time - Can we do it?
----
c/o Ann for Ken Olsen Jerry Witmore (not on EMS)

Follow Up 4/20

At the MIT visiting committee last week, Larry Roberts suggested we "give"
computer time, and then get the appropriate tax deduction.

Telenet would supply free time off hours and suggested we do the same.
Currently MIT uses the horrible MULTICS system at $20/hr. or $5/hr. off peak.

How much time could we make available after hours? How much could we deduct
for it? Is this a crazy idea? It feels like we could make money doing
this...unless it takes away a sale.

Historical   Application
Operational   High- DEC
Pres.   for Visitors   for Museum   level
rep.
displays
"Magnet-

school"

SCI. MUSEUM,
LONDON   ***   *
*

SMITHSONIAN   *

NAT'L MUSEUM
OF SCI.
TECHNOLOGY,
OHAWA   **   **   *

	**			
LOS ANGELES SCI. MUSEUM	* (IBM)	*		
MARYLAND SCI. CENTER	* (IBM)	**	*	
BOSTON SCI. MUSEUM	* (HONEY WELL)	*		
BOSTON CHILE MUSEUM	*	**	*	
CAPITAL CHILD MUSEUM	* **	**		
OMSI	* **	**		**
LAWRENCE HALL OF SCI.		*		*
TORONTO SCI. CENTER	*	***	*	
CHICAGO MUSEUM OF SCI. & IND.	(IBM & BIG * NEW	*		

FUNDS)

DEUTSCHES
MUSEUM *

FRANKLIN
INSTITUTE (?)

Gwen and I put this together to aid in understanding future requests from these folks. Hope it's useful to you.

GB0002/20

EMS 11-APR-79
14:53:33 500 1
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this...unless it takes away a sale.

REA

EMS 11-APR-79 14:53:33
500 1
To: Al Crawford, Leo Bennett, Jim Bell, Bob Puffer, George
Chamberlain
To: Ann Jenkins
From: Gordon Bell
Date: WED 11-APR-79 14:53:33 EST
Subject: Corporate Contribution of Computer Time - Can we do it?
----
c/o Ann for Ken Olsen Jerry Witmore (not on EMS)

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How much time could we make available after hours? How much could we deduct
for it? Is this a crazy idea? It feels like we could make money doing
this...unless it takes away a sale.

Command:

EMS 11-APR-79 16:18:06
230 1
To: Gordon Bell
CC: Al Crawford, Leo Bennett, Jim Bell, Bob Puffer, Ann
Jenkins
From: George Chamberlain
Date: WED 11-APR-79 16:18:06 EST
Re: Corporate Contribution of Computer Time - Can we do it?
From: Gordon Bell Date: WED 11-APR-79 14:53:33
EST
Message ID: EMS 11-APR-79 14:53:33 500 1

----
1. Is it crazy idea? Probably not crazy, but not wise. Issue here is
ability

to service additional customer on top of inhouse loads. 2. Make money/deductions. The only deductions the company gets are for actual cost
expended, not "notional" cost or equivalent costs saved. To extent company
provides use of existing facilities, there is no incremental deduction for
providing the service. Clearly you can't make money.

Suggest you work with Bob Puffer to determine whether we should go forward.

Command:

EMS 11-APR-79 17:17:08 010 1
To: Gordon Bell
CC: Leo Bennett, Jim Bell, Bob Puffer, George Chamberlain, Ann Jenkins
From: Al Crawford
Date: WED 11-APR-79 17:17:08 EST
Re: Corporate Contribution of Computer Time - Can we do it?
From: Gordon Bell Date: WED 11-APR-79 14:53:33 EST
Message ID: EMS 11-APR-79 14:53:33 500 1

Top of the head: we do have some excess capacity during 2d and 3d shift.
Non e at all during prime shift. I suppose we incur some security risk by
inviting student wizards to come on board. Admin cost would probably not be
too great, in that we already account for detailed consumption of machine
time--at least in the IPC and CAD systems.

If the contributions and tax guys say to pursue, I will dig into feasibility
some more.

Command:

EMS 11-APR-79 21:54:09
200 1
To: Al Crawford
From: Gordon Bell
Date: WED 11-APR-79 21:54:09 EST
Re: Corporate Contribution of Computer Time - Can we do it?
From: Al Crawford Date: WED 11-APR-79 17:17:08
EST
Message ID: EMS 11-APR-79 17:17:08 010 1

Thanks. I hope it would be worth our while to consider. Maybe we should try
a breadboarding of this with a small group. If you could bound how many
ports, blocks, etc. then we could ask mit to try it for some calss or
another.

Command:

EMS 12-APR-79 15:29:29
450 1
To: Gordon Bell, Jim Bell, Leo Bennett, George Chamberlain
To: Al Crawford, Ann Jenkins
From: Bob Puffer
Date: THU 12-APR-79 15:29:29 EST
Subject: CORPORATE CONTRIBUTION OF COMPUTER TIME - CAN WE DO IT?

MIT is not the first such organization to request contribution of computer
time. We have in the past received requests from local towns, school systems
and the community colleges. I can recall several discussions of this at the
Contributions Committee where we concluded that we didn't want to get
involved. Although in principle it would bbe easy, in practice it turns out
to be quite difficult since the "for free" customer expects the same level of
service and support as does the customer. The "free" customer is not willing
to be thrown off at our whim whenever we want to rejuggle loads or

reschedule
internal jobs. The admin- istrative costs of keeping the "free" customers
happy are perhaps in fact higher than servicing our regular customers in
house. I think it is a good way for everybody to lose since the odds are that
the "free" customer will be unhappy and will feel hassled.

One exception we have made in the past was when an employee was doing
charitable work using our system, for example, Tom Stockebrand doing the
Boxborough voting lists. I think our past policy is a good policy, and we
should not change it.

Command:

EMS 12-APR-79 17:23:34 510 1
To: Bob Puffer
CC: Gordon Bell, Jim Bell, Leo Bennett, Al Crawford, Ann Jenkins
From: George Chamberlain
Date: THU 12-APR-79 17:23:34 EST
Re: CORPORATE CONTRIBUTION OF COMPUTER TIME - CAN WE DO IT?
From: Bob Puffer Date: THU 12-APR-79 15:29:29 EST
Message ID: EMS 12-APR-79 15:29:29 450 1

I agree with Puffer.

Command:

EMS 13-APR-79 12:05:48 490 1
To: Gordon Bell
CC: Leo Bennett, Jim Bell, Bob Puffer, George Chamberlain, Ann Jenkins
From: Al Crawford
Date: FRI 13-APR-79 12:05:48 EST
Re: Corporate Contribution of Computer Time - Can we do it?

From: Gordon Bell Date: WED 11-APR-79 14:53:33 EST
Message ID: EMS 11-APR-79 14:53:33 500 1

I got a strong negative vote from my guys who would have to make it work.

On balance, I conclude there is no financial benefit, there would be admin
cost, and the hassle would not be worth whatever PR we might derive.

I agree with Bob.

Command:

EMS 15-APR-79 14:56:15 090 1

To: Al Crawford
From: Gordon Bell
Date: SUN 15-APR-79 14:56:15 EST
Re: Corporate Contribution of Computer Time - Can we do it?

From: Al Crawford Date: FRI 13-APR-79 12:05:48 EST
Message ID: EMS 13-APR-79 12:05:48 490 1

I am stopping the pursuit of the idea.

Command:

00 BURT DECGRAM ACCEPTED S 10465 O 76 30-JAN-82 15:49:55

****
* d i g i t a l *
****

TO: ANDY KNOWLES DATE: SAT 30 JAN 1982 3:46 PM EST
BILL STEUL FROM: GORDON BELL
cc: DICK BERUBE DEPT: ENG STAFF
DIGITAL MUSEUM EXT: 223-2236
LARRY PORTNER LOC/MAIL STOP: ML12-1/A51

SUBJECT: PLEASE FUND HAROLD COHEN... BUT I CAN GO TO THE OC IF NECESSARY

History
Gwen asked Andy, head of MR and the Technical Product lines for
an 11/44 for Harold Cohen. Harold will do more paintings with
his new program. Andy agreed, and Harold is waiting. Therefore,
I don't see any way out of doing it. I want to do whatever is
necessary to fund it, including seeing the Operations Committee.

I see these alternatives for funding Harold:

1. Andy fund it or load it out in his past job.

2. I get some funds from engineering and support it that way. Larry, what you say?

3. Technical and Engnineering do it.

4. Operations Committee. Since 6 is out, I'll go there, very sheepishly with the request.

5. If none of the above, then I see no alternative but for Gwen and I to fund it personally or we assist Harold in getting a computer somewhere else.

   Harold had offers from others, I asked him to stay with us because I had confidence in this work and that we would benefit. I believe Intel, Motorola, HP or IBM would fund Harold if both of us asked them.

Andy and Bill,
What you say?

If no, then I'll go to the next Operation Committee meeting.

6. The Corporate Contributions Committee would fund it when

hell
freezes over. I don't see why they didn't fund it.

Harold's at the University of California/San Diego. The machine will be available to others there. I don't know what the issue is about it being his or theirs. At any rate, I believe this point could be gotten around. Given the strange overhead associated with organizations, having Harold responsible for it sure makes good sense. Given that Harold travels around for shows and sabbaticals, I don't think the University should own it. (The rule about not supporting people is idiotic. Organizations don't do anything, people do! All real work is funded to people.)

Digital directly benefits in many ways. It is good AI research. His paintings are in our buildings and the results of this larger program will be a larger painting. His students are exposed to our computers. We get the benefit of his publicity. His painting of the MR2 building was on the cover of Datamation. His next work is resulting in many shows including the Tate, etc. The 11/44 and GIGI will occupy a predominate point in the exhibit! We'll get more PR from this than 50% of our spending in this area. Thus DIGITAL directly benefits!

As a commentary on our values, I think funding Harold is much more important than the self serving, glossy brochure that extolled our contributions. This was clearly designed to make the committee feel good because it had no substantive or useful information, but was a complete waste of resources.

GB3.S2.62
November 30, 1981

Dr. Joseph Capowski
University of North Carolina
Medical Research Wing 206 H
Chapel Hill, NC 27514

Dear Dr. Capowski:

I certainly appreciate your predicament due to NIH cutbacks. We have not given funds for staff in the past so I don't believe we could help in this regard. Normally our assitance has been limited to equipment grants and exchange of equipment for research.

Funding proposals should be addressed either to George Chamberlain, our treasurer who also handles corporate contributions or to Joel Schwartz, head of our Laboratory Data Products Marketing group.

Sorry I can't help.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:mal
ID#GB3.S1.54

ID#0266

| d | i | g | i | t | a | l | interoffice memorandum

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|   |   |   |   |   |   |   |
+---------------------------+
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Subject: **Advanced Development and Development Progress**

To: Dick Clayton, Ed Corell,
Bob Glorioso, Len Halio,
Charlie Rupp, Walt Tetschner

CC: Bruce Delagi, Andy Knowles,
Roy Moffa, Ken Olsen,
Stan Olsen

Date: 11 SEP 78
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

The VT100 appears to be going well. I'm happy that the customers like it because this will stimulate our sales and marketing to pull. I believe the LA34 and LA120 should also do well.

Let me officially congratulate you on the progress in Advanced Development. For the first time in the last year, I feel good about the long term engineering for terminals -- having been away six weeks and walking around the lab. There's a good base of knowledge and good packaging concepts. Thus, I think we can quickly design and build about any terminal that's needed...this puts some pressure on defining specifically what's needed in the product/market domain (e.g., an electronic typewriter).

I hope we'll get Hong Kong into manufacturing to cut costs, and you have people motivated and capable to get us the low cost, high quality electronic typewriter for typing, word processing, as a terminal and for electronic mail. The possibilities for a great analytic/display smart terminal calculator are there and I want to stay with this one personally because I need/want one. Let's keep these people motivated. These breadboards also form an essential media for marketing interaction and product definition.

The work in Ed's area is really nice, especially considering the position only 10 months ago.

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST: Dick Clayton ML12-2/E71 Ed Corell ML5-2/E93
Bruce Delagi ML12-1/F41 Bob Glorioso ML3-2/E41
Len Halio ML5-2/E93 Andy Knowles ML5-2/A53
Roy Moffa MR2-1/M64 Ken Olsen ML12-1/A50
Stan Olsen MK1-2 Charlie Rupp ML3-2/E41
Walt Tetschner ML5-3/E12

+---------------+
! d i g i t a l ! i n t e r o f f i c e m e m o r a n d u m
+---------------+

Subject: **The Cornell Submicron Semiconductor Facility**

To: Steve Testa, Rochester

CC: Bill Green, Bob Kusik,
John Leng, John Mucci

Date: 15 MAY 78
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

follow up 5/29/78

We're selling 10's and 20's to many of the universities that do semiconductor research. CALTECH just got theirs and we are interacting with them and expect to share programs, etc.

(MIT, CMU, Washington, also are involved and have machines).

Why isn't Cornell a target user for CAD equipment for VLSI?

Have you talked with them?

Have our semiconductor people talked to them/been there?

GB:ljp

September 17, 1979

Joseph Ballantyne
Cornell University
306 Phillips Hall
Ithica, New York 14853

Dear Joe:

Enclosed is more information on Sam Fuller.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:swh
GB0004/53
April 1, 1984

Ms. Debbie Hall

and

Ms. Ann C. Neumire
Consumer Service Dept.
Corning Glass Works
Corning NY 14830

Dear Ms. Hall and Ms. Neumire:

In early March I sent Ms. Hall an order for <u>6 liners</u> for the TR-1 Coffee On Demand Carafe. I enclosed a check for $57 to cover the cost of the <u>liners only</u> at $8 plus $1.50 for shipping, per Ms. Hall's letter to me (Ref 535-003, 20 February 1984) where she quoted the price.

Last week I received 6 complete TR-1 Carafes at a price of 180, and an invoice (c 032991, March 21) for the excess which was $136.10
(180 + 9 sales tax + 4.10 shipping - 57).

<u>I only want liners NOT complete Carafes!</u>

I have taken the liners from the six Carafes, which I assume you wanted to use as shipping containers and am returning the six Carafes, <u>without</u> the liners, to you. I am not charging you the additional shipping costs to return the liners or the cost of my labor for removing the liners from the Carafes.

Sincerely,

Gordon Bell
Page Farm Rd.
Lincoln, Massachusetts, 01773
****
* d i g i t a l *
****

TO: KEN OLSEN DATE: MON 18 AUG 1980
8:43 AM EDT

FROM: GORDON BELL
cc: DICK BERUBE DEPT: OOD
OOD: EXT: 223-2236
OPERATIONS COMMITTEE: LOC/MAIL STOP: ML12-1/A51

SUBJECT: CORP REPORT CARD/PARAGRAPH FOR YOUR LETTER/MSG TO TROOPS

Glad you asked. Note the following:

WHAT I'D LIKE TO SEE IN THIS ISSUE TO ALL DEC EMPLOYEES:
0. NO CORPORATE REPORT CARD OF THE FORM GIVEN
1. Your letter which you've asked me for a paragraph for
2. Take the milestones calendar and have a paragraph and picture
for each entry, or some quotes from various people
3. Possibly a page from each function, giving its milestones...
note I have included mine below in about a dozen paragraphs
(The new facilities would be described in this section, if
someone can rewrite it in something resembling english.)

NO CORPORATE REPORT CARD

No way do I believe we publish the "Corporate Report Card" ...
like all things done by a committee, it is awful! At most, it
is our report card, and perhaps that of our direct reports. The
screw-ups I know about are also known about by those who screwed
up. If we say all those bad things about product introduction,
I'll lead a witch hunt to get to the bottom of every one and I
don't think this is very productive. Also, I think it is pretty
lenient in areas where I think there is no leadership or sheer

incompetence. Do we really want these out in the open?

I don't know how this'll help the masses, especially someone who's just produced all the terminals they've been asked to and then we tell them they've missed commitment. If it's for everyone, then let's make sure it targets them. Mostly, the report card as proposed is totally irrelevant to most employees.

Let's put out a very positive message for employees in a big issue of DECworld, really descriptive and aimed at communication, not winning photo or artistic contests. Content, not Form!

ENGINEERING (in one paragraph)

For the first time, our computers can be connected into large networks, with any terminal on any machine interconnected with any other machine. Also, these DECnetworks can be connected to the developing international X.25 standard-based networks. DEC's engineers have the advantage of being interconnected on a 100 node computer network spanning from Reading, England, to Colorado Springs, allowing them to work co-operatively, exchange programs and ideas via Electronic Mail, while located with their appropriate manufacturing and marketing groups. This year semi-conductor engineering and manufacturing moved into a new plant in Hudson, Mass., the new RM03 and RL02 disks were designed at the Colorado Springs plant where they are manufactured, and the commercial software for VAX-11 was developed in conjunction with the Commercial Systems marketting group at Marrimack, New Hampshire. Together with Xerox and Intel, Digital has proposed an international standard for interconnecting computers which will allow us and our users to begin to substitute communication for transportation, saving energy.

ENGINEERING (IN A DOZEN PARAGRAPHS)-excuse the rough draft

We celebrated the tenth anniversary since the introduction of the Model 20 PDP-11. Since then we have introduced 15 basic models, including the recent 11/44 System. We also celebrated the fifth anniversary of the VAX project which produced the VAX-11/780, introduced in 1978. The DECsystem 2020, introduced in 1979, won an IR 100 Award. We use a significant number of computers in our engineering in applications from word processing and electronic mail to checking whether the computers we design meet the specifications we originally intended for them. The network connecting our main engineering computers became operational, and now includes 100 machines.

NEW PRODUCT INTRODUCTIONS

The 11/44 System based on the RL02, 10 Megabyte disk was introduced in November to provide much more capability then the 11/34-based system we introduced in 1976. It allows a main memory of ? Megabytes, performs at about ? times the 11/34, but includes the Commercial Instruction Set. With remote diagnostic capability, it has lower basic monthly maintainence charges. When running the various timeshared or multi-process systems, we expect an installation would get more than ? times the use, for a constant workload.

The Commercial software was introduced for the VAX-11,

permitting
users to have a single computer type for either technical or commercial applications. This provides a VAX-BASIC, COBOL, PL/1,
and the existing languages, together with a powerful data management system, and a unique Sort capability. We believe the
performance and capabilites in this important application area
will be as significant as VAX-11 was for technically oriented users.

DECnet, Phase III was announced, permitting larger networks to be
built with the ability to pass information among nodes and the
ability to have a terminal on a given machine to be connected on
any of the machines. This enables true networks to be built, versus those which we believe will be limited because they are
based on a hierarchy. Also, we introduced the ability to interconnect DECnetworks to the emerging versions of the international standard X.25. Finally, we are working with Xerox
and Intel to specify and build a local network interconnection
standard based on Xerox's Ethernet, which will be capable of interconnecting computers and terminals within a connected radius
of ?? Km. and transferring information at a 10 Mhz. rate. We have proposed this standard to the various standards organizations.

ENGINEERING ORGANIZATION AND FACILITES

Two, significant engineering facilites have been opened this year at Spitbrook Rd. in Nashua, New Hampshire for system's software, and Hudson, Massachusetts for semiconductors. In general, engineering is co-located to be part of a critical business unit either on the basis of a manufacturing technology or for a critical market. For example, the RM03 and RL02 disks, and the Commercial software for the VAX-11, are engineered at the Colorado Springs disk plant we opened in 1977, and the Commercial Product Group at Merrimack, New Hampshire, established in 1976.

We have run several experiments on video teleconferencing and are using crude teleconferencing (based on the best available technology) between Maynard and Colorado Springs. Our annual engineering conference used teleconferencing to extend the coverage to all the sites, thereby doubling the number of attendees. We are emphasizing our ability to communicate electronically, as a means of increasing productivity.

WE USE OUR OWN COMPUTERS
Computers are the tools of our engineers. We have over x terminals for word processing, provided by dedicated (WPS 200/WPS 78 series) and timeshared facilities. These also are connected to various typesetting systems. In addition, they connect into both the corporate-wide Electronic Mail System and the 100-node Engineering Network stretching from Colorado Springs to Reading, England. As one of the largest computer networks in existence, it is used for: interperson communication via its own electronic mail systems, as a communications network for virtual terminals permitting a user on one system to access another system, file transfers among persons or to unique facilities (eg. typesetting), for load levelling, program updates on a network-wide basis, and as a laboratory in terms of networking

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The use of on-line systems for drawing logic schematics has increased, and in some areas we can draw, simulate, and go on to automatic layout of chip or printed circuit board. A significantly better simulator has been introduced, with the capability to do automatic generation of production test patterns. For the first time, we can verify that a given hardware implementation of a design meets a formal specification.
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MANUFACTURING PROCESSES TO BUILD COMPUTER SYSTEMS

Of course tools to design are nice, but for us, the manufacture of the design is essential. We now have production lines for terminals and low cost disks that must attain the volume of consumer oriented units. These lines operate with computer assistance for tracking and controlling flow, testing, measuring quality and productivity. In our basic technologies, we have recently introduced a line to manufacture all the media for our high volume RL01/02 cartridges. In semiconductors, the Hudson facility is now operational and producing both MOS and bipolar parts. We are able to produce significantly higher density printed circuit boards for the one board microprocessors and also for high performance machines, although the later require multiple layers with controlled impediance to handle the high speed signals.

We are extremely happy that the product quality goals set several years ago for products are now being attained, in what we called our "Dock Merge" program. This enabled parts such as disks and terminals to be inventoried in our Final Assembly Test plants and shipped directly to a customer without the necessity to test the system as a whole. We have established a new goal, "customer site merge", which permits us to hold parts at each of the high volume plants or in distribution warehouses, and to have them field merged. We believe this will permit much lower inventories

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and product engineering.

Pls excuse this last section, as it is a draft and shouldn't be
widely circulated. Somehow if you adopt the first suggestion,
it would be used, otherwise, we would publish it in some form
just within engineering as a letter from Larry and I.

Hope there is something here you can use.
g

GB1.S6.22
****
* d i g i t a l *
****

TO: KEN OLSEN   DATE: MON 18 AUG 1980
8:43 AM EDT
                                 FROM: GORDON BELL
cc: DICK BERUBE   DEPT: OOD
    OOD: EXT: 223-2236
    OPERATIONS COMMITTEE: LOC/MAIL STOP: ML12-1/A51

SUBJECT: CORP REPORT CARD/PARAGRAPH FOR YOUR LETTER/MSG TO TROOPS

Glad you asked. Note the following:

WHAT I'D LIKE TO SEE IN THIS ISSUE TO ALL DEC EMPLOYEES:
0. NO CORPORATE REPORT CARD OF THE FORM GIVEN
1. Your letter which you've asked me for a paragraph for
2. Take the milestones calendar and have a paragraph and picture
    for each entry, or some quotes from various people
3. Possibly a page from each function, giving its milestones...
    note I have included mine below in about a dozen paragraphs
    (The new facilities would be described in this section, if
    someone can rewrite it in something resembling english.)

NO CORPORATE REPORT CARD

No way do I believe we publish the "Corporate Report Card" ...
like all things done by a committee, it is awful!   At most, it
is our report card, and perhaps that of our direct reports. The
screw-ups I know about are also known about by those who screwed
up. If we say all those bad things about product introduction,
I'll lead a witch hunt to get to the bottom of every one and I
don't think this is very productive. Also, I think it is pretty
lenient in areas where I think there is no leadership or sheer
incompetence. Do we really want these out in the open?

I don't know how this'll help the masses, especially someone
who's just produced all the terminals they've been asked to and
then we tell them they've missed commitment. If it's for
everyone, then let's make sure it targets them. Mostly, the
report card as proposed is totally irrelevant to most

employees.

Let's put out a very positive message for employees in a big issue of DECworld, really descriptive and aimed at communication,
not winning photo or artistic contests. Content, not Form!

ENGINEERING (in one paragraph)

For the first time, our computers can be connected into large networks, with any terminal on any machine interconnected with
any other machine. Also, these DECnetworks can be connected to
the developing international X.25 standard-based networks.
DEC's engineers have the advantage of being interconnected on a
100 node computer network spanning from Reading, England, to
Colorado Springs, allowing them to work co-operatively, exchange
programs and ideas via Electronic Mail, while located with their
appropriate manufacturing and marketing groups. This year
semi-conductor engineering and manufacturing moved into a new
plant in Hudson, Mass., the new RM03 and RL02 disks were designed
at the Colorado Springs plant where they are manufactured, and
the commercial software for VAX-11 was developed in conjunction
with the Commercial Systems marketting group at Marrimack, New
Hampshire. Together with Xerox and Intel, Digital has proposed
an international standard for interconnecting computers which
will allow us and our users to begin to substitute communication
for transportation, saving energy.

ENGINEERING (IN A DOZEN PARAGRAPHS)-excuse the rough draft

We celebrated the tenth anniversary since the introduction of the

Model 20 PDP-11. Since then we have introduced 15 basic models,
including the recent 11/44 System. We also celebrated the fifth
anniversary of the VAX project which produced the VAX-11/780,
introduced in 1978. The DECsystem 2020, introduced in 1979, won
an IR 100 Award. We use a significant number of computers in our
engineering in applications from word processing and electronic
mail to checking whether the computers we design meet the
specifications we originally intended for them. The network
connecting our main engineering computers became operational, and
now includes 100 machines.

NEW PRODUCT INTRODUCTIONS
The 11/44 System based on the RL02, 10 Megabyte disk was
introduced in November to provide much more capability then the
11/34-based system we introduced in 1976. It allows a main
memory of ? Megabytes, performs at about ? times the 11/34, but
includes the Commercial Instruction Set. With remote diagnostic
capability, it has lower basic monthly maintainence charges.
When running the various timeshared or multi-process systems, we
expect an installation would get more than ? times the use, for a
constant workload.

The Commercial software was introduced for the VAX-11, permitting
users to have a single computer type for either technical or
commercial applications. This provides a VAX-BASIC, COBOL, PL/1,
and the existing languages, together with a powerful data
management system, and a unique Sort capability. We believe the
performance and capabilites in this important application

area
will be as significant as VAX-11 was for technically oriented users.

DECnet, Phase III was announced, permitting larger networks to be
built with the ability to pass information among nodes and the
ability to have a terminal on a given machine to be connected on
any of the machines. This enables true networks to be built, versus those which we believe will be limited because they are
based on a hierarchy. Also, we introduced the ability to interconnect DECnetworks to the emerging versions of the international standard X.25. Finally, we are working with Xerox
and Intel to specify and build a local network interconnection
standard based on Xerox's Ethernet, which will be capable of interconnecting computers and terminals within a connected radius
of ?? Km. and transferring information at a 10 Mhz. rate. We have proposed this standard to the various standards organizations.

ENGINEERING ORGANIZATION AND FACILITES

Two, significant engineering facilites have been opened this year at Spitbrook Rd. in Nashua, New Hampshire for system's software, and Hudson, Massachusetts for semiconductors. In general, engineering is co-located to be part of a critical business unit either on the basis of a manufacturing technology
or for a critical market. For example, the RM03 and RL02 disks,
and the Commercial software for the VAX-11, are engineered at the
Colorado Springs disk plant we opened in 1977, and the Commercial Product Group at Merrimack, New Hampshire, established
in 1976.

We have run several experiments on video teleconferencing and are
using crude teleconferencing (based on the best available technology) between Maynard and Colorado Springs. Our annual engineering conference used teleconferencing to extend the coverage to all the sites, thereby doubling the number of attendees. We are emphasizing our ability to communicate electronically, as a means of increasing productivity.

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GB1.S6.22

COST* FOR VARIOUS MAIL SYSTEMS

	TRANSMISSION		LABOR	
POST	**.16**		**4.06**	
TELEX	**1.75**		**4.69**	**5.31**
FAX	**1.60**		**4.44**	**4.81**
PHONE (3 MIN)	**.75**		**3.82**	**4.50**
COMPUTER	**.27**	**.98**	**2.25**	**3.76**

FROM: GORDON BELL DATE: FRI 26 OCT 1979
2:53 PM EST
DEPT: OOD
EXT: 223-2236

TO: WAYNE ROSING

SUBJECT: COST TARGETS--F/U 11/2/79

GB0005/34/EMS

Could you send me back a list of cost targets for the system and components of Nebula SUTC (e.g. Disk, CPU and Memory, CRT's)?

GB:swh

COSTS TO USE A COMPUTER

	$K/YEAR		R/HR @ 2400 HOUR	
HUMAN	0,5,10,20,40		0,2,4,8,16	
COMPUTER	1.2	2.5	0.5	1.0
TERMINAL	0.25	0.75	0.1	0.4
SERVICE	0.05		0.02	
POWER	0.005	0.010	0.002	0.004
LINE (COMM)	0.	2.4	0.	2.
PAPER	0.	0.1	1/3	0.10

SPACE 0.05 0.1 0.02 0.04

ID#406

| d | i | g | i | t | a | l | i n t e r o f f i c e m e m o r a n d u m

Subject: **Acoustic Couplers/Built-In Modems/Connecting Our Terminals**

To: Bruce Delagi, MR2-1/M64
Len Halio, ML1-2/H26
Ed Lazar, ML5-3/E12
Stan Pearson, ML12-2/E38
Art Williams, ML5-3/E12

Date: 8 JAN 79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

follow up 1/22/79

Do you have a responsibility to make it clear just what the strategy/policy is for interconnecting to our terminals? In my first use of the LA34, I was appalled to find it connected via a kludgy acoustic coupler that we didn't even supply. The LA120 and VT100 are the same step backward from the LA36 with its built in coupler (even though the coupler is relatively poor).

Sometime ago, I asked to have this question looked at, prior to the time we came out with the terminals. I found that virtually everyone agreed that we wanted to provide adequate connections, including modems, phones, phone lines, separate modems and computers including 20 ma loops and the 2 EIA standards, but there was no plan. Also, DCG felt strongly that we should do nothing because their customers buy in volume and provide their own interconnect to get maximum added-on value (what/how do they connect?) Apparently, the only people we listen to is DCG, as opposed to our end-users. Nor do we bother figuring out a "right" solution.

Note the quote from our December District Manager Report:

"Steve Mahoney/Mike Rogosin, Sales Unit Manager, Washington, D.C.:
VT100 with built-in modem
The VT100 will be one of our most successful products. If we offered an optional built-in 1200 baud modem with the VT100, we could:

- Reduce the total cost a customer may pay for a terminal and separate Bell modem.
- Offer a one-vendor (DEC) maintenance solution to remote terminals. Currently, our customers are concerned because DEC will not maintain their 1200 baud modem."

This case is a classic one in which "Marketing says" thinking (in this case a whisper) dominates and we conspire, by neglect to screw the users and in the process minimize our revenue. As engineers, shouldn't we know how to use and connect terminals? Until there is some knowledge we'll continue to be data and content-free driven! In asking about this, I found we don't want to (and now can't) build in acoustic couplers and/or built-in modems because:

1. there's too much competition, we can't make any money on them, and no one buys, (how about the LA36?, or how much would one pay for the convenience of a single vendor? a clean seller interface?);

2. all phones come equipped with the new connection (how many old phones are there? Have we tested this interface? Is a DAA still needed? What about phones with in-set dialers?);

3. all terminals are hardwired (what is the experience now? projected?);

4. European phones are different (what about modems?);

5. some of the above;

6. none of the above.

Why can't we get some data and do the "right" thing here?

GB:ljp

CC: Bill Chalmers, MR2-2/M67
Dick Clayton, ML12-2/E71
Ed Kramer, MR2-2/A67
Roy Moffa, ML5-2/E93
Stan Olsen, MK1-2/C36

George Plowman, ML5-5/E97
Dick Schneider, ML11-4/E53

D I G I T A L INTEROFFICE MEMORANDUM

DIST: Bruce Delagi MR2-1/M64 Len Halio ML1-2/H26
Ed Lazar ML5-3/E12 Stan Pearson ML12-2/E38
Art Williams ML5-3/E12

Bill Chalmers MR2-2/M67 Dick Clayton ML12-2/E71
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+---------------------------+
|   |   |   |   |   |   |   |
| d | i | g | i | t | a | l |  i n t e r o f f i c e   m e m o r a n d u m
|   |   |   |   |   |   |   |
+---------------------------+
```

SUBJ: BASIC STRATEGY--ANOTHER PASS Date: 11/1/78 Wed
From: Gordon Bell
TO: OOD Dept: Office of Development
MS: ML12-1/A51 Ext: 223-2236

Follow up: 11/6/78

Attached is the latest version of the BASIC STRATEGY. Please review/comment.

mj

```
+----------------------------+
|   THE COMPUTER MUSEUM      |
|        MEMORANDUM          |
+----------------------------+
```

SUBJ: Information for Reference Manual

TO: Museum Staff

Date: December 13, 1982
From: Marie Berndtson
Dept: <>
MS: <> Ext: <>
EMS: @MR16

It would be very helpful if you could fill out the attached questionaire about your job. I will want to set up a time to talk with you regarding this information so please return the questiona as soon as possible and at least 2 days before our meeting. Use another sheet if necessary.

Any help you can give to make the information correct and complete will be much appreciated.

PRELIMINARY

ENGINEERING

STRATEGY

OVERVIEW

October 16, 1978

Mr. David L. Cox, Manager
Applications Planning Center
AT&T Long Lines Headquarters
Bedminster, New Jersey 07921

Dear Mr. Cox:

Thank you for your kind letter.

I'd like to visit the ACS test, and will try to arrange it on my next visit to the New Jersey area.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:ljp
ID#0298

COMPUTER TYPE TAXONOMY

```
|Single C-----|1 Pc----------|1 Bus---------|Pc + nK's  Unibus-type
|(10-100us.)+     |(uniprocessor)|
|(1 cabinet)      |             |P-M Bus-------|Pc + nK's
                 traditional mini,PC
|                 |             |             |Pc + nPio          360
|                 |             |             |Pc + nCio          6600
|                 |             |
|                 |             :attached P|C--|C + Pf|Cf* eg. array
proc.
|                 |
|                 |n Pc----------|1 bus n(P + C)|functional mP   NCR
Tower,Plexus
|                 |(multi-P)    |(eg. Multibus)|symmetric mP
|                 |             |
|                 |             |S.gen, symm.mP|ssmP (2-10)      Cray
xmP,Elexsi
|                 |              (for perf. &|msmP (10-100)   C.mmp,
Cm*,Dennelcor
|                 |              high avail.) |lsmP (100-1K)  Cedar
|                 |                           |vlmP (1K-10K)
|                 |                           |ulmP (>10K)
                 IBM?,Ultra-C
|                 |
|                 |multi-instr/data-------------|Dataflow
```

```
architectures     ??
|                 |
|                 |fault-tolerant---------------|duplex C
|
|Close Area---|reg. connect--|memory--------|grid
| Net (.1-1ms.)+  |
| (1 room)        |             |links---------|tree           DADO
|                 |                            |grid       Transputer
|                 |                            |binary n-cube
Caltech 64 C
|                 |
|                 |ad hoc connect|via P or M "closenets"      flight
simulators
|                 |
|                 |switched------|bus-----------|functional cluster
                 LLL Octopus
|                                              |hi avail      Auragen,
Tandem, VAX
|                                              |backpanel cluster   CT
|
|Local Area---|spanning tree,---------------|LAN cluster,
fmCmultiC
|Net(1-100ms.)+topology: bus, central, ring |       Cambridge Ring
Computer
| (1 building     modulation: base,broadband                         |
|  or campus)     media:tw.pr,coax,fiber   |homogeneous cluster
Apollo,STAR
|                                              |heterogeneous network
|
|Wide Area----|fixed connect----------------|multidrop
 Net (.1-10s)+|               |tree         SNA
 (global)         |
                  |store & forward--------------|Hybrid      DECnet
                  |                            |seperate network
ARPAnet,Telenet
                  |
                  |seperate switch--------------|PABX etc.   common
carriers
```

C := Computer; P := Processor; K := Controller
Cluster := collection of C's acting as a single C
+(interprocessor communication times) determine parallel processing grain
*function := arithmetic, array processor, signal processor, communication (front end), database (back end), display,

simulation, etc.

PROCESSOR-TYPE TAXONOMY

```
|single instr-|hardwired----   |simple--------|minimal  PDP-8, NOVA
| single data     |            |             |complex
|                 |            |
|                 |            |ad. hoc spec.
                  |algorithm   display,sort,search
|                 |            |
|                 |            |pipelined_____|load/store
                  MIPS,Pyramid,RISC
|                 |                          | " + multifunction
units             6600
|                 |
|                 |microprog.___________________|simple        8086
|                                            |CIS            360, VAX
|                                            |user microprogramming
|                                            |P.language       LISP
|                                            |P.gp emulator
|
                  |Descriptor/capabilities
|
|single instruction,_________________________|voting (detect)
| single data, high availability             |dup. vote
(det./corr.)      Stratus
|                                            |TMR (det./corr.)
|
|single oper., multi data____microprog._____|pipeline
|                                            |systolic array
|
|single instruction,_________|open microprog|array processor   FPS-
164
  multi-data                   |             |many functions     ELI
                               |
                               |hardwired    |vector          CRAY 1
                               |
                               |structural   |tree           non-VON
                                 analog      |associative Memory
                  STARAN
                                             |array/grid   Illiac IV
                                             |grid + n-cube
                  Connection Machine

G. Bell 9 Sept. 1984
+---------------------------+                                ID#0235
|   |   |   |   |   |   |   |
```

| d | i | g | i | t | a | l | i n t e r o f f i c e   m e m o r a n d u m
| | | | | | | |
+-------------------------+

Subject: **CPU/System Upgrades and H/S Bus**

To: Dick Clayton, Bill Demmer,   Date: 78 AUG 15
    Ulf Fagerquist   From: Gordon Bell
                                        Dept: OOD
                                        Loc.: ML12-1
Ext.: 2236

Users certainly like the notion of Field/CPU upgrades. The 34-->34/A is an example they'd have liked. The answer may be a trade in. Clearly they want to use all peripherals, etc. Make minimum changes to get the new capability.

People say look at the Datapoint Serial Bus. That's the way to interconnect peripherals!

GB:ljp

CRAFT GENERATION

By 1620, the beginning of the craft generation, the abacus and counting table devices were in use for calculating, but a need existed for a device that would supplement the memorization of the multiplication tables. Although movable type was available, the complementary printing and paper industries were very rudimentary. In this context, John Napier of Merchiston, a mathematically oriented scholar who conceived the idea of logarithms in 1614, was bent on making long multiplication "free from slippery errors. In 1617, he invented an inscribed set of rods or bones with number series that could be carried in the pocket and used as a look up table for multiplying. They immediately became quite popular, distributed through the network of seafaring, mathematically oriented traders. Since addition still needed to be carried out, sets of bones were sometimes paired with an abacus or a slate. Although Napier's bones are classified as manipulable tables, they may have stimulated ideas for mechanical calculators.

In 1620, Gunter placed the logarithmic scale on a rule and then a sector, and these devices rapidly came into widespread use satisfying the growing needs of exploration and trade. With developing trade and exploration and the ease in which they could be copied and crafted, the speed of adoption of such devices was rapid. These two devices, the bones and the development of rules with logarthmic scales, mark the beginning of the craft generation that was to last about 200 years.

MEMORY

The ability of machines to either write or read on memory is the primary distinction separating these devices.   Napiers bones is the unique example of such a device that was neither machine writable nor readable, was etched by hand. They held a full multiple digit multiplication table in a box that could fit in the hand and easily be carried in a pocket. These small units were short lived, dying out with the wide spread availability of printed books of tables. Memory devices that are either writable or readable by machine, include species that are still with us. The final group, memories that are both writable and readable by machine, did not develop until the electro-mechanical generation and are central to the development of computers and automata.

NEITHER MACHINE WRITABLE OR READABLE

FIXED PHYSICAL STATE

NAPIER'S BONES

TABLE - MANIPULABLE

P   Napier's bones act as tables that can be reconfigured. Each rod is inscribed with a set of numbers facilitating the multiplication and division of large numbers.   John Napier, Laird of Merchiston in Scotland, invented the rods and described them in his RABDOLOGIAE, (1617). He wrote that the multiplication and division of great numbers is troublesome, involving tedious expenditure of time, and subject to "slippery errors." His tables reduced these difficulties to simple addition and subtraction, and won immediate recognition. A set of Napier's bones is usually made of boxwood or ivory and often contained in a box or case that would fit in a pocket. A set usually contains 10 rods, plus extras representing squares and cubes.

Use. To obtain a product of 224 x 44, the rods 2, 2, and 4 are put alongside each other, and the result is read off by combining the numbers in the fourth row

-- 0/8, 0/8, 1/6 -- adding on each diagonal for the correct answer 896. This is repeated and the two partial products added together to give 9856. The bones are sometimes paired with an abacus to provide a store.

Napier's Bones, ca 1700, 8x6x2 cm, Wood, (B27.79).

"SUMADOR CHINO", 7.5x20x30 cm, Brown, Green, Paper, Wood, Glass, Loaned by Jim Rodgers (X10.80)

A set of Napierian rods incorporated with a reusable surface.

WRITABLE OR READABLE MEMORIES

PAPER WITH RANDOM ACCESS

BOOKS

The technologies of movable type, paper, and printing presses certainly all affected the development and utilization of books. However, their widespread accessibility certainly did not come into being until the seventeenth century. Of particular interest to this collection are the books of computed tables. Many of the very first computers were invented to produce such books: the ENIAC was commissioned by the Army to produce ballistic firing tables; Harvard's Mark I was justified as being able to produce tables of Bessel functions; and Babbage had the calculation of tide and navigational tables in mind when applying for grants to develop his machines. The books of tables and other reference works are being replaced by calculators and computers.

The listing below, of books of tables, is a sampling through the generations to give some representative idea of their scope and evolution, prior to extinction.

P
TRIGONOMETRIA" by William Oughtred, published by R. & L.W. Leybourn, 1657, 14x18x3.5 cm, Original leather binding, (B160.81).

The original set of logarthmic tables and their explanation as made by William Oughtred, who made significant improvements on the slide rule.

P "Table of the Products and Numbers" by Charles Hutton, 1781, 28x42x1 cm, (B2.76).

Compiled in 1781 by Charles Hutton, this early book of mathematical tables contains the products of the numbers 1 through 1000 by the numbers 1 through 100. It also contains squares and cubes of numbers and conversion tables for units of measurement. One of the main problems with handcrafted books is the number of errors. On one page alone, every figure is off by one thousand.

"The Oriental Calculator or Tables for the Calculation of Interest, Exchange & Commission" by Dorabjee Hormusjee, Thomas Graham, 1860, India, 15x23x4 cm, Green, Paper, Third Edition, Good condition (B177.81).

Part I contains Interest Tables in Rupees, Dollars, and Sterling from one-half to 12 per cent per annum. Part II contains tables for the conversion of rupees, into sterling and dollars; and sterling into dollars. Part III contains commission or Inland Exchange Tables; Key showing indirect exchange between England, India and China; Tables showing the comparative rates of exchange for sight bills, and tables showing the estimated value of one pound of cotton with all charges and varying exchange rates.

In the preface to the third edition the author states, "The rapid sale of the previous Editions of the "Oriental Calculator" and the pressing demand for it, are evident proofs of the utility of this work in mercantile circles; and the production of the Third Edition is the result of the liberal patronage and support the author has been favored with."

"The Model Ready Reckoner with Tables showing the value of any number of articles, from one to thirty thousand from one-thirty-second of a penny to twenty shillings; including interest, commission, population, exhange, bank rate, stamp duties, wages, weights and measures, commerical forms, etc., London, Frederick Warne and Co., 1881, 288 pp., Loaned by Peggy Sullivan (X30.81).

The publishers' preface states, "The Model Ready Reckoner having passed through the hands of numerous editors to insure its correctness and completeness, has, in this Thirty-Second Edition, an entirely revised Table of the Relative Values of the Coinage of the World and Bank of England Rates of Discount for 30 years included in its additional contents."

"Handbook of Chemistry and Physics, A Ready-reference Book of Chemical and Physical Data," Thirty-first edition, Charles D. Hodgman, Editor in Chief, Chemical Rubber Publishing Co., Cleveland, Copyright 1910, Thirty-first edition 1948. 2737 pages.

The "Rubber Bible," as it is affectionately known among physical scientists who used it, was an institution for half a century. First published in 1914 by the Chemical Rubber, it was revised with each subsequent edition. For example the preface to the 31st edition notes, "Among the important tables added to recent editions is the very complete table of isotopes giving the percent abundance, type and energy of radiations and half-life for about 900 natural and artifical radioactive isotopes and stable isotopes." (p. iv)

"Handbook of Mathematical Tables and Formulas" compiled by Richard Stevens Burington, Handbook Publishers, Inc., Sandusky, Copyright 1933, 1940, 1948, Thrid Edition, 1949, reprinted 1950, 196 pp. The publishers include the following note "To the Student who uses this Handbook: As a student of mathematics you are studying the subject, either because you have a liking for it or, because it is required subject in your professional training -- happily, if for both of these reasons. The subject is one of the fundamental natural sciences and perhaps the most fundamental of all. While a mathematician may not necessarily need to know of engineeringing, physics, chemistry, or other natural sciences, yet to every engineer, physicist, chemist, or other scientist, mathematics is a necessity.

Unquestionably you will many times in later life need to know the formulas and the numerical data to be found in this Handbook. These, if not forgotten completely, will be recalled then so hazily as to be subject to doubt. Since mathematics is an exact science doubt can have no place in its applications.

The contents of this Handbook were carefully selected by one who has had many years of experience in the applications of mathematics and in teaching the subject to prospective scientists and engineers. You have become familiar with its contents in your own use of it. Where could you possibly find a more handy and reliable source for the information which it presents and which you need?

The subject matter is not ephemeral but everlasting -- as true in the future as it has been in the past. By all means, retain this book for your own reference library. You will need it many times in years to come."

NOMOGRAPHS

"<u>Transmission Line Calculator</u>," P.H. Smith, Bell Telephone laboratories, Jan 1939 and Jan. 1944 Electronics, The Emoloid Co., Inc., Hillside 5, N.J., loaned by Clifford H. Hafen Jr., (X29.81).

The calculator relates the series components of imppedance at any position along an open-wire or coaxial transmission line to (1) the impedance at any other point, (2) the standing wave amplitude ratio (SWR), and (3) the attentuation. It also relates the impedance to the reflection coefficient and to the admittance and, in addition, provides a means for determining the equivalent parallel components of impedance. If the power (PP is known the voltage and current at any position along the line are readily calculable from impedance information obtained.

Use. All impedances are read on the resistance and reactance coordinates on the central disc. The rotatable "wavelengths" scale around the rim provides the means for translating impedances at a given point along the line to another point a given distance away. Attenuation in 1.0 db steps and current or voltage SWR scales are plotted on the rotatable radial arm (nearest index) together with scales which are a function of SWR.

ANALOG CALCULA

Analog calculators work by analogy, that is, they create a physical model of a mathematical problem or a physical model of another physical system. Many physical situations can yield mathematical results, provided they can be interpreted properly. The extent of a lateral or a rotational movement of a mechanism or the voltage on a wire are examples of quantities that can be used to represent numbers. The most important breakthrough for analog calculators came with the invention of logarithms by John Napier in 1614. This allowed the processes of multiplication and division to be carried out by addition and subtraction at distances along a scale. The results are interpolated between the marks on the rule. Other types of analog calculators include devices used in drafting, measuring and integrating, e.g., planimeters, pantographs and harmonic analyzers.

The families in this order, which spans several generations, are divided according to the complexity of the mechanism itself -- single part, two or three part, and many part. This reflects a rough evolutionary development with multiple part devices not developing until mechanical tooling was improved in the early nineteenth century.

SINGLE PART

DRAWING INSTRUMENTS

Drawing Instruments, ca 1800, 15x17x30 cm, Brass, Wood, Marble, Cornelius Conklin (owner), (B92.80).

Drawing Instruments, 20x11x4 cm, Steel & Brass, (B19.78).

Cased

English drawing instruments made in the

second half othe 19th century. Brass and steel instruments, ruling pen with ivory handle; 13 separate items in lift-out tray. Small boxwood rule in space below. Rosewood veneered case and instruments in fine condition except that the large compass is missing its pivot locking nut and the brass has become a bit dull.
p
<u>Drawing Instruments</u>, ca 1850, 16x7x2.5 cm, Green, Shagreen Case, Brass, Steel, Ivory, Silver & Ebony, (B106.80).

<u>Drawing Instruments</u>, ca 1900, 6x16x2.5 cm, Black Case, Brass, Steel, Wood, Cardboard, (B130.80).

<u>Drawing Instruments</u>, 7x15x2 cm case, Wood, Fabric, Brass, Steel, (132.80).

<u>Drawing Instruments</u>, 10x19x4 cm box, Wood, Brass, Velvet, (B133.80).

FIXED RULE

<u>Parallel Rule</u>, ca 1870, 45x6x1 cm, Rosewood and Brass, (B24.78).

<u>Parallel Rule</u>, W.H. Harling, ca 1890, 4x33x8 cm, Steel, (B20.78).

Cased presentation of an English rolling parallel rule. Pasted to the inside cover is the presentation certificate, "Bradford Technical College Prize Awarded to Fred Inman at the Annual Examination, 1893, by order of the Lords of the Committee of Her Majesty's most honourable privy council on education."

<u>Parallel Rule</u>, T.S. & J.D. Negus, 8x45 cm, Brass, Inscribed with Degrees (B104.80).

<u>Parallel Rule</u>, ca 1890, 3.5x15x.2 cm, Ebony and

Brass, (B122.80).

Proportional Rule and Protractor, C.W. Dizey, New Bond St., London, ca 1890, 4.3x15.2x.2 cm, Ivory, (B120.80).

A protractor and architect's proportions are inscribed on one side; engineer's scale and vernier on the other.

Proportional Rule and Protractor, United Chemical Engraving Co. Ltd., 1932, 15x5x.2 cm, Cream, Plastic, Inscribed D.A.E. Carter, (B121.80).

Protractor and table with set scales at 1/20,000, 100,000, and 250,000 inscribed on one side. The other side has scales of one half inch and one inch to the mile, a scale of 1/20,000 in meters and listing of metric equivalents.

Rolling Parallel Rule, 6x46x2.5 cm, Brass, Patent No. 160100, (B105.80).

Rule and Ruled Compass, 3x12 cm, Metal, "W.B.Pierce Co. Civil Engineers", (B138.81).

GUNTER RULE

About 1607 Edmund Gunter devised a scale that was to be the predecessor of the modern slide rule. In 1623 he published a description of this scale that is composed of two scales of the logarithms from 1 to 10 placed end to end.

Use. A pair of dividers is used to measure a distance (the multiplicand and the multiplier) along the rule and add it to another distance, the multiplicand, forming the combined distance, the product, on the rule. The accuracy of an answer is limited by the length of the rule and the user's ability to interpolate between numbers.

P Gunter Rule, ca 1800 5x60x.5 cm, wood, (B4.76).
Gunter Rule, 15x3x.5 cm, Boxwood, (B41.79).

Navigator's Gunter Rule, ca 1800, 5x60x.5 cm, Darkened Boxwood, Minor Warping And Edge Chipping, (B54.80).

SECTOR

The sector is used to solve problems of proportion, working on the principle of similar triangles. Sectors were made with a variety of scales for use in calculation by navigators, surveyors, gunners, and draughtsmen. At first sight they look like jointed rules usually made of ivory, brass, wood, or sometimes silver. First described by both Galileo in Italy and Thomas Hood in England the sector was in use by 1600.

Use. A pair of dividers is necessary to read the relationships on all sectors. This sector is marked: "Chords, Sec, Lines, Tangents, tan, Ver Sine, Sines, & Num." The scale layout permits this sector to be used as a Gunter rule as well, although it is not laid out to follow any of the five editions of Gunter.

P

Sector, ca 1623, England, 9 inch, 24x5x.5 cm, Brass, (B176.80).

Nine inch brass sector as described by Edmund Gunter (1581-1626) in 1623. Unsigned by probably made by Elias Allen in 1623.

Navigator's Sector, 33x6x1 cm, Boxwood With Brass Hinge, 21 Scales On both Sides and Outside Edges, (B21.78).

Navigator's Sector, 4x16 cm, Cream, Ivory and Brass, Chipped, (B102.80).

Navigator's Sector, 1800c, 16x3.5x.3 cm, Ivory, Lee & Son, Portsea Engraved, (B119.80).

Navigator's Sector, ca 1880, USA, 3.5x16x.3 cm, wood (B168.81).

Navigator's Sector, ca 1880, USA, 3.5x16x.3 cm, wood, (B169.81).

SLIDE RULE

In 1654, Robert Bissaker made the first real slide rule in which the slide worked between parts of a fixed stock (Pugh 1975). The term slide rules applies to all instruments designed so as to allow relative motion between the indices and the scales. The classification used here is that established in the British Science Museum Catalogue i.e., straight, circular, spiral or cylindrical, and log-log. The collection illustrates the improvements in slide rules. The rules were originally made of boxwood, brass or ivory, in 1886 Dennert and Pape started to use scales on strips of white celluloid to give much greater distinction in reading. The spiral and cylindrical scales allowed an increase of effective length, hence accuracy, without equivalent increase in size. The collection shows the diversity and specialization that resulted from peculiar needs at particular times.

STRAIGHT SLIDE RULES

Slide Rule, Dietzgen, 26x3x1 cm, Wood and Paper, (B145.81).

"Slide Rule 689", KEUFFEL & ESSER, ca 1950, 32x6x1 cm, (B32.52).

Slide Rule, Foto-mem Inc., 2x14x.5 cm, (B37.79).

Slide Rule, KEUFFEL & ESSER, Gift of Dick Clayton

(D50.76).

P
Coggeshall Slide Rule, ca 1800, 4x33x.5 cm, Boxwood and Brass, Hinged with Two Slides, (B109.80).

A modified Coggeshal type slide rule with one brass and one wood slide. Navigational scales including meridian, chords, latitudes, and hours are inscribed. Freeth and Co. Brimingham is overstamped.

Coggeshall Rule, Stanley Rule and Level Co., New Britain, Conn, 32x4x.4 cm, Wood and Brass, (B146.81).

"Measuring Made Easy: Or the Description and Use of Coggeshall's Sliding Rule", by J. Good, much Enlarg'd by J. Atkinson, Sen. London.", W. Mount and T. Page, at the Postern on Tower-hill, 1744, 10x16x1 cm, , Paper and Leather, 96 Pages with 2 folding Engraved Plates. Portion of Spine lacking but still tight, without fly leaves., (B139.80).

Taylor (1966) lists John Good (1706-33) as a mathematical teacher and notes a 1751 edition of this work edited by Atkinson, A maker of slide rules. The first plate illustrates Coggeshall's Sliding rule.

Coggeshall Timber Slide Rule, Richardson and Co., Middleton, Co., 4x31.5x.3 cm, Boxwood, Brass, and Steel, (B147.81).

Coggeshall Slide Rule, ca 1850, USA, 4x33x.5 cm, Wood and Brass, No makers name, wood cracked, shows signs of real wear, (B170.81).

"Hydralculator", Lewis & Tylor, Limited, ca 1940, 7x19x.5 cm, Cream, Cardboard, One Rule on one Side, (B113.80).

"Hydralculator", patent number 396,533, published by Lewis & Tylor Ltd., Gripoly Mills, Cardiff, the manufacturers of "underwriter" super fire fighting hose, for the use of their "Friends in the Fire Service."

Use. To find the quantity of water discharged for any given nozzle and a known pressure, place pressure on scale "b" opposite nozzle on scale "a", and read discharge through window in slide. To find height of jet for given pressure and nozzle diameter, proceed as above and read opposite arrow in center of slide, the height given on scale "d" for the appropriate nozzle.

Inland Revenue Slide Rule, Dring & Fage, 1825, 60x5x1 cm, Boxwood, One ink Stain, (B55.80).

The rule is specially arranged for the use of excise officers and maltsters in gauging computations. Slide rules for this purpose were first devised by Thomas Everard in 1683, and modified by Vero, Leadbetter and others. In this example, four scales appear on one side and the other side is blank.

"Leadbetter Slide Rule", Dring and Fage, ca 1800, 31x3x2 cm, Brown, Boxwood, Four Sided Slide Rule with Slides on each Side, (B108.80).

"Musketry Rule of 1918", Metallograph Corp., ca 1918, 3x13 cm, Black, Metal, (B83.80).

Teaching

Slide Rule, Welch, 2x23x125 cm, Black, Masonite, With Hangers, (B103.80).

"Thomlinson's Equivalent Paper Slide Scale", J Thomlinson Ltd Glasgow, ca 1940, 8x58x1.5 cm, Brown, Wood, One Sided with Two Moving Rules, (B107.80).

This specialized rule was designed for the paper and printing industry. The A scale indicated length, B scale the breadth, and area in square inches was read off the C scale. The D scale was used to read off translations of inches to centimeters, kilos to pounds, 480 and 500 sheet reams, and various weights of different standard paper cuts.

Timber

Slide Rule, L.&I.D., ca 1800, 60x5x1 cm, Boxwood, (B30.77).

Use. On one side, the A line on the rule and the B and C lines on the slider are each numbered twice from 1-10, reading from left to right. The fourth line E is inverted, and is so arranged that 144 is opposite 1 and 10 on the A line. So that if length in feet on E be set opposite thickness in inches on C, the volume in cubic feet is read off on B opposite width in inches on A. The B line is subdivided into tenths, while the A, C, and E lines are subdivided into fourths. On the other side of the rule are A, B and C lines with the girt line (marked D) numbered from 4-40 and bearing various gauge points. The A and D lines are subdivided into fourths. The two edges of the rule bear scales of inches divided into quarter-inches.

Timber

Slide Rule, Stanley Rule & Level Co., 4x30 cm, Brass and Warranted Box Wood, (B99.80).

Timber Slide Rule, Stanley Rule & Level Co., 4x30 cm, Brass and Warranted Boxwood, Cracked, Warped and Stained, (B100.80).

CIRCULAR SLIDE RULES

P

"Boucher's Calculating Circle", Manlove, Alliott, Fryer & Co., (B52.79).

"Circular Concise Slide Rule", ca 1960, 8d cm, White, Plastic, No. 28; Reverse has Standard Equivalency Tables, (B114.80).

Circular Slide Rule, The Cleveland Twist Drill Co., ca 1920, 8d x.3 cm, Cream, Plastic, Printing worn off, (B125.80).

This specialized rule is copyright 1911, The Cleveland Twist Drill Company.

Use. The rule indicated drill speeds for wrought iron, machinery steel and soft tool steel. One side shows revolutions per minute for diameters ranging from one-sixteenth to three inches for both high speed and carbon steel drills. The other side shows tap and drill sizes and the decimal equivalent for inch divisions.

"E.A. Sperry's Calculator", KEUFFEL AND ESSER, 6d x2 cm, Pocket Watch Style, (B97.80).

"Fowler's Calculator", Fowler & Co., , 6d x1 cm, (B59.80).

"Fowler's Textile Calculator", Fowler & Co, ca 1900, 6.5d x.7 cm, Chrome, Glass, Paper, Two-sided Circular Rule, (B112.80).

Short scale type of "Fowler's Textile Calculator" with two scales on one side. The other side holds a table equivalency for weft, looms, and reeds.

"Fowler's Calculator", Fowler's (calculators) Ltd Sale, ca 1920, 6d x1 cm, Chrome, Glass and Paper, Long Scale Calculator, (B124.80).

"Fuller's Computing Telegraph," J.F. Fuller, 1847, 28x28x.5 cm, Cream and Black, Cardboard, "Palmer's improved by Fuller Computing Scale" and "Fuller's Time Telegraph" is on the reverse, (B110.80).

"Palmer's Computing Scale" patented in 1843 by Aaron Palmer was improved and produced by J.E. Fuller in 1847. This model is printed from the original Palmer plate with Fuller's name and own patent added to the engraving, done by George C. Smith, 186 Washington St., Boston. The reverse side, "Fuller's Time Telegraph" was patented in 1845.

Use. The first note to the user is, "The Numbers on this Scale are arranged accoding to their Logarithmic Values and occupy the same relation to each other in space that they do in value." "Palmer's Computing Scale" was used to calculate square measures, cubic measures, timber measures, grain measures, liquid measures and interest rates from 3 percent to 10 percent on a daily and monthly basis. "Fuller's Time Telegraph" (on the reverse) was used to calculate time lapse in days or weeks between any two given dates. In concert these two measures would be useful to dealers in grain, alcohol and other commodity trading.

"Fuller's Computing Telegraph," with complete instruction book, from the collection of I. Tomash

(X25.81).

"HALDEN CALCULEX", J. Halden & Co., Ltd., ca 1910, 6 cm diameter, Metal ring with glass discs covering paper scales, (B158.81).

Cajori in his "History of the Logarithmic Slide Rule" (1909) lists this unique instrument as No. 211 and notes the manual.

Lord's Calculator, R. Waddington, Coventry, 7d x1.5 cm, Chrome and Glass, (B123.80).

P SPIRAL SLIDE RULES

"Fuller's Spiral Slide Rule", Stanley, 1902, 9x9x33 cm, Cardboard, Mahogany, Brass, (B5.76).

Designed in 1878 by Professor George Fuller, the logarithmic line is arranged spirally on the surface of a cylinder. The logarthmic line is in 50 turns, giving a working length of 41 feet 8 inches. All numbers of four figures either have a mark upon the scale or are midway between two marks, so that results accurate to four figures are easily obtained.

Use. By means of movable cylinders any length of spiral line may be at once transferred to any other part of the scale, and multiplications and divisions containing a series of factors can be worked with facility. Logarithms of numbers are given by means of a scale on the longer index arm together with a circular scale on the first cylinder, so that powers and roots are obtainable. The surface of the middle cylinder bears printed tables of decimal equivalents, natural sines, etc.

"Fuller's Spiral Slide Rule", Stanley, ca 1880, 33x10x10 cm, paper, wood, metal, (B51.79).

"<u>Thacher's Calculating Instrument 4012</u>", KEUFFEL & ESSER ca 1920, 13x13x63 cm, Wood, Varnished Paper, and Brass, (B29.77).

Patented in 1881 by Edwin Thacher, the instrument is described in an 1884 instruction book notes, "The oridinary rule in use is 12 inches long, with radii of 11 and 5 l/2 inches, the divisions of which are cut by hand, copying from a machine divided plate. In the present instrument the radii are 60 and 30 feet, the divisions of which are printed directly from machine divided plates. Those plates contain over 33,000 divisions, calculated to seven places of decimals from Babbage's tables by using a common multiplier, every line being subjected to correction for error of screw and temperature variations, so that possibly every line center is within .0001 inch of its true place."

The instrument consists of a cylindrical slide, which admits of both rotary and longitudinal movement within an open metallic framework of 20 equidistant triangular bars. The bars are connected to rings at their ends which admit rotation within standards attached to the base. Upon the slide are wrapped two complete logarithmic scales, each of which is divided into 40 parts of length equal to half that of the slide. The parts follow each other in regular order around the cylinder, and the figures and divisions which constitute any part of the right are repeated on the left, one line in advance.

<u>Use</u>. By the rotary and longitudinal movement of the slide any of its divisions may be brought opposite to or in contact with any division on the fixed scales. The divisions on the upper lines are transferred to the slide by means of a pointer fitting over the bars, which is also convenient for

retaining the position of any division on either line while the slide is being revolved into the required position. Near the commencement of each scale on the slide is a heavy black mark designed to catch the eye.

"Thacher's Calculating Instrument", KEUFFEL & ESSER, 1925, 16d x58 cm, Wood, Brass, And Varnished Cardboard, (B56.80).

LOG-LOG SLIDE RULES

"DIETZGEN MULTIPHASE STYLE-M IMPROVED DECIMAL TRIG TYPE LOG RULE", EUGENE DIETZGEN CO., 1954, 5x32x.4 cm, Aluminum and Plexi, (B144.81).

Slide Rule, Post, #803182, Loaned by Clifford H. Hafen Jr. (X28.81).

Slide Rule #405171, Pickett & Eckel, Inc., 1960, USA, 31x6x3 cm, Yellow, Aluminum and Plexi, Box, Case, instruction pamphlet, and guarantee, (B172.81).

DMCAT1.3f

May 14, 1984

Dr. Earnest F. Gloyna, Dean
College of Engineering
The University of Texas at Austin
Austin, Texas 87812-1080

Dear Earnest,

I am delighted to respond to your call, and I strongly support Harvey Cragon as a member of the University of Texas faculty. Harvey is one of the outstanding computer and digital system designers / architects in the field today.

It is difficult to add anything to the great letters of recommendation by Ted Glaser and Jack Kilby you sent and to the acknowledgements of his accomplishments by the IEEE and the National Academy of Engineering. His accomplishments are truly signficant.

Harvey would be a great addition to the faculty in many ways, including his ability to understand, teach and mentor. His ability to both engineer and mentor is proven at TI, and these qualities are essential for helping graduate students, current and new faculty, and most of all -- experimental research projects. He would significantly increase the quality of ANY computer science, computer engineering or electrical engineering department faculty that I know!

I also think he is critical in order to have the kind of department that you promised MCC. I know of no one who is better qualified to this task and have no hesitation in recommending him for a named or chaired professorship.

Sincerely,

Gordon Bell

GB14

January 3, 1979

Dr. J. Craig Mudge
Dept. of Computer Science, Mail Code 256-80
California Institute of Technology
Pasadena, California 91125

Dear Craig:

I've talked with Marcie, Heidi and Del regarding your concern
about royalties. I can't support your request, but will see

I am appreciative of your effort as a co-ordinator with Ron, Sam, Dan and John. Without this, I'd have spent more time and much of this time would have fallen to Mary Jane and Heidi, or the book would have taken longer. Certainly our discussions were helpful to the writing.

Like the issue of whether we'd write books together again, I think it's inappropriate for you to ask to make this change.

Overall, I'm happy with and proud of the book and you should be too. It will reflect equally (or poorly) on all of us. I look forward to our continued personal and professional interaction.

Sincerely,

Gordon Bell

GB:ljp

ID#378

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7:32:01

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION   DATE: MON 13 SEP 1982
4:41 PM EDT

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

MESSAGE ID:
5175576719

SUBJECT: CRAPPY PRODUCTS:THE SIDE EFFECT OF SLIPS AND VOIDS

THE EFFECT
Nature (the market) abhors a vacuum... when there's a product
void, all available resources rush in to try to fill it.

Usually the products targetted as interim hole fillers are
crappy
and we don't get the market. Worse yet, the product hole
issue
consumes vast resources at all levels and all parts of
Digital.
Many of us are spending much time on what are trivial, me-too
products that contribute no long term gain. The only
justifi-
cation is that they fill a short term product hole.

Several times we've all swore that we would design NO MORE
CRAPPY
PRODUCTS. Occasionally, we design bad products from scratch,
but

mostly it seems crappy products are the side effect of slipping a
schedule and then we go all out to fill the void. There's a
similar effect around not having a critical component when the
market demand it (eg. a 32-bit microprocessor), and then having
to do a number of projects that try to fill in this vacuum.

SOME MORE DATA POINTS
OPERATING SYSTEMS ON THE 11 initially- DOS caused many other
operating systems: RT for one user, RSTS for timesharing with
BASIC-only, and RSX -11 A,B,C,D,...M,M+, MUMPS for databases,
UNIX for the university timesharing users who wanted gp and
performance and didn't want to pay high prices, and IAS was
unsuccessful at filling the general purpose, interactive void
until M was extended more and till it went away with UNIX.

SOME OF THE DISKS HISTORICALLY (eg. RM05 for RP07 slip)-
Fortunately we're better now... good people and much
management.

VT's- Our whole VT series since the VT100 (eg. VT101, 192, 18x)
is nothing but a series of short term products with incremental
cost reductions that try to make up for having a good product.

PC's- A never ending serialized saga beginning with PDT and
PDP-8.

OFFICE TODAY- The commitment was a product now that ran on VAX
and little CT. We failed and the result is many other products
to fill the void: extension of EDT on EMS for wps, the CT middle

level editor, DECword on RSTS (and externally available on M and
VMS), DEC? on Dibol, and Europe's DECTEXT. The OC, European Managment, field, several market groups and office engineering
all spend more time and energy to find a way around the void than
it would take to do the product right in the first place.

THE LOW END VAX- The state of the art is clear! Motorola has set
it with their chip and bus standard and we want to be there now.
Many projects aimed at taking NEBULA down in price: single user
workstation to protect against APPOLLO, repackaging NEBULA to get
lower base systems cost for a lower performance single user,
starting the whole MicroVAX architecture early using NEBULA as a
starting off point, etc. The trick is which ones.

THE HIGH END- The state of the art is clear, a 3-5 mips mini. We
have to do: CI clusters (both for performance and for reliability
like we promised), NI clusters, microcode, mP's (beyond 782).
Many of these are committed independent of the high end.

WHAT DO WE DO?
0. Realize when we're in the situation.

1. Design critical products and then manage them without slip.

2. Avoid doing ALL the backups. Some are essential, but

having
all of them which in turn have their own slips, turn us into
a
dangerous short term, downward spiral of crappy products.

3. Look at whether we really need the mainstream product.
Sometimes we can simply get out of an area we're floundering
in
and maybe one of the backups is a better alternative.

GB3.S7.28

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****
* d i g i t a l *
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TO: see "TO" DISTRIBUTION DATE: SUN 11 APR 1982
9:05 PM EST

FROM: GORDON BELL
cc: DEMETRIOS LIGNOS DEPT: ENG STAFF
KEN OLSEN EXT: 223-2236
BILL STRECKER LOC/MAIL STOP: ML12-
1/A51

SUBJECT: CRAY GROUP WHO WANTS TO BUILD A VAX

I certainly don't want to believe this, nor do I want one
more
problem or opportunity to deal with. The attached seems to
good to be true. Somehow, I'd like to listen to the story
in order to see if and what they know that we don't. They
may suffer from illusions from being near the master, but
not really understanding the killing details of how to really
do it.

Is there some way we could at least listen?

Bill and BJ,
What you think?

Is there a way we could get the lab to go for R and D money and we could buy their output if they are that good?

The Japanese or IBM are fools to not pick them up.

"TO" DISTRIBUTION:

BILL DEMMER ULF FAGERQUIST SAM FULLER
BILL JOHNSON JACK SMITH

ATTACHED: MEMO;117

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* D I G I T A L *
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TO: GORDON BELL DATE: FRI 9 APR 1982
8:52 AM EST

FROM: DEMETRIOS LIGNOS
cc: BILL DEMMER DEPT: LOW END VAX SYS DEV
KEN OLSEN EXT: 247-2990
LOC/MAIL STOP: TW/B02

SUBJECT: ATTACHED MEMO FROM OMUR TASAR ON CRAY RESEARCH LABS

OT2.14

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| d | i | g | i | t | a | l |       I N T E R O F F I C E
M E M O
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To: Gordon Bell Date: 5 April 1982
From: Omur Tasar
CC: Bill Demmer Dept: Low End VAX
Systems Dev
Demetrios Lignos Ext.: 247-3027

Ken Olsen Loc/Mail Stop: TW/B02

Subject: CRAY RESEARCH LABS

I spent the day (1 April) at Cray Research Labs recruiting. As you know, Mr. Cray cancelled the project that was aiming to develop a machine 10 times the performance of CRAY 1. A team of about 50 people were told they can seek other opportunities. The recruiting went very well.

My purpose of writing to you is not about making recruiting successful, but to explore the possibility of an adventure.

The people in Boulder don't want to split up. They want to stay together and make a very high performance machine. They would like Digital to sponsor them. I must say what they have to offer is exciting and may be worth your close attention.

Here is what they can do when:

- A VAX machine that is:

  - 500 times the performance of 11/780.

  - A uniprocessor with 8 MB of main memory.

  - Built with existing ECL process (500 picosec delay).

  - Packaged in a 10" x 16" x 24" box that needs approximately 50 KW.

- Schedule--assuming start in Q1 FY'83:

- Architecture defined -- Q1 FY'84.
  - Working prototype -- Q4 FY'85.
  - Production starts -- Q4 FY'86
- Budget--they need to accomplish the above:
  - FY'83 -- $3.5M
  - FY'84 -- $6.0M + capital
  - FY'85 -- $7.0M + capital
  - FY'86 -- $7.0M
- This machine would sell for about $2M.

Obviously, this does not cover VMS, diagnostics, peripheral adaptors.
But I was fascinated by the knowledge of an undertaking within the time mentioned.

I am not exposed to the perspective you have but I would guess that there may be some customers out there who would love to have a machine like that. How would you like to have a program done in 6 minutes that an 11/780 would take 50 hours to run. We need such a beast today for system simulation.

The six people I talked to were the best I have interviewed in a long while. They possess excellent knowledge of their field. Some are multidiscipline experts. They are sincere and open. They love Boulder and they said if DEC sponsored them not one of them would leave. They formed a cohesive, dynamite team who teach, help and care for each other. I asked about management philosophy. They said, the organization was formed with small groups where managers participated at the technical level. They said, they went out of their way to get critics of their design and came up with the most state-of-the-art machine. They believe in themselves and in what they can do so much that there is not the slightest doubt in their minds whether this project would be successful.

Admittedly, I am all charged up with what I heard and what I saw in people's faces. I urge you to look into the matter and listen to them. We heard a rumor that an aerospace company was ready to write a check to buy the outfit. It may be the E-beam facility they are buying.

From where I sit today, it looks like a golden opportunity for Digital. If it can be done, it would take a half a dozen DEC folks and a VAX architect to go to Boulder and work with them. Boulder is such a beautiful place I don't think we'd have difficulty in finding volunteers for a hot project like this.

Please call on me if you'd like to know more.

OT:clc

GB3.S4.33

In this year's strategy update, I identified developing our skills as #2 in the top 10 list, just below sorting out what work we have to do and who does it.

During the last few weeks I've been exposed to several projects which are mainstays of the product strategy, and find:

> THERE'S NO WAY WE CAN IMPLEMENT CRITICAL PRODUCTS IN THE PRODUCT STRATEGY <u>WITHOUT</u> SIGNIFICANT ON-THE-FLY TRAINING OF ENGINEERS AND THEIR MANAGERS!

Frankly, I'm stumped, and think we have a stalemate and are not addressing training. EMC members seem to want no part of education for two reasons:

- your people are adequately trained for the current work, and your particular work environments are actually quite nice. Hudson and Marlboro fall in this category. Littleton's improving. I don't know of other acceptable environments.
- the situation is hopeless, and you're hoping the problem will go away. Pockets of the mill, some A/D, and Tewksbury are typical

WHAT IBM DOES
Erich Bloch, VP who built and operated Fishkill for many years, is in charge of their education. They just have to have an edge because:

- technical people take about 4 weeks per year in new courses
- managers take 3 weeks per year including one week of required technical education

EMC AGENDA ITEM
I'd like to discuss this critical item for a few minutes at EMC because the number of poor projects has reached epidemic proportions as measured by our performance against schedules (measured in being 1-2 years late) and simply by looking at the projects (and feeling my gut).

A long awaited task force report is in process, but it is not aggressive enough in time, effort or direction.

Mostly, I want several projects very badly, but I don't believe they are possible with the current people as trained and managed.

(DRAFT) COMMENTS ON

(CONVENTIONAL, NUMERICAL) SUPERCOMPUTER DEVELOPMENTS

DRAFT NRC/OSTP BRIEFING DOCUMENTS

Gordon Bell
Encore Computer Corporation
15 Walnut Street
Wellesley Hills, Massachusetts 02181
617-237-1022

SUMMARY
I believe the report greatly underestimates the position and underlying strength of the Japanese in regard to Supercomputers. The report fails to make a substantive case about the U. S. position, based on actual data in all the technologies from chips (where the Japanese clear lead) to software engineering productivity.

The numbers used for present and projected performance appear to be wildly optimistic with no real underlying experimental basis. A near term future based on parallelism other than evolving pipelining is probably not realistic.

The report continues the tradition of recommending that funding science is good, and in addition everything be funded. The conclusions to continue to invest in small scale fundamental research without a prioritization across the levels of integration or kinds of projects would seem to be of little value to decision makers. For example, the specific knowledge that we badly need in order to exploit parallelism is not addressed. Nor is the issue of how we go about getting this knowledge.

My own belief is that small scale research around a single researcher is the only style of work we understand or are effective with. This may not get us very far in supercomputers. Infrastructure is more important than wild, new computer structures if the "one professor" research model is to be useful in the supercomputer effort. While this is useful to generate small startup companies, it also generates basic ideas for improving the Japanese state of the art. This occurs because the Japanese excel in the transfer of knowledge from world research laboratories into their products and because the U.S. has a declining technological base of product and process (manufacturing) engineering.

The problem of organizing experimental research in the many projects requiring a small laboratory (Cray-style lab of 40 or so) to actually build supercomputer prototypes isn't addressed; these larger projects have been uniformly disastrous and the transfer to non-Japanese products negligible.

Surprisingly, no one asked Seymour Cray whether there was anything he wanted in order to stay ahead. (It's unclear whether he'd say anything other than getting some decent semiconductors and peripherals, and to be left alone.

Throughout the report I attempt to give specific action items, and the final section on HOW TO FORWARD gives some heuristics about projects together some additional actions items.

I have commented on the existing report, using its structure because of a personal time constraint. Hopefully, my comments don't conflict too much with one another or are too vague. If they are, I apologize. I would like to rewrite the report to make it more clear and concise. Or in the words of somebody: "I wrote a long letter because I didn't have time to write a short one".

(COMMENTS ABOUT THE) INTRODUCTION
The second two sentences are fallacious and unfounded; from them follow faulty conclusions. Supercomputers aren't that fast today, nor are they increasing in speed rapidly over the last decade. The report lacks substance and detail, e.g. it doesn't differentiate between MIPS, MOPS or MFLOPS and the notion of peak and average. Note these data:

	DF	LLL	Av	Pk	Min	Year	% / yr. increase
Cray X-MP	33	53	150	3	83	8%	
Cyber 205	25	40	80	2	82		
Cray 1	18	38	83	3	75?	32%	
FPS 164	1.3				84		
7600	3.3				69	52%	
6600	.4				64	(base)	
Fujitsu VT200			132	190	5	84	
Hitachi 820		100	240	4.2	84		

DF Megaflops- Dongarra's Double Precision LINPACK
LLL Megaflops- Livermore Kernels of 14 as of Jan. 84

The above data <u>should not</u> be used for conclusions without more basic understanding; it is all I had immediately available. If the Crays run at a much slower then the above average rate, averaged over an entire day, then this would strongly argue for simple, cheap 10 mip machines to front end and offload everything that can't run in a highly parallel fashion.

The committee was very unclear about what kind of operations are desired. Is it having:

- .the greatest MIPS for just a few problems and national prestige?
- . a much larger number of MIPS for researchers who now get by sharing a Cray?
- . or is it simply having some reasonable fraction of a Cray at a much lower cost?

In general, I took the problem to be one of national prestige and having something that computes faster than anything else. On the other hand, if it's to provide lots of effective cycles, I would urge us to terminate all existing, complex architectures used for building microprocessors and to make available a simple, very fast, hardwired processor such as Hennessey's MIPS or Patterson's RISC chip but with floating point and memory management.

It is quite likely that the basic approach to multiple pipelines to increase M (in SIMD) is risky when you look at delivering either more or the most cost-effective operations. Given our poor understanding of multiprocessor for parallelism, much work is needed in order to get anything reasonable out of a multiprocessor, let alone a multi-processor, multi-pipelined machine. Based on large differences among peaks and long term averages, much basic and applied work in compilers needs doing now; as such research is required.

ACTION: Data suggests there are at least these problem areas:

- understanding about existing machine performance,
- fundamental work on compilers to utilize current pipelined machines (especially for non-floating point work), and
- alternative machines and structures to get around what appears to be poor utilization of expensive resources. (Here, I think several startups may be addressing this.)

ACTION: Given the Fujitsu and Hitachi are IBM compatible and should perform very well for a more general load, particularly ones requiring a large virtual memory, I believe we should urge the National Labs to take delivery of one of these machine at the earliest possible time in order to proceed with this understanding. Time should be available for computer science.

RISKS IN PREDICATING THE FUTURE OF SUPERCOMPUTERS ON PARALLELISM:
While I concur, the report is unconvincing because results to date are sparse. Note:

Existing Pipelined Computers. It would appear that fundamental work is still required in order to design and exploit these computers, especially when multiple pipelines are used.

Real, Experimental Machines. The only, experimental evidence for parallelism (that I'm aware of):

. C.mmp and Cm* multiprocessors at CMU showed that many problems could be solved giving near linear speedup, but NO general results were obtained; Several multiprocessors are entering the market (Dennelcor, Elexi, and Synapse), and many more are coming, based on the commodity micros. Clearly the Dennelcor machine should have produced some useful results to demonstrate parallel processing; I know of now.

. Manchester's Dataflow machine works for a few "toy" problems that were laboriously coded; I am unconvinced that general purpose Dataflow Machines will provide high performance-- i.e. be useful for supercomputers. I am completely convinced that it will NOT be cost-effective. Dataflow structured hardware may be the right way to control signal processors! It may be possible to use a Dataflow language to extract parallelism for pipelined, multiprocessors and multicomputers --- but alas, NO ONE is working on what should be the first thing to understand about dataflow!

. Fisher, at Yale has a compiler that can exploit the parallelism in array processors; He is continuing, by building a machine along these lines which he believes will provide parallelism up to 10 using a single, wide instruction to control parallel execution units. The work is convincing--and he may have a reasonably, super, computer.

. IBM built the Yorktown Simulation Engine and showed that logic simulation can be run with a special purpose multiprocessor oriented to simulation; and

. Fox and Seitz built a 64 computer Hypercube which has been used for various physics applications. This looks extremely promising because the machine hardware is so trivial. Larger machines are in progress. We need to understand its general applicability.

<u>"In Progress" Machines That Promise Great Parallelism</u>. These include:

- MIT's Connection Machine being funded by DARPA and built at Thinking Machines Corp; This is a fascinating SIMD machine that has 64K processing elements with extensions to IM. While originally designed for AI, it appears to be suitable for arithmetic calculations.
- Systolic Array Processors; Several machines are in progress, including one by Kung. It is unclear whether a systolic organization of a dozen or so pipelined processing elements can either be controlled (programmed) or have a rich enough interconnections structure for more than a few applications.
- MIT Dataflow Projects; The whole dataflow area needs review.

<u>Inoperative or Poor Experimental Machines</u>. There are at least twice as many machines which yielded either poor or no experimental evidence about parallelism. Some are published, but few describe the failures so that others may profit from their mistakes. Some that are continuing should be stopped to free valuable resources!

Conjecture Machines. There are at least a factor of ten more machines that are irrelevant for anything other than tenure and miss-training graduate students.

Especially distressing is the work on large scale and ultra large scale multiprocessors with thousands of processors because we have only sparse data and no understanding now of whether multiprocessors really work. Resources are needed to work on both the general problem and specific applications involving a dozen to a hundred using <u>existing</u> machines. We can always build a 1000 processor system if we can find out that they "work."

(1) PURSUE ALL DESIGNS LIKELY TO SUCCEED IN ANY BIG WAY
This simply is and can not be implemented. We have two cases:

- our potential talent is being wasted on examining structures that look interesting because they can be built using VLSI; and

. we are not working on the structures that must be built and understood, or those which we have but don't understand well enough to apply broadly.

Poor Work. There's probably no way to outlaw or manage poor work, but funding for it could be stopped. The only reason to worry this is that there's so much real work to do! I would like to take a budgetary "chain saw" to cut tree, grid, and other partially connected structures, as well as banyan and perfect shuffle switches etc. that claim to provide anything useful for computing. None of these have either systems software or applications understanding behind them; they are only interesting because they may some day be buildable and are publishable. This work (similar to associative memory research) yields about 10 to 20 micropapers per research dollar with absolutely no use for any future (10-20 years) timeframe. The work can be easily re-invented anytime, by anyone and usually is in every 5-10 year increments.

Potential, Good Work. Supporting a major supercomputer project within a university or government laboratory across hardware, software and systems applications has shown to have been impossible. A major, large project of this type requires on the order of 30-40, focussed, well-led researchers and engineers. The machines are important to build; universities have many of the "right" people to build them but lack leadership, hardware and software engineering discipline, skills and facilities to build them. Companies have few people with the vision (willingness to accept risk), or ability to do much of the research to carry them out. A combination of the two institutions is somehow needed. The IBM-CMU Development Laboratory is one interesting experiment for building large systems. Also, Entrepreneurial Energy, released by Venture Capital may be an alternative way to carry out these projects... but Venture Capital alone is very un-venturesome.

Great Individual Researcher or Small Team Work. Universities are incredibly cost effective for building systems where a single professor or group can work on a project with a dozen or so students. The work on non-microprogrammed processors

(RISC and MIPS), Cal Tech's Hypercube, the SUN Workstation forming SUN Microsystems, Clark's Geometry Engine forming Silicon Graphics, the LISP Machine as the basis for Symbolics and the LISP Machine Company, Scald as the basis of Valid Logic, etc. are all examples of this kind of work.

Nearly ALL of the great ideas for modern CAD on which today's VLSI is based seem to emenate from the individual professor-based projects (Cal Tech, Berkeley, Stanford, MIT ... Mead's VLSI design methodology, the silicon compiler, Supreme, Spice, etc.). This software has either moved directly to use (eg. Supreme, Spice) or been the basis of a startup company (eg. Valid and Silicon Compilers) to exploit the technology.

ACTION: I would like to limit poor work, fund the great work in small projects where results and people are proven, and find someway to address the large projects where past results have been almost universally disastrous and poor. It is essential to get small projects surrounding large systems; these are likely to produce very good results.

(2) GET DESIGNS INTO THE HANDS OF USERS NOW
ACTION: I concur. We need to immediately engage in working (experimentally) on parallelism at the systems software and applications levels right now, using real, existing computers. Both multicomputers (the Seitz-Fox Hypercube) and multiprocessors (Dennelcor, Elexsi, Synapse) can be placed in universities almost immediately to start this work.

(3) ACCELERATE COMMERCIAL DESIGNS INTO PRODUCTION
Several methods can be used to accomplish this provided there is anything worth producing:

- Great, Individual Researcher doing seminal work (works well)
- Cray-style Laboratory (untried, except by Cray)
- Large project in small scale research environment (typical, but poor)
- NASA-style Project (multiple, interconnected projects) (used effectively by DARPA for very well-defined, focused projects... requires a prime contractor)
- Consortia of multiple companies or universities (current fad)

- Industry-University Partnership (on premise or dual labs) (Could be effective, provided universities permit them.)

The committee could have examined these alternatives and developed some heuristics about the kind of projects that are likely to be successful based on real data about past work.

(COMMENTS ON) SPECIFIC TECHNOLOGICAL AREAS

The report examines the constituent technologies for supercomputers in a less than quantitative, friendly, fashion. The US has only one, unique resource for building supercomputers, Seymour Cray; hopefully the ETA Lab of CDC will be a backup. Without him, supercomputers wouldn't exist. In order to provide backup to the well funded, well organized, super hardware technology based Japanese efforts, much fundamental AND applied work is required, to be followed by exceptional hardware, software and manufacturing engineering.

CHIP TECHNOLOGY

U. S. chip technology available through conventional semiconductor companies and computer companies outside of IBM doesn't appear to be relevant to supercomputers. Chip technology lag with respect to Japan is increasing because all major Japanese suppliers are working hard across the board in all technologies, including significant efforts in sub-micron research. Note:

- basic CMOS for RAM and gate arrays; Japan is several years ahead because suppliers were slow to make the transition from NMOS to CMOS. America's only serious gate array supplier, LSI Logic is Toshiba based.
- high speed circuits based on HEMT, GaAs and conventional ECL; The Japanese continue to increase the lead in today's ECL gate array circuits, and they continue to build and describe the highest speed circuits (ISSCC).
- state of the art, microprocessor peripherals; While not directly relevant to supers this does indicate the state of the art. Many of the major chips are designed in Japan such as the NEC graphics controller for the IBM PC.
- conventional microprocessors. These are dominated by U. S. "Semicomputer" manufacturers quite likely because the Japanese are unwilling to make the investments when the leverage is so low. These architectures are clearly wrong for today's systems. All manufacturers need to abandon their current architectures! This would provide much more scientific operations than any

supercomputer effort.

. Computer Aided Design of VLSI. This area has been developed by U. S. Universities. The programs move rapidly across all borders, creating an even more powerful industry in Japan. This work aimed at small systems could be extended for supercomputers.

ACTION: It is heartening to see real research being carried out at the chip level now by Berkeley, MCNC, MIT, and Stanford. Unfortunately, all of this work is aimed at lower cost systems. A U.S. supplier of high performance chips for supercomputers is needed.

PACKAGING

Packaging is vital for supercomputers. Cray's creative packaging has been in large part, the reason why his computers remain at the forefront. IBM is able to fund the large "Nasa-style" projects for packaging large scale computers, but it is unclear that this packaging is suitable for building supercomputers. It clearly cannot be used outside of IBM. Hopefully, Cray will come up with something again.

ACTION: With the demise of Trilogy's Wafer Scale Integration, we have lost the possibility of a major lead. If it is important to have Wafer Scale Integration, we should encourage Trilogy to work with the Japanese. If we are concerned that Cray's next package is inadequate, then an effort should be considered.

ELECTRO-OPTICAL TECHNOLOGIES

The report omitted this important area. This offers potential both for computation and for interconnections.

DISK TECHNOLOGY

The report fails to acknowledge the fact that the U. S. is only leading in the production of low cost, 5" winchester disks. A recent, innovative U. S. designed disk is in the process of being transferred to Japan for manufacturing because U. S. manufacturing technology is lagging.

ACTION: The Fujitsu Eagle provides the greatest real density. Only a few universities such as the University of Minnesota are doing fundamental work in magnetics; the Japanese have graduate students in these labs. We simply need research in magnetics to regain the lead coupled with a major effort in manufacturing engineering.

ACTION: It was heartening to learn that a very high speed optical disk would be available in the next few years. However, one should point out that the current optical disk was invented by MCA, but had to be taken to Europe and Japan for manufacture. My skeptical guess is that it is just a demonstration, like the vast number of past demos by large, military contractors whose main goal is funding, not science or products. If, indeed there is a "breakthrough" optical disk, then we should make every effort to support and exploit it.

CURRENT AND NEW COMPUTER ARCHITECTURES
The first statement of this section claims:

> "During the next five years, new types of machines based on large-scale parallelism ... thousands ... will appears along side today's high end computers ... these machines will progressively supplant present designs in some market sectors."

This statement finally destroys any of the report's remaining credibility through wild optimism. Although I strongly believe in an emerging class of multiprocessors and multicomputers using possibly a few hundred processors, I don't see this as a serious alternative to supercomputers for general purpose computation in the next 5 or 10 years.

The section on New Parallel Supercomputer Designs leaves open the door to magic whereby with a small amount of intellectual work, one obtains vast payoff, leaving the "competitor" surprised. Unfortunately, any design of this type that emerges quickly is easily replicated, and either doesn't work at all or works for only a limited set of applications. There are no easy roads to success. All the parallel machines are going to be tough to build and program. Selected, special purpose function machines can be useful and should be encouraged as an alternative path to understand generality. For example, a dataflow controlled multiple (array) processor may be able to deliver vast amounts of ops or flops, but for selected functions.

SPECIAL PURPOSE COMPUTING
The ability to rapidly construct systems in silicon may be the best way to provide cost-effective solutions to a wide range of problems. This process, I call VLSIzation is coming along nicely, but should be better understood and extended to high performance technology.

COMMUNICATIONS TECHNOLOGY
LANs will cause higher speed LANs to be required. With the widescale availability of Ethernet, hopefully other standards that operate an order of magnitude faster will be forthcoming. These will require significantly better interfaces between the link, processor and various levels of system software. In affect, this is "spatial parallelism" or distributed processing.

Clearly we need an upgraded ARPAnet to carry large files and videoconferencing.

ALGORITHMIC AND SOFTWARE ISSUES
This section of the report underestimates the need for changes to languages to express parallelism, including the possibility of using a Dataflow language. Also, neglected is the possibility of using expert systems for organizing problems for parallel execution... but in order to accomplish this, we need much more experience.

EFFORTS ABROAD
We need to couple into the British for ideas and fundamental advances, and could couple to the Japanese for semiconductors, other hardware technology, manufacturing, and engineering.

ARTIFICAL INTELLIGENCE ISSUE
This effort needs to be co-ordinated so that the fixed resources capable of building fast systems can be effectively employed toward either or both numeric and/or symbolic

problems. It should be pointed out that the Japanese manufacturers are well along in having both fast and low cost LISP Workstations.

HOW TO MOVE FORWARD (Bell Heuristics)

In general, I believe it is important to:

1. Narrow the choice of architectures that are to be pursued. There are simply too many poor ones, and too few that can be adequately staffed.
2. Fund only competent, full-time efforts where people have proven ability to build hardware and software systems. These projects should be carried out by full-time people, not researchers who are servicing multiple contracts and doing consulting. New entrants can spend a year or two to demonstrate competence by actually building something!
3. Have competitive proposals <u>and</u> projects. If something is really an important area to fund in the first place, then have two projects with forced intermediate progress information exchange.
4. Fund balanced hardware/software/systems applications. Doing architectures without user involvement (or understanding) is sure to produce useless toys.
5. Recognize the various types of projects and what the various organizational structures are likely to be able to produce.
6. A strong infrastructure of chips to systems to support individual researchers will continue to produce interesting results. These projects are not more than a dozen people because professors don't work for or with other professors very well.
7. There are many existing multicomputers and multiprocessors that could be delivered to universities to understand parallelism before we go off and build really large multi's.
8. It is essential to get the Cray X-MP alongside the Fujitsu machine in a computer science setting in order to understand the two approaches and also to work on the parallelism associated with multiple processor, multiple pipeline machines.
9. Build "technology transfer mechanisms" in up front. Transfer doesn't happen automatically. Monitor the progress associated with "the transfer".

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a n d u m
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+---------------------------+
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Subject: **Cross Product P/S Programs**

To: Distribution

CC: OOD
Joe Smith, ML8-3/T13

Date: 7/3/79 Tue
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

follow up: 7/17/79

I recently reviewed some of the Cross Product Power Supplies under development in the Central Power and Packaging Group in Maynard. A matrix of these products, comprised of Power Suppliers and Enclosures is attached.

Products of this type can play an important role in Digital's future effort to reduce overlapping product mix, development costs, new product start-up (NPSU) costs, tooling costs, inventory costs and Field Service costs.

I strongly suggest you use products from this matrixes unless there is an overwhelming financial advantage to designing a custom cabinet or supply. Remember that transfer costs does not include the Digital investment to introduce and support a new product, nor money to stock spares.

Please discuss your plans for new applications of power supplies and enclosures with Joe Smith at extension 223-8793.

Some specific possibilities I wonder about are:

MPS - HSC50, HYDRA, MERCURY, VENUS, 2080

LEM - NEBULA "M" RAM MEMORY, TM78 (FY82), 11/24

LVPS - TM78 (FY80,81) NEW LOW VOLUME REQUIREMENTS

PC - 30: VENUS, 2080, MERCURY, HYDRA
10: NEBULA, COMET, (EXP), 11/44, RL02 OPTION CABS, 11/24, TS11, TU78, 11/23

H9640 FAMILY - NEBULA, 11/44, 11/23, COMET

H9610, H9614 - RL02 OPTION CABS, TS11, 11/44, RM80, RA80, R81, VENUS, MERCURY

BBU - NEBULA, 11/24, VENUS, 2080, "M" RAM MEMORY

Can each of you tell me or Joe why not?

GB:swh
Attachment

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Hank Allard	ML5-3/E12	Phil Arnold	CX
Stewart Beckley	MK1-1/J14	Ron Bingham	MR1-2/E85
John Caulfield	AC/E44	John Clarke	ML1-2/E60
Dick Clayton	ML12-2/E71	Joe Cosgrove	WF
Brian Croxon	TW/C04	Dick Dreslinski	WM/P93
Walt Dunham	MK1-2/E13	Brian Fitzgerald	MK1-2/H32
John Gilbert	TW/E07	Bob Gray	MK1-1/J14
Bob Hall	TW/D15	Art Hamill	AC/B70
Bill Hazen	ML8-4/E86	Per Hjerppe	MR1-2/E78
John Holman	PK3-1/P84	Lou Klotz	ML1-2/E60
Bernie Lacroute	TW/A08	Jim Lawrence	ML8-3/T13
Demetrios Lignos	CZ	Jim Marshall	TW/A08
Bill Mathrani	CX	Jim McElroy	MO
Bill Minor	ML3-4/E81	Roy Moffa	ML5-2/E93
Bill Montero	CZ	Fred Oldfield	ML5-1/E32
Ralph Platz	CX	John Pratt	ML21-1/E81
Wayne Rosing	TW/C03	Steve Rothman	TW/D06
Grant Saviers	ML3-6/E94	Henk Schalke	ML11-4/E86
Dick Schneider	ML11-4/E53	Herb Shanzer	ML21-2/E81
Ken Sills	ML3-6/E94	John Sofio	TW/D02
Don Staffiere	ML11-4/E53	Joe St.Amour	ML1-5/E29

Phil Tays ML11-4/E53 Hank Tucker WF
Charlie Vaillant ML5-1/E31 Pete Van Roekens TW/B02
Jim Walls MR2-3/M84 George Wood AC/E44
Sultan Zia MR1-2/E47

CC: Jim Cudmore ML1-5/E30 Bill Demmer
TW/D19
Ulf Fagerquist MR1-2/E78 Sam Fuller
TW/A08
Bill Johnson ML12-3/A62 Mitch Kur ML12-
2/E71
John Meyer ML12-1/A11 Larry Portner ML12-
1/T32
Joe Smith ML8-3/T13
REA

EMS 7-MAY-79
14:35:33 520 1
To: Ulf Fagerquist
CC: Ron Bingham, Robert Kusik, Len Halio
From: Gordon Bell
Date: MON 7-MAY-79 14:35:33 EDT
Subject: CRT Approval for VLSI Advanced Development

I gave Ron permission to buy a hi resolution color CRT
contingent on your
approval. Also, Ron was to co-ordinate to get an interface
that is common to
our corporate effort.

Command:
1 February 1983

Mr. Marcus Paltridge
CSIRO
Division of Computing Research
P. O. Box 213
Eastwood, S.A. 5063
Australia

Dear Mr. Paltridge:

This is in reply to your letter of 21 January 1983.

Sorry, I am going to be in Colorado at that time. I would really like to talk to you about the 100K gate chip you are designing and whether you might do something for us. I have asked Walt Tetschner and/or Bob Supnik to meet with you in Hudson in this regard.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

cc: Walt Tetschner
Bob Supnik

GB4.S1.27

ID#0258

d i g i t a l **i n t e r o f f i c e m e m o r a n d u m**

Subject: **CSS Controller for RL01**

To: Grant Saviers
CC: Michel Depeyrot, John Holman,
John Kevill, Bob Puffer

Date: 8 SEP 78
From: Gordon Bell
Dept: OOD
Loc.: ML12-1
Ext.: 2236

follow up

9/20/78

Do you know about a CSS controller for an RL01 to make it look like Diablo?

Why is it done there (no training, difficult) versus in Colorado? It could be a good product, especially with RL02. We need the volume! Let's not jeopardize it by a high cost, low volume, unreliable product.

GB:ljp

FROM: GORDON BELL DATE: TUE 22 JAN 1980
4:49 PM EST
DEPT: OOD
EXT: 223-2236
TO: GERALD V BUTLER
cc: LARRY PORTNER
DICK CLAYTON
JOHN HOLMAN
BILL DEMMER
GEORGE PLOWMAN
BILL PICOTT @MR16

SUBJECT: CSS YOUR CALL RE: CHARTER TO BE H/W PRODUCT FOCUSSED

As your hardware engineering and manufacturing organization has always known, there are always product holes and overlaps. These are now ripe for partitioning and charter, especially given the pressure to get out of customer special systems. What may be possible:

Graphics - Compatible architectures with Regis at the high end assuming we ever do Gigi, and VT125 to start the low end. Currently CSS has the VSV, VT30, VS61, and higher end Megatek stroke based system but according to no pattern/theme/architecture.

Communications - holes in 780, and other areas. Here you seem to select every possible hardware hole, to partially fill it but with inadequate software.

Line printers - open ended. I'd like all line printers to be put on serial lines ASAP. Needs co-ordination.

Process I/O - Much overlap within CSS, MDP, and CSI. Why not make this your highest priority.

We have to discuss this and understand the real opportunities. Can you talk independently with each of the engineering groups?

GB:swh
GB1.S1.30

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+---------------------------+                          GB0003/30
|   |   |   |   |   |   |   |
| d | i | g | i | t | a | l |   i n t e r o f f i c e   m e m o r a n d u m
|   |   |   |   |   |   |   |
+---------------------------+
```

Subject: **CSS versus P/L (For Process I/O) and Central Engineering**

To: Jerry Butler, NU
Roy Clites, MK1-1/M37
Bill Demmer, TW/D19
Martin Hall, PK3-1/P84
John Holman, PK3-1/P84
Andy Knowles, ML10-2/A52
Stan Olsen, MK1-2/C36
George Plowman, ML5-5/E97
Bob Puffer, ML12-2/E38
Bob Savell, ML5-2/E50
Charlie Spector, ML5-2/A53
Jack Shields, PK3-2/A58
Jim Wade, RA

Date: May 29, 1979
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

Follow-Up: 6/15/79

Having just talked with various salespersons in Germany let me pass along their frustrations in an amplified fashion:

1. Our process I/O is really poor! There are at least 3 solutions--P/L (1 or ??); CSS-Germany, CSS-Canada--and all are inadequate! Note the similarity in terms of our former product strategy when

we were aggressively extending the 10/20 up and down and building new high end 11's all to be competitive with each other - none of which would ever get finished. Why can't we just pick the base, have this down in one place and stop the rest? Don't we have to be really good here?

2. The process world is still doing its own thing and now its based on microprocessors. A good, high volume, low cost standard line is important.

We have the best microprocessor architecture in the 11/23 and let's build on it and get the process I/O! The user's perceive we're getting out of this business - now's the time to get in!

3. CSS do no SS anymore because they are too expensive. Furthermore, CSS has to supply low volume products in order to get enough profit as a bribe to take on CSS real work. Special Systems and Systems Management are required and could be provided somewhere in the company. Should this function be in the services organization?

4. The field badly needs a protocol converter for the myriad of special communication systems. They asked, like I did, why this can't be compiled automatically? Failing automatic generation of handlers, they would like 11/03-based hardware, with special converters, which would convert among all the odd-ball DEC and other protocols. This can be the solution until we can get all these protocols into the DECnet framework, which we may get to in the post '85 time frame. Why can't CSS be specialists in providing these products?

GB:swh

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Jerry Butler	NU	Roy Clites	MK1-1/M37
Bill Demmer	TW/D19	Martin Hall	PK3-1/P84
John Holman	PK3-1/P84	Andy Knowles	ML10-2/A52
Stan Olsen	MK1-2/C36	George Plowman	ML5-5/E97
Bob Puffer	ML12-2/E38	Bob Savell	ML5-2/E50
Charlie Spector	ML5-2/A53	Jack Shields	PK3-2/A58
Jim Wade	RA		

****
* d i g i t a l *
****

TO: GERALD V BUTLER
ROGER CADY
cc: WIN HINDLE
JULIUS MARCUS
JACK SHIELDS

DATE: FRI 8 MAY 1981 9:50 EST
FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: SURVIVING BUILDING GM'S KLUDGE IN CSS

We should make the best out of this situation by doing a really thorough review of their logic and by really high quality construction to give a large MTBF! I hope that we could avoid a redesign,

do only
minor changes and not spend precious resources even in Phase
II in
designing anything for GM.

The complaint by Field Service of poor diagnosability,
resulting in
poor MTTR, can be ameliorated to a large extent by making
MTBF large.
While the design by the GM Research Group is likely to be
poor in
engineering terms, since it's probably built by a group of
computer
scientists, it can be incrementally improved to give high
payoff in
MTBF.

Finally, assuming the bad timing and electrical problems have
been
fixed, the best way to improve MTBF is by high quality
construction.

Don't wirewrap. Use only tested burned in ceramic IC's, and
high
quality power supplies.

GB:swh
GB2.S5.46

00 BURT DECGRAM ACCEPTED S 24780 O 514 21-APR-81
23:36:57

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION   DATE: TUE 21 APR 1981
23:34 EST

FROM: GORDON BELL

cc: MARY JANE FORBES   DEPT: ENG STAFF

EXT: 223-2236

LOC/MAIL STOP: ML12-

1/A51

SUBJECT: OC REVIEW OF CT/VT FAMILY: IT DOES MEET THE ORIGINAL GOALS

The attached memo outlines our first meeting on CT, which we first named KO.I believe the project has stayed completely on the target we outlined then. Note the key features:

.modularity to form a complete range from dumb terminals up to a Wini based personal computer

.two basic engines to drive it based on Fonz and Tiny

.several alpha and graphics options

.the basic list of modules we outlined are being built

The tuning recently has sharpened things and put us back on the modularity ... THIS MUST BE THE KEY THING WE SELL, AS IT ALSO HAS TO PROTECT OUR TERMINAL BASE AND GIVE US A BASE TO BUILD ON IN THE FUTURE.

The new bus is somewhat of a red-herring, as other efforts to build terminals require a complete new set of options in order to be competitive. The bus is essential for:

.user installability, maintainability

.cost, especially as it is applied for use in a terminal

.ability to adapt to future industry standard chips

The change to integrate Tiny with graphics in order to get cost as in the CT25 does seem appropriate.

Clearly we are all disappointed that we can't match human gestation times for products. However, I will be delighted if the product is operating and is defined and truly ready to be produced in the 9 month period (ie. by May 28, 1981).

I believe we have an exciting set of products coming up for approval on Tuesday.

"TO" DISTRIBUTION:

BUZZ BROOKS ART CAMPBELL PETER F. CONKLIN
BARRY JAMES FOLSOM SI LYLE AVRAM MILLER
OPERATIONS COMMITTEE: BILL PICOTT

ATTACHED: MEMO;16

****
* d i g i t a l *
****

TO: OOD: DATE: THU 28 AUG 1980 10:09 AM EDT

FROM: GORDON BELL
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: KNOCK OUT: AN APPLICATIONS TERMINAL AND SMALL SYSTEM

CORE Archived on MON 23 MAR 1981
Archive Call number: 510122.1662

GB2.S6.8
****
* d i g i t a l *
****

TO: AVRAM MILLER DATE: TUE 9 JUN 1981 9:35 EST

FROM: GORDON BELL
cc: F/U 6/12 VIA FORBES DEPT: ENG STAFF
MARY JANE FORBES EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: CT BREADBOARD AVAILABILITY FOR PROGRAM DEVELOPMENT

F/U 6/12

I thought we had agreed that there would be architecture breadboards of ct available for various groups to program on. How can we possibly get any software there without this?

Is there anyway to recover so as to get something to everyone by
say Sept. 1 at the latest?

What is the plan?

GB2.S6.29

****
* d i g i t a l *
****

TO: AVRAM MILLER DATE: SUN 10 MAY 1981
16:33 EST
KEN OLSEN FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: CT CONNECTORS USING MODULAR JACKS

Little did I know that we would go off and tool special modular
jacks so that each connector on CT is unique for the phone, the
headset, the printer, the keyboard, etc. My original thought
was to use the STANDARD modular jack or the 4 and 6 prong ones
so that a user could be compatible with the standard cables and

hence could get cables anywhere. By having many different ones, he has to buy from us, and more than likely, he alsways has the wrong ones.

I don't know how to decide on what is right here, based on the conventional payoff to us, or costs to users. My instinct
says that the path chosen is higher (with more engineering and
manufacturing parts numbers), and it is more expensive for the
user too.

The chosen path does offer us the chance to lock 'em in, to charge higher, to be unique, and for the user to maybe make fewer mistakes in terms of pluggin things in.

Is there anyway to say pick a locking scheme so that a 6 prong
connector/cable can substitute for any of the other types? In
this way, we might be able to have our cake and eat it too.

GB2.S6.38
00 BURT DECGRAM ACCEPTED S 17164 O 285 27-APR-81 18:23:46

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* d i g i t a l *
****

TO: OPERATIONS COMMITTEE: DATE: MON 27 APR 1981 16:29 EST

FROM: GORDON BELL
cc: SI LYLE   DEPT: ENG STAFF
AVRAM MILLER   EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: CT ENGINEERING LOCATION

Part of Engineering	Part of Product Line
+ Easier access to: design support and stds quality support and stds architecture consulting	+ Less bureaucracy
+ Depends on easy access to: mass storage, semis, RSX, software, dist. processing, Ofis, Terminals and 16-bit	
+ Interaction with engineers	+ Interaction with marketing
	+ Makes engineers entrepeneurs
+ Engineering on hook, wants chance	- Marketing proximity hasn't worked yet
	- Will be viewed as a PL and other products will be built

GB2.S6.17

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* d i g i t a l *
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TO: OPERATIONS COMMITTEE:

cc: SI LYLE
AVRAM MILLER

DATE: MON 27 APR 1981 16:29 EST

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: CT ENGINEERING LOCATION

Part of Engineering	Part of Product Line
+ Easier access to: design support and stds quality support and stds architecture consulting	+ Less bureaucracy
+ Depends on easy access to: mass storage, semis, RSX, software, dist. processing, Ofis, Terminals and 16-bit	
+ Interaction with engineers	+ Interaction with marketing
	+ Makes engineers entrepeneurs
+ Engineering on hook, wants chance	- Marketing proximity hasn't worked yet
	- Will be viewed as a PL and other products will be built

GB2.S4.44
00 BURT DECGRAM ACCEPTED S 16990 O 11 09-MAY-81 12:00:52

****
* d i g i t a l *
****

TO: AVRAM MILLER
BRUCE STEWART
cc: SI LYLE

DATE: SAT 9 MAY 1981 11:57 EST
FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: A CT FOR WPS? CAN WE GET TEH 278 BETTER?

It was clear to me that we have a major problem either in the understanding of the performance or the real performance of ct for wps. We must get these groups together tor resolve.

I side with the wps folks as I have in the past. I'm typing at a marginal product right now, and CT will be worse vis a vis its ability to deliver real user cycles.

I want the design approach to be to put in the dma, and then to test the breadboard this way, taking it out if possible.

We don't have an adequate understanding of this point, nor do we have a decent model. My gut (and this 278) says we are way shy of cycles. The 278 simply isn't a competitive product for anyone who has typed on other wps systems (Burroughs,
Wang, IBM ... which I did on Wednesday at NCC). Furthermore, I'd expect Apple 3 to be quite good too.

Some reasonable benchmarks should include being able to emulate
a terminal at at least 9600 baud, at least gigi speed for graphics, 1200 baud transmission from floppy and keeping the screen up to date, background printing on a la24 or la120 while
not seeing degradation on the screen for editing, virtually instantaneous cursor position of lines, characters, words (versus where we are in the 278). Here, I want the wps folks to say what the benchmarks are, what performance they expect and
what it means to the total system design.

The groups had better get together. Right now, I would advocate
building something around the vt134 alpha approach and scrap the ct approach. Given that there is no dma, then the 134 approach
can't be used, so we have a dilema.

There are other issues too: the operating and file system, the keyboard and whether there is a need for an interim ni.

The real question is, whether the WPS folks can use CT. If not
it, then how much is it going to cost to get a system that can
be used? who can take it on? etc.

I want to get these questions posed and answered quick!

(The wps folks have to write down what their product tree is going
to be over the next few years too: the minimal floppy only, the
server based one, the big one with wini, graphics, the shared
versions, etc.)

GB2.S6.36
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* d i g i t a l *
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TO: see "TO" DISTRIBUTION   DATE: WED 25 MAR 1981 8:48 EST

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

cc: SI LYLE
    AVRAM MILLER
    LARRY PORTNER

SUBJECT: CT FY'82 SHORTFALL

THIS MEMO IS FROM LARRY PORTNER, AVRAM MILLER, SI LYLE, AND GORDON BELL

****

Since the start of the project there has been a shortfall in the FY'82
budget for the CT Program of some 4.5 million dollars' even after a

shift of 5.6M from other projects and activities. We have found
sufficient funds for the CT Program in FY'81 and FY'83. It does not
appear possible to cover this shortfall out of FY'82 Central
Engineering funds without adversely effecting a number of major
programs which could potentially have a significant impact on
corporate NOR. Furthermore, we have investigated and concluded that
no significant reduction can be made in the CT budget without totally
jeopardizing the program goals. It is our opinion that this would be
equally disastrous to the corporate strategy since we are of the
opinion that personal computers, personal computer clusters and
intelligent terminals for VAX Systems play a key factor in continued
corporate growth. The OFIS plans are extremely dependent on the CT
project. Product lines are considering products which layer on top of
the CT, in terms of hardware and/or software.

The CT100 must play an important role in many of the product line
plans.

1. Technical Products Group
    Recent discussion with the Technical Products Group would indicate
    that CT-150 (Winchester based product) would play an important
    role for ESG (selling to such corporations as Boeing), ECS (as a
    GIGI II candidate and as a mini host for GIGI 1.5 products), LDP
    (as a base for TLC), MSG (for small DMS systems) and government.
    It is not yet clear to us whether or not TOEM plan to

market the
CT100 as a desk top scientific terminal and/or a hardware value
added package. In our opinion the CT100 is a perfect candidate
for a low end TOEM offering. Especially if ones considers that
the architecture permits the video monitor and the video
controller to be removed from the kernel package and therefore the
CT could be an ideal vehicle for machine to machine type
interfacing.

Avram has made a proposal to TOEM for developing documentation and
testing which would allow the CT to be made available to TOEM
customers. We understand to meet the Technical Products Group
medium resolution graphics option supported by Regis is mandatory.
We are committed to provide such a option for the CT. Avram has
been working deligently with his group and has made a great deal
of progress in this area. He will be ready within one or two
weeks to come back with a concrete proposal which he feels
confident will meet the Technical Products Group's needs with
respect to graphics. The GIGI 1.5 work can and must be brought
within the family spectrum and marketed as a full member of the
family. We're all busy working with Joe Meany on this.

2. Commercial Products Group
It is still unclear whether or not the Commercial Products Group
will market the CT computer as a personal computer to any extent,

although, it would seem likely CSI, TIG, MDC might consider this...especially when it is clear that clusters replace timesharing. COEM has been working with the CT Program Office in order to understand the possibilities of layering both hardware (for serial multiplexers) and software (RSTS) in order to use the CT as a base for low end CTS 500 systems. If it turns out that it is not possible to support RSTS on the CT150 configuration (because of the limitation of the 5 megabit disk) we understand that COEM is considering releasing CT300 on that hardware configuration. Furthermore, the CT Program Office is planning to incorporate Aztec into the CT family hardware offering in order to develop personal computer clusters (shared file facility). We believe that this will allow CT/AZTEC based version of the CTS500. Furthermore, the CT Program Office is attempting to understand the long term implications of personal computer clusters and how we might migrate RSTS customers onto personal computer clusters and/or the use of CT's coupled to VAX. In this area, the primary concern are around language, file capabilities and migration tools.

3. Computer Products Group
The CT100 family is clearly a mainstream product for word processing and RPG. It seems clear that the CT120 and 150 can meet the needs of such major distributors as Sears, etc. CSS has

shown a strong interest in the CT Program. It is our understanding that they are currently considering writing application software which they can market for the CT family.

While there is still a great deal of contention about whether or not the CT100 could take the place of the VT134 project for TPG, TPG has indicated that follow on versions would definitely replace the VT134 and has also shown a definite interest in marketing the CT100, as well as the VT134.

As I noted earlier, the CT100 is a necessary ingredient in our entire OFIS strategy, which I believe plays an important role in many of your product line plans.

In order to resolve the funding issues around the CT Program, in an expedient way I am asking each one of you if you are prepared to provide 1.5 million dollars worth of incremental funding towards the CT Program in FY'82. In order to make sure that there is no confusion with respect to expectations, the deliverables of the CT Program are:

1. FY'83 Deliverables

    a. CT100 (F11/128-256KB, floppy based, Winchester and video monitor, and controller with medium resolution graphics option, color monitor option and telephone management system.

2. FY'84 Deliverables

a. NI adaptor
    b. AZTEC subsystem and file server (Scenario B, if
accepted).

3. FY'85 Deliverables

    CT200 family based on J11, new mass storage offerings and
full
    page video subsystem (VT200 components).

What the funding for CT does not include is the proposal
which Avram
has made to COEM for a serial multiplexer to allow a four
user CGS
system to be configured. It also does not include the money
required
to document the CT Bus for TOEM should they decide to market
it as an
added value hardware product.

I would like us to resolve the funding issues before the 1st
of April,
if at all possible. We are all available to answer any of
your
questions in full detail. We would appreciate having your
feedback on
this very important question as soon as possible.

GB2.S4.11

"TO" DISTRIBUTION:

TED JOHNSON ANDY KNOWLES JULIUS
MARCUS
STAN OLSEN
00 BURT DECGRAM ACCEPTED S 13485 O 59 18-APR-81 17:07:55

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* d i g i t a l *
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TO: KEN OLSEN DATE: SAT 18 APR 1981
17:04 EST

FROM: GORDON BELL
cc: see "CC" DISTRIBUTION DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: RE: CT REVIEW AND APPROVAL

Fine.

Let's make sure they are all portable, including the ones that
are pedestal ones! They should be
shippable by ups, (not as console tv sets you send via truck or
large station wagon), and they should be
customer installable (ie. the various parts and options can
be put together without a serviceperson). New options can be
sent to the user and he can build it up.
THESE ARE ALL SATISFIED BY CURRENT APPLES+, AND ANY FUTURE
REASONABLE OFFICE COMPUTER IS CLEARLY GOING TO BE DONE THIS
WAY!
(Thus pedestals are fine as long as they don't imply
this very high support cost of handling that the Pedestal 278
has.)

We must not make the small one bounded. Again,
the apple folks set the floor. NO CURRENT MACHINES ARE
BOUNDED,
that I fear this approach implies. Note Gigi suffered at intro
immediately with the need for some version that has rom,
ram, extra floppies, modems, etc. Frankly, I'm concerned we
will design another one of these kinds of products. Again,
the competiton doesn't do it, so why should we? (I also
might add that are terminals suffer from being non-expandable
and not being able to have integral modems, extra rom,
ram or mass store, etc. (Maybe we should use the Apple cards as

our I/O options to get the peripherals????) We should be able to make them cheaper than Apple according to Jack Smith.)

"CC" DISTRIBUTION:

CHARLES MALLETT PETER F. CONKLIN TED JOHNSON
SI LYLE MIKE WEINSTEIN AVRAM
MILLER
STAN OLSEN

GB2.S6.4
****
* d i g i t a l *
****

TO: AVRAM MILLER DATE: MON 24 MAY 1982
10:00 PM EDT

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: YOUR FIRST CT

Received your comment on marketing vis a vis channels, customers,
applications (a layering product) and completely concur.

Jack Smith is going to discuss alternatives with you to try to
get you out of the current mood, but more importantly get the right set of activities so that we can go balls out to market CT. Agree you could go out and build another product now, but
this would be a waste, given that this one is so good and we ought to be pushing it.

I think many of us (Ken, Andy, Jacks, and Win) all feel committed
to making the organization right so it can succeed.

What do you think is the best way to organize and do the marketing for maximum impact?

What do you want to do in this?

Certainly my own biasses as an engineer have been to not want to
have you waste your time on this, but to go on creating. I realize you have different motivation and drive, so let's make
things right for you and more the maximum company good.

Want the input and to resolve in right way.

GB3.S5.48
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* d i g i t a l *
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TO: KEN OLSEN DATE: SAT 25 APR 1981 20:58 EST

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: RE: TUESDAY, APRIL 28 DISCUSSION OF CT

Have absolutely no problem with this memo. Why would you think
this would bother me?

Am looking forward to get the positioning done on the various CT's and VT's and want to get on with it. I think Avram is showing us that we can hurry. We do get boards turned around in 2+ weeks and the excitement and push is worth it. Frankly this is ideal for us.

We must be careful to ask Avram and Si to do it when they have the information... not the hunches. They are working very hard to get us a product. Think what they could do if we trusted them and that we didn't ask them questions every day, .

The product phase review is designed for this. Namely, in the current phase, there aren't big comits. When they go into phase 2, we do start this. I believe they are not yet at this stage (or shouldn't be) until we see that working breadboard.

Frankly, I've learned a lot in watching Avram and the WPS folks:
give them a charter, stand back, and then review them at the right project times.
So far, these both seem right by all the measures I can think of.
Also, they are doing exactly what we outlined in the August 28 meeting. The office folks are building the architecture designed to get us a really competitive WPS!

Let's have a new slogan:
Let bodies in motion remain in motion, until they reach certain predefined points. At that time, then let's either let them remain in motion, deflect them somewhat, or stop them!

(Another plaque for crowded walls.)

GB2.S6.11
****
* d i g i t a l *
****

TO: ART CAMPBELL DATE: MON 2 MAR 1981 20:58 EST

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION

DEPT: ENG STAFF

EXT: 223-2236

LOC/MAIL STOP: ML12-1/A51

SUBJECT: RE: CT100 FUNDING

After your presentation today, and after our performance in recent product design, I am firmly convinced that we have to get the VT resources applied to some sort of winning product.

Your goals of time to market, high cost, high performance at any cost, and building what is basically an alternative to the CT and to the VT is going to take us down the tubes.

No way do I intend to let this product stand as is.

We need to get something that is going to win, and you are heading for the fourth or so loss (ignoring your part in doing these idiotic cost reductions on the VT100 and block mode VT13x'x). The VT134 will probably not be quite as bad as a PDT cause you started with a few more winning components, but the costs will be high and the market need is clearly questionable in light of the good Personal Computers.

I repeat,
you must work with Avaram to get these together along the lines outlined by Ken. Failing that, and failing Stan's and my ability to resolve the issue, I am remiss in not getting this issue raised higher.

As a seperate issue, I hope you will consider the VT125 and Gigi as alternatives to help your revenue problem. If you need another copy of my note on how you might use GIGI for fixed function terminals, I'll resend.

Let's get this settled this week.

"CC" DISTRIBUTION:

BARRY JAMES FOLSOM SI LYLE KEN OLSEN
STAN OLSEN

GB2.S5.18
****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION DATE: SUN 8 FEB 1981
22:02 EST

FROM: GORDON BELL
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: PETE'S CONCERN ABOUT TIMING OF A 32 BIT PC

I worried and want to have some answer to this. Since you are all pretty flat out, I'm not urging you to answer orr comment. Still, it is pretty frightening, and I think w e should advise the company just how much risk we are taking with the 11. Pete and I are hopefully really very technically
oriented and we won't have that much of a problem for that long.

Still, we do need Suvax bad.

"TO" DISTRIBUTION:

BILL DEMMER	SAM FULLER	PER HJERPPE
BILL JOHNSON	BERNIE LACROUTE	SI LYLE
AVRAM MILLER		

ATTACHED: MEMO;61

****
* d i g i t a l *
****

TO: PETER F. CONKLIN DATE: SUN 8 FEB 1981
21:57 EST

FROM: GORDON BELL

DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: RE: CT AND 16 BIT ARCHITECTURE

Peter,
Thanks for writing a memo that shares my very deep concern. Frankly, I don't know what the answer is here. The one I have rejected several times is taking on another architecture,
cause I think it would kill us... unless we found someway to be truly architecture independent, say like embracing UNIX, along with everyone else including the Japanese!

My best answer is get the concern raised higher so we can get a terminal based vax earlier. Go like hell to get the 11 based one and make the applications not get into the 32 bit space. Also go like hell to get Suvax and sell it as a high end machine, possibly at a lower markup. Thus we cover the range but have a gap in performance
where appollo, perq, etc can enter. But sell vax as the family range so that users will buy the upward end versus going to appollo. Work to have VAX applications that no one else can touch with the 22 bit micros.

The other alternative is to look at cost per terminal much harder and see what we can do, based on Nebula and nifty terminals to get the cost down, and then sell performance and cost/terminal... this is going to be the issue in the near term. When the PC clusters are introduced the issue is going to get even hairier.

Can you run some numbers projecting what you think the costs are going to be on various PC and shared systems over the next few years including scorpio and gemini vax? Then let's get some folks together and review them to see if there are any ways out. Then we'll issue a more wide scale document that shows the dilema (at certain points in time).

I don't think people realize how fast we move. Recall:
70-72 we were just introducing the 11 and rsts, and the
10 was becoming really good? Six years ago was the
vax anniversary and it's only been sold for 3 years.
It's mind boggling what I'm projecting in 90:
A cray for 250K, a shared rsts system for about 1.2K,
a 780 for 16K (actually looks the easiest), a 2.5K and
6.25K VAX should have been on the market for several
years (if we can get the chips).

Look forwarrd to some work and interaction on this critical
issue.
Gordon

GB2.S4.20
00 BURT DECGRAM ACCEPTED S 4894 O 260 26-FEB-81 13:01:14

****
* d i g i t a l *
****

TO: GROUP VP COMMITTEE: DATE: THU 26 FEB 1981
12:42 EST
    SI LYLE   FROM: GORDON BELL
                                           DEPT: ENG STAFF
                                           EXT: 223-2236
                                           LOC/MAIL STOP: ML12-
1/A51

SUBJECT: DISCLOSING CT

Absolutely no review of CT to Boeing until we have a bread-
board. We should listen to them about their requests,
say we're doing something and ask how they feel about price,
resolution, etc. At the same time, let's show them SUVAX
and describe our goals for it.

GB2.S4.37
00 BURT DECGRAM ACCEPTED S 34479 O 25 23-APR-81 08:12:56

****
* d i g i t a l *

****

TO: see "TO" DISTRIBUTION DATE: THU 23 APR 1981
8:06 EST

FROM: GORDON BELL
cc: MARY JANE FORBES DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: KNOCK OUT + CT ORIGINAL GOALS

Reference my EMS of 4/21, 23:34 -- OC Review of CT/VT Family: It Does Meet the Original Goals

The following is the referenced attachment:

00 BURT DECGRAM ACCEPTED S 22451 O 86 28-AUG-80 10:20:27

****
* d i g i t a l *
****

TO: OOD: DATE: THU 28 AUG 1980
10:09
AM EDT
OPERATIONS COMMITTEE: FROM: GORDON BELL
cc: see "CC" DISTRIBUTION DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: KNOCK OUT: AN APPLICATIONS TERMINAL AND SMALL SYSTEM

Knock Out: Attentive Modular Personal Applications Terminal
...
Small Computer System

The following describes a system of building terminals and small,
personal computer systems. It is based on the current

LA/VT200
and PDT efforts, assuming compatibility between them. It is
also
the results of a Woods Meeting of Ken, Stan, Avram Miller,
Bernie
Geaghan, Don Gaubatz and I. Bob Daley, Bruce Stewart and Bob
Travis came later and discussed the software options with
respect
to WPS. It is a project that Ken would like to do in 9
months
and we need maximum support from each group.

We will discuss the product on Tuesday at the Operations
Committee to enlist maximum support

PROBLEMS THAT KO SOLVES:

.a small system based on the 11, concentrating programming
.lower cost, faster time to mkt. small system
.competitively sized (ie. desk top)
.competition from personal computer systems for WPS and
business
.competition of new, stand alone WPS products
.concentration of scarce resources (eg. communications) to
get
one good, versus multiple marginal, later products
.unreasonably long vt/la product introduction date
.all capabilities in proposed VT/LA200 applications terminals
but
with earlier, first introduction based on common, highly
modular,
customer merge and customer replacement approach to repair

PRODUCT RANGE AND APPROACH:

Introduce a common set of modules from which the range of all
existing and proposed terminals and small systems can be
built,
including: VT/LA200 series, fixed function editing VT's,
GIGI,
PDT's, and RX's. Also includes the 11/03 and 11/23 with up
to

256 Kbytes of primary memory and 10 Mbytes of secondary memory.

Aimed at evolving dumb, with increasing smart (pre-programmed function) functions, to intelligent (programmable) terminals and
terminal based small systems for both stand alone and host coupled applications. Aimed at competing with personal computers
and being alternative to using semicomputer company micro for application terminal, but able to extend to larger system application for the single user.

Point of manufacture with customer merge by actual user (eg. secretary) and customer repair by replacement. Assembly requirements similar to Hi Fi. Modularity is a a key selling point, using a combination of rom on modules and floppy based ram
for achieving goal.

Market is anyone wanting to use the base modules and the supporting software for applications (eg. WPS, single user small
system as in a DIBOL machine, technical person's work station,
small business system)

GOALS:

Nine months till first product introduction, followed by a constant stream of new module introductions permitting the building of terminals and small systems with the capabilites well
beyond that envisioned by LA/VT/PDT plans.

Introduce and evolve by adding new modules and capabilities in
what is similar to approach used in the evolution of Unibus 11

Introduce, then cost reduce based on technology opportunities!

Maximum use of off the shelf one chip VLSI peripherals and other peripheral approaches to get low cost. Use personal computers as a model of the approach. Be prepared for all opportunities and attendant incompatibilites and new interfaces such as wands, light pens, joy sticks, etc.

Base the architecure on semicomputer company architectures

Be as compatible as possible with current DEC peripherals, but trade-off to get cost, sacrificing i/o compatibility in an explicit basis

Trade off cost for performance subject to inability to build fast access mass storage based products or highly interactive systems

Support a physical address space appropriate to memories

Target applications with implied bounded software, not general purpose use with implied compatibility, unboundedness, sys gens and support of all operating systems.

KO IS AN APPLICATIONS TERMINAL- the alternative is to try and build such an application using the control microprocessor instead of an 11 which is now the controller

KO IS A COMBINED CONTROLLER AND SMALL SYSTEM WITH BOUNDED MASS STORAGE AND INTEGRAL CRT CONTROL (for performance and cost) for writing large applications programs such as WPS and small business systems. Our competitors use micros and IBM uses the 8086. It is not a gp 11!

Main target application: WPS and OFIS-type products with very good filing capability, sorting, list processing and table manipulation. Visicalc!

MODULES:

Large computer module based on Fonz processor, 256 Kbytes user
ram, system ram, rom, serial port for printer, and standard serial EIA port (US and European use, up to 9.6Kb, EIA data only
lines would connect to local systems)

Small computer module based on Tiny processor, 65Kbyes user ram,
system ram, rom, serial port for printer, and standard serial EIA
port

Rom/ram cartridges for specialized software packages

Telephone interface with 300/1200 baud modem, auto answer, auto
dial, phone line in and handset or telephone out. Ability to dial out for data or voice use.

Ethernet interface sans modem, but includes any necessary rom and
ram to operate interface

DECnet interface, X.25 interface, SDLC/HDLC interface using appropriate ram and rom for protocols

Dumb terminal mux with multiple standard serial EIA ports

Combined controller for T/E 5" diskette and 5 Mbyte Winchester

Controllers handle combinations of the following monitors:
    .BW, RS 170 Composite video and European std giving 240 lines

.BW, 2 x 170, 480 lines (40 lines)
.BW, 4 x 170, 960 lines (full page, 80 characters)
.RGB Color, 240 lines
.RGB Color, 480 lines

Each controller will handle BW with intensity or simple color and
keyboard interface. Multiple virtual terminals with ability to
assign split screens to various terminals. Four versions:
.240 line, VT100 compatible, character only
.960 line, full page black and white, character only
.240 line, bit map, two plane, GIGI oriented
.480 line, bit map, two plane, high resolution color

Serial printers with serial port and bus interface such that processor can be used in non-dumb versions. (It is unclear that we should add anything to base printer cost in order to provide for computer modules.)

Keyboard- probably should go to standard serial format

WHAT A USER MIGHT BUILD:

VT200 starter- small computer module and 24 line char gen, keyboard, printer option, telephone option, or Ethernet option

VT200 Basic WPS- above plus floppy. Deluxe WPS editing would include full page monitor

Remote hard copy unit- printer, small computer module, telephone option, keyboard ... unclear what characteristics should be

Student starter- small computer module, floppy, telephone interface, bit map, monitor

Single user deluxe WPS or Small system- large computer module, dual floppy and Wini or 2 Wini, comm option if in a large organization, appropriate printer.

Clustered system with shared single user database- above with serial interface to dumb terminals or multiple crt/keyboard/monitors

SOFTWARE:

Single user, operating system with well defined interface and including all aspects of language, file system, terminal (screen), and communications.

Able to be interconnected to DEC systems and write terminal emulators to other systems by applications or field programmers
using some form of state table or higher protocol description language

Able to be interconnected easily with other single user systems
of the same type for file and message transfer
Explicit decisions made on i/o compatibility, both now and as we
proceed with deign. We have three architectural alternatives:

.fully 11 compatible, which is most likely to be uncompetitive
from cost and performance standpoint

.incompatible i/o, which is marginally competitive based on 11
chip set, but requires modifications to selected handlers

.semicomputer company architecture (eg. 8086), language and operating system to get lowest cost and highest performance, but
may not be able to be brought in on a timely basis.
Unfortunately, our competitors such as HP and IBM are using this
approach! If we can not make changes in our own i/o ISP

architecture, we must go this route. (Simple analogy to IBM's introduction of 360 like Series 1 instead of modifying 370 architecture)

PEOPLE:

.Avram Miller is driving overall program to get the product defined and resources assigned to implement it
.Ken is architecting the packaging
.Don Gaubatz (and I intend to be involved) will take on the responsiblity for the PMS and ISP (i/o) architecture, together with Bernie Geaghan who has the implementation responsibility for the modules necessary for terminals. ? has the implementation responsibility for PDT.
.Bruce Stewart is driving the WPS project
.? has the responsibility for implementing the base system software including an special handlers, the operating system, language and file system

"CC" DISTRIBUTION:

PAUL BAUER	BOB DALEY	MARY JANE FORBES
GAUBATZ VIA FORBES	BERNIE GEAGHAN	BILL HEFFNER
BILL KEATING	AVRAM MILLER	BOB PUFFER
HERB SHANZER	BRUCE STEWART	BILL STRECKER
BOB TRAVIS		

GB1.S6.23

"TO" DISTRIBUTION:

BUZZ BROOKS	ART CAMPBELL	PETER F. CONKLIN
BARRY JAMES FOLSOM	SI LYLE	AVRAM MILLER

OPERATIONS COMMITTEE: BILL PICOTT

GB2.S6.9 (5/21/81)

OUR PLANE CONVERSATION

1. SWE contracting/interfacing other groups is hard. There are too many requirements. Funding is separated for layered products. This means "Joint" goals. A buyer/seller might work. Alternatively, why not simply let the buyer have the code? In the case of layers for OFIS, let's simply obtain other's code (eg. Cobol, Basic) and use it as a black box.

2. CT. We must have a common o/s. This implies one organization.

3.CT. There is no process or person to interface with on critical issues at critical times.

3a.CT. Graphics decision needs all alternatives including NEC, VIM, VT134 and Hampton Saylor Alpha.

3b. CT Keyboard. No time

3c. CT Performance. What is it?

4. CSSE. Can't ship software ever. How can we get reasonable goals for products?

5. OFIS. Is now a language and O/S group. Who will do the applications for OFIS?

6. P/L. New base is a bitch! How can our old customers use it?

7. OFIS $

8. WPS278 is a study in very slow motion.

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7. OFIS $

8. WPS278 is a study in very slow motion.

We've got to look at the packaging of 11-based systems in light of the CT (both as a system and a VT). In particular, I've got the following questions:

1. Is the design of CT adequate to serve our terminal needs in the VT200 (1/2 - 1 page)?

2. How are we going to handle the very large number of CT/VT system types we may potentially design or need?

3. How are we going to package Q-bus based system?

4. Can we move to eliminate further Q-bus/U-bus systems? Using CT for most?

<u>CT's and VT's</u>

We're committed to MANY! CT mother boards to meet the various cost performance, graphics, and possibly form factors (if the CT cost is too high, requiring a separate VT effort in order to avoid jeopordizing our terminal business). The inevitable CT's CT-Fonz/VT100+; CT-Tiny/VT100+; CT-J/?; CT-?/VT200 (1/2 page); CT-?/VT200 (full page); plus any other mother boards required as part of a VT-only effort. As an operational guide, it seems like we would declare:

1. The CT and VT are one in the same. We are on a tact of offering increased functionality first, then possibly reduced cost.

2. The CT200 is a high resolution terminals/system to come out ASAP and use the CT box, PS and options. This is the VT100 replacement! Possibly it should be the first J-based product. Note there are 3 efforts that should be used for this: Tewksbury's SUVAX graphics, the Research Group's Gigi II, and the VT200 A/D.

3.

Any look at a T-based VT or CT should offer a drastically reduced cost. Quite possibly it should be packaged as an integral unit using the option boards. However, I'm skeptical that it has much to offer over a PDT 150 unless it is an extended graphics and terminal architecture.

U-and Q-bus Based System Products

Given the move to a different form factor for disks, it is ludicrous for us to perpetuate the 19" rack!

We must move now to make our future 11-systems site merged with parts arriving by UPS! By packaging, I want to eliminate Type IV systems (11/03 - 11/34 where there is a CPU box and disks in a single cabinet so as to eliminate FAT.) We need to decided on the form factors for the 23B, and how it will be packaged based on the systems configurations and their use. I see them as:

1. Multi-terminal systems going head to head as an alternative to the personal system. Alternatively, it might be ideal if personal systems could grow to shared ones...but this doesn't seem possible.

2. Diskless as concentrators and gate arrays. (CT doesn't seem suited yet.)

3. Evolution to Q-and U-bus based systems. (Here we might use the 19" rack.)

Aztec

Aztec has the performance to let us build a very nice multi-terminal system, but by putting it in a 19" rack, we don't get the main benefit.

I don't understand why we don't design a package for single Aztec which will be somewhat universal. Free standing with power (I don't see an economy of showing with another box) that can be used anywhere (CT, Q-bus, Nebula or as an add on). Possibly a number of these could be mounted in or "stored" within some other frame so as to minimize floor space. Since Aztec only requires front access, then why can't we make a frame to hold/stack several?

In this way, we get Aztec to be a fully customer site merged product. Nebula, would contain a frame or housing for inserting one or two side by side.

<u>Overall</u>

I hope we can look at these packaging questions in the next few months and build some protos before we slip into what's the easiest (19"), by the worst path for the future.

GB:swh
GB2.S1.3
Dr. Glen Culler, Chairman
Culler Scientifici Systems Corp.
100 Burns Place
Santa Barbara, California 93117

Dear Glen:

It was nice to see you at the workstation conference on the 9th of January. I've just looked at some of the material on the Culler 7 from Jeffrey Simon, and want to congratulate you and your team on producing an exciting new scientific computer.

I am writing to begin to enlist your support of The Computer Musuem, and enclose some material describing it. Although I would eventually hope you might contribute important artifacts, I believe it is essential to visit The Museum in order to appreciate what it does. Therefore, let me simply invite you to join as a member so that you get its material, and then come for a visit. Gwen, my wife, is it's founder and president and is usually tending the "store". Either of us would be delighted to give you a tour.

Please give my regards to Gerry Butler.

Sincerely,

Gordon Bell
Trustee

EXAMPLE OF A "MAKE VS. BUY" ANALYSIS

This section presents the issue of high-end disk investment as a case study for "make vs. buy" analysis. The following memos illustrate the complexity of decisions about backward integration.

CURSORY THOUGHTS ON HIGH END DISKS by Gordon Bell

While I support investing in mass storage technology, I don't believe we should build higher end disks, because:

1. It stretches our range, and level of integration farther, and I believe it is too large for the money we are investing. I think we should try harder to cap our systems at $250K.

2. There are two low end threats to our traditional mid range business that are going to require resources: the personal computer involving both floppies and hard disks; and the small shared system is now sub-19" rack and will require hard disks.

3. We are biting off too much: floppies, Smaller winis, Aztec, Pinon, and evolving the R80, through the 81 and beyond. We're doing too much to get in manufacturing: T/E (2.5K), 5" wini (6.25K), Aztec (16K), Pinon (100K), R81/TU78 (>100K), and RP07 (in mfg.).

4. These disks take a disproportionate share of engineering resources for a disproportionate part of the revenue. Also, they are technically the most difficult to do. Given our limited engineering budget vis a vis the Japanese, HP, and IBM, I believe we have to select.

5. It is more important to have a better system range and to fund the important generic applications, such as the OFIS program than to backward integrate into this part of the system range.

6. We are not a dominant part of the market in terms of units, and hence we will not get the costs vis a vis the BCG learning curves. CDC (NPI), Fujitsu, Nippon Peripherals, STC and IBM all cover us.

7. Maybe there is a joint venture that would be satisfactory such that the facility would get market share.

8. We are not a dominant supplier in this part of the business and hence will not get the volume to make the investment worthwhile. Note the small number of RP07s ordered.

9. If we ever start looking at roi/roa, there's no way to justify this investment. Buying out or joint ventures will be much better...provided we don't handle them to death in our multi-FAT sites.

10. We should get our better cost/megabyte by going after more aggressive mid-range system disks and then putting several of them on the larger systems.

11. Our successful products are those that go across both end user and OEMs. This would only go into the less profitable end user segment.

12. From a general direction standpoint, I think we should consolidate the range of products we have and

invest in layered software together with the networking, while only manufacturing the parts where we make a dominant volume of the market needs, i.e. the mid range. This is the make criteria to be successful in the OEM business.

COMMENTS by Grant Saviers

1. It stretches our range: Our average 11/780 system is selling now for >$250K. Venus is certain to raise the ASP even higher. If Venus is to be a major system from a revenue viewpoint, we must have competitive, profitable disks. An alternative is to market Venus as a CPU, allowing others to integrate the systems and or sell the disks. This might be an acceptable strategy for a small market at the extreme of our range. Two major risks to this strategy are the willingness of customers to deal with multiple suppliers and lack of account control (sales and service).

2. Low end threats: We are expanding our range downwards with CT and agree that this extension is requiring additional disk products.

3. Biting off too much: We (development) believe that 25% to 30% year to year real growth is a realistic management limit. At current inflation rates this translates to 35% to 40% funding growth. The manufacturing growth rate has been 5% to 10% higher because of the rising percentage of NES in storage and continuing increase in the make/buy ratio.

4. Unfavorable ROI: Our large disk analysis indicated a favorable ROI. Our FY82 large disk only (no systems, controllers) NES is about $300M. Our current investment (fully loaded) is about $2M/year. It appears that any disproportionate investment is elsewhere.

5. Generic applications and systems breadth are more important integrations: It would seem that making what we know how to sell in high volume (large disks) has lower

risks.

6. We have a small market share: We buy more disks than <u>any</u> other systems manufacturer in the world. IBM, CDC, Univac, Burroughs, NCR (via joint venture), HIS (via joint venture), Fujitsu, Hitachi, NEZ make their large disks. We will purchase about 8,000 large disks in FY81. This is more than MRX's or ISS/Univac production. It is about 3X Fujitsu's or Hitachi's production rate. CDC and STC produce about 10K-15K per year. IBM's 1980 annual report states "ten's of thousands of magnetic disk files... are being shipped to customers annually". Our large disk usage has been growing at an annual unit rate in excess of 40%. If we produced our current products, we would be a major producer.

<u>DEC's share of OEM shipments* (Non-captive)</u>

1. Pack Drives (>100 MB)

	CY79	CY80	CY81	CY82	CY83
A. CDC	7500	13000	16500	18000	17000
B. MRX	5000	6500	6000	4500	2600
C. Other	800	6500	7400	7200	6500
D. Total (WW)	13300	26000	29900	29700	26100
E. Total DEC	3400	4300	6100	6100	5300
F. DEC % / WW	26%	17%	20%	21%	20%

2. Fixed Media (>200 MB)

G. Total WW	100	900	3200	5400	7600
H. Total DEC	-	-	500	1700	2800
I. DEC % / WW	-	-	16%	32%	38%

3. Total DEC % / WW OEM Disks (>100 MB)

J. WW Total	13400	26900	32100	35100	33700
K. DEC Total	3400	4300	6600	7800	8100
L. DEC %/WW Total	25%	16%	21%	22%	24%

* Source for Worldwide (WW) data 1980 Disk Trend Report + CDC input.

NOTE:IBM large disk products are typically about 30
units per year.

7. Joint venturing looks attractive: We have given this considerable thought and see the guidelines for joint venturing as:

Why we might be interested:

- We can't afford it, but need it
- Skill need beyond our abilities
- Acquisition of a technology base
- Political/tariff/government pressures
- Economical facility too large for DEC
- Only game in town

Hygenic factors:

- Our value added is elsewhere
- OK for competitor to have it
- We can work with the partners
- Adequate control of the results
- Partners contribute value

8. Small number of RP07's ordered: The Product Line requests are disappointingly low. We see this as a consequence of the earlier 300 MB cancellation, the RM05 introduction, large backlogs, and risk aversion.

9. Buy out or joint venture, don't FAT: Buyouts will always find the test of being competitively profitable unless we can market at 1.8X markup. 25% of the $150K and up systems costs (current large disks) could be shipped to customers from the volume factory (ours or suppliers). This should be done in any case.

10. Multiple mid-range disks to cover our large needs: This appears attractive and may be a viable solution. However, it requires a competitive technology base (hence investment). We are carefully examining this alternative as it may give us fewer better products.

11. Successfull products go OEM. Large disks "only go into the less profitable and user segment". We want to sell OEM and today have products that are saleable. We only build OEM competitive storage products. If end user is less profitable, why enphasize "generic applications" (#5)?

12. Invest in layered software and networking. Make only in the mid range. My view is to invest in a few key hardware technologies and leverage these technologies into products across our range. This should maximize ROI/ROA and establish adequate volume/market share to be competitive.

GB2.S4.6

GB0002/61

| d | i | g | i | t | a | l | **i n t e r o f f i c e m e m o r a n d u m**

Subject: **Another Ask-Any-User Idea**

To: Dave Cutler, TW/D08
Bill Demmer, TW/D19
Rose Ann Giordano, MR1-1/A65
Bernie Lacroute, TW/A08
John Leng, MR1-1/A65
Dave Rodgers, TW/C04
Ron Spinek, PK3-1/M40

Date: 5/13/79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

Bill Strecker, TW/A08
Doug Towle, MR1-1/M55
Jerry Witmore, PK3-1/M40

E. Kantorowitz of Technion's Computer Science Dept. (and formerly a Naval Architect) was with a group of people coming through investigating the purchase of a VAX. We were selling, and hopefully they will buy...hence we can't use this one until we make the sale. I assume this is a detail that the Edu Product line will soon take care of.

Anyway the quote was something like: " I think the VAX architecture is great. For a university, it is important to have the best examples of design so that students can learn the right way".

GB:swh

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Dave Cutler	TW/D08	Bill Demmer	TW/D19
Rose Ann Giordano	MR1-1/A65	Bernie Lacroute	TW/A08
John Leng	MR1-1/A65	Dave Rodgers	TW/C04
Ron Spinek	PK3-1/M40	Bill Strecker	TW/A08
Doug Towle	MR1-1/M55	Jerry Witmore	PK3-1/M40

This was a worthwhile visit from a customer! We are a preferred vendor of minis. IBM and Univac supply big machines and HP, terminals. They really want 1 vendor for a given system. Some of his comments obvious, some subtle. All worth attending to!

VAX PERFORMANCE
They're getting 1.6-2.6 times a 780 out of a 4341 benchmark. Though they prefer VAX because of the programming environment and DCL, in which they've invested much programming, he stated: "Tell us to go buy from Big Blue or to keep the faith". They need a factor of 10x780 in 1985, not 2.5. They have some 10's and want to go to Tops 20 and want the 2080, but they want transparent movement of programs to the 2080 from VAX. I hope we can:

1. Get at the issue of increased VAX performance via microprogramming.

2. Get Rose Ann and Pete Hurley to visit there to see how to address the offloading of VAX to a fast compute engine.

3. Get a plausible plan to get a fast VAX.

CABINET FLOORSPACE... A NEW CABINET or AN INSTANT BALCONY?
They complained about the low cabinet density since space cost like $40/year. An extra cabinet costs in the range of $1000 per year plus installation. Fundamentally, they want some scheme to get equipment in tall cabinets OR they want a scheme to make balconies so that equipment can be stacked on top of each other.

4. Dick, Ken, Why can't we solve this one somehow? It might be a special CSS request, but virtually anything is cheaper than retrofitting a room or more floor space.

GRAPHICS
They want a high performance graphics device so that every chemist at DuPont can have one in their office. He likes the 512 x 512 x 8 Adv. Elec. Design system because it can work either on a Unibus or via a comm. line. Should we consider them as a supplier? What about buying the company? They like HP

5. George, we should be able to do this too with our own design.

6. He complained that the VT125 must be able to interpret the Tektronix protocol. I complained too. Let's just do it Bill!

HIGH LEVEL SELLING
We don't, we aren't known and it's difficult to be there in the IBM camp. He sees several needs:

7. Some kind of course for very high level managers to be taught on how to manage the high growth of computing. Their expenes in computing are growing at 40%/year.

SCIENTIFIC APPLICATIONS CENTERS ALA IBM
He proposed we set up something similar to the IBM Scientific Applications Centers. I completly concur with this.

8. Pete Smith, Bill Long, Win Hindle, What about working

out an arrangement where we could do this between engineering and the technical group? I propose that we hire someone to set up something of this nature. It would be operated within Technical marketing and the purpose would be both applications and marketing support. This would permit us to hire some really good locals and do real software engineering.

SCIENTIFIC ADVISORY PANEL
DEC needs one. A systems or research journal would be nice.

April 22, 1981

Professor Gerald J. Popek
University of California, Los Angeles
Computer Science Department
School of Engineering and Applied Science
Los Angeles, CA 90024

Dear Professor Popek:

Thanks for the letter on the 780. I don't know what can be done, however, I've sent a copy of your letter to Al Avery, the Product Marketing person and Jack Shields, head of Service in the U.S. Joe Meany has the market responsibility for your account. I don't know what can be done to help now, but it's clear we all need to do more since we have not experienced this kind of performance with other VAX's running VMS.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:swh
GB2.S5.40

CC: Al Avery
Bill Demmer
Andy Knowles
Joe Meany
Bill Munson
George Newton
Jack Shields

Are any DECwest ideas applicable here? somewhere else?

to: emc

cc: Cutler, Ken

Visiting DECwest and talking with Dave, on their organization of 24:

Dave-(writing microcode, worked on O/S, etc., manages group)

Secretary for the group

Bob Friedman- facilities, produrement, also for California,

Reid Brown + Ron Parson in ZK for Product Managment

Roger Heinen + 5 programmers for the O/S and SEApascal

3 technical writers for hardware and software (2 for hardware)all of which have a Xerox STAR for manual production

Larry Coppenrath-interface with manufacturing and service

Peter Schnorr-head of the hardware design and designer

Bob Short and Bruce Butz, engineers

Ken Abramson-simulation and microverify, on board diagnostics

Diagnostics person (hardware and software)

1 technician, 1 technican from Burlington for checkout

1 representative from CSSE

1 Mfg. person

They get help from personnel with what amounts to about 1/4 time, and they're getting their boards layed out in Colorado Springs. Also, Burlington Manufacturing is taking on much responsibility.

SOME OBSERVATIONS:

0. All the effort is directed to their products. Both of which look great! The group size doesn't require meetings and travel for resolution. There are almost no surrogates and "process/staff" folks.

1. Only 5 people, two of which are non-engineering, don't work on the product... for a staggering 79% efficiency! Note, that in a hierarchy with a span of control, s, and number of layers, l, where only the bottom layer works, the loss due to management overhead is roughly 1/s! The main loss of direct, product output is through the large number of "process" workers: CAD, testing, publishing, etc. versus direct product workers. Within DEC, as one of the overhead, I estimate we lose at least 25% in "management" overhead, that is, only 1/4 have to work because they aren't managing. I'd also estimate we have only 10-20% directly working on products. (This would mean about 600-1200 for all of engineering, of which 19 are in Seattle.)

2. By taking on more responsibility as individuals, and by buying out Process tools, and a chip they're able to DOUBLE what amounts to productivity by NOT having a CAD group! For example, the CAD groups for Venus, Nautilus and Scorpio are at least as large as the group doing the work on the product, immediately halving the group output. (Presumably this is corrected for by inordinately higher productivity of the designers.) I should point out, however, that the Nautilus CAD group of 70, is doing a trivial amount of work compared with the Trilogy CAD group. Also, Nautilus appears to have 2-3 times the designers that Trilogy has for a machine that has about 1/10 the number of gates. (I also think Nautilus

is one of our best projects.) We also ought to buy out more of our CAD tools now that startup companies are doing so much in this area!

3. By using STAR workstations to do publishing, the whole manual editing and publishing group is unnecessary. This may give a factor of 3 improvement. The writers always see the page layouts, do all the work, eliminating the publisher (where 1/2 the people are) and this interface time (negotiation, surrogates for both sides).

4. Diagnostics are done mostly by the design team. Here again, there's a large number of people who are often not accounted for in the project costs, but cost at least as much as the design.

5. Special VLSI is being bought out, reducing the number required, and the associated management requirements.

6. By living small across the board, an extra management layer is eliminated, thus cutting out a whole set of meetings where turf is described, discussed and divvied.

7. Note there's only one secretary. We managers require many secretaries to sustain the paper blizzard.

8. There are no draftspersons. This is a major breakthrough, and the way I remember doin engineering, because the documents are the only things that engineers produce.

9. The team had a product and use vision and built it. (We're spending many times that of DECwest on VT chips, and there's only a fuzzy future product vision, and no way to attain it. The effort to produce the UNA at 1/2 the performance twice the cost and 2 years after it had been done

outside is legend; and probably the biggest single reason that Ethernet won't some into significant use.)

10. Cray's laboratory has always been about 30 people for supers.

In going on to Colorado, I was similarly impressed, and would be curious to see a comparison.

The revelation was that we ought to look at the whole notion of quality and individual responsibility in a different light so that as Dave says- we must drastically raise our expectations as to what can be accomplished by an individual... because they can. In doing this, the quality of the product would get very, very high (never mind the fact that engineering could produce 5 x what it does today). We probably should be trying 5 x as many ideas as we do now, some of which might fail because they're too daring. Those settlers in the west seem to have only one care- getting a product; not their careers, training, processes, tools, interfaces, etc. which we spend our lives worrying about here in New England.

I doubt that we can change the bureaucracy we've created, but I think it's imperative that we try and create at least one more group of the same size and quality because we need more high quality products so that the empire (and the mediocre products) can be sustained.

Any candidates for another remote group?

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SUBJ: **CX Review and Dock Merge** Date: 7/26/79
From: Gordon Bell
Dept: OOD
MS: ML12-1/A51 Ext: 223-2236

TO: Dave Brown, CX
Dick Clayton, ML12-2/E71
Bill Demmer, TW/D19
Ulf Fagerquist, MR1-2/E78
Sam Fuller, TW/A08
Mike Gutman, ML3-6/E94
Dave Knoll, ML1-4/P14
Andy Knowles, ML10-2/A52
Bob Puffer, ML1-5/B94
Grant Saviers, ML3-6/E94
Jack Shields, PK3-2/A58
Jack Smith, ML1-4/A54
Will Thompson, ML1-4/P14

Overall very cooperative atmosphere between HV Manufacturing and Engineering. It really felt good. Missing was an interaction with FAT necessary to get anywhere in the Dock Merge Program. Jack Smith and I might do the next review jointly to encourage communication plus give some overall direction that we want Dock Merge and Field Integration. We must establish a much more healthy, supportive attitude to get dock merge to work (and to get the benefit of these good products). The concern of DM ability in CX and with me is that we wink, nothing matters and business as usual forever with never Field Integration. The RL never has been <u>off</u> the DM list, I'm told, even though the FAT organization says it isn't <u>on</u> the list.

I asked about PR making DMable controllers. They don't now. My intuition says that this should happen - this as a PR, CX, and Manufacturing Engineering problem. The RL cartridge isn't on the DM list, yet the majority of the cartridges go through AS + G with customer merge. Note the Alice through the looking glass world...we DM non DMable products; we don't DM the DMable products.

OPENING RL BOXES AND TESTING THEM IN FAT PLANTS, ESPECIALLY FOR THE ADD-ON BUSINESS, ONLY ADDS DELAYS DUE TO TRANSSHIPMENT, ADDS COST DUE TO HANDLING AND DELAYS, AND LOWER YIELDS BY HANDLING, BREAKAGE AND RETESTING!

RM05

This could be depressing:

0. We need twice the parts numbers due to the need to show a cabinet between two devices.
1. All the parts (MBA and CDC drives) have gone already through DMT/PMT yet there's no way to get parallelism in this testing and reduce the time to market.

2. The flow within manufacturing doesn't allow for the potential cost savings inherent in the structure of the drive and its free standing interface. I predict we will:

a. Partially build (non-DM) the MASSBUS Adapter (MBA) in PR.
b. Get the MBA and make it work with the cabinet in CX.
c. Unpack the drive, test the MBA with it, and disassemble the MBA and drive; pack, ship them to FAT plants.
d. Unpack the whole mess and reassemble for both systems and add-ons. Probably we will first test as a sub-assembly.
e. Disassemble, pack, ship, unpack, and reassemble at customer site.
f. Make it work again in the field, if it isn't broken beyond repair given this <u>sixth</u> test!

3. To minimize transshipments and costs; let's:

a. Get CDC to ship to a DEC depot which holds both FI and Customer add-ons!
b. Get the MBA made at DM quality in PR.
c. Ship MBA's to CX, test on an AQL basis, put in cabinets and transfer to the depot.

<u>RL0X's</u>

The fixed and removeable RL04 as we have been working at doesn't yet feel right. However, there are now many interesting possibilities being explored that gets more bytes, the same costs as the RL02, a shorter schedule and are based on the existing tooling/assembly line. I am really encouraged here.

<u>UDA</u>

I'm concerned that there's enough error detection/correction, and diagnostic hardware in the design. Sam Fuller and I must get out the Recommended Guidelines for the (Hardware) Design of system quickly so that people building these complex devices have a baseline.

<u>HSC</u>

We spent the last full day on this and this is covered in a separate document.

R80

Going very well. Anxious to see how we do when Manufacturing builds this next lot. It was good to move ahead and decide not to do the R80 in the corporate cabinet.

Product Strategy Planning

I went through an exercise with a small group. The planning technique must be carried out under the system/disk group sponsorship. I want a first pass of this output for this years Redbooks!

GB:swh

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Dave Brown	CX	Dick Clayton	ML12-2/E71
Bill Demmer	TW/D19	Ulf Fagerquist	MR1-2/E78
Sam Fuller	TW/A08	Mike Gutman	ML3-6/E94
Dave Knoll	ML1-4/P14	Andy Knowles	ML10-2/A52
Bob Puffer	ML1-5/B94	Grant Saviers	ML3-6/E94
Jack Shields	PK3-2/A58	Jack Smith	ML1-4/A54
Will Thompson	ML1-4/P14		

Mr. Dan Bricklin, Chairman
Software Arts
27 Mica Lane
Wellesley Hills, Massachusetts 02181

Dear Dan:

Enclosed is a copy of the Capital Campaign brochure and also the letter I wrote about a year ago on why support the Museum. The Core Membership program is descibed on page 11, and I hope you can make a personal pledge for the four years, but if this time is not right, then I certainly understand.

Your observations today were helpful:

1. The east coast is the right place to record the history, because it has been involved much longer is probably the best answer we can give. The west is still plowing up farms to get space for building new companies and is hardly stable enough to consider recording what they do. Also there is a tradition

about learning from the past here, near Europe.

2. The Museum is a place where one should see a number of ideas that were explored before the right techological time. The best example is the Babbage machine which not only could not be programmed, it couldn't be built. The technology was about 100 years too late for Babbage.

We see lots of modern day examples, including the tremendous surge of multiprocessor now made possible by the Micro, whereas the B5000 and PDP-6 tried, but the economics weren't right. I'll start scouting around for a copy of the design notebook for Multics, including Daly, Jim Mills, Mike Spier, etc. as another example which, no doubt, will contain ideas.

3. We see inspiration from early artifacts which were personally created by today's leaders such as Kemmeny, Kurtz, Olsen and Wang.

4. There are lots of funny gadgets for the time, such as the fire extinguisher for the Sage.

The Museum will certainly appreciate receiving your pioneer, videotape library.

Also, I look forward to the scheduling of a talk this spring at the Thursday evening or Sunday afternoon lecture series. Someone from the Museum will contact you.

Sincerely,

Gordon Bell

CC: Gwen Bell
June 18, 1984

Mr. Dan Gregory
Greylock Management Corporation

One Federal Street
Boston, MA 02110

Dear Mr. Gregory:

I enjoyed meeting you at the Museum Pre-Preview party last month.

A first rate team is designing the exhibits, including Dr. Oliver Strimpel, curator of the Science Museum in London and Dr. Paul Ceruzzi, a young history of computing scholar. In addition to the exhibits with historical artifacts, two major interactive galleries are being built for PC's and on the computer and the image. Predictions are that we should have attendance of over 200,000. This world-class, international Museum should be a major attraction and asset for the high tech and computing community.

The enclosed brochure describes the Capital Campaign. Now I want to enlist your support as a leader in the venture capital community in this first round which will result in opening the Museum, November 12:

1. Greylock's "core" membership in the Capital Campaign at the 4K level, Since we've also talked with Bob Henderson, I hope that the company is convinced and can justify this investment. The Museum will be available for company functions.

2. your personal "core" membership, and

3. assistance in the capital campaign to reach world-class status.

I'm also enclosing two articles: a letter which attempts to justify why I think the Museum is a good investment in the future, and a paper on the micro-based industry, which is drafted for publication in November. I hope both will be of interest to you.

I'll call you next week and hope that we can have lunch soon at The Musuem to discuss your support.

Sincerely,

Gordon Bell

Enclosures - 3

ENCORE COMPUTER CORPORATION

RESEARCH AND DEVELOPMENT IN

HIGH PERFORMANCE AND FAIL SOFT MULTIPROCESSORS FOR PARALLELISM;

AND SYSTOLIC ARRAY PROCESSORS FOR SIGNAL PROCESSING

March 10, 1984

Encore Computer Corporation
15 Walnut Street
Wellesley Hills, Massachusetts 02181

Contact: C. Gordon Bell
Phone: 617-237-1022

FOR DARPA USE ONLY- PLEASE DO NOT CIRCULATE

1. INTRODUCTION

ENCORE OPERATING PHILOSPHY: Encore Computer Corporation was founded in July 1983 with the principle of forming and supporting, very high-quality autonomous product companies. Each company has its own development, manufacturing and market support groups. A single sales, service and finance company is responsible for distribution -- the only economy of scale we can identify in computing today. Companies are tied together by common strategic goals and standards.

Although Encore currently consists of approximately 100 individuals in six companies, the central staff is limited to 15 individuals (including secretaries) who have the responsiblity to help the operating companies. Each member (see personnel section) of Encore Central has an average of nearly 25 years experience in computing. The staff's role is:

- serving as members of internal boards for each company
- strategic marketing and product positioning
- supplying capital for each company
- providing help with critical and technical decisions
- reviewing operating plans

Aside from the products, the most important aspect of Encore for DARPA is our ability to establish VERY HIGH QUALITY companies rapidly and to build rapidly using the natural Entrepreneurial Energy that exists today. We believe these companies can provide results an order of magnitude faster, cheaper and better than large companies. Also, we believe our companies will out perform conventional venture capital financed companies.

Unlike today's conventional startups who use the venture capital approach, Encore Entrepreneurs move more rapidly from design to prototype and to production, freed of the hassle of building a larger, full-scale company. Such a company requires expertise in financing, marketing, field sales and service. As such most startups rapidly become inefffective and ultimately fail. (For example of the 100 companies who formed in the early 70's to build minicomputers, only 7 are successful now. Seventy percent failed.)

RESEARCH AND DEVELOPMENT PHILOSOPHY FOR MAXIMUM DARPA SUPPORT

Encore's research, development and product goals are to provide the broadest possible range of technically excellent products by using multiple, high performance 32-bit microprocessors. Over the past decade MOS technology has enabled processors to evolve at a rate of over 60% per year; in contrast bipolar technologies (TTL and ECL) have evolved at less than 20% per year. Within two years these zero cost MOS (and CMOS) processors will exceed the performance of TTL-based computers. Instead of using micros as simple uniprocessor replacements for today's computers we are predicating all of our products on multiple processors to give much greater performance, reliability and cost-effectiveness. The ultimate aim of the product line is full parallel processing.

We believe Encore is uniquely positioned to be of vital assistance to DARPA's research because of our expertise and commitment to parallelism and products. We have several approaches to transfer research results to commercial and military products in minimum time.

2. RESEARCH, DEVELOPMENT AND PRODUCT COMPANIES FOR PARALLELISM

. HYDRA COMPUTER SYSTEMS is building a medium scale multiprocessor for high performance computation. HYDRA is a large multiprocessor which can operate with up to 16 processors sharing a common 32 Megabyte primary memory and interconnected via a very high speed switch with data transfer rate of approximately 100 megabytes per second. The price will be less than conventional mini-computers.

Highest performance and the most cost-effective computing will be supplied by using properly loaded, shared HYDRA Computers which are interconnected to high performance, high resolution terminals (see below). With the proper configuration, a user can be guaranteed much greater performance at lower costs than are possible with today's ill-configured workstations.

The large number of processors provide very high interrrupt capacity for interfacing specialized real time equipment such as speech, video and other signal processing devices. This simple computer could be the basis of much of DARPA's work in real time and AI.

. ULTRA SYSTEMS is a laboratory in Pittsburgh currently under the direction of Dr. Siewiorek. ULTRA is building higher performance and higher availability computer system using the HYDRA multiprocessor cluster as the basic building block. ULTRA computers will have over one hundred processors in the basic configurations and the ability to access up to a Gigabyte of primary memory.

The construction of high performance, fail soft signal processing multiprocessors requires a team with expertise in a number of widely varying disciplines. The Encore staff involved in this effort has over 100 man-years of experience in architecture, hardware development, logic design, operating systems, programming environments, signal processing, fault tolerant design, reliability analysis, and computer aided design.

. RESOLUTION TERMINALS AND WORKSTATIONS is building high resolution terminals for various shared systems. These terminals will rapidly evolve to standalone workstations as sufficient processing and memory technology is available to provide cost-effective computing.

. FOUNDATION COMPUTER has the responsibility for all languages to insure compatibility across the entire product range. In addition, Foundation has developed a Fourth Generation Language, Ally, for accessing data via reports coupled with rapid forms entry. This environment appears to be ideal for generating command and control applications. Foundation is also responsible for commercial and office applications software.

. TECHNICAL AND AI SOFTWARE SYSTEMS DEVELOPMENT has the responsiblity for technical software applications in the CAD/CAM and technical/scientific area. Encore is currently examining various research and development group proposals to implement environments for AI languages including LISP, Prolog and Production Languages.

. SYSTOLIC COMPUTING LABORATORY AND PRDOUCTS. Encore supports and would like the opportunity to help develop

Systolic Processing with Professor H. T. Kung by the formation of a laboratory and product company in Pittsburgh aimed at producing systolic processors. Our relationship with Professor Kung is described below.

. A network company is being formed to take the responsiblity for concentrators, gateways and interfaces to other computer vendors and telecommunication suppliers. A primary function of the network is the interconnection of high performance terminals and workstations to our large, shared systems. In addition, each product company is responsible for its own network needs.

. We are actively persuing companies who could provide better architectures for increased performance using parallelism and by simpler, Cray-type (load/store/operate) architectures.

3. RESEARCH, DEVELOPMENT AND PRODUCT EXPERIENCE

Encore personnel have been actively involved in multiple and parallel processing for nearly twenty years. This experience includes the design and construction of nine diverse multiprocessor and multicomputer structures--including local and wide area networks.

PDP-6 (circa 1966): one of the first multiprocessors. Initially a master-slave processor in the early 70's, it evolved to a fully symmetric multiprocessor system. PDP-6 was initially designed to execute LISP effectively, and even twenty years later continues to do so.

C.ai: a very large multiprocessor for AI research was posited in 1970 in response to a DARPA request for significanlty more computation for AI research. Several special LISP language processor designs were posited. Both the Stanford S1 and CMU C.mmp were direct descendants of this work.

C.mmp: Computer - MultiMiniProcessor. C.mmp was motivated by the need for more computing power to solve speech recognition and signal processing problems and to understand the multiprocessor software problem. Until C.mmp, only one large, tightly coupled multiprocessor had been built - the Bell Laboratories Safeguard Computer. C.mmp is the classical multiprocessor, with 16 processors sharing 16 memory modules through a cross-bar switch. The Intel 432 is the nearest descendant of this work and unfortunately suffered from inadequate addressing.

C.vmp: Computer - Voted MultiProcessor. C.vmp is a triplicated microprocessor system designed for realtime control environments. Major design goals included the use of off-the-shelf microprocessors and software transparency (ie. the fault tolerance is achieved without modification to operating system or application software). C.vmp is composed of three separate machines capable of operating in independent mode executing three separate programs. Under control of one of the processors or an external event, C.vmp can synchronixe its redundant hardware and start executing a critical section of code.

Cm*: Computer - Modular,MultiMicroprocessor. Cm* was designed to be an "open" architecture with no fundamental limits on the ultimate size of the system. The actual system consists of 50 LSI-11 processors divided into five clusters. Each LSI-11 has a 64K local memory which resides in the global address space of the system. A local switch determines if a processor produced memory request is destined for local memory or a memory outside the Computer Module. If outside, the request is handed to a cluster controller. The cluster controller may find the data resident in its cluster or hand the request to the cluster where the data resides. Two operating systems were built for Cm* as well as an Integrated Instrumentation Environment which allows users to rapidly develop and monitor performance of their applications code. Modern microprocessor busses such as Multibus I, II, Futurebus and VME all use the concepts developed in Cm*.

PDP-11/74mP: The PDP-11/74mP was motivated to improve reliability, availability, maintainability, and performance for the PDP-11 family. The system consists of four PDP-11/70 processors attached to a four-port shared central memory. I/O devices are either dual-ported or attached to multiple buses through a bus switch. Each processor had a write-through cache. An Interprocessor Interrupt and Sanity Timer provided the RSX-11M executive software with interprocessor signaling and a fault tolerant clock. Although 100 11/74's were manufactured, only a few were delivered since the VAX market success did not require the additional product revenue.

PULSAR: PULSAR was a 16 LSI-11 multiprocessor designed to investigate
the cost-effectiveness of multiple microprocessors as an alternative to building a single large machine. It covered the performance range from a single LSI-11 to greater than a PDP-11/70, but at a cost less than the 11/70. The processors communicate with each other, a common cache, and I/O
via a high-bandwidth, pipelined, synchronous bus.

11/784: A 4-processor multiprocessor version of the VAX-11/780.

VAX Clusters: Up to 16 VAX computers can be interconnected in a close area network (100 meter radius) with message passing and process to process interconnectino of 2 x 10 Mbytes/sec data-rates.

4. PUBLICATIONS

The Encore staff has published over 200 books, papers, articles,
technical reports and patents in this area since 1970. Following
is a brief list of representative works.

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Principles and Examples", McGraw-Hill, 1982, 960 pages.

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Kung, H. T., "The WARP Processsor: A Versitle Systolic Array For Very HIgh Speed Signal Processing," Private Copy (Working Paper), January 1984.

5. PERSONNEL

Kenneth G. Fisher is President and CEO of Encore Computer Corporation. Mr. Fisher was President and CEO at Prime and under his leadership Prime grew from $7 million to $350 million during the period 1975 to 1981. Mr. Fisher has over 25 years experience in the computing industry and was responsible for various field marketing and sales operations at General Electric and Honeywell.

C. Gordon Bell was Vice President-Engineering for Digital Equipment Corporation and the firm`s chief technical officer for the past eleven years. At Digital he was responsible for all research, design and development activities in computer hardware, software and systems. Among other products, Mr. Bell was responsible for the VAX line of 32-bit super minicomputers. He also headed computer design at DEC during 1960-66. From 1966-1972, Mr. Bell was a member of the faculty of Carnegie-Mellon University and a consultant to DEC during the formation of the PDP-11. He was one of the principal architects of C.ai, C.mmp (a 16 processor system) and Cm* (a 50 processor system). In 1981-83 Bell led the Alpha-Omega definition group of the Microelectronics and Computer Corporation. Bell is on the faculty of Carnegie-Mellon University (on leave) and a member of the National Academy of Engineering.

Henry Burkhardt is Treasurer and head of Corporate Development at Encore. Mr. Burkhardt was a founder of Data General and a member of its five person board until 1982. At Data General he was the principle architect of the NOVA. He lead the software development, was the Chief Financial Officer and eventually headed the manufacturing organization before he left DG.

Ed Fredkin is currently a full-time consultant to Encore. Professor Fredkin is interested in parallelism, computational physics, the human interface and the application of computers for Artificial Intelligence.

Julius Marcus recently joined Encore after 13 years at Digital as one of three Senior Marketing Vice Presidents.

Marcus has extensive experience in marketing and engineering products for real time and office products. He began his career at Digital with responsiblity for markketing the PDP-11.

Robert Puffer spent 15 years at Digital in various enginnering and manufacturing capacities at the Vice President level. Most recently, he headed all of the Mass Storage manufacturing, roughly 1/3 of DEC manufacturing.

HYDRA COMPUTER SYSTEMS

David J. Schanin is President of HYDRA Computer Systems and was employed at Digital Equipment Corporation where he was generally recognized as an expert on interconnecting multiple microcomputers. He was the architect of the Professional 350 computer and responsible for implementation of Digital's multiprocessing architecture for microcomputers.

Steven E. Chapin was Manager of Operating Systems Software Development and Manager of Distributed Systems Architecture at Prime Computer. Prior to Prime, he was at Data General where he designed one of the firm's operating systems for its current advanced MV computer series and was a member of the Advanced Architecture Group. Mr. Chapin is in charge of Software at HYDRA as Vice President.

Russell L. Moore was Manager of a CPU development program at Prime Computer where he was responsible for one of the firm's future generation super minicomputers. For the nine years prior to 1981, Mr. Moore held numerous positions at Digital Equipment Corporation including responsibility for engineering on the PDP-11/74 multiprocessor, various peripheral switches and multiported memories for high relibility configurations. Mr. Moore is a graduate of Carnegie Mellon and is Vice President of Software at HYDRA.

RESOLUTION TERMINALS AND WORKSTATIONS
Charle' Rupp is the President of Resolution. Dr. Rupp has nearly 20 years experience in building display systems of all types including high performance military simulators, commercial terminals. Most recently he was responsible for Digital's Research in Graphic Terminals and Workstations and was the principle designer, while heading the research group, of ALL of Digital's Graphics Terminals.

Ike Nassi is the Chief Technical Officer of Resolution. Dr. Nassi has extensive experience in software including the implementation of one of the early ADA compilers. Most recently, Dr. Nassi was Vice President of Development for Visual Technology Incorporated.

ULTRA AND SYSTOLIC LABORATORY COMPANY PERSONNEL
In addition to it`s regular employees, Encore retains critical consultants who are working on more advanced parallel processing including:

Professsor Daniel P. Siewiorek Carnegie-Mellon University faculty. His accomplishments at CMU include leadership responsibilities on the Cm* project that culminated in an operational 50-processor multiprocessing system and construction of C.vmp, a triply redundant high reliability computer. Dr. Siewiorek, currently on leave from CMU, heads ULTRA Systems --the laboratory responsible for the large scale multiprocessor. Dr. Siewiorek intends to return to Carnegie-Mellon to resume his position as a senior member of the faculty. Encore fully supports this position.

Ivor Durham, a candidate for the PhD at CMU is the principle system software designer of the large scale multiprocessor at ULTRA. Mr. Durham implemented the principle operating system for Cm*. Mr. Durham intends to join ULTRA as a full-time employee at the completion of his dissertation.

Andrew Wilson, a candidate for the PhD at CMU is the principle hardware designer for the ULTRA multiprocessor. Mr. Wilson has extensive hardware design experience. His dissertation is on the design of a very large scale multiprocessor. Mr. Wilson intends to join ULTRA as a full-time employee at the completion of his dissertation.

Professor H.T. Kung is a member of the faculty of Carnegie-Mellon University. His accomplishments originally in numerical analysis now include the invention, theory and development of programmable systolic processors. He is the architect of numerous VLSI chips and systems for various special purpose systolic processors for signal processing. WARP: a Versatile Systolic Array Processor for high speed signal processing is the latest of these systems. Encore has offered to establish a product laboratory (perhaps initially co-located with ULTRA) for Prof. Kung in Pittsburgh so that the research results at Carnegie-Mellon can be transferred to a product as rapidly as possible and under his direction. It is our intent to facilitate the formation of a company in which Prof. Kung could play a major leadership role. We believe it is in the best national interest that Prof. Kung remain a full-time professor at CMU. We also believe that Encore can provide the best environment for transferring Prof. Kung's work to practice in the shortest, most expeditious fashion.

6. PRIMARY AREA OF RESEARCH INTEREST

With the amassed experience in the areas of multiprocessors, reliable computing, and signal processing the time is ripe for the design and construction of a very large Fail Soft Signal Processing Multiprocessor (FSSPM). The FSSPM should combine recent advances in high speed signal processing with the flexibility of a general purpose multiprocessor. The program development environment and operating system should allow efficient generation of application software that fully exploits the architecture. Furthermore, the inherent modularity and replication of basic hardware and software components provides the basis for constructing a reconfigurable system which can adapt to failures while maintaining the required application throughput.

The FSSPM will be constructed by integrating the HYDRA cluster currently under development with the WARP designed at CMU. In addition, ULTRA will use conventional multiprocessing techniques pioneered at CMU to give on the order of 100-fold parallelism.

A significant amount of our research will be aimed at specialized hardware and software to fully exploit the architecture of HYDRA and ULTRA. In particular, we want to supply versions of LISP, Prolog and Production Languages.

Kung's work on Systolic Processing is vital. It is essential to build and evalutate these processors. The key questions are generality and programmability.

We are following the Dataflow work closely, especially languages. We believe that the first application of Dataflow will be at relatively coarse grain size suitable for execution on conventional multiprocessors.

7 . TRANSFER OF TECHNOLOGY FOR MILITARY APPLICATIONS

We believe Encore personnel have demonstrated far more capability of transferring research results in laboratories into cost-effect products than any other company. For example, these transfers include: the first commercial timesharing system (DECsystem 10 from CTSS and DECsystem 20 from Tenex), LISP, early DEC graphics, computer networking (DECnet from ARPAnet), various editors and languages including APL, BLISS, TECO, etc. Encore is committed to this tradition of NOT reinventing concepts, but rather making them available to the computing world in a most expeditious fashion.

Encore's product line is directed toward the high performance, real time market place found in scientific laboratories. Initial applications will be general purpose in nature and evolve to both the technical and commercial markets such as office processing.

Encore is actively negotiation with several companies regarding licensing military versions of all products. Ruggedized and militarized licenses will be available concurrent with first prototype operation. In this fashion both conventional commercial and fully militarized versions of Encore equipment will be available.

<u>Kenneth G. Fisher; Chairman, President, CEO, Founder</u>

Mr. Fisher is computer industry executive with 25 years experience, including General Electric and Honeywell, as Vice President of Central Operations, where he had responsibility for one-third of field operations.

In July 1975 he became President and CEO of Prime when it had 150 employees with net sales of $7M per year. Prime's first computer was predicated on Multics, but at 1/10 the price. When he left Prime in 1981, Prime had grown at 88% per year to have over 4000 employees and sales of $350M per year.

<u>C. Gordon Bell; Chief Technical Officer, Founder</u>

Mr. Bell has been responsible for supplying DARPA's computing for the last 20 years in his position as head of computer design (1960-66) and Vice President of Engineering at Digital Equipment Corporation (1972-1983).

He led the PDP-6 (the forerunner of DECsystem 10/20) development, the first, computer designed explicitly for interactive timesharing. The PDP-6/10 was explicitly designed for executing LISP, and is still the LISP benchmark computer. The PDP-6 was designed and used as multiprocessor.

During 1966-1972 as professor at Carnegie-Mellon University, he researched and wrote books, including Computer Structures with Allen Newell. While at CMU he consulted on the design of the PDP-11; the Unibus and General Registers concepts came from the research on computer structures. In 1971 he proposed a 16 processor, computer, C.ai, for AI applications; this was the basis of Stanford's S-1. C.ai was also the basis for CMU's C.mmp, a 16 processor computer, built in 1972, the first large scale experimental multiprocessor. In 1974, Cm*, a 50 processor computer was started with Siewiorek and Fuller; it became operational in 1976 and still continues to be used as one of the world's few, operational large scale multiprocessors.

In 1975 he lead the VAX architectural development, which was introduced in 1978. In 1978 he architected the VAX strategy which interconnected computers in various ways including Ethernet for distributed computing, high speed LANs for multicomputing and multiprocessors. At Digital, he sponsored and contributed to four multiprocessor projects ranging from 4 to 64 processor computers.

At Encore, he and Burkhardt are responsible for the overall Encore architecture and product strategy. Encore is predicated on developing the Multi, ie. multi(ple) microprocessor computer and parallel processing. Encore's products include workstations using LAN based intercommunication.

Mr. Bell has written books and papers on computer structures, has various awards and is a Fellow of the IEEE and a member of the NAE.

<u>Henry Burkhardt, III, Vice President, and founder</u>
Mr. Burkhardt has a broad range of skills ranging from legal issues to manufacturing, finance and system and software

design.

Mr. Burkhardt co-founded Data General in 1968, resigning in 1976 and remained on the board until 1982. At DG he was the principle architect of the NOVA and head of software engineering. He also managed the development of innovative software including the first PL/1 for the minicomputer. He was the firm's Chief Financial Officer and directed administration. In 1974 he became head of Manufacturing and developed an organization and system for high efficiency and throughput, while at the same time increasing customer satisfaction.

After leaving Data General he became active in startup medical and communications firms as a consultant, investor and director.

Mr. Burkhardt is co-ordinating the creation of the Encore Computing Environment, and is especially interested in the areas of secure, distributed computing and parallel processing.

Fisher, Bell and Burkhart founded Encore in July 1983.

<u>Professor Daniel P. Siewiorek, Technical Director of Ultra and Principle Investigator, DARPA Project</u>
Professor Siewiorek is half-time at Encore and a member of the Carnegie-Mellon University Computer Science and Electrical Engineering Faculty. His specialties include performance analysis, reliability / availability anaysis, Digital Computer and Digital Systems Design including CAD of VLSI circuits, and parallel processsing.

At CMU he led the Cm* effort for the last 8 years resulting in papers, reports and a book (in press) which gives the experience gained about parallel processing. This book is the only report to examine parallel processing from an experimental view. Siewiorek was also responsible for the design of C.vmp, a triplicated computer also built in the CMU environment.

Dr. Siewiorek is an author of numerous books and papers on reliablity and computing structures, including being the principle author in 1981 of an updated version of Computing Structures with Bell and Newell. He is a consultant to numerous corporations including AT&T, Bendix, Digital, and United Technology. He is also a Fellow of the IEEE.

Julius L. Marcus, Vice President, Business and Product Management

Mr. Marcus is a general manager with broad experience in the computer industry including product marketing, divisional management and engineering managment and design. He is a member of the board of directors of Ultra.

Prior to joining Encore, Marcus was a Senior Vice President with Digital Equipment Corporationh for 15 years holding numerous positions in engineering, product and business management. Most recently, Marcus was responsible for the Office Products Division Products. His first assignment with Digital was as Marketing Manager for the PDP-11.

Robert W. Puffer III, Vice President, Operations

Mr. Puffer's professional background includes a wide range of managment positions in engineering and manufacturing. He is a member of the board of directors of Ultra. He is has operational responsibility for various Encore groups.

Prior to joining Encore, Puffer was Vice President of Storage Systems where he was responsible for manufacturing all disk and tape products. These facilities encompassed approximately 1/3 of all Digital manufacturing. Mr. Puffer's earlier efforts included responsiblity for Digital's first peripheral engineering and Manufacturing Engineering.

Ivor Durham, Software Engineering Leader, Ultra Laboratory

Andrew Wilson, Hardware Engineering Leader, Ultra Laboratory

Mark Reich, Program Manager, Ultra Laboratory

David Schanin, President and Chief Technical Officer, Hydra Computer Corporation

Steve Frank, Analyst and Consulting Engineer, Hydra

IA. CLAIMS (9/27/84)

1. The design of a single, integrated mix-and-match architecture to support three types of processors for: multifunction, symbolic and signal (and special) processing in a unifed physical and programming environment.

2. A modular hardware design which scales linearly, and efficently over a four level hierarchy to form a single, large multiprocessor computer with over 1000 microprocessors, in a single 32-bit memory address-space and include: processor-cache (substrate); processors (card); Hydra Multi(processor) Computer (medium scale box); Ultra Multi(processor) Computer (close area cluster computer). This gives 1000 Mips in 1988.

The programming environment includes a fifth level, the Local Area Network which is used for: interconnecting computers, gateways to other computers, concentrators for terminals and PCs, network connected host-based workstations and host-compatible workstations.

One common package (box) and about ten card types provide: the medium and large scale Multi's in a single, scaleable performance, availability and applications (multifunction, symbolic, signals) range architecture.

3. Deployment now for parallelism research applications using the medium scale Hydra Multiprocessor Computer including: robotics at CMU and Harvard, Productions Systems at CMU, and parallel Lisp (breadboard) at Stanford; two simulation activites within Computer Aided Design at CMU and Encore; and next generation Systolic Signal Processing with Kung. Deployment of the large scale Ultra Multi can begin in '87.

4. Reliability and maintainability can be optimized anytime by redundant components to give an order of magnitude improvement in MTTF and downtime over uniprocessors. Security of the environment will be DOD Level B.

5. Monitoring hardware for measuring performance and diagnosing system faults. Analytic tools and models for hierarchical Multi's, with multiple level caches and filter memories will be provided.

6. The 64-bit architecture is standards based and oriented to high performance, including caching, instruction lookahead (for symbolic processing), and signal processing. Performance scales gracefully both by utilizing a hierarchy and by microprocessor evolution.

Encore would assist a DARPA initiative to change complex instruction sets of microprocessors to a simple load/store format ala Cray, MIPS and RISC. Near-term microprocessor performance increases can be greatly accelerated using advanced DARPA technology.

July 28, 1982

Professor Barry Richmond
Dartmouth College
Hanover, New Hampshire

Dear Barry:

I'm really grateful for the incredible job you did in "modeling" DEC as the basis for management training in Engineering. Although I regret I couldn't attend this session, I do want to play the game. The real endorsement came from the enthusiasm of the managers who attended the course and gained the insight.

It is really important that we refine the model and make it suitable to operate across Digital because it looks like the best of all training mechanism. The part about servicing looks especially good and I believe that Customer Services would also benefit by using it. Your course should also be the ideal second course in the cross organizational series. I also see it as a vehicle to explore effects of changes in organizational structure.

Prompted by your course, I'm writing a brief note to Science or Electronics regarding the effect of "overfunding" in basic research. What I "conjecture" is the basic loop: ARPA and NSF are discovering the basic ideas for computer science and are publishing them widely; there's no mechanism or funding (we can't afford to do the refining) to move the ideas into the corporations; the Japanese are now organizing, selecting and developing the ideas which result in products; the result is inadequate funds back into the goverment sector and hence deficits; finally, there's no market for engineers and scientists as the industries are aimed at distribution rather than development/manufacturing. For example, the Japanese Fifth Generation Program is a collaborative, advanced development program based on world basic research in AI that's been done over the last 20 years.

I'd like to encourage you to proceed to build a model of the Japanese industrial sector and mode of operation that could be played by various MBA's-to-be, corporate and government managers so they can see the problem and ultimately deleterious effects in competing with Japanese corporations.

Again, thank you for the extraordinary effort in the model and in leading the course. I look forward to a continued interaction.

Sincerely,

Gordon Bell
Vice President, Engineering
GB3.S6.42

CC:

Larry Bornstein	Chris McGrath	Jack Shields
Del Lippert	Ken Olsen	Jack Smith

January 21, 1980

Professor George R. Stibitz
Department of Physiology
Dartmouth Medical School
Hanover, New Hampshire 03755

Dear Professor Stibitz,

Digital Equipment Corporation is in the process of developing a Digital Computer Museum. Last fall, we had an opening of the exhibits of pre-computer calculating devices, parts of Whirlwind, MIT's TX-O, and DEC machines representing each of the subsequent generations of computer technology. Professor Maurice Wilkes presented our inaugural lecture. I would like to ask you to give the second Digital Computer Museum lecture on Thursday, May 8th.

We would like you to talk about your pioneering contributions on binary and floating-point arithmetic, memory indexing, operation from a remote console, and program-controlled computations and the environment in which these were made. The lecture will be attended by engineers at Digital Equipment Corporation, and invited computer scientists from the Boston community. We will have about 100-200 people in attendance at a 4:30 lecture followed by a pre-view of the museum exhibits and reception. The lecture will be video-taped for the museum archives.

I am able to offer you an honorarium of $500 plus any expenses incurred. I certainly hope that you will be able to do this as I am sure that the computing community, especially our engineers will greatly benefit from understanding more of the history and tradition to which they belong. If you have any questions please feel free to call me at 617-493-2236. I am looking forward to hearing from you.

Cordially,

Gordon Bell
Vice President,
Engineering

GB:swh
GB1.S1.32

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* d i g i t a l *
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TO: SAM FULLER
12:02 PM EST
    LLOYD DICKMAN

DATE: MON 10 MAR 1980

FROM: GORDON BELL
DEPT: OOD
EXT: 223-2236

LOC/MAIL STOP: ML12-1
A51

SUBJECT: OPERATIONAL DATA FLOW MACHINE

Do you know of Operational Data Flow Machine? at:

CERT de Complexe
Aerosplanent de Lespinet
by J.C. Syre
2 Ave Edieved
Belin, 4025
Toulouse 31055
FRANCE

GB:swh
GB1.S2.46

Digital **Interoffice Memo**

Subject: **Data Tablets Make versus Buy**

To: Sam Bosch
Bernard Geaghan
Ed Kramer
Herve Lavoie
Bill McBride
David Skyrme

Date: 15 OCT 76
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

I can't understand how the Geaghan, Skyrme Data Tablet Business Plan makes any sense whatsover because:

1. It fails every test of what has been proposed to be a rational make vs buy policy! (see attached)

2. I believe it's significantly understated in terms of development cost ($75K for this is too optimistic based on what other

tablets cost to design!--see their P/L statements)

3. I believe the price is unrealistically high based on the Summagraphics Product.

4. There was no ROI calculation!

5. There are at least two good buyouts...maybe more!

6. The same $100K+ applied to software will move to get a critical mass which will easily generate more than $1M in extra sales for current products (WITH software)!

7. Let's buy out or better yet, structure so our customers can.

GB:ljp

Attachment

CC: Graphics Steering Group
Jim Cudmore
Win Hindle
Jesse Lipcon
Ken Olsen

GB3.S10.31

00 CORE DECGRAM ACCEPTED S 002888 O 691 04-DEC-82 18:14:33

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TO: SAM FULLER DATE: SAT 4 DEC 1982 5:08 PM
ALAIN HANOVER FROM: GORDON BELL

BILL KEATING
BOB SUPNIK
STEVE TEICHER

DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5183715769

SUBJECT: GOING TO ARPA FOR SUPPORTING THE DATAFLOW WORK

Since ARPA has a supercomputer effort, I'd like to start going
to them with work we have unique skills in and can make a contribution. Also, I want to go outside for our funding for work such as DATAFLOW where the payoff is either very long or very high risk.

I talked to Arvind (MIT) and he'd really like to see us go out to ARPA to get this production level complier for dataflow
and have it available widely. He believes that it requires a significant engineering effort (as well as some research possibly). In the past, ARPA has funded companies to do work of this type when it requires significant engineering (eg. the ARPANET, various large stores, Illiac IV, etc.). Also, much of the CMU work should have been bought out because it was engineering, and didn't get done well or on a timely basis.

Can we get together and approach ARPA to build the compiler?

This is simply another reason why I believe engineering work should be done in a group who has the expertise to do the job.

GB3.S10.30

00 CORE DECGRAM ACCEPTED S 002870 O 679 04-DEC-82 18:10:42

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! d ! i ! g ! i ! t ! a ! l ! I n t e r o f f i c e M e m o
!___!___!___!___!___!___!___!

TO: see "TO" DISTRIBUTION
DATE: SAT 4 DEC 1982 4:56 PM

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

cc: TOM GANNON
ALAIN HANOVER

MESSAGE ID: 5183715683

SUBJECT: DOING DATAFLOW RESEARCH

Although I can understand Alain's viewpoint it makes me sick.

As a someone who is interested in Dataflow as a way to describe
algorithms and makbe as a way of building machines, I have to
ask at times, does anyone look at this work? does anyone care?
what's the priority of the work? when do we expect the payoff?
why should we be doing any work at all besides tracking this?

Ivan has been doing this for several years, and we are missing
him in the routing work, and I'd like to get him back into
helping in technology scaling using AI techniques, perhaps.
Now, Ivan has a second person working in applications of
Dataflow machines, and I for one am pretty sure that there
aren't going to be Dataflow machines... at least in the next 5
years. My belief and reason for support is that it will drive
parallel processors ala PPA.

Ivan asked me to fund another person to make a compiler, and
I agree such a compiler is really essential for the myriad

of Dataflow work being done in the outside research community.

Since none of you in Hudson have any particular experience in dataflow compilers, I really do want the work (if we are going to do it), run by the languages group. Steve Hobbs uses the Dataflow approach in his compilers, and it's fairly natural to have the Technical Languages group do this work Also, the techniques they develop any should find their way back into the other languages. I believe it is very hard for a specialist operating in a different environment to remain very good simply because there's no one to talk with about questions of writing such a compiler.

There seems to be several questions:

1. Should we spend so much on dataflow?
2. Why is the dataflow work connected to semiconductors?
3. Why isn't the extra person that Ivan got working on the critical compiler instead of more applications?
4. Does anyone review the goals and objectives and the progress and timetable for this work? eg. RAD?

"TO" DISTRIBUTION:

SAM FULLER　　BILL KEATING　　BOB SUPNIK
STEVE TEICHER

ATTACHED: MEMO;46

****
* d i g i t a l *
****

TO: GORDON BELL
8:17 PM EDT

cc: WAFER/DOBES @CNS1
WAFER/HANOVER @CNS1

DATE: WED 1 DEC 1982

FROM: ALAIN HANOVER
DEPT: VLSI ADV DEVELOP
EXT: 225-4072
LOC/MAIL STOP: HL1-1/008

MESSAGE ID: 5183409962

SUBJECT: WHY NOT FUND TECH LANGUAGES TO DO SAL?

I do not want to get involved in cross group projects. When I don't control the developers then the job can't be depended upon. If I agree to run a project I want the people under my direction and control. I don't want to be responsible when they screw up or if their management changes direction if they aren't under my control.
I have a track record for finishing and delivering on commitments I make. This may seem a bit selfish, but I have been burned too many times here at DEC. I believe that any other way to operate is untenable and too risky. There is no way we can run a joint project with the languages A/D people unless the developer is right here and we review his work regularly. Also trying to exercise the software will be hard enough with some of it in Manchester, we don't need another long-distance connection with Spit Brook. We're the ones who have the Dataflow technology and needs here.

I have no problem if Technical Languages wants to assign a person to work here and then the person gets to rejoin their
group, but we must direct and control the person to assure success for our project goals and assure that our time is well
spent. Also, we need to specify when the person is done. I don't

want the person walking off when the job is incomplete or not debugged fully, because either time is up or his boss wants him
to work on other things. After a year, I want the option to let
that activity continue and fund it myself a little longer, if
dataflow will benefit. I want to protect Dobes and his
co-developers from any unnecessary outside distractions so they
can complete their major tasks successfully.

That is my position on the subject.

Alain

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+---------------------------+                                ID#415
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Subject: **Datamation Software Survey 1978**

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To: Bruno Durr, PK3-2/S56                 Date:  10 JAN 79
    Larry Portner, ML12-3/A62             From:  Gordon Bell
                                          Dept:  OOD
CC: Ed Fauvre, MK1-2/E06                  Loc:  ML12-1/A51  Ext: 223-2236
    Bill Heffner, TW/C10
    Win Hindle, ML10-2/A53
    Ted Johnson, PK3-2/A55
    Jack Shields, PK3-2/A58
    Dick Snyder, MR1-2/E37                follow up 1/23/79
```

This year our software has gotten worse, it seems! Can
you have someone get some understanding, statistically
and intuitively.

1. How do we compare overall with other vendors?

2. What's the overall rating correlated with? (I.e., how does quality vary with documentation? ease of use? vendor support?)

3. How does this compare with previous years? (E.g., why has 11M gotten worse, RT better?

4. Anything else that can be gleaned?

Come to Marketing Committee after we have some insight to explain things.

How can we get better.

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST: Bruno Durr PK3-2/S56 Larry Portner ML12-
3/A62
Ed Fauvre MK1-2/E06 Bill Heffner
TW/C10
Win Hindle ML10-2/A53 Ted Johnson PK3-
2/A55
Jack Shields PK3-2/A58 Dick Snyder MR1-
2/E37
June 30, 1980

James F. Riley
Dataquest Research Newsletter
19055 Pruneridge Avenue
Cupertino, CA 95014

Dear Jim,

Enjoyed your Update on Intel, Vol III, 8.04. Do you have a better, more detailed breakdown of the Microcomputer Systems Division? This would include several cuts by level of integration (boards, boxes, development systems, and software), and also by family. It would include some comment as to how much there is a family, and some way of looking at a distribution of their customers in the categories. Also, I would like to have a more complete list of their facilities and what they do there, eg. do they make PC Boards in Puerto Rico?

If you have these readily available or if you can refer me to some other source, I would certainly appreciate the information.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:swh
GB1.S5.12
Professor David Parnas
Department of Computer Science
University of Victoria
P. O. Box 1700
Victoria, British Columbia V8W2Y2

Dear Dave,

This is a note to confirm that I would like to hire you as a consultant to Encore Computer Corporation on Saturday, June 23 for a critical review of an operating system project. The review will be held at Hydra Computer Systems, 15 Mercer Street, Natick, Mass.

I have discussed the review with Dave Schanin, the President of Hydra and told him of your suggestion for attending your course on Software Engineering the week of June 18. We both think this is an excellent idea, and are trying now to figure out who (including Dave and I) should / could attend your course.

I understand the fee will be at your normal consulting rate and no other comparable company receives a lower rate.

The information we provide for the review will be treated in a confidential manner, and we'll ask you to sign a standard agreement regarding this information.

Sincerely,

Gordon Bell
Chief Technical Officer

CC:
David Schanin
Henry Burkhardt, Encore
Steve Emmerich, Encore

The Business Manager reports to the Director.

The main function of the Business Manager is to free the Director, Exhibit
Coordinator, Programs Coordinator, and Office Manager from bookkeeping and other money related chores.

From the Business Manager's viewpoint the Museum is divided into four areas: Director's Office, Exhibit Center and Archives, Program Center, and the Resource Center.

The Business Manager performs the following tasks areas and they relate to the four larger areas of the Museum mentioned above: payroll, insurance, bank accounts, bookkeeping and accounting, budget, taxes, state and federal reporting, store management, bill paying, invoicing, money handling, preparing for audit, relations with vendors, petty cash, and keeping track of fundraising. Also photography, report editing, and tasks for special events.

Payroll. Shawmut Automated Payroll Service -- Contact is Thomas Chatelier, 292-2197. In Payroll File see sample forms for: New Employee Setup for both salaried and hourly employees; Employee Revision Form for any change e.g. salary change, tax status; Employee Prelist (comes from Bank each payday, to be filled in with hourly employees' hours listed. Time cards are collected every 2 weeks. Employee Prelist Total is stapled to Prelist and must be into Bank by 2 p.m. on Monday following the end of pay period. Pay period is Sunday through Friday, biweekly. Checks are processed on Tuesday and can be picked up at the bank on Wednesday a.m. Bus. Mgr. has key to the bank pouch. (More bank forms can be obtained from the bank when needed.)

All employees must fill out a W4 Form for Federal withholding tax and a M4 Form for State withholding tax. These forms may be obtained from the IRS Center in Holyoke.

Other forms: Employee Reference Card from bank will verify pay status of a new employee or that revisions have been made to the pay status of an existing employee.

Insurance. Two areas--Museum Insurance and Health Insurance.

Museum Insurance includes: 3 polices with Johnson & Higgins, 3 Center Plaza, Boston -- Joan Goldberg 742-5300

Director's and Officers' Liability

Underwritten by Chubb; includes areas of Embezzlement, Limits on Personal Liability, and others.

Blanket Excess Liability Policy

Underwritten by Fireman's Fund: includes areas of Bodily Injury, Automobile Liability, Workman's Compensation, and others.

Commercial Insurance Program (biggest area)

Underwritten by Federal Insurance Co. (Chubb): includes areas of Property and Building Losses, Bodily Injury (visitors, accidents), Employee Dishonesty, Personal Property.

Health Insurance Group # (or Employer #) is 26232. Plan Administrator is MSP (Multiple Security Program); Claim Office is John Hancock Mutual Life Insurance Co, St. Louis Group Claim Office, 13523 Barrett Parkway Drive, Building #2, Suite 250, Ballwin, MO 630ll, Telephone # 314/821/3002.

Health Insurance or more correctly called Small Group

Insurance Plan includes: accident, hospital, dental, mental, surgical, $10,000 Term Life, long term disability, $10,000 accidental death and dismemberment.

Claim forms include: Statement of Claim (to Dr. or hospital)
Dental Claim Form
Group Hospital Insurance Form (to hospital)
plus Claims Filing Instructions.

Contact at MSP (Plan Administrator) is Vivien A. Benning, Contracts Service Coordinator at MSP Insurance Trust, P.O. Box 786, Boston, MA 02117, Tel. No. 421-5000.

To enroll new employee in plan two forms must be filled out and mailed to Vivien Benning: John Hancock/ MSP Group Insurance Enrollment Card and John Hancock/MSP Statement of Health.

Bank Accounts. The Business Manager maintains 3 accounts, writing checks, keeping registers , and reconciling bank statements for each.

All are at the Shawmut Community Bank, Marlboro West Branch; Manager, Susan Smith 485-6697.

l. A deposit account for VISA and Mastercharge sales. Account #294-4146.

2. A membership account (checking) formally called Non-DEC Contributions;
an interest bearing account; the general operting fund (the largest acct.)
Account # 275-959-4

3. Store and Events (checking) account; deposits from store, play, etc.
Account # 275-960-8. Out of this account comes money for store inventory, food for special events, expenses for any money-making event.

For Investment Information the contact is Gail Chadwick at the Framingham Office, 620-1100 X362--info on IRAs, CDs, etc.

Bookkeeping and Accounting. For each of four areas of museum there are income and expense records in file folders.

Budget. On Floppy kept in Gwen's Executive Committee Notebook, in pocket in back. Monthly Budget Report shows Projected, Year to Date, For Current Month, Total, Deviation. Income and Expenditures for all 4 areas.

Fiscal Year runs July 1 through June 30.

Taxes. Federal ID # is 042-747-017 (also called Employer ID # and Tax ID #.)

The most important filing is Tax Exempt Filings for Federal Form 990 and Schedule A; and for State Form PC. These are filed after close of Fiscal Year and a period of 5 months is allowed for filing. (The due date for the Museum would be November 15.)

Quarterly Sales Tax Form ST9Q (State form)

Withholding Taxes: Federal Form 941E--Quarterly Return of Withheld Federal Income Tax. (Museum has not yet filed with State in regard to withholding income taxes.)

We are in an Advanced Ruling Period with the IRS until June 1984. The IRS

will give permanent tax exempt status to the Museum at that time if in the
probationary period it maintains a 2-l ratio (For every $2 that is contributed by corporations, there is $1 from the public).

Store--info from Carole.

Bill Paying. Invoices come in and are 1. grouped by when they are to be paid, 2. o.k.'d by person initiating the expense securing as much info about it as possible, and 3. paid out of correct account.

Invoicing. Use invoice form. Mostly for dinners done for groups. Copy goes in Receivables folder. When paid goes in account folders.

Petty Cash. Taken out of membership account when needed. See Petty Cash file folder. Usually an expense voucher is filled out and must be ok'd.

Audit. Coopers and Lybrand do the auditing (gratis) after the FY is over. The Business Manager supplies the raw data from the income and expense files. Contacts at C&L are Scott Eston and Ed Gillis, 1 Post Office Square, Boston (574-5000). All information should be given to C&L in September so that tax forms will be ready by the November deadline for filing.

Relations with Vendors. The policy of the Museum is to pay bills promptly when due. They may be potential members of the museum or possible contributors of money or goods for special events.

Keep track of fundraising. Important to watch the income and to go slow on outgo, keep expenses down, and process deposits quickly when income is less.

The Business Manager is for the present the official photographer for the museum. Equipment is kept in the Twilight Zone and in the file cabinet in the Bus. Mgr.'s office. Equipment includes:

Cameras Nikon F body Serial #6972015
Nikon F Viewfinder Serial #497271

Lenses Nikkor-UD Auto 1:3.5 f=20mm Serial #434267
Micro-Nikkor-P Auto 1:3.5 f=55mm Ser #648625
Nikkor-P Auto 1:2.5 f=105mm Serial # 428755
Nikkor-Q Auto 1:4 f=20cm Serial # 198738

Accessories Nikon M2 (extender?)
Nikon HS-4 lens shde for 105mm
Nikon K1, K2, K3, K4, K5 (filter holders)
Aetna Close Up Lens #1 52mm
Aetna Close Up Lens #2 52mm
Nikon hot shoe

Davis and Sanford Model B Floating Action tripod
Panrite Universal tripod head
Mole-Richardson light stand
Larson Soff - Box flash diffuser
Larson Reflectasol Clamp

Studio FlashNorman 800 Flash Power Supply & Power Cords

(3) Norman Lh 2000 Flash heads
Norman aluminum light stand
Background stands
PC Synch cord

Good contact for photo advice is Steve Spellman, Brownstone Group, Brookline. He is a professional photographer and also a Founder member of the Museum.

The Bus. Mgr. has done some report editing and performed tasks for special events (such as stage mgr. for play).

Floppies are stored in "Software" file folder and are as follows:

Budget Monthly budgets.

TWIT Archives expense voucher, purchase order forms, invoice forms, list processing, etc.

DHB 001 Notes to financial reports (taxes), other tax information, receipt form, information about Report.

File Folders contain procedures for payroll, preparing taxes according to printed instructions, accounting system. There are no printed instructions for most procedures but easily learned by a newcomer.

Legal Advice: Jim Davis at Bingham, Dana, and Gould, 100 Federal Street, Boston, specializing in legal affairs for non-profit organizations. (Expensive) Clerk of our Board of Directors.

Sends copies of any legal or tax filings to
Davis for locating potential problems.

Darman Wing, DEC Legal Department, Secretary to Executive Committee; also gives general advice

Legal information is filed in bottom drawer of file cabinet.

From DHB: Procedures for Processing Museum Store Sales, Procedure for Handling Money Given to Museum, Museum Store Purchasing of Inventory & Supplies, Procedure for Handling Money Given to Museum, Procedure for Handling Accounting for Functions. MB will go over these procedures when time permits.

November 1, 1983

Donald W. Davies
Vice President
Division of Information Technology and Computing
National Physical Laboratory
Teddington
Middlesex TW11 OLW
ENGLAND

Dear Donald:

I would be pleased to give the "Silver Jubilee Lecture, 1984" to The British Computer Society and its guests on Wednesday 14 March, 1984. (I am unavailable on 28 February.)

Please let me know when you need the title, abstract, and biographical information. I would like to use the talk as the draft for a written paper, and trust this is acceptable.

I look forward to giving the talk.

Sincerely yours,

Gordon Bell
Chief Technical Officer

GB7.24

Donald W. Davies
Vice President
Division of
Information
Technology and
Computing
National Physical
Laboratory
Teddington
Middlesex TW11 OLW
ENGLAND

MEMORANDUM

SUBJECT: Digital's competitive position vis-a-vis our market segment.

TO: Gordon Bell, Vice President, Engineering

COPY TO: Ted Johnson, Vice President, Marketing: ML10-1/A55
Bill Avery, Engineering Manager, Terminals and Work Stations:

ML12-2/E71
Dick Loveland, Program Manager, DECmate: ML1-2/T29

FROM: Gerald Davis, TEAG

I came to Maynard as a user-requirements consultant. I have been advising a client who now uses DEC systems, but was considering turning away from DEC, and starting to buy small and portable systems from some other supplier. I wanted to know if DEC's product development (including products not yet announced) would be adequate to meet this client's needs.

Jointly with our clients, we have recently assessed the leading computer manufacturers vis-a-vis both their present product lines and their likely directions for product development to about a 5-year horizon. We rated suppliers against three main factors:

A. For work done on mid-range and larger systems. Digital was seen as the prefered vendor.

B. Suitability for use by professionals and managers, etc. Digital was seen as the preferred vendor, but because of its stalled product development, the competition is catching up to DEC, and sometimes passing it.

C. For work requiring small systems at a wide range of locations. We doubted whether Digital would be an effective competitor, since it was falling behind in hardware, software and price, and had no portable unit in sight. We therefore were considering going to a second vendor for systems for this application.

Following my meetings at Digital today, I feel that I have enough information to be able to rate Digital as best against all three factors; subject, however, to;
- the emergence within the next six to nine months of the product development and up/down compatibility in word- and small-systems that was discussed today; and,
- availability of units discussed today, that are small and rugged enough to be portable or easily transportable.

Our ratings are summarized on the attached pages.

Gerald Davis

SUMMARY OF OUR RATINGS OF DIGITAL AGAINST THESE THREE FACTORS.

A. FOR WORK DONE ON MID-RANGE AND LARGER SYSTEMS.

Digital was seen as the prefered vendor.

- Compatibility with existing key users in our field, and with relevant data bases. Digital is seen as the leader. For instance, PDP-11's are used at most of the universities where research in building science is conducted.
- Computer professionals and scientists are familiar with the operating systems and software requirements. Digital was preferred.
- Hardware and basic operating systems are effective, reliable and sufficiently mature. RSX-11M is widely known, and is used at key sites. RSTS-E is less common in our environments and VAX-VMS is relatively new. These systems are seen as reliable and programmer-friendly. Hardware reliability is seen as competitive, and field service in the Ottawa area has improved markedly.

B. SUITABILITY FOR USE BY PROFESSIONALS AND MANAGERS, ETC.

Digital was seen as the preferred vendor, but because of its stalled product development, the competition is catching up to DEC, and sometimes passing it.

- Operating systems are user-friendly, and suitable for professionals and middle-managers. We considered the basic approach of DECword, its use of menus, user protection, and other features, to be the best in the field for this type of product.
- Operating systems are convenient for the occasional user with no prior computer experience, and no knowledge of programming. We considered DEC's systems to be excellent, but sometimes "muscle-bound", and requiring much more work and many more menus than the competition to perform some frequently required functions, such as: sort a list of records each of which is only one line long; or, edit in one or another of two columns of text which must be side-by-side, and so on.

C. FOR WORK REQUIRING SMALL SYSTEMS AT A WIDE RANGE OF LOCATIONS.

We doubted whether Digital would be an effective competitor, since it was falling behind in hardware, software and price, and had no portable unit in sight.

- Compatibility between small systems and the family of mid-range and large systems. Digital is seen as poor, but not worse than IBM. Media (diskettes and disk-paks) cannot be hand-carried between DEC's small systems and DEC's PDP-11's. Until recently, documents/files could only be communicated to DEC's mid-range and larger systems with CX, i.e. formatting codes were stripped out; DEC recently corrected this with the release of a DX software product for PDP-11's.
- Commitment to small-product development. The PDP-8 has been declared a "mature" product. We are told that the WS-200 is a dead-end product, with no further software development planned. Software development for the WS-78 family had been stalled for several years. We questioned whether DEC had sufficient commitment to office systems.
- Cost-effectiveness. DEC's small-system products were seen as cost-effective for only a few specialized situations. New suppliers, such as Toshiba, are entering the market with cut prices and products that look to the buyer very much like market leaders.
- Portability. It had appeared to us that Digital was not in this market. After our meetings today, I infer that within nine months Digital is likely to have first production of a small system that is "transportable", and that Digital may have a product that is portable, i.e. that will fit under an airplane seat, and is not too heavy.

January 25, 1982

Gerald Davis
TEAG
P.O. Box 1088, Station "B"
Ottowa, Ontario

Dear Gerald:

Gwen and I enjoyed the visit and dinner with you and Francoise. Thanks again.

The report and discussion with our product designers was enormously helpful.

I'm sorry that you couldn't use our next system, but ask that Dick Loveland test it with you.

As usual, please feel free to comment on our products to me or directly to our development people.

Again, thanks for dinner and the comments.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

cc Dick Loveland

GB:mal
ID#GB3.S1.73

February 15, 1980

Mrs. Gwen K. Bell
Page Farm Road
Lincoln, MA 01773

Dear Gwen:

It is my pleasure to appoint you Assistant Keeper of the Digital Equipment Corporation's Digital Computer Museum at the Tower Building at One Iron Way, Marlboro, Massachusetts. We look for you to set up and manage all phases of this exciting project that will trace the evolution of computing.

As such, you will design and lay out the exhibits and displays, schedule lectures, handle museum publications and, in general, do everything that is required to establish an interesting and representative display of computing history.

Digital's resources are available to assist you in your ambitious schedule, to open the museum at Digital's Board meeting, September 22, 1980. The resources include our purchasing functions so as to be able to obtain equipment and supplies.

More specifically, the original term of this appointment is the calendar year 1980 and, while such appointment neither designates you as an agent or an employee of Digital Equipment Corporation, you are to be granted the honorarium of one dollar ($1.00) per year. Of course, you shall be reimbursed all of your expenses in this activity in accordance with our existing policies.

Let me extend my personal appreciation for this most gracious contribution of your time to this undertaking of such importance to Digital. Please feel free to call upon me if I can be of help.

Very truly yours,

Shel Davis
Vice President, Personnel

79-04-19

	Name	Address	Telephone
8:30 --> 12:00	Gordon Bell, VP of Engineering	146 Main Street	
	(617)493-2236		
		ML12-1/A51	
		Maynard, MA 01754	
	Roy Moffa, sitting in for Dick	146 Main Street	
	(617)493-3295		
	Clayton - Small Systems Engineering		ML1-2/H26
	(includes hardware for WP)	Maynard, MA 01754	

Bruce Delagi, Manager of Components
One Iron Way (617)481-6627
Group Engineering MR2-1/M64
Marlboro, MA 01752

Leslie M. Dole, Sales Programs MK1-1/J14 (603)884-5892
Manager, Word Processing Product Line. Also represents Stan Olsen and Jack Gilmore. Merrimack, N.H. 03054

Ken King, Office of the Future (617)493-3066 146 Main Street
ML3-2/E41
Maynard, MA 01754

Don Herbener, Product Support (617)493-3823 129 Parker Street
PK3-2/S20
Maynard, MA 01754

1:00 --> 2:00 Jim Tereshko, Components Group One Iron Way (617)481-5710
Hardware Quality and Reliability MR2-1/M64
Marlboro, MA 01752

2:00 --> 3:00 Robert Gray, Word Systems MK1-1/J14 (603)884-5874
Hardware Engineering (works for Travis) Merrimack, N.H. 03054

Ray Glaser, Programming Group, MK1-2/C08 (603)884-6010
Supervisor WP-8 Development Merrimack, N.H. 03054

Jack Gallagher, Observer from MK1-2/E15 (603)884-6982
Customer Support Merrimack, N.H. 03054

Real Blouin, Salesman, Word Processing (514)342-5321 Eastern Canada District
Digital Equipment of Canada, Ltd.
394 Isabey Street
St. Laurent, Quebec, Canada H4T 1V3

Bud Lawrence MK1-2/G15
Merrimack, N.H. 03054

6:00 --> Dinner	Bill Zimmer, R&D, Hard Copy Dot (617)493-4819 Matrix, character recog.	146 Main Street ML3-2/E41 Maynard, MA 01754
	John Martin, Human Factors (617)481-6820	200 Forest Street MR1-2/E18 Marlboro, MA 01752

79-04-20

9:00 --> 11:00	Ken King, Office of the Future	
	Don Alusic, Electronic Mail	MK1-2/K34 (603)884-5187 Merrimack, N.H. 03054
11:00 --> 1:00	John Kirk, VT78 Hardware Design (617)493-3595	146 Main Street ML1-2/E60 Maynard, MA 01754
	John Clarke, Manager VT278 (617)493-3087	146 Main Street ML1-2/E60 Maynard, MA 01754
1:00 --> 3:00	Len Halio, Graphics (617)493-5687	146 Main Street ML1-2/H26 Maynard, MA 01754
	Charles Rupp, Base Terminals, (617)493-4814 VT-100's	146 Main Street ML3-2/E41 Maynard, MA 01754
3:00 --> 4:00	Dick Schneider, Industrial Design (617)493-2256	146 Main Street ML11-4/E53 Maynard, MA 01754
	John Martin, Human Factors	
?	Bob Lotz, Acoustics (617)493-5774	146 Main Street ML8-3/T13 Maynard, MA 01754
?	Roy Clites, Communications	MK1-2/D03 (603)884-7910 Merrimack, N.H. 03054

Am glad we've decided to continue this and find out by finally building and evaluating DAWN.

I understand it's being funded by Lou Klotz group and that we are considering moving it to him.

Given that Lou is new to SW management, has a number of people to hire, and is not in the systems programing development business, I'd like to insist that it be managed either within CRG or SWE. It could go to Ollie Stone or Bob Daley. Can we please make this happen?

ID#373

| d | i | g | i | t | a | l | **i n t e r o f f i c e m e m o r a n d u m**

Subject: **What's The Story On Helping A DBMS-11 User**

To: Tony Comito, PH
Bruno Durr, PK3-2/S56
Dariel Smith, PH

Date: 4 DEC 78
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

follow up 12/18/78

At DECUS, Robert F. Curley, Director of Computing at the American College of Radiology, 925 Chestnut, Philadelphia 191107 (215-574-3150), hit me up on the poor support of DBMS-11.

Why did we sell it?

What can we do now that he's in trouble?

How can engineering help?

GB:ljp

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+---------------------------+                                  ID#437
|   |   |   |   |   |   |   |
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a n d u m
|   |   |   |   |   |   |   |
+---------------------------+
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Subject: **What's the Conflict Between DCG and T/SS Engineering? We want to help now!**

To: Dick Clayton, ML12-2/E71
Bruce Delagi, MR2-1/M64

CC: John Meyer, ML12-1/A11
Stan Olsen, MK1-2/C36
Bob Puffer, ML12-2/E38

Date: 1/28/79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

<u>Stan and I have agreed to meet with you in two weeks</u> in order to get an understanding of the above problem. Hopefully by the time we get together the problem can be well formulated so that we can begin to resolve it. From all that I can see and hear, there is a real problem here and we must act quickly to resolve it.

Some of the symptoms:

- Engineers leaving the T/SS group (and Company) count this as a reason
- There is no joint planning or communications among what is apparently the same charter space
- Central engineers who develop products aren't coupled into market requirements, sales meetings, given credit, etc.
- Pressure on LSI group is so high to do products that can't be done (i.e. Tiny, that we do no product rather than a 2 chip

processor)
- A duplicative product, the TOBY, is posited rather than build on a DCG product
- Requirements for DCG products for 11 compatibility aren't the same as those developed within T/SS, creating heat
- Architectural planning, advanced development, control is unclear
- Development priorities are yanked around even within T/SS in response to latest market ideas (e.g., low cost portable terminal)
- Unclear responsibility of product support for DCG/T/SS-designed products (eg BSR)
- Long time to market for DCG-designed PDT's due to unclear Product Manager drive alignment with DCG
- Multiplicative products for End user, TOEM and DCG (hopefully solved now)

There are probably more symptoms, but I doubt if this is the best way to attack the problem definition. In fact, I don't know how to approach it...all that is clear is that we must focus on defining and solving this quick. Let's not lose or waste engineering resources in this fashion.

Stan and I are committed to help. Please get us going. What can we do?

DOCNO8/26

D I G I T A L INTEROFFICE MEMORANDUM

DIST: Dick Clayton ML12-2/E71 Bruce Delagi MR2-1/M64
John Meyer ML12-1/A11 Stan Olsen MK1-2/C36
Bob Puffer ML12-2/E38

Digital **Interoffice Memo**

Subject: DCG Engineering Plan Discussion

To: Andy Knowles
Roy Moffa

Date: 9 DEC 76
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

CC: Ed Corell, Dick Clayton
Henry Lemaire, Bob Peyton
Larry Portner, Bob Puffer
Steve Teicher

Thanks for updating me today on your direction. I look forward to a full meeting with the group who receives this memo to work out some issues.

I believe you are building a strong engineering function within DCG and will generate products which are necessary to your markeplace and to the other product lines. It feels like you are under control (since you're adding people before you take on work) and are providing products more cheaply than we are, hence, I believe incremental growth should be within your area. We must support you in this effort. I believe your charter should be extended to include both products that we are not aggressively pursuing or are critical products which could benefit by a competitive, alternative approach.

The issues we discussed:

1. T-11 - how do we drive to get it? Who builds it?

2. Low cost logic peripherals for LSI-11 must get addressed.

3. Interim LA120 versus LA120 to get LA00 quicker. Seems like a reasonable idea.

4. Low cost peripherals aren't being done in central engineering.

5. VT78 board might be used vs 8080 based RX36, especially in lieu of our commitment to field support an 8080 programming system.

Other issues that should be dealt with:

6. Could DCG be 8080 systems manager?

7. How can we help beef up programming in DCG?

Long Form of the Issues

The five areas we discussed should be discussed with the larger OOD group on an open, hassle-free basis.

1. T-11. While Steve is driving to get a proposed design from Bill Roberts, I worry about its timeliness - hence we have to be open about getting the detailed design and fabrication outside. A T-11 with 8080 bus within the next 18 months would be a red-hot product...too much longer might be non-viable. Roy is the driver of this now in terms of strategy. I don't see that much design activity here.

2. Low cost peripherals for LSI-11 based on industry chips would wreck 11 program compatability. I have no hangup on rewriting handlers for RSX and RT as long as the hardware development project pays for it. A customer is clearly going to win with this approach. Roy should drive to get a low cost system, and then get the handlers rewritten on a prototype basis. We must investigate costs via a prototype before getting uptight or rejecting the idea. Now, it seems, our hardware's too costly.

3. LA120 versus LA00 - My gut feel is that we should finish the LA120 prototype and then get an ECO phase-in program to get functions (volatility and electronics enhancements, 11 wire matrix, plotting) and cost reduction (1 board, LSI, knock down) on the existing LA180. This would generate 3 functional models (basic, high quality, plus plotting). Our effort should go to a low cost unit...and possibly Bickoff should investigate an alternative, up to prototype stage.

4. Low cost peripherals - The paper tape deal, 3M cassettes, TU60 repackage, other low cost media are all possibilities. If the group doing paper tape and their design could be acquired, it would be worthwhile increasing our electromechanical design capability. Also I support a design for a hand-held console based on calculator technology. This, if cheap enough, would feedback into our peripheral and cpu as a common

console/control panel.

5. VT78 board versus RX36 - This would get us to a DEC supported cpu product versus building an 8080 system which would be field supported. If we ship the 8080 and provide 8080 systems software (loader, ODT, device handlers, associated diagnostics) it should be a corporate decision. Right now I would oppose an 8080 product that is not entirely ROM based! (Andy points out: he and I have totally switched positions on the 8080 this last year!) I would like to move to CMOS-8, as the Corp. microprocessor if it's available!

There are two other issues which should also be addressed:

6. 8080 support/standards - I've gotten nowhere in getting Lorrin to lead this. It includes all aspects of programming convention and support, physical and logical architecture, testor design, etc. Since DCG is the 8080's biggest user, this would be a natural home for 8080 systems architecture and standards. We're doing many 8080 based products and there's costly anarchy that will hurt in reliability, support, etc.

7. Getting a strong applications programming staff for DCG - The amount of programming will increase rapidly over the next few years, and we have to help provide this. (Larry, could you please talk with Roy and Andy?)

We all have too many commitments to products to get involved in hassle. I want us to come away from a meeting with fairly clear charters.

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST: Ed Corell ML1-3/E62 Dick Clayton
ML3-3/E71
Andy Knowles MR2-2/A52 Henry Lemaire
ML1-4/A97
Roy Moffa MR2-1/M64 Bob Peyton
ML1-3/E63
Larry Portner ML12-3/A62 Bob Puffer
ML1-3/E38
Steve Teicher ML1-2/E65

Selected University-Based
Computers

Use
toResults (in addition to
First Concept- Project-
total engineering
and scientist
Machine Use Use Use Use
Life training)

Harvard MarkI
= IBM ASCC 8/44 7 5
15 .7 Use,

IBM SSEC 1/48 - 2.5
4.5 .6 Use,

ENIAC 6/46 4 3 9
.7 Use, stored program,
Electronic Computer

MIT Whirlwind 6/50 5.5
3.5 9 .6 Use,
circuits , core memory,
real time and interactive
computation, proto for SAGe
system

ILLIAC I 9/52 4 3
10 .7 Use, proto for
6 others

MIT/Lincoln Lab
Use,
transistor circuits,
TX-0
large core memory

ILLIAC II 6/63 5.5 3
3 .3 Asynchronous
logic, design too
conservative

ILLIAC IV 11/7512
8.5-10.5 6.5 .3 Use,
parallelism (algorithms),
accelerate bipolar memory
develop, stimulated
competitive approaches

CMU C.mmp 5/75 5 4.5
6 .7 Parallelism,
Intel 432 proto

CMU Cm* 9/76 4 2
>6 >.6 Parallelism,
Multibus-type structures,

TEXAS TRAC 83 7 5
>1 >.1 -

GB8.21

7 June 1983

El Corral Bookstore
California Polytechnic State University
San Luis Obispo, CA 93407
Attn: Catalog Dept.

Gentlemen:

Per our phone conversation today, kindly send one copy of your
catalog which includes your Engineering School. A check for

$3.50
is enclosed to cover the cost.

Thank you for your help in this matter.

Yours truly,

Claire Fluet

Enclosure

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! d ! i ! g ! i ! t ! a ! l !           I n t e r o f f i c e
M e m o
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TO: see "TO" DISTRIBUTION                       DATE: TUE 15 FEB 1983
                                                FROM: GORDON BELL
cc: ROSE ANN GIORDANO                           DEPT: ENG STAFF
    ED KRAMER                                   EXT:  223-2236
    BILL LONG                                   LOC/MAIL STOP: ML12-
1/A51

                                                MESSAGE ID:
5191028925
```

SUBJECT: CFM: COST. PERF., PERT., PPA, TITAN

GB4.S1.29

Cycles for the Masses is beginning to look up. The following table indicates we have some very interesting possibilities for competitive machines everywhere. Note the following table.

	Time	Price($M)	Perf.	mflops	flops/$	# Users
Microvax W/S	85	0.01	0.9	0.45	45.0	1.0
Scorpio	85	.04	0.9	.45	11.0	5-500
780	78	0.4	1.0	0.5	1.25	5-500
790	6/84	0.5	5.0	2.5	5.0	5-500
Nautilus	4/85	0.25/.4	4./8	2/4	8/10	5-500
dual proc.		0.4	8.0			
PPA ?	6/85	0.25	40.0	20.0	80.0	5-500
Titan	12/83(prato)	0.1	10.0	5.0	50.0	1- ?
KL	74	0.75	1.33	0.66	0.9	10-500
Jupiter	+30 mos	0.75	6.0	3.0	4.0	10-500
Cray 1	76	10.0	40-100	20-200	2-10	50-1000
with vectors						
Cray 2/XMP	85	10.0	120-300	60-600	6-30	
with vectors						

Notice there are several ways to get a performance:

1. Supercomputers (eg. Cray) operated in batch mode. At LLNL, a large user gets a maximum of 1 hr/day. Therefore, if one of our systems can deliver only 1/8 to 1/24 the performance, the price performance is likely to be better with a Supermini depending on the problem. In a real environment, most users would

rather have
something else.

2. Supermini, operated as a personal or with a small number of users.

3. The new, powerful microprocessor based Personal Computer with
750-780 performance. This gives a user the most power.

4. The shared, supermicro such as Scorpio - These computers have the
best cost/user, but will the added sharing be worth it.

5. Specialized facilities such as PPA, FPS, XYCAD for high
performance batch. Quite interesting.

Performance/price depends on the fraction of a system that can be dedicated to a user. With MicroVAX PC - the price may be in the don't care range 10K-20K (or 10% of a professional's salary) but the performance is at 780 level. Therefore, work will migrate both from supers and superminis.

We have some incredible opportunities. It would seem desireable that we consider Titan and PPA as purely computational processors, although Titan would eventually be a PC when it has software. They would be

operated as servers running say Fortran, to off-load a KL on VAXen
a CI.

This VLSI generation is going to generate many more kinds of computers
than ever. Supers, mainframes, and superminis are all going to feel
the impact.

"TO" DISTRIBUTION:

BILL AVERY CFM TASK FORCE: BILL DEMMER
ULF FAGERQUIST BARRY JAMES FOLSOM BILL JOHNSON
DEMETRIOS LIGNOS AVRAM MILLER OPERATIONS COMMITTEE:

WPS USERS - Leave HP mode and type <CR>

June 14, 1983

Prof. J. F. Traub
Computer Science Department
Computer Science Building
Columbia University
New York, New York 10027

Dear Joe:

Would prefer to speak on Monday, and will probably come down for the weekend. Since I'd like to interact with your folks designing machines, I hope there'll be time.

I just spent 3 weeks at Stanford, and am reforming opinions about building machines for AI and other special purposes at universities. In particular, given the current state of understanding of AI programs, it's a significant waste of resources to be designing a computer for AI. These machines will require a large effort to build (i.e. probably an order of magnitude greater than C.mmp or Cm*), and I don't see the experimental and analytical underpinnings, experience and reasons to proceed especially since there is such a limited supply of talent. It also became clear to me that Carnegie is 10 years ahead in understanding parallelism because it had built and used those machines.

Am looking forward to a lively conference, and chance to formulate and expose some ideas. Regards to Pam.

Sincerely yours,

Gordon Bell
Vice President,
Engineering
10/15/83 Sat

Dear Fellow Friends of JVA:

Please let us join you in honoring this great computing pioneer on his 80th birthday.

His ideas we take for granted about using binary arithmetic, storing information by regeneration which he called jogging and is the basis of today's random access semiconductor memory, processing information serially and fast division are almost 50 years old, and have been right.

From the moment we heard about the ABC at the Computer Museum in November 1980, we believed that others should know the story too. Over the last few years John and Alice have worked at writing about the invention of the first electronic digital calculator and we look forward to finally seeing it in print. We also applaud the movie as another way to tell the story.

We regret not being present on this occasion, but look forward to viewing and preserving the movie.

Sincerely,

Gordon Bell
Encore Computer Corporation

Gwen Bell, Director
The Computer Museum
June 14, 1983

Mr. Jack Worlton
Los Alamos National Laboratory
International Technology Division
P.O. Box 503
Los Alamos, New Mexico 87544

Dear Jack:

Thanks for the invitation to the conference, and I regret that I can't attend because I'm recovering from a by-pass operation, and am trying to limit my commitments, especially those requiring travel. I would have liked to hear about the Cray, Dennelcor and CDC machines. Bill Strecker's attending from Digital, so I feel we're represented.

If it's not too late, let me urge you to reconsider the speakers from academia and invite someone who has produced results. None of the speakers, besides Kuck have ever built anything. The folks at Carnegie and Manchester are about 10 years ahead of their colleagues in understanding parallelism and how to build systems. The attendees should understand that parallelism does exist and can be exploited to varying degrees using dataFlow and multiprocessors.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

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| D | I | G | I | T | A | L |              I N T E R O F F I C E
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TO: Dick Berube
Bruce A. Ryan

CC: "CC" Distribution

Date: 9 FEB 1983
From: Gordon Bell
Dept: Engineering
MS: ML012-1/A51 Ext: 223-2236
EMS: @CORE

SUBJ: Computational Quality Ad for VAX

Sam and Charle just pointed out that VAX delivers more accuracy than any other competitor. This translates to quality (the absence of errors).

Can we get an "Ask Any User" (see attached) ad on this important aspect? It could be a knockoff.

"CC" Distribution:
Sam Fuller
Charle Rupp
Mary Payne
Bill Strecker
Bill Johnson
Bill Demmer

Attachment: "Ask Any User" brochure

June 14, 1983

Admiral Robert Inman
1501 Wilson Boulevard
12th Floor
Arlington, VA 22209

Dear Bob:

Dr. An Wang suggested that Wang might like to join MCC if offered.

What's the possibility of joining MCC? Do you want to call him?
Telephone: 617-851-4111.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:
When I was at Carnegie, I looked at the jobs. The dean's jobs were the hardest. Turf everywhere to fight for and protect, with finite budgets, more programs than money, and everyone with ideas to spend more money, and no action on programs you consider vital by an obsolescing or otherwise inert faculty.

Several of us were called in to a university a couple of years ago to sort out CS... where did it belong? It grew up as programming in the math department which was part of the school of science, the EE's did their thing, and the provost asked for a blue ribbon committee. Several of us, all engineers who do a lot of computing, unanimously recommended that it be part of Engineering. At last look, a new school was established for computing. I thought how dumb... but maybe something good will come out of it. It agrees with my model about the importance of computing. Maybe you'll try it. I'll argue this later, but not very hard.

I remember Herb Toor aging about 10 years in 2 years, as CMU's dean, followed by a heart attack. In february, my heart stopped for awhile, and shortly thereafter had a bypass operation.

I can relate to this, I have many groups that do various kinds of engineering that result in either products, components or processes to make components. In a sense, it's a lot like being a dean.

Why am I here?
The usual rationale. My stacks of books to read on engineering education has grown to where I couldn't see over them. If I have to give a talk, I'll learn the subject matter... just like the reason to teach a course... why else would one ever teach a course except to learn it?

Also, I wanted to take my mind off my problems, and turn them to yours for diversion. As you can see, as a typical engineer, I'm a problem formulator, and occasionally a solver.

What do I see as the issues in engineering education today, and do I have anything useful to add?

As an activist, I feel I must make some comments NOW that I have you that I hope are relevant. Not that I can speak to everything that's relevant. The issues can come from a single problem statement:

HOW TO SUPPLY THE DEMAND FOR QUALTIY, HIGHLY TRAINED ENGINEERS, IN THE FACE OF TECHNOLOGY CHANGE BOTH HERE AND FROM ABROAD (JAPAN) NOW.

THE USUAL WORRY IS WHETHER THE DEMAND IS REAL AND SUSTAINED WITHIN THE TIME SCALE OF UNIVERSITY DECISION MAKING,

THIS REQUIRES MORE TEACHERS: THE BUDGETS ARE FIXED AND THE LOADS GO UP MAKING ACADEME LESS ATTRACTIVE

QUALITY HAS TO GO WITH LARGER COURSES.

TECHNOLOGY IS CHANGING, BUT HOW DO YOU MOVE THE PROFESSORS?

TECHNOLOGY IS CHANGING, BUT HOW DO YOU TRAIN THE AGING ENGINEERS?

THIS REQUIRES $ AND COMPUTING (MY INTEREST) FOR BOTH TEACHING AND RESEARCH!

I HAPPEN TO BELIEVE THAT COMPUTING IS DRIVING A SUBSTANTIAL AMOUNT OF THIS CHANGE, AND I DON'T SEE THE BROAD CHANGE THAT'S REQUIRED ACROSS ENGINEERING. THIS MEANS THAT MORE EXPOSURE TO COMPUTING IS NEEDED!

FINALLY, THE JAPANESE ARE BEATING US IN THE WORLD MARKETS, INCLUDING COMPUTING.

NOW, TO TOP IT OFF, THEY'VE ANNOUNCED THE 5TH GENERATION OF COMPUTING IN WHICH THEY OPENLY CLAIM THAT THEY'LL OWN COMPUTING BY 1990!

THERE YOU HAVE IT: ENGINEERING DEMAND UP, TEACHER DEMAND, FALLING QUALITY, CHANGES IN KNOWLEDGE IN THE FIELD CAUSING AN OBSOLESCENCE BOTH IN THE FACULTY AND IN INDUSTRY, LACK OF RESOURCES... ESPECIALLY SINCE COMPUTING IS AT THE HEART OF THE CHANGES, JAPANESE COMPETITION, AND THE FUTURE! NEARLY ALL THE PROBLEMS YOU... LET'S SAY WE FACE!

HOW TO SUPPLY THE DEMAND FOR QUALTIY, HIGHLY TRAINED ENGINEERS, IN THE FACE OF TECHNOLOGY CHANGE BOTH HERE AND FROM ABROAD (JAPAN) NOW.
The report, by the NAE in 1981 Academe/Industry/Government Interaction in Eng. Educ exlored the overall issue. George Lowe's opening address was especially insightful.

concern- reward teaching. I've asked several of our groups, and they say you're doing a good job! Let me congratulate you.

Since I'm more remote, I have some concerns: I asked where's the best school? San Luis Obispo. Why? They don't do research, they teach! Their teachers do and teach engineering.

I think the supply is diminished by driving them out with publishing requirements that may be difficult to meet in experimental fields.

I've seen this in virtually every school, especially those who work in building systems, as a sure road to non-tenure. Illinois vs CMU; Northeastern, U Mass drove one of our best engineering managers to us by a non-tenure decision. The students stopped building and we don't get as many students from there anymore. In other cases, they're driven out into high paying jobs and start ups where they become millionaires.

THE USUAL WORRY IS WHETHER THE DEMAND IS REAL AND SUSTAINED WITHIN THE TIME SCALE OF UNIVERSITY DECISION MAKING, Computing has been on an uncontrolled growth since its beginning, and many faculties simply cannot accept the fact that information processing is as fundamental as mathematics, or mechanisms. It took 15 years ater the computer and profession was established, BEFORE a department of Computer Science could be formed in the first university. I know if the computer to were to vanish tomorrow, it would be at least 15 years to get rid of it.

We're also losing them to MBA school, which I regard as a waste of time. You could give a short course and give honorary MBA's. There's even a book.

THIS REQUIRES MORE TEACHERS: THE BUDGETS ARE FIXED AND THE LOADS GO UP MAKING ACADEME LESS ATTRACTIVE
believe that people in industry could help (I'm on the academic board of the Wang Institute of Graduate Education... requirements teach very well, be a great engineer, can do research and knows several particualar fields, yet can teach all the courses. It turned out that the quiz they gave every applicant was a graduate seminar... and they all flunked! no wonder. Unless you've spent enough time, you can't speak the language. Having gone from industry to academe, I had to learn, but people were willing to gamble. Probably couldn't make it into CMU today.

It's important to figure out how to communicate with industry. Dean Louis Padulo of BU suggested a Dean of the Month program, where we communicate between our engineers, the dean, and various department heads. We have a similar program with researchers, where we describe our problems.

QUALITY HAS TO GO WITH LARGER COURSES.
I don't understand why much of the increased load can't be handled by TVI?

I think maybe the pendulum has swung too far to specialization, especially in EE where Computing can occupy a large fraction of a person's curriculum. 10 years ago I was on a series of Computers in COSINE... computers in ee. to get some changes to the curriculum and the courses. about 6 courses.

Now, I think we have to go back into some fundamentals where discrete and continuous mathementics are taught. I noted that YOU folks are taking these courses right here at these conferences.. Digital signal processing, or how to get those functions into a form the computer likes.

TECHNOLOGY IS CHANGING, BUT HOW DO YOU MOVE THE PROFESSORS?
MIT's Centennial Celebration focussed on Continuing Education. They have an excellent report. I urge you to NOT have another task force, report, etc. and simply adopt

theirs. My fear is that nothing will happen, the report took so much work.

Who can blame them? The faculty already is overworked: they can't spend all the money that's been foist on them by ARPA and IBM, the loads are high, and they haven't any time for any more teaching.
consulting, co-operative courses,

TECHNOLOGY IS CHANGING, BUT HOW DO YOU TRAIN THE AGING ENGINEERS?
we badly need continguing education programs
we have to have your help
This is an excellent way to start and improve the necessary relation that must exist between university and academia.

THIS REQUIRES $ (AND COMPUTERS) FOR BOTH TEACHING AND RESEARCH!

COMPUTERS IN TEACHING
lots of reports, and occasionallys some money. I think you'll find that this problem will go away shortly. The $25 slide rule that engineering students used to buy would now cost $150, or about the price of what is becoming a useful computer.

COMPUTERS IN RESEARCH
Let me recommend the recent report by the NSF, U-I Research Relationships: Myths, Realities and Potentials

Here, we have quite a lot of positive experience, and the recent posture of various funding agencies is hopeful, by virtually demanding that we work together. It isn't easy because of the conflicts about owning knowledge, and deadlines that we insist on.

One of the healthiest relationships has been between DEC and CMU to build experimental machines. The only problem in retrospect, is that we should have done more to make it work. Starting in 1970 CMU built about 3 parallel machines.   As a result CMU knows more about parallelism than any other university. I'm sadened by the proposals I read to do research in this area that will yield results that were known 10 years ago.

Several of us with Jerome Feldman put together a successful plea to get computers for CS research. Even more successful than the grant was the idea that companies would get extra benefit for computing equipment. This became a law, and equipment's starting to flow.

Focussed Research Institutes are GREAT: Robotics, Semiconductors at CIT, then Berkely and Stanford, Magnetics at San Diego and possibly CMU, Some fundamentals in optics, ceramic material... we ain't making it folks.

Then there's manufacturing engineerng.

I HAPPEN TO BELIEVE THAT COMPUTING IS DRIVING A SUBSTANTIAL AMOUNT OF THIS CHANGE, AND I DON'T SEE THE BROAD CHANGE THAT'S REQUIRED ACROSS ENGINEERING. THIS MEANS THAT MORE EXPOSURE TO COMPUTING IS NEEDED!

GIVE THE PAGE OF STATISTICS OF COURSES AT THIS CONFERENCE

cs should be difused 4 years ago I wrote an appeal to the CS&ERB to revamp the thinking about computing so that the other disciplines start doing their share. The problem is that computing people won't let them.

Computers are things to be taught not to fear and to be ordered around view (MBA school... where you know enough to order up some programmers, tools (analyzers, displays, drawers), simulators, and
then they become components of the systems you build.

I'd like to see ALL of this, but I'm greedy, I want more. I'd like to see engineering faculties become entrepreneurs by encoding their knowledge in programs. It already happens; in vlsi Stanford and Berkely have been doing in for years. Cogo and Stress were done years ago. NYIT builds some of the world's best graphics systems, which by the way it sells extensively. It is the only university I know that's also an OEM. After all, what's wrong with packaging this knowledge in a program and getting a royalty? Professors have been doing that for years.

Now there's more work to be done in the form of expert systems.

What are they, what are some examples: interpretation, prediction, diagnosis, design, planning, monitoring debugging, repair, instruction, control.

Let me talk about the system, XCON... XSEL...

Here, I may be reminded of the doctor, lawyer and engineer that were to be guillotined. The first two were spared because they rope ws binding. The engineer just had to redesign it so that it worked.

FINALLY, THE JAPANESE ARE BEATING US IN THE WORLD MARKETS, INCLUDING COMPUTING.

5 years ago was my first visit, last summer my second. I consider them to be the world's greatest engineers.
The threat's described in Feigenbaum's book: The 5th Generation

The issue is the building of computers that can behave as experts, say like engineers or engineering professors, or engineering managers. I've already started one to be me.

The expert system is built by a combination of knowledge engineer and and expert. The design problems enclude knowledge reprsentation, and then getting sufficient knowledge to be able to solve problems.

NOW, TO TOP IT OFF, THEY'VE ANNOUNCED THE 5TH GENERATION OF COMPUTING IN WHICH THEY OPENLY CLAIM THAT THEY'LL OWN COMPUTING BY 1990!
knowledge information processing systems
knowledge engineering

To me this means certainly everyone has thereown machine like I described. This is being done right here at RIT, Clarkson's doing it, and CMU has an institute dedicated to it. Other institutions are moving forward including Standford and MIT that I know of.

Every student will have one. YOU HAVE NO CHOICE, THEY'LL BRING THEM IN WITHIN A FEW YEARS.

It can comunicate with all the others in a community. YOU HAVE A PROBLEM: CAMPUSES MUST BE REWIRED TO SUPPORT THIS. Like our engineering net. We have over 1K computers in the net.

The machines are doing more than communication, but are teaching, allowing people to design by positing, analyzing, simulating.

Expert systems should play a major role in this future by allowing knowledge to be encoded and used, versus being static like in books.
April 23, 1984

Mr. John Opel
Chief Executive Officer
International Business Machines
Armonk, New York

Dear Mr. Opel:

I am writing to you because Fred Brooks said you were an intelligent man. I am asking you and IBM to support The Computer Museum.

IBM did not ask The Computer Museum to be born, but it is alive and number one, especially in its collection. Now we need IBM's support so it can reach its full potential. Having reached a critical mass with a strong, attainable vision of what is a unique, technological museum, we (myself, the staff, the board and members) are now even more determined to succeed. This means it will be the mecca for all professionals in information processing with a wide variety of activities ranging from supporting other museums (including The Smithsonian) to being visited by a large audience.

Let me attempt to summarize in one place, why The Computer Museum needs IBM's support and why it is in IBM's interest to give support.

IBM's cooperation is needed to efficiently preserve, interpret and exhibit the entire story of information processing. For example, there are more IBM artifacts in the collection than any other manufacturer. IBM has preservation activities, yet we also will have to collect and display in overlapping areas in order to portray a complete picture. Worse yet, I am concerned that our historical quality may suffer when we are forced to take a "black body" view of IBM, rather than to interact and determine the best presentation of a subject.

The October opening includes a number of IBM computers: SAGE, a 1401 insurance office recreation, a few PC's, and many events on the 1950-1973 timeline, starting where the original Eames Wall stopped. In January 1985, the exhibit on the Computer and The Image, other artifacts will be required from IBM. We need a few artifacts, some background material and a few photographs. But mostly we need an interface with IBM.

While the Museum was founded under Digital Equipment Corporation's support using a Digital building, it has been a non-profit organization for two years and is now located in Boston (with The Children's Museum, near the site of the new Boscom Computer Mart). While Digital continues to give even greater financial support, it is essential to have wide international and corporate support. The risk phase sponsored by Digital is over. By supporting the Museum now, IBM can lead and get significant recognition.

Given IBM's reputation and image of supporting culture, such as ballet, the Olympics and a television show on Leonardo, the Museum should be at the top of the list in terms of cultural support. What is more significant culturally than the history of information processing? (The amount requested recently was probably less than it took to make the recent temporary exhibit on computing at 590 Madison Avenue.)

IBM people have made suggestions and expressed concerns about our interface with The Smithsonian to which we have responded.

- One of Roger Kennedy's associate directors for technology is being nominated as a board member.
- We remain dedicated to supporting the Smithsonian both now and in the future in every possible way, including sharing of artifacts and exhibits, and even ultimate acquisition of The Computer Museum if this is best. Our activities may have stimulated the Smithsonian to begin thinking about a new computer exhibit. Like any important project, having a backup insures that the work will get done sooner and at a higher quality. More interaction will give us both ideas and motivation. The result may be TWO, high quality exhibitions in two major cities. This is surely desireable.

The Museum focusses ONLY on information processing. As such, the Museum doesn't have to make tradeoffs between displaying Archie Bunker's chair, a steam engine, or computers.

The Museum's charter as a scholarly, international museum versus a national institution means that we are likely to have a significant role forever. We will not get caught up in national puffery when many ideas started in the U.K. and are now coming from Japan.

The Computer Museum has demonstrated competence by reaching public, non-profit status -- all for about a million dollars incremental expenditure. Perhaps it should have first come to IBM with a proposal for a museum, but now one can view real results instead of promises. Since the past is the best predictor of the future, it is very low risk to support known winners. This next level of activity will cost about ten million dollars in over five years. The next one, which we hope to attain by the early 90's will cost about 100 million. Today, the Museum has:

- key artifacts and archives - For example over 300 machines and 200 films are preserved. It also includes books, manuals, and photographs. These are available to authors, the media, companies, and universities to aid in the understanding of information processing.

- a staff of 15 involved in artifacts, exhibits, historical research - No museum has this level of activity in computing. The curator from Britain's Science Museum is preparing one of the major galleries.
- a building that is centrally located, operational and able to be used during this consolidation phase
- a dedicated board of computer industry leaders (including Erich Bloch and Jean Sammet from IBM)
- dedicated members and supporters ranging from Amdahl and Atanasoff to Zuse. Every IBM person who has visited the Museum believes it is significant and worthwhile; many ask about IBM support. A large number of IBM employees are founders.
- support from other technical people at IBM, including: Lewis Branscomb, Fred Brooks, Bob Evans, Jerrier Haddad, and Ralph Gomory

Lewis Branscomb commented that if the Museum never opened, it would be really significant in terms of its collection function. At first glance, this may be true, but the Museum needs to be open and very active because:

- Exhibits and a place to visit are required in order to get public and individual member support, including new artifacts.
- Exhibits force the deadlines to organize our thoughts, taxonomies, and displays without which the Museum would just be a collection of uninterpreted artifacts.
- Exhibits start with an initial wish list for the collection, but as collecting is carried out, the final result is often quite different. This is just like research in science.
- These "firsts", being routinely thrown out every day, need to be saved now. An avalanche occurs when we start the process.

At a personal level, I believe my own work in computing has benefited IBM. The Museum will be no exception. This work includes:

. Training of various IBM scientists and engineers at Carnegie-Mellon in computer systems because of the experimental engineering nature. Carnegie-Mellon was first in this area and continues to lead the big three universities.

. Writing texts for scientists and engineers. My 1971 book with Allen Newell just made "classic" status in terms of citations.

.Collaborating with Erich Bloch in selling the Semiconductor Research Consortium to SIA and work in defining the program. IBM will benefit most.

. Establishing by way of example, a model for co-operation between industry and academe at Carnegie-Mellon. DEC pioneered this and now IBM is benefiting by taking over DEC's 1970-1982 role.

. Engineering exemplarity, first systems (archetypes) that are the mainstay of IBM's products including timesharing, the minicomputer, Local Area Network and LAN clusters. The later two are not yet mature.

. Using the Museum's collections to understand and interpret the computer industry. As a result of Museum work, two papers are being published within the next three months: one on Standards (Keynote talk at IEEE's Compcon) and the others on how the microprocessor is restructuring the industry.

While I can't guarantee that IBM will benefit as much from the Museum as from the above work, I believe it will benefit. I am asking for you to trust me. In this regard, can I apply to be an IBM Fellow for historical work?

I would like to urge IBM to support the Museum at the two million dollar level for five years as requested when IBM visited on January 25, 1984. If this is not acceptable or IBM is concerned about some aspect of our relationship, then let me urge an initial grant for two years at $800,000 followed by annual reviews.

If there are any questions regarding any aspect of the Museum, I or any member of the Museum's staff or board are available to answer questions and visit you. The Museum is open for review and inspection.

To reiterate and close, The Computer Museum needs and wants IBM's support.

Sincerely,

Gordon Bell
Member of the Board, and Curator ex officio

CC: Erich Bloch
    Lewis Branscomb

GB13.14

The Secretary reports to the Office Manager.

A major portion of the secretary's job is replying to requests for information, tours, literature and taking messages for the Staff.

Other duties include:

updating the calendar daily for the whereabouts of the staff and to keep track of museum happenings (e.g. tours and lectures)

processing all outgoing correspondence

processing new memberships

scheduling tours and

assisting with bulk mailings.

An "Office Procedures" manual is located in the secretary's office which supplies most of the information needed to perform the secretary's duties. It contains the following information:

A. New Member Procedures including an example of the form used for Matching Gift Program for DEC employees and

Membership Card and Receipt.

B. How to Section including How to Run Labels, How to Run Rolodex Cards, How to Pull a Founder List, How to Do a Member List, and Procedures for Correspondence File Headings.

C. Disk Indices including the following floppies:

SUESYS -- DECMATE System disk

DEBBIE

SYSMBR -- System disk for memberships

MBR001 -- Membership List

C001 -- Chronological correspondence

C002 -- same
C003 -- same

D. Miscellaneous information regarding: the calendar, letters, mail, and filing.

Forms used frequently are: Tour Information Sheet, Tour Information Summary, Museum Tour/Office Calendar. (Add any others.)

00 CORE DECGRAM ACCEPTED S 000229 O 19 14-NOV-82 11:35:18

****
* d i g i t a l *
****

TO: ANDY KNOWLES DATE: SUN 14 NOV 1982 11:08 AM EST

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5181684383

SUBJECT: RE: THE 10/20 BUSINESS

Jupiter was born right here in the River City Engineering Department! It should have been a relatively straight-forward machine to engineer, but it is a big project, and much bigger than what was thought, simply because the guys doing it didn't have the knowledge of the 10, didn't understand the magnitude of the project, and hadn't managed anything this complex. The first version (2x KL at lower cost) is what I'd expect from going to 100K. Getting a 5x KL at only slightly more money was the proverbial "free lunch".

The 10 is now more complex and difficult to build than VAX in terms of data types, because of recent extensions, particularly to deal with extended addressing. I didn't understand the complexity of the machine at the time, nor what they were doing because the whole project was done in what I call the "one head" model. Since the original machine, the 6 was so simple (I did the whole machine, except the arithmetic control (Kotok did it) plus lots of the I/O and memory), I thought it was pretty easy for a small, dedicated team and a few designers. The 2020 was done with a few people and that reinforced my belief that the 10 was

simple enough. Jupiter is complex and didn't have the external
reviews and tests that are needed when there's not "one head".
The project added people but without the discipline and
management. The stupidity is that virtually all the problems of
VENUS were on Jupiter (project organization, management, quality
design versus build and try it, simulation, modelling). The
problems were masked because they were debugging a powered on
machine... little did I know that they were still designing it...
otherwise, I would have pulled the plug on the proto 18 months
ago!

My concern about the 10 is exactly that of the 8 ... both
machines will bleed us dry if we have to add programs to them. I
have enormous respect for the machines in their time, and I hate
to see them being forced into situations where they are not
suited. Mostly I hate to see these classics become non-profit
institutions and be eaten up in the marketplace. For example, it
costs about $200 to add an instruction to any PDP-8 program
simply because the memory is full. No way can one build
competitive software on the 8 today, except by using an
existing, well-debugged, high level language such as Dibol.

It's still unclear that these programs would be competitive.

To make the 10 competitive requires a full re-write of every compiler and other programs to handle the large address. Once the re-write, the machine will slow down enormously because of the extra indirect references, and today there's no way to make a 10 competitive with VAX due to the equal complexity and lack of software. Our customers have been creative about using multiple processes (forks) to get a bigger address, but this is enormously expensive in programmer time. What concerns me is the fact that we are in for a very large software bill.

The 10/20 is a cult, and we have to have machines to support these customers. It's important to realize that Honeywell's Multics users, Univac's 1100 series (a super/super kludge based on the 1103/1107/1108/11xx evolution to get address bits and for function), and Burroughs machines (the Barton Stack machines) are somewhat cultish too because the buyers bucked IBM. I hate to even think of these machines in the same sentence as the 10, because the interaction isn't there... except Multics.

The thing that these machines have in common with the 10/20 is the continued support requirements of the customer base. This is historically what's killed all the mainframers. The simply haven't provided for the transition or the evolution of competitive machines. Thus, when I say we're like BUNCH, I believe we have the same problem in being enveloped in past support, and like them, we too will go down the tubes holding on to the base. VAX did a great job in dealing with the base ... mostly because the minis were more dedicated and there wasn't the apparent, large investment. In reality the software investment and base is much larger; it's just not concentrated in a few sites. RSTS was moved to VAX using software tools and VAX provided a direct execution environment for RSX-11/M.

I don't see a way out of this dilema where we can ever make the last 10 (or last 8). Common I/O is a way to reduce the engineering bill a bit, plus things like common compilers (we tried one on APL). Never have I felt so stressed: there are lot of great things we should be doing, but because we've screwed up schedules (Jupiter, J, Venus,...) and have no resources, we're committed to the past. I want to get on with MicroVAX based products for example, and VAX is a much, much better base to build on now.

It really bothers me now to see a strong marketing group unhook VAX sales and get us further committed. I believe the upsurge in 10/20 sales are simply substitutions of what would have been VAX, since we are selling resource/marketing constrained here.

It would be nice to see some aggressive marketing in the cluster domain with VAX or with VAX and AI, but I certainly don't believe the 10 group could do it... it's religious as your memo descibes.

We're getting a strong AI group in order to go after this business. The 10 is now very overpriced here, the 2080 is likely to perform poorly with LISP, and it will be a real

poor performer when the extended addressing is put into LISP, if
and when it is. The point on the AI is that we have one set of
resources... we should go after the AI maarket with VAX, while
holding anything we can with the 20. The AI market wants LISP in
a 30K workstation... and Xerox is offering it. Again, like
the multi-Pc's, the enemy is outside, NOT inside.

These examples typify the problem: We can never sell/market
outside while stopping the development inside, when a product
should be a cash cow! The PDP-8 should have been an all time
cash winner. Instead, in it's last days, like India where cows
of all kinds roam the streets and buildings, we have to build
hospitals for life support.

Bottom line
Am strongly committed to honoring our growing commitments and
getting this follow-on to the KL. At some point, someone is
going to have to work on the solution for Digital for life after
the 2080... a problem I wish we now had.

WPS USERS - Leave HP mode and type <CR>

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+---------------------------+                    GB3.S5.8
|   |   |   |   |   |   |   |
| D | I | G | I | T | A | L |          I N T E R O F F I C E
|   |   |   |   |   |   |   |            M E M O R A N D U M
+---------------------------+
```

TO: Carla Mason
FJ

Date: May 26, 1982
From: Gordon Bell
Dept: Engineering
MS: ML12-1/A51

Ext: 2236

EMS: @CORE

SUBJ: REIMBURSEMENT FOR TICKETS TO CALIFORNIA

The enclosed check is for a ticket that was obtained through DEC by Gordon for a trip to California. The amount of $514. has since been reimbursed to Gordon by CalTech's Visiting Committee. Therefore, Gordon is reimbursing DEC for that amount.

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+---------------------------+                    GB0003/46
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| d | i | g | i | t | a | l |   i n t e r o f f i c e   m e m o r
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Subject: **DEC, A Shrinking Ecological Nitch**

To: Gordon Bell

Date: June 6, 1979
From: Dan Siewiorek
Dept: CMU

I was having a discussion with Lloyd Dickman this afternoon that stimulated this memo. I observe DEC from afar, and occasionally from close up, I see several disturbing signs. These signs seem to indicate that one of my most favorite biological organisms, DEC, may cease to exist the way we know it today.

I am sure you are familiar with many of these signs, but let me ennumerate them.

1. Increased time to market. Even though DEC is growing in personnel at a high rate, it is taking longer for a design to reach market. Even simple reworks of an existing design takes 18 months.

2.Technology is rapidly changing. Part of the increased time to market is due to introducing a new technology into DEC and learning all about it. There is almost a different technolgy for each major project (i.e. Dolphin was using ECL gate arrays, COMET bipolar gate arrays, NEBULA TTL, Fonz NMOS, etc.) This technology learning process delays the timely introduction of the new technolgies into the DEC marketplace.

3.Processors ain't all that different. Ed Snow's study of the PDP-11 implementations illustrated their high degree of similiarity. A recent comparison in Datamation of the IBM S/370-168 and 3033 also indicated a high degree of similiarity. Certainly in this day and age processor design is well enough understood that we do not have to start from ground zero each time.

4.Decreasing number of new processors. There are essentially no new PDP-8's under development. The only PDP-11's are the model 44 and the JAWS-11. DEC has seemed content to hold PDP-11 top of the line performance at the 11/70 level. Does that mean the JAWS-11, or perhaps a follow on project with an 11/70 on a single chip, will be the last PDP-11? Then there will probably be three or four VAX's: small, medium, and large.

5. Lack of design aids. Since there are so many diverse technologies to support, a do-all design aid system is too complex to build. Thus as design complexity increases, so does design time (at a greater than linear function).

6. No new value added. The semiconductor houses will beat DEC at the K-bit MOS processor game and shortly at the 32-bit game. They are already talking significant RAMP features, something DEC has failed to treat in a uniform manner. DEC is not developing other non-MOS technologies that could be a value added feature. There are fiber optics, integrated optics, and Josephson's Devices that IBM and Bell Labs have been investigating, just to name a few.

At some point, DEC may be reduced to a software house with others mass producing DEC's hardware (e.g. I would guess that already today half of the gate count in a typical system running DEC software is due to non-DEC vendors). At that point DEC would stop growing its user base. Existence on a fixed size use base will limit growth and challenges. The limiting of challenges will lead to an exodus of creative talent leaving behind a hollow shell.

I think that two major actions, backed by corporate wide commitments, are necessary.

1. Technology. Standardize on a single (or at most two) technology, as IBM has done on gate arrays. By constraining designer choices, a set of design aids and a mechanized production facility can be developed. The technology may be suboptimal compared to hard packing designs, but the cost savings and reduced design/manufacturing time should more than pay for it. DEC's designers have too much freedom today, almost akin to unrestricted use of Goto's in FORTRAN I.

2. Technology research. DEC should be doing active research in new technologies both for logic and for peripherals. DEC can no longer afford to borrow the technology of others.

FROM: GORDON BELL DATE: WED 17 OCT 1979 8:42 AM EST
DEPT: OOD

EXT: 223-2236
TO: JACK SHIELDS
    CARL JANZEN @CLEM
    ED KRAMER @CLEM
    JEAN CLAUDE PETERSCHMITT @CLEM
    TED JOHNSON @CLEM
cc: WIN HINDLE
    LARRY PORTNER
    SHEL DAVIS
    BRUCE RYAN @CLEM

SUBJECT: VISITING (OVERSEAS) OFFICES -- FOLLOW-UP 10/31

GB0005/9/EMS

Subject: **Visiting (Overseas) Offices, Plants, Engineering Facilities at the Right Time of Year: Are There Any Guidelines?**

Having just come back from a four day business trip (accompanied by Gwen) to Rio and Sao Paulo here are some observations and questions based on this and other trips:

Appreciated -

1. Book on economy of country (e.g. Brazil) as homework.
2. Japan in August (manager later fired) because itinerary well (jointly) planned and extremely intense and effective customer, office and vendors. Intense sightseeing on weekends. More accomplished than in the U.S.
3. Written background, briefing information (possibly this could be a voice on a cassettee - with no written copy). As a non-verbal communicator, I process written information much better, however. A collection of articles or references or internal memos would suffice.
4. DEC purchased flowers and fruit in hotel, could have been omitted.
5. Evening affairs with office, their family and/or customers.
6. Dinner at homes (and always reciprocate).
7. Wife-Wife diplomacy, but clearly well

outside of responsibility.

8. Mostly talk about computers, Digital, or general business including time when wives are present.

Am concerned about -

1. DEC employees at swimming pool with novels during working hours.
2. Planned sightseeing during working days.
3. Maynardians in an office for inspection/fact-finding when there's no formal review mechanism scheduled.
4. Maynardians or customer inspection tour with no pre-planned itinerary.
5. Whether we have too many Maynardians on the road.

In general, one should expect to accomplish more on a visit than at home, because of travelling overhead and the limited time we have on these trips, independent of whether travelling with members of ones' family.

GB:swh

WPS USERS - Enter HP mode and then type <CR>

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION

DATE: TUE 23 FEB 1982 11:28 AM EST

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION

DEPT: ENG STAFF

EXT: 223-2236

LOC/MAIL STOP: ML12-1/A51

SUBJECT: 2080 SLIP CAN'T MEAN NI AND PLUTO WILL SLIP!

Now that the 2080 has slipped a bit, there may be a tendency to want to slip the software and possibly slip Pluto. We can't do this.

The irony is that the 10/20 group spent so much time worrying about Pluto and backing it up, that they screwed up their own work. This is a classic DEC disease and that is especially prevalent in LSG Engineering.

The main point is, putting Ethernet on the 2080 cold turkey is
just plain idiocy anyway. We have a new machine, a new operating
system, and a new way of doing things with NI and CI. The right
way is to test the product on a 10 or 20 which has an NI on it!
We should have seen this and not accepted the plan based on simultaneous testing of all the unknowns.

By the next 2080 review, could you make sure that our Pluto and
NI integration plans are not slipped, but are based on using current hardware for testing?

I hope that we can deliver a Pluto to VAX at the same time in March, so we can begin the checkout of the NI distributed architecture there too.

Having given a presentation of the wonders of Ethernet with Xerox
and Intel last week, I'm really sold on our need for it.

We must have one operating in MR on a production basis by no later than July 1, and it must operate for testing when Pluto arrives there!

"TO" DISTRIBUTION:

JOE CARCHIDI	RON CRISS	ULF FAGERQUIST
JIM FRIEL	BOB GLORIOSO	PETER HURLEY
BERNIE LACROUTE	BILL MCBRIDE	JAMES G

MILLER
DAVE RODGERS JOHN ROSE

"CC" DISTRIBUTION:

ROSE ANN GIORDANO DICK HUSTVEDT ANDY
KNOWLES
BILL STRECKER

WPS USERS - Leave HP mode and type <CR>

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|   |   |   |   |   |   |   |
| d | i | g | i | t | a | l |   i n t e r o f f i c e   m e m o r a n d u m
|   |   |   |   |   |   |   |
+---------------------------+
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Subject: DECAIR'S Kamikazee Flights That Shouldn't Be Scheduled

To: Mary Jane Forbes, ML12-1/A51
Jeff Randall, HN

CC: Al Bertocchi, PK3-2/A56
Ed Finn, MS/B87
Ken Olsen, ML10-2/A50
Bob Puffer, ML12-2/E38

Date: 6/2/79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

Every now and then I have short lapses of sanity at which time I find myself in a situation, sometimes not totally of my own making, that is patently dumb. Several of these lapses revolve around flying on DECair. Namely, DECair should have never provided the service in the first place because it is not cost effective, and then given the situation, it ought to back out of the deal quickly.

Flying to Stratton Mountain is one of the places in the world that should be off limits to DECair. It takes slightly over 2 hours by car and when all the smoke has cleared, about 1.5 hours by plane if everything goes well. Unfortunately, the probability is low that one can get in to the Red Fox (Sly Fox) airport. When this happens, going to Springfield airport takes an added hour by car, or a Vermonter's 1/2 hour because the clocks only go half as fast in that part of the world. Thus, the actual time can go to easily twice as long as driving in the first place when all the waiting and messing around is considered...certainly the expected (in a probablistic sense) time is longer by air than by car. Thus, I submit you should under no circumstances offer the service.

Having been involved in just a few other trips of this kind and having been involved in the potential for several in which I was smart enough to not be involved, I would like to put some responsiblity in your hands to say no and to not offer such dumb sevices. Even though I may not be very bright as I get older, it seems to me there are people who are no brighter than I that end up in the same situation and we need your help.

GB:swh

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Mary Jane Forbes	ML12-1/A51	Jeff Randall	HN
Al Bertocchi	PK3-2/A56	Ed Finn	MS/B87
Ken Olsen	ML10-2/A50	Bob Puffer	ML12-2/E38

8 December 1984

Mr. Edson DeCastro, President
Data General Corporation
4400 Computer Drive
Westboro, Massachusetts 01580

Dear Ed:

I was glad you could come to dinner on Thursday and view the Museum first hand. I hope you like what we've done with Data General's generous funding and its equipment.

The physical realization has turned out to be much more exciting than our plans showed. The staff made a very large "stretch" to open a range of galleries. The reviews have been positive and it is easy to spend a half day in productive learning. Knowledgeable teenagers are spending their days at the Museum. The most flattering comment to date has been that it is the first American technology museum to be at European standards. Dr. Oliver Strimpel, who did the Museum's Image Gallery has just become the Associative Director and Curator. Oliver was formerly the Curator of the Mathematics Section of The Science Museum, London. The long collecting period and five year breadboard at Digital really paid off in collecting artifacts, building exhibits, doing lectures (ranging from Amdahl to Zuse) and gaining widescale support from computer people and companies.

I want to see this phase aimed at:

- putting a formal educational program in place,
- continued collecting of artifacts (whether letters, films, manuals or machines) in order to record the significant, information processing events, and
- getting broad public support from computer-knowledgeable people who want to learn more about the past and future history of computing.

Henry recently gave a thousand shares of Data General stock to the Capital Campaign, and I've given about 1/2 of my salaried earnings the last two years. I would like to convince you to become a major financial supporter now, and a board member within the next few years. The board is a four-year appointment.

Sincerely,

Gordon Bell

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+---------------------------+                                    ID#399
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|   |   |   |   |   |   |   |
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Subject: **DEC Standard Busses: Know Anymore?**

To: Sam Fuller, TW/A08
Bill Johnson, ML21-3/E87

CC: OOD

Date: 20 DEC 78
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

follow up 1/2/79

Please check, add, comment on:

Speed	Bus	Use	Conductors	Distance
110 ~ 3000	Communications Async	C-nT (LA36)	3 Stds.	L, B
300 ~ 1200	Communications Async	C-nT (LA120)	3 Stds.	L, B
9.6Kb	Communications DDCMP	C-nT's	TWP	L, B
19.2Kb	TU58 Async. Interface			
56Kb	DEC Dataway (IPG)	C-n(T or C)	Coax	B
56Kb	Communications DDCMP	C-n(T or C)	TWP	L, B
56Kb	?SDLC	IBM; C-nT		L, B
56Kb	?x25(HDLC)	Standard in Europe,ACS?		L, B
56Kb	?ADCCP	?		L, B
1Mb	DMC11 Pt-Pt. DDCMP	C-C		
1Mb	DMC11 multidrop DDCMP	C-nC		
1 ~ 3 Mb	?High speed, Comm.	nC	1-2 Coax	B
1 Mby	IEEE 488	C - (K or C)	16 ribbon	R
64Mb	Massbus	K-nK(Ms)	50 ribbon or TWP	C, R
1.5 or 3Mby	IBM Channel (MPX, Selection,Block MPX)	Pio-nK (DX20)	?TWP	R

25Mb	SDB-NDS - Ms.drive (pt.-pt.)	C-Ms	16 ribbon, C TWP
100Mb	ICCB for inter-C 50~200m transmission on Reliable Computer	nC	1 Coax
2Mby	8080 Bus B, M	intra-C (Pc,Mp,K)	
4Mby	8086 Multibus B, M	intra-C (nPc,Mp,K)	
16Mb	Qbus (up to 128kw) B, C	intra-C(Pc,Mp,K)	
?	Omnibus for PDP-8	intra-C(Pc,Mp,K)	
24Mb	Ubus B,C,R	intra-C(Pc,Mp,K)	56
6 x 8Mb	CMI (COMET)		
13.5 x 8Mb	SBI (780) B, C	intra-C(Pc,Mp,K)	
40 x 36Mb	Dolphin (10/20/VAX)	intra-C(Pc,Mp,K)	

L-Long distance via common carrier, B-intra building, R-intra-room, C-within a cabinet, B-on a backplane, M-on a module

GB:ljp

D I G I T A L   INTEROFFICE MEMORANDUM

DIST:

	Dick Clayton	ML12-2/E71	Jim Cudmore	ML1-5/E30
	Bill Demmer	TW/D19	Ulf Fagerquist	MR1-2/E78
	Sam Fuller	TW/A08	Bill Johnson	ML21-3/E87
	John Kevill	ML3-6/E94	John Meyer	ML12-1/A11
	Larry Portner	ML12-3/A62	Bob Puffer	ML12-2/E38

<subj>NATIONAL ACADEMY OF ENGINEERING
<from>LIEBOWITZ, HAROLD
<to>BELL, GORDON
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<to>BELL, GORDON
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<to>LONG, CARL F. DR.
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<from>ARMER, PAUL; TOMASH, ERWIN
<to>BELL, GORDON
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<to>BELL, GORDON
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<to>OLSEN, KENNETH H.
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<from>RANDELL, BRIAN
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<from>BIERMANN, ALAN W.
<to>BELL, GORDON

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<subj>NATIONAL SCIENCE FOUNDATION
<from>LEHMANN, JOHN R.
<to>BELL, GORDON
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<subj>MANAGEMENT STRATEGIES INCORPORATED
<from>CLARK, MAC
<to>BELL, GORDON
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<dispo/date>BILL JOHNSON - 1/2/80
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<subj>PURDUE UNIVERSITY
<from>DENNING, PETER J.
<to>BELL, GORDON
<date>79/12/19
<date rec>12/26/79
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<dispo/date>CIRC. - RICK PEEBLES, JIM BELL, ULF FAGERQUIST, DICK ECKHOUSE, + RETURN - 1/18/80
<message>COULD/SHOULD WE GET PETER HERE?
<answer>DICK ECKHOUSE WROTE A LETTER TO PETER - 9/5/80
<f/u>2/8/80
<filed>
<ret-gb>TOSSED - 9/10/80
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<subj>NAE
<from>PERKINS, COURTLAND D.
<to>BELL, GORDON (MEMBERS)
<date>79/12/17
<date rec>12/26/79
<log#>12-34

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<from>SPRINKLE, ROBERT M.
<to>BELL, GORDON
<date>79/12/18
<date rec>12/21/79
<log#>12-33
<dispo/date>JOHN MEYER - 1/2/80
<message>WILL YOU DECIDE ON THIS ONE? LET'S ONLY DO IT IF IT WILL HELP US IN A COUNTRY WHERE WE NEED SALES/SERVICE
<answer>
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<from>LENNON, UNA B.
<to>BELL, GORDON
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<subj>RENSSELAER POLYTECHNIC INSTITUTE
<from>LOW, GEORGE M.
<to>OLSEN, KENNETH H.
<date>79/12/10
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<subj>AMWAY CORPORATION
<from>SIEBERT, JOHN M.
<to>BELL, JIM
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<dispo/date>JIM BELL - 12/20/79
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<subj>COGIT SYSTEMS, INC.
<from>COPELAND, JACK
<to>BELL, GORDON
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<dispo/date>LU ABLE - 12/20/79
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<from>WESTON, DAVID
<to>PORTNER, LAWRENCE
<date>79/12/7
<date rec>12/17/79
<log#>12-28
<dispo/date>ORIGINAL TO F/U - 12/17/79 (CC:MARY PAYNE, JOEL SCHWARTZ, SI LYLE)
<message>DO WE WANT?
<answer>
<f/u>1/4/80
<filed>
<ret-gb>
<roll>
<>

<subj>INTERSIL INSIGHT
<from>PHELPS, MEL
<to>BELL, GORDON
<date>79/12/?
<date rec>12/17/79
<log#>12-27
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>RENSSELAER POLYTECHNIC INSTITUTE

<from>LOW, GEORGE M.
<to>BELL, GORDON
<date>79/12/?
<date rec>12/17/79
<log#>12-26
<dispo/date>JIM BELL - 12/18/79
<message>FYI
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>AT&T
<from>MCGILL, ARCHIE J.
<to>BELL, GORDON
<date>79/12/12
<date rec>12/17/79
<log#>12-25
<dispo/date>ALAN KOTOK - 12/18/79 (CC:ROGER CADY,JULUIS,PAT COURTIN)
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>DUKE UNIVERSITY
<from>BIERMANN, ALAN W.
<to>BELL, GORDON
<date>79/12/10
<date rec>12/17/79
<log#>12-24
<dispo/date>DICK ECKHOUSE - 12/18/79
<message>LET'S GET IT. PLEASE ANSWER. (CC:JIM BELL)
<answer>THIS IS GEORGE POONEN'S REQ. I'LL WORK IT WITH HIM AND GET BACK TO YOU. - 12/20/79

<f/u>12/28/79
<filed>
<ret-gb>
<roll>
<>

<subj>ROLLER REINFORCED PLASTICS, INC.
<from>MOSIER, JOHN A.
<to>BELL, GORDON
<date>79/12/11
<date rec>12/17/79
<log#>12-23
<dispo/date>DICK SCHNEIDER - 12/19/79
<message>FYI
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>MANAGEMENT STRATEGIES INCORPORATED
<from>CLARK, MAC
<to>BELL, GORDON
<date>79/12/12
<date rec>12/17/79
<log#>12-22
<dispo/date>BILL JOHNSON - 12/18/79
<message>YOURS.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>HARVARD UNIVERSITY
<from>BUCHANAN, JACK R.
<to>BELL, GORDON

<date>79/12/13
<date rec>12/17/79
<log#>12-21
<dispo/date>CIRC. OOD, STAN OLSEN, MARCIA KENAH - 1/7/80
<message>FYI
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>SRI INTERNATIONAL
<from>JAMES, KATHERINE
<to>BELL, GORDON
<date>79/12/11
<date rec>12/17/79
<log#>12-20
<dispo/date>JIM CUDMORE - 12/18/79
<message>I SAY NO UNLESS YOU WANT IT. MJ PLEASE ROUTE CALL TO JIM. WHY EDUCATE THEM TO EDUCATE OTHERS?
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>RESUME' - EXCEL PERSONNEL
<from>LEMONS, TOM
<to>BELL, GORDON
<date>79/11/28
<date rec>12/14/79
<log#>12-19
<dispo/date>ARMAND LA VALLE - 12/17/79
<message>LOOKS INTERESTING. (CC:DEMMER, HANSON)
<answer>
<f/u>
<filed>
<ret-gb>

<roll>
<>

<subj>SCIENCE MUSEUM (SOUTH KENSINGTON)
<from>STRIMPEL, OLIVER DR.
<to>BELL, GORDON
<date>79/11/5
<date rec>12/14/79
<log#>12-18
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>BOSTON UNIVERSITY
<from>O'DETTE, DEBORAH
<to>BELL, GORDON
<date>79/12/10
<date rec>12/14/79
<log#>12-17
<dispo/date>JOHN MEYER - 12/17/79
<message>YOURS. LET'S GO!
<answer>JANE GORING IS HANDLING THIS MATTER. YES. WE ARE GOING. IT'S BEING COORDINATED BY DIFFERENT GROUPS. - 1/9/80
<f/u>1/4/80
<filed>
<ret-gb>
<roll>
<>

<subj>ADDISON-WESLEY PUBLISHING COMPANY
<from>GRUENER, WILLIAM B.
<to>BELL, GORDON
<date>79/12/?
<date rec>12/14/79

<log#>12-16
<dispo/date>MARCIE KENAH - 12/17/79
<message>FYI
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>CAL TECH
<from>GOLDBERGER, MARVIN L.
<to>BELL, GORDON
<date>79/12/10
<date rec>12/13/79
<log#>12-15
<dispo/date>CIRCULATE - 12/18/79 (ECKHOUSE, CLAYTON, TEICHER, MUDGE, ZEH, CUDMORE, PATEL, ABEL, KUSIK
<message>FRANKLY, I'M IMPRESSED. I HOPE WE CONTINUE TO INTERACT + GET STUDENTS + SW. WHO'S GOING TO GO TO NEXT MEETING?
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>R.H. STURDY CO., INC.
<from>SERVETNICK, JOHN
<to>KNOWLES, ANDREW
<date>79/12/10
<date rec>12/12/79
<log#>12-14
<dispo/date>GRANT SAVIERS - 12/17/79
<message>YOURS.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>

<>

<subj>RAND
<from>WARE, WILLIS, H.
<to>OLSEN, KENNETH H.
<date>79/12/6
<date rec>12/12/79
<log#>12-13
<dispo/date>DEL LIPPERT - 12/17/79
<message>GOOD WORK. A REALLY GOOD RECOMMENDATION. YOU MIGHT WANT TO SOLICIT QUOTES. (CC:MARCIE, HEIDI, ANDY)
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>WANG INSTITUTE
<from>WANG, AN
<to>BELL, GORDON
<date>79/12/10
<date rec>12/12/79
<log#>12-12
<dispo/date>CIRCULATE - 12/20/79 (JIM BELL, ECKHOUSE, FULLER)
<message>
<answer>
<f/u>1/4/80
<filed>WANG - 1/7/80
<ret-gb>
<roll>
<>

<subj>THAYER SCHOOL OF ENGINEERING
<from>BOYLESTAD, ROBERT L.
<to>BELL, GORDON
<date>79/12/10
<date rec>12/12/79
<log#>12-11

<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>UNIVERSITY OF NEW SOUTH WALES--TWX
<from>VOWELS, REX
<to>BELL, GORDON
<date>79/12/12
<date rec>12/12/79
<log#>12-10
<dispo/date>TWX'D BACK VOWELS - 12/20/79
<message>SORRY I CAN'T HELP. THE EDUCATION PRODUCT LINE CAN NOT IMPROVE ON THEIR APRIL/MAY PROMISE. PLEASE CONTACT JERRY WITMORE, PRODUCT LINE MANAGER, OR STEVE SAMPSON WHO IS ATTENDING TO YOUR DELIVERY SITUATION. SORRY. MERRY CHRISTMAS.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>RESUME -- UNIVERSITY OF CAMBRIDGE COMPUTER LABORATORY
<from>DELLAR, CARL
<to>BELL, GORDON
<date>79/12/3
<date rec>12/11/79
<log#>12-9
<dispo/date>ARMAND LA VALLE - 12/12/79
<dispo/date>ARMAND LA VALLE - 1/7/80
<message>CAN WE GET HIM IN? ASK MAURICE WILKES. CC:JIM BELL,RODGERS,FULLER
<message>DID WE GO AFTER HIM??
<answer>

<f/u>1/4/80
<f/u>2/11/80
<filed>
<ret-gb>
<roll>
<>

<subj>UNIVERSITY OF NEW SOUTH WALES--TWX
<from>VOWELS, REX
<to>BELL, GORDON
<date>79/12/6
<date rec>12/6/79
<log#>12-8
<dispo/date>FORWARDED MESSAGES TO JERRY WITMORE,MR. SAMPSON - (GB0006/43/EMS) - 12/7
<message>REX IS A PERSONAL FRIEND OF MINE AND RON SMART'S. CAN YOU PLEASE HELP? WHAT DO YOU WANT ME TO SAY HERE?
<answer>
<f/u>12/14/79
<filed>AUSTRALIA
<ret-gb>
<roll>
<>

<subj>COGIT SYSTEMS INC.
<from>COPELAND, JACK
<to>BELL, GORDON
<date>79/?
<date rec>12/10/79
<log#>12-7
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>RESUME' - AKIRA OKAYA
<from>OKAYA, AKIRA
<to>BELL, GORDON
<date>79/12/4
<date rec>12/7/79
<log#>12-6
<dispo/date>ARMAND LA VALLE - 12/11/79
<message>ANY INTEREST? CC:JIM BELL,RODGERS,FULLER,WILLIAMS - LOOKS POSSIBLE. LET'S INTERVIEW HIM - CALL ARMAND IF INTERESTED TO SCHEDULE
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>CASE WESTERN RESERVE UNIVERSITY
<from>ROSE, CHARLES W.
<to>BELL, GORDON
<date>79/12/3
<date rec>12/6/79
<log#>12-5
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>BELL LABORATORIES
<from>VERMA, PRAMODE K.
<to>BELL, GORDON
<date>79/11/26
<date rec>12/4/79
<log#>12-4
<dispo/date>TO LETTERBOOK - (GB0006/41) - 12/7/79
<message>

<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>DR. DVORKOVITZ & ASSOCIATES
<from>DVORKOVITZ & ASSOCIATES, DR.
<to>BELL, GORDON
<date>79/11/27
<date rec>12/4/79
<log#>12-3
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>CORNELL UNIVERSITY
<from>BALLANTYNE, JOSEPH M.
<to>BELL, GORDON
<date>79/11/30
<date rec>12/4/79
<log#>12-2
<dispo/date>TO LETTERBOOK (GB0006/46) - 12/11/79
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>RESUME' - JEFFREY M. ARNOLD
<from>ARNOLD, JEFFREY M.
<to>BELL, GORDON
<date>79/11/28
<date rec>12/3/79

<log#>12-1
<dispo/date>ARMAND LA VALLE - 12/3/79
<message>ANY INTEREST? PLEASE HANDLE.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>AMERICAN SOFTWARE
<from>EDENFIELD, JAMES C.
<to>BELL, GORDON
<date>80/12/8
<date rec>12/30/80
<log#>12-48
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>RESUME' -- GEORGE T. CROFT
<from>CROFT, GEORGE T.
<to>BELL, GORDON
<date>80/12/24
<date rec>12/30/80
<log#>12-47
<dispo/date>JOHN MEYER, CC:DICK CLAYTON, SI - 1/6/81
<message>JOHN--LET'S BRING HIM IN. PLEASE CONTACT BY 1/12.
DICK/SI--WHAT ABOUT PRINTERS AREA? ADVANCED MFG.?
<answer>JOHN DIPIETRO HAS AND WILL CALL TOIGHT 1/8/81 Thu
13:26
<f/u>1/16
<filed>RESUME (A CC FROM ANDY K.)
<ret-gb>
<roll>
<>

<subj>NATIONAL ACADEMY OF ENGINEERING
<from>KING, RANDOLPH W.
<to>BELL, GORDON
<date>80/12/19
<date rec>12/29/80
<log#>12-46
<dispo/date>RANDOLPH KING - 1/5/81
<message>PLEASE USE MY REVISED COMMENTS. I HAVE TRIED NOT TO CHANGE INTNET OR ADD OR DELETE.
<answer>
<f/u>
<filed>
<ret-gb>COPY OF ENTIRE DOCUMENT RET. TO GB.
<roll>
<>

<subj>CARNEGIE-MELLON UNIVERSITY
<from>SIEWIOREK, DAN
<to>BELL, GORDON
<date>80/12/?
<date rec>12/29/80
<log#>12-45
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>AFIPS--ANNALS OF THE HISTORY OF COMPUTING
<from>GALLER, BERNARD A.
<to>BELL, GORDON
<date>80/12/19
<date rec>12/29/80
<log#>12-44
<dispo/date>TO LETTERBOOK (GB2.S1.20) - 1/19/81

<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>UNIVERSITY OF MANCHESTER
<from>EDWARDS, D.B.G.
<to>BELL, GORDON
<date>80/12/11
<date rec>12/29/80
<log#>12-43
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>INTERNATIONAL BIOGRAPHICAL CENTRE
<from>ELLWOOD, SHEILA
<to>BELL, GORDON
<date>80/12/?
<date rec>12/29/80
<log#>12-42
<dispo/date>NO SUBMISSION 1/5/81 Mon 11:02
<message>
<answer>
<f/u>
<filed>N
<ret-gb>
<roll>
<>

<subj>DREXEL UNIVERSITY

<from>GERBER, E.L.
<to>BELL, GORDON
<date>80/12/18
<date rec>12/24/80
<log#>12-41
<dispo/date>DICK ECKHOUSE, CC:JOEL SCHWARTZ, ANDY KNOWLES - 1/7/81
<message>PLS. CO-ORDINATE A RESPONSE! WE NEED TO MAKE DEALS LIKE THIS TO GET MORE UNIVERSITY SUPPORT OF LDP. CAN WE HELP THEM? IT'S LDP'S CHARTER I BELIEVE.
<answer>
<f/u>1/23/81
<filed>
<ret-gb>
<roll>
<>

<subj>NATIONAL ACADEMY OF ENGINEERING
<from>RODRIGUEZ, LADY
<to>MEMBERS
<date>80/12/18
<date rec>12/24/80
<log#>12-40
<dispo/date>
<message>
<answer>
<f/u>
<filed>NAE-AD HOC COMMITTEE ON MEMBERSHIP
<ret-gb>
<roll>
<>

<subj>TWX--PRICE INCREASE
<from>BERUBE, DICK
<to>BELL, GORDON
<date>80/12/23
<date rec>12/23/80
<log#>12-39
<dispo/date>
<message>

<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>NATIONAL ACADEMY OF ENGINEERING
<from>LIEBOWITZ, HAROLD
<to>BELL, GORDON
<date>80/12/12
<date rec>12/22/80
<log#>12-38
<dispo/date>
<message>
<answer>
<f/u>
<filed>NAE
<ret-gb>
<roll>
<>

<subj>ZUSE, KONRAD (PHOTOS FOR LECTURE)
<from>ZUSE, KONRAD
<to>BELL, GORDON
<date>80/12/4
<date rec>12/22/80
<log#>12-37
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>BOROVOY, ROGER S.
<from>BOROVOY, ROGER S.

<to>BELL, GORDON
<date>80/9/3
<date rec>12/19/80
<log#>12-36
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>RENSSELAER POLYTECHNIC INSTITUTE
<from>LOW, GEORGE M.
<to>OLSEN, KENNETH H.
<date>80/12/12
<date rec>12/18/80
<log#>12-35
<dispo/date>JOHN MEYER - 12/19/80
<message>LET'S SUBMIT SOMEONE.
<answer>
<f/u>1/5/81
<filed>
<ret-gb>
<roll>
<>

<subj>BOOZ-ALLEN & HAMILTON INC.
<from>HARRIS, JOHN M.
<to>BELL, GORDON
<date>80/12/12
<date rec>12/17/80
<log#>12-34
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>

<roll>
<>

<subj>STEELCASE INC.
<from>PEW, ROBERT C.
<to>BELL, GORDON
<date>80/12/10
<date rec>12/17/80
<log#>12-33
<dispo/date>
<message>
<answer>
<f/u>
<filed>ATANASOFF - 1/5/81
<ret-gb>
<roll>
<>

<subj>CHARLES BABBAGE INSTITUTE
<from>TOMASH, ERWIN & STUEWER, ROGER H.
<to>OLSEN, KENNETH H.
<date>80/12/4
<date rec>12/17/80
<log#>12-32
<dispo/date>KEN - 12/18/80
<message>THIS SHOULD BE GWEN BELL. YOU WANT HER TO ANSWER THIS LETTER OR WILL YOU?
<dispo/date>TO GWEN'S CORRESPONDENCE FILE (GB1.S15.39) - 12/22/80
<answer>
<f/u>12/19
<filed>
<ret-gb>
<roll>
<>

<subj>MEMOREX CORPORATION
<from>QUINN, THOMAS J.
<to>BELL, GORDON

<date>80/12/10
<date rec>12/16/80
<log#>12-31
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>SRI INTERNATIONAL
<from>PORTER, WILLIAM A.
<to>BELL, GORDON
<date>80/12/11
<date rec>12/15/80
<log#>12-30
<dispo/date>JIM CUDMORE - 12/16/80
<message>A GOOD STUDY TO AVOID?
<answer>YES - 12/19/80
<f/u>
<filed>SENT TO JERRY TODD (LET'S NOT BUY IT) 1/5/81
<ret-gb>12/19/80
<roll>
<>

<subj>NATIONAL ACADEMY OF ENGINEERING
<from>LIEBOWITZ, HAROLD
<to>MEMBERS
<date>80/12/9
<date rec>12/15/80
<log#>12-29
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>

<>

<subj>CARNEGIE-MELLON UNIVERSITY -- QUO VADIMUS REPORT
<from>TRAUB, J.F.
<to>BELL, GORDON
<date>80/6/?
<date rec>12/15/80
<log#>12-28
<dispo/date>CIRC. GLORIOSO, ECKHOUSE, FULLER, ULF - 1/5/81
<message>FYI
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>SCHLUMBERGER (JIPDEC REPORT)
<from>PENET, M.C.
<to>BELL, GORDON
<date>80/12/3
<date rec>12/15/80
<log#>12-27
<dispo/date>TO LETTERBOOK (GB1.S13.63) - 12/17/80
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>IBM
<from>HOLLISTER, C.C.
<to>BELL, GORDON
<date>80/12/10
<date rec>12/15/80
<log#>12-26
<dispo/date>

<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>UNIVERSITY OF ROORKEE --INDIA
<from>EKTARE, A.B.
<to>BELL, GORDON
<date>80/12/2
<date rec>12/15/80
<log#>12-25
<dispo/date>ANSWER CAN BE FOUND IN RL0.S9.4 - 1/9/81
<message>
<answer>
<f/u>
<filed>FILE #13 - 1/9/81
<ret-gb>
<roll>
<>

<subj>TWX--HILL SAMUEL GROUP
<from>LANGFORD, ALAN
<to>BELL, GORDON
<date>80/12/15
<date rec>12/15/80
<log#>12-24
<dispo/date>ORIGINAL TO GB, CC:OOD, RODGERS, HUSTVEDT, LAUCK, PLOWMAN, PEARSON, EBOD - 12/16/80
<message>FYI. I HOPE WE MAKE IT THIS GOOD.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>PRIME
<from>FEUSTEL, EDWARD ALVIN
<to>BELL, GORDON
<date>80/12/10
<date rec>12/12/80
<log#>12-23
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>POSITIONS INC.--RESUME' (HUSSEIN EL-GOHARY)
<from>MCDONOUGH, MARK
<to>BELL, GORDON
<date>80/12/?
<date rec>12/12/80
<log#>12-22
<dispo/date>JOHN MEYER, CC:RODGERS, PEARSON, DEMMER -
12/15/80
<message>INTERESTED? JOHN, PLEASE HANDLE.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>TWX--CT-JR PROJECT SCREENING
<from>KOBAYASHI, TOM
<to>BELL, GORDON
<date>80/12/12
<date rec>12/12/80
<log#>12-21
<dispo/date>
<message>
<answer>

<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>FRIEDRICH-ALEXANDER-UNIVERSITAT ERLANGEN-NURNBERG
<from>HANDLER, PROF. DR. W.
<to>BELL, GORDON
<date>80/11/24
<date rec>12/11/80
<log#>12-20
<dispo/date>TO LETTERBOOK (GB1.S13.59) - 12/12/80
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>APPLE COMPUTER INC.
<from>ROSING, WAYNE
<to>BELL, GORDON
<date>80/12/8
<date rec>12/11/80
<log#>12-19
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<to>BELL, GORDON
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<to>BELL, GORDON
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<from>LASKE, OTTO; ROADS, CURTIS
<to>BELL, GORDON
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<from>GERSTENFELD, ARTHUR
<to>KNOWLES, ANDREW C.
<date>80/11/19
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<dispo/date>TOM DUNDON - 12/11/80

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<from>BUZZELL, COLBY
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<from>ATANASOFF, JOHN & ALICE
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<from>KILLEN, MICHAEL
<to>BELL, GORDON
<date>80/12/2
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<from>LIEBOWITZ, HAROLD
<to>MEMBERS
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<from>PINTSOV, LEON & VADIM
<to>BELL, GORDON
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<from>STRUCK, DEBBIE
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<to>BELL, GORDON
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<log#>12-5
<dispo/date>HERB SHANZER, CC:BOB TRAVIS, PAUL BAUER - 12/9/80
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GB3.S14.9

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LEFT BOTTOM

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- LRP

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- BASIC PROD. STRAT. SUMMER 79
- STRAT. PRES. 2/79
- ORIGINALS

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BBN
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CONSULTANT, FUSFELD
CONSULTANT, BILL ROBERTS
CONSULTANT, METCALFE, BOB

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BRAZIL 10/79
OVERHEADS 10/31/79, 11/1/79, 10/28/79

****
* d i g i t a l *
****

TO: A. M. BERTOCCHI DATE: THU 3 JUL 1980 1:36 AM EDT
|AL BERTOCCI FROM: GORDON BELL
cc: OPERATIONS COMMITTEE: DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: PLEASE HELP ME EXPLAIN OUR DECISION AND DECSION MAKING TO ALAN

Al
d you look over this draft and help me explain to one of our 3 Senior Consulting Engineers (who's product designs have helped bring in something over a couple of a billion $) just what he should do on the teleconferencing?

Feel free to use any business talk (he has a fresh MBA), is a lot brighter than either of us, is mature (over 40), and has about 25 years of experience dealing with all forms of computers, telephony (he helped design the DEC phone system with ma bell), and understands video, etc.

I don't think he is going to be sweetalked into your business type sounds "included in the FY 81 Capital Budget - prioritized list _ for Corporate decsion-making on what to exclude".
He might want to know what the criteria are for priority, who has the list, who is the Corporate, when, where, etc.

Above all he might want to know why the hell you have sat on this for 6 months and spent more money studying the god damn thing than simply doing it?

I think we would all be happy with the simple answer I intend to give him, if we can't agree on the text of this draft it is:
No- go back and work on products, it's too much of a hassle and not workth trying to make any change of any kind in the domain of trying to save time? Furthermore, I'm going to suggest he minimize the interaction with you communications people whose job this is and who have spent more damn money and got us nothing.

In short with don't patronize, collude with or go near city hall. Get back in the back room and work with me.

ATTACHED: MEMO;239 MEMO;30
****
* d i g i t a l *
****

TO: ALAN KOTOK

DATE: WED 2 JUL 1980
FROM: GORDON BELL
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: TELECONFERENCING- I DOUBT IF A DECISION WILL BE MADE

Alan,
Al and we met with Larry finally when Al could do it.

Al sent a memo to me stating what he thought we agreed to,

which
was not the same as we thought we agreed to. In essence it was:
1. He supported the proposal
2. It has to be done as part of the Capital Budgeting as part of the FY 81 to be part of someting called the priotitized list as to what to include... as part of the corporate decision making.
3. We would be willing to reduce the Engineering budget over the next two years to directly fund it.

We thought it was only items 1 and 3. We propoposed 3 simply to show that it is possible to tradeoff expenses for capital when one has a good plan. His memo after the meeting was a blow which I will never recover from.

The offer was to reduce complexity and to show how one can trade-off expenses for capital in a simple way got shoved under the table.

Al, Win and Ken are running the company from building 10. All decisions about Space, Who gets what equipment, and what the capital equipment budget is are made there in what appears to be closed, unclear processes in a top-down arbitrary way. The fact that I thought I could approve a plan, or comit to a product plan based on an expense budget (where capital or computers or space is implied in the numbers) seems to be a farce, given that these other variables are controlled somewhere else in an arbitrary, capricious way. Somehow, I feel responsible for results (including getting us better facilities) and that there is no way to perform against these plans, is tying me in a

knot,
and I don't want to be a party to wasting any more time on this...
either yours or mine. Therefore the answer is:

We should not bother to engage in anything having to do with teleconferencing between ML and MK due to the problem of getting
any way to do the planning or approval of capital equipment. It
is a hell of a frustrating way to do anything. This, like computer equipment and space is another issue that I, nor my peers can not discuss in any kind of rational fashion, let alone
straighten out.. Furthermore, I can not even read a memo or listen to what is generally a content free discussion on any of
these subjects because it is such a waste of time and so frustrating.
Order processing is an example of another such process but we in engineering have been spared this. I have been been only mildly harassed as a bystander, but have had to listen to the vacuous arguments.

My reasons why it is not worthwhile persisting any longer are based on a whole set of things:
1. None of these 3 areas have any formal processes, objectives
or responsible persons assigned to them, nor is there anyway of judging one proposal against another.
2. If there is any need to cut the budget, I believe it will be
this 400K, even though we will pay for it in 1 or 2 years (a
hell of a lot highert than some of the squirrely projects or capital that it would compete with. The cut is obvious because it
is a clear, line item. I recall us spending 30 minutses cutting
the library budget back to a flat budget (requiring layoff) severl
years ago, while allowing several fat, incompetent groups to

grow
at a 20% rate, simply because "libraries can get out of control"...
despite my cries to the fact that our output in the library and
cost per unit output (books, information delivered) has been declining. At the same time we built a brand new library in a
building far away from here that spent more than the library budget.

The issue was that this part of a 20M$ expenditure where there
was no visibility as to the 50, 400K line items that formed it.

This year, I expect another 1 or 2 helicopters and airplanes to
be approved simply due to the linear growth way we do planning.
We've all liked these since our childhoods and will support getting
more due to the hassle we get into at airports and the fact that
we can't plan what to do if we have to drive or spend the time.
Never mind the fact that just this afternoon 10 people met
with Larry, BJ, and I this afternoon for 2 hours, with 2 hours
of driving to discuss the WPS Product development . (Here
we spent only about 10M, lost revenue of maybe 100M, and lost
some of the market share and customers that we need. All of the concerned parti
parties who fouled it up will suffer probably with only 10%
raises and only average stock options granted worth about 5
times what a very good, unique individual contributor will
get for developing a product that will bring in 1-2 billion
in revenue.

3. We have gotten so big in some sort of sick way that the old
Do the right thing rule is absolute bullshit in light of

mediocre
bureaucrats and people who only exist now to check on anyone who comes forward with a proposition. I think we will get to a situation soon where there won't be anyone coming forward. Cutler is extremely concern, and I have to go off and work with Jack Shields to find out why Jack requires 50 signatures before a product can be released to the field. Presumebly these 50 add something, but NONE are categorically capable, in some real sense of tcarrying Dave's listings. Here, I don't
want Dave to leave, so this fight is not optional. If the 50 would leave, I think I would personally sponsor the going away
party, it's clearly not company policy to allow any rewards like parties for jobs well done, except in the sales department.
(Maybe we could get milk from this sacred cow because teleconferencing obviously could be used to minimize these needs. ... but don't hold your breath.)

4. We have to also support not only the checkers in 3, but also
the studiers in tgroups like telecommunications who are asking
when we should build such a system. I have tried to tell Al that when he goes to play golf with all the other large corporate executives who play with the real golf players that he
could really one up em by telling them about our teleconferencing.
My guess is that we have spent more than 400K on studying teleconferencing in Al's department alone to get paper.

This would get him pioints and even a golf game, but he's worried
about how he's going to make this big 4ooK decision in light of
a 400M request... and I'm glad he's worried. I'd be petrified
given our state of decision making, ability to discuss, to have
any clear criteria, etc. Therefore, again, I can't blame Al,

he's OK, it's just that the company did him in. Therefore he has to say no to someone, and it had best be to you instead of the 21M$ board shop in Phoenix.

5. We have to spend money doing dumb things like sandblasting your conference rooms rather than putting insulation up which would save money because there was a rule someplace apparently
and the space people are afraid to change anything that is working becuase space has such high level concern about what it is. This has resulted in more expensive buildings becaue
no one wants to make a mistake here. At a recent meeting a number of us were present who had earned our golden plummer's helper and golden shovel awards (I only have the plummer award,
but an honorary golden crowbar award... for taking care of the
Mill for a few years and for making a bunch of changes including
the sandblasting which apparently no one can undo now, just as
I had a bitch of a time doing the first one) You get the shovel
if you put up a building. We all agreed that it was the worst
experience that we had. We get all the bad things: relatively
expensive buildings and questionable results. The capital budgeting favors open offices and I am now ready to wquestion this wisdom given the noise, etc. But it appears to be cheap and you can write the furniture off in a few years.
Again, notice that we budget (control) the input, not the results.

6. Our capital is really stetched because of inordinately high
inventories. This comes about for a few simple reasons including
the way (where) we build (a design problem in manufacturing and
engineering), forecast (strictly bottom up by clerks with no

concept of what people buy) , and flow (through every god damn
plant in the country and Far East) prodcucsts. This is a disaster of vast proportions.
There's conservatively about 150M in i
inventory carring charges and waste work in flowing products in this morass as a conservative estimate.

7. We can and do hire, creating expenses of vastly more than the 400K. A helicopter pilot creates a lifetime expense of something like several million doollars, vastly more than this experiment. There is no process to validate hiring requests
versus capital equipment which we can get rid of through depreciation. People are a much greater drain. The good ones
get trained, tired and turned off (and leave). The slow ones just say no or ask others to do things. (One of the joys of work to me now is the museum and its because we all do work including putting on lectures, building exhibits, archiving, writing papers, understanding)... however, when I interface to
a large group to get a piece of equipment, or information or make a slide or a poster or generally do anything it is so depressing because there are intermediaries who manage and generally only screw things up. Again no concept of quality and
output, only input. For the 100K we spend, we do more work than
just the cost of the interface people alone. Now I begin to understand all those books nd papers on big bureucries and groups. I don't think DEC is especially worse, it's even better
than most, it's just the size and so we might as well all go back to our desks and cancel something. (There are some bad people though, one of the "management" in MR thought he was entitled to some of the building's plants, so he took them because he had the right as a part of his status and power.)

Well, Alan I am not going to help you anymore on this one. You have to decide whether you want to keep pushing. I still feel that it is very important process, but I have no idea

what the so called prioritezed list - for Corporate desion -making on wh
what to exclude list is that Al told me about. Based on my past experience on space, buildings, getting computer equipment, getting EMS slots, ... etc. I can't begin to tell you when or how or where or who to talk with (Ken likes t make sure things like this are presold when the9 come before the Operations Committee, but make damn sure you do it carefully, because we all hate politics.) Buy I doubt if the Operations Committee will get involved in this one because it's only 400K, unless there's a good chance to say no and let us show the world what hard headed, tough minded, results oriented, down tto earth, futuristic (Ted just went to the Aspen Institute), solid (we eat lots of carbos) business men we are. If you want to bring it before us, I'll gladly stand behind you (especially if you have presold it), and if it looks like it can't go through, then I'll probably be a hell of a long way behind you.

As to bringing in a competent person. If they are a friend and has to work in the middle of this dreary bunch, I say no because I think you should valuable your friendship more. If the person can work in anothe group where he can really feel good and get something accomplished, then why not get them there? On the other handthere are days I worry about getting things done i
too.   Which reminds me: I think it is time we got to work on the array processor in earnest. .. assuming we can somehow get the machine to use for this.

Let's really concentrate on projects that will produce results... my tendency is to forget the whole damn thing.

Let's get together and figure out the possibilities, there's never been a better time to do engineering.

ATTACHED: MEMO;30

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* d i g i t a l *
****

TO: GORDON BELL
5:30 PM EDT

cc: ARTHUR DEAN
SAM FULLER

DATE: WED 2 JUL 1980

FROM: ALAN KOTOK
DEPT: OOT
EXT: 223-7381
LOC/MAIL STOP: ML3-5/H33

SUBJECT: VIDEO CONFERENCING DECISION

I have not heard whether you, Larry and Al Bertocci discussed the proposed system, and whether or not we have a go-ahead. This thing has dragged on so long, that my patience is almost expired. I now gather that the thing is somewhere in some budgeting cycle, looking for money. If it was worth doing last year, it ought to be worth doing this year.

Although I realize we cannot make decisions based on hiring a particular person, I really believe we have a first rate guy lined up to do this project, who can only be hired if we have a project. He presently has an outstanding offer from another firm, and can only wait until Tuesday.

It seems as if nobody can make any decisions in this company anymore. Is that the price of giant size? It may be too big a price to pay.

GB1.S5.42

****
* d i g i t a l *
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TO: see "TO" DISTRIBUTION
10:08 PM EDT

cc: SAM FULLER

DATE: SUN 31 AUG 1980

FROM: GORDON BELL
DEPT: OOD

LARRY PORTNER EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: DECMAIL SCHEDULE SANITY CHECK USING EMS AND WPS PROGRAMS

I was impressed with the aggressive schedule that the DECmail folks talked about last week. It seems like we've had many other schedules before and others might have trouble believing us. Why don't we test whether the schedule is reasonable by looking at how we've performed on EMS, whose listing I am sending to you and on our other WPS programs? Also, I've asked Bruce to gather data on productivity on WPS. This shouldn't take more than an hour to get a back-of-the-envelope estimate.

I'd like each of you to estimate the time to get DECmail, which we have promised, and is to be roughly EMS, but with a better interface and a better file system. However, it should answer, and be verified against past performance. Also, I would be skeptical if it violated the Brooks hypothesis about programmer productivity (a neat article in March Datamation computes the output for various sized groups). In our case, I think we ought to include as part of the team: writers, program managers, product managers, and architects because they take time for interaction too. For example, I spent a day with several of the non-programmer group, but I'm not sure whether this decreased productivity or increased it cause the 2 or 3 designers didn't have anyone to talk with that day. What is your assumption about the output of the group? How many lines/day/group can be written?

So, given we have an EMS, in MUMPS, let's make assumption about productivity in the given language (now it might be PL/1 cause it's only for VMS), also considering differences in what it takes to get the file system and the screen manager, and assuming the editor is already there. How many Mumps lines per line of the language of choice? What are the times you assume about when we can start writing the programs that don't exist now? What are the other delay times for test, etc. that get added into the Pert chart?

I'll coordinate the collection of envelopes as you get the listing. Bob or Bruce should send us an organization chart and since Tom is the acting product manager, he can send us a list of the open issues (which we can estimate the time to resolve). The only ones I know that are pending are: the file system and how messages are mapped to files, how communciations protocols to other systems are handled, distributing directories, user interface, terminals supported (I asked them to reconsider because there were only 2: 9600 baud dumb terminals and everything else which was considered like a Teletype... I didn't like being in this category), the commands, etc. DECmail is part of the undefined OFIS program and I assume it relies heavily on CATS, which is incomprehensable to everyone by Rich Kalin and Product Managers. The editor is pinned down though and

that's
the part that programmers always complain about, and since every
part of the design is table driven, the semantics of the operations are nearly defined, it is simply up to some hypothetical user to figure out how to map screen images to commands. Bob and Tom, could you send this data around so we can
get our estimates started?

"TO" DISTRIBUTION:

BOB DALEY	BILL JOHNSON	BILL KEATING
GLENN REYER	BRUCE STEWART	TOM VLACH

GB1.S6.47

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!___!___!___!___!___!___!___!
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TO: see "TO" DISTRIBUTION   DATE: MON 3 JAN 1983 3:11 PM EST

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION   DEPT: ENG STAFF

EXT: 223-2236

LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5186755549

SUBJECT: WHY BOTHER WITH DECMAIL?

GB4.S1.10

DECmail is not preferred by the field organization for various reasons:

1. All-in-one requires support and brings in revenue

2. DECmail is written in Mumps (whatever that means)

3. DECmail is a large system requiring central support and sold to
central people. Our forte is distributed systems for departments

4. All-in-One is adequate, given the state of the user base (where
Digital was four years ago).

I think we should formally (or quietly) withdraw DECmail and go for it with only All-in-One in an evolutionary fashion. We'll evolve All-in-One to do all the functions and to operate both in a central and a distributed environment.

Why have the extra development experience and the field support if it's not going to be sold? Could we have a formal proposal?

"TO" DISTRIBUTION:

HENRY ANCONA BOB DOCKSER JULIUS MARCUS

"CC" DISTRIBUTION:

WIN HINDLE KEN OLSEN JACK SHIELDS
JACK SMITH

WPS USERS - Leave HP mode and type <CR>

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* d i g i t a l *
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TO: BOB MCKENZIE AND STEWART DATE: WED 1 OCT 1980
5:29 PM EDT
BRUCE STEWART FROM: GORDON BELL
cc: BILL JOHNSON DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: DECMAIL: AM ANXIOUS TO SEE GOALS, CONSTRAINTS AND
PLAN

We have not cancelled DECmail. As you may now, I am
concerned
about our ability to produce a product here. The external
views seem reasonable, although there are lots of rough
parts,
indicating a poor knowledge of EMS as we know it today.

Mostly, I'm worried about what the structure looks like
internally (architecture) such that there is any credibility
that this product can be built in anything resembling a
reasonable
time and with any flexibility to be extended to all the other
functions that this facility will ultimately require.

I support our taking EMS/VMS to market in a controlled
fashion
in order to get reactions from other organizations with other
types of users. Also, I want to take the pressure off this
project until we have some better understanding of it.

I understand we are to review DECmail goals and constraints
within the next week and then review the plan within two
weeks.
I await this, in hopes of getting some better understanding
of
how to better proceed about how to best fill this important
product area.

If there are any concerns you have about my concerns (eg. interface, architecture, product structure, or sheer proof of being able to produce the product in a timely fashion with a given set of resources) please ask for clarification.

GB1.S7.24

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TO: BARRY CIOFFI
PETER V. K. PARSONS
cc: OPERATIONS COMMITTEE:

DATE: TUE 25 MAY 1982 4:08 PM EDT
FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: RE: DECMATE I & II VS. THE WANGWRITER

WANG IS STILL KILLING US

Although we all agree about Wangwriters and DECmates, note the paradox:

1. DEC completely dominates Wang in distributed processing.
2. DECmate completely dominates Wangwriter!
3. DEC is losing in Word Processing.
4. Wang is winning with good, shared word processing. (Because Wang also has distributed processing.)

LET'S STOP WANG!

The key is to use our full set of strengths (in a large organization):

1. DECmate for lowest per terminal cost.

2. For shared, word and distributed processing user: 11/23... 11/70.
3. If you want heavier duty word processing use DECmates for terminals.
4. For real, open ended heavy duty work, mail, data and distributed processing use VAX's and DECmates.

DECmate also has a very good and fast BASIC that some users would like.

VT125 emulation would give a capability such that virtually few, rational buyers of the VT100 or VT125 would buy DECmate II's instead.

I don't understand why we can't offer and push DECmate as an alternate terminal across all P/L's?

Above all, we've got to market OFIS products.

GB3.S5.51

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I don't understand why we can't offer and push DECmate as an alternate terminal across all P/L's?

Above all, we've got to market OFIS products.

GB0002/58

| d | i | g | i | t | a | l | i n t e r o f f i c e m e m o r a n d u m

Subject: **DECNET**

To: Dick Loveland, ML12-2/E71

CC: Dick Clayton, ML12-2/E71
Stan Pearson, ML12-2/E71
George Plowman, ML5-5/E97
Chuck Stein, ML5-5/E97

Date: 5/10/79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

I enjoyed reading the articles you wrote on DECnet. Keep it up and encourage others too.

GB:swh

D I G I T A L   INTEROFFICE MEMORANDUM

DIST:
Dick Clayton ML12-2/E71 Dick Loveland ML12-2/E71
Stan Pearson ML12-2/E71 George Plowman ML5-5/E97
Chuck Stein ML5-5/E97
00 BURT DECGRAM ACCEPTED S 35163 O 521 09-APR-81 22:40:02

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION

DATE: THU 9 APR 1981 22:33 EST

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION

DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: DECSET: A VERY NICE BASE... BUT A TIME TO FOCUS

The designers and developers are to be congratulated for a really fine, general purpose language and data base for storing and processing text. Also, the text processing editor looks very fine. I was especially impressed with the incredible productivity in terms of program size. It should be the base for us and our customers to build some really useful typesetting systems.

The review did raise some concerns:
1. Presentation/architecture- I felt a need for better understanding
the structure and function. This didn't come out of the presentation
or the brochure or any of the previous documents I've read. A model
based on layered machines seems best for showing languages... which
this is. The model should identify the parts, how they connect
(database, process, mailboxes), and which ones are variable as program
or tables. I really think I could understand this, given the right
documentation.

2. Product Cost looks way out of line for what is basically a word
processing editor, albeit a nice (hopefully great) one. As a more
"Wang style" editor, I doubt if it outperforms a Wang, and at 10K
terminal cost plus 1/16 of a $256K VAX giving a cost per terminal of
$25K, it feels high. This is why you have to stay out of the word
processing market ... where they know what's going on. Also, many of
the nice features such as spelling and grammar checking needed there
are in WP's and in VAX, but inaccessible to DECset.

3. Systemness/completeness, whatever be the market. Since I don't
understand or relate to the typographer market, I won't comment except
to say, poor devils. As a typesetting system for the office, it looks
like a long time. For direct authors, as yours told you, it had
potential. This means: indexing, table of contents, control

of pages,
figures, word processing conversion BOTH ways (not just getting a
wps file into a VAX file), spelling and grammar, proof reading at all
stages etc. (Note Bob Ulichney has any font at any scale you need to
do dot matrix printing.) I believe this is the requirements for simple
office tasks like brochures, manuals and books.

4. Compatiblity with WPS. This may not be needed in the Typographer
market. I trust they don't know any better, nor do they care. They
have typesetters, unions and a vested interest in preserving the
status quo. These are the people who have helped stretch our
production cycles for printing to the absurd.

5. Overhead- I heard that there were 18 programmers who did the work.
The amount of people inputting to them and which their product has to
support was frightening. It was amazing that they built anything.
It's clear that the incredible input did produce an incredibly general
product that is potentially good for any typesetting task. The
question is: Can anyone define any market segment, or any class of
users and then set about using it? Which leads to---

6. Market segmentation for finally defining the product, targetting
the customers, selling them, and supporting them. Here, it feels like
there are several classes of users (and customers):
. in house publishers, who are staffed by typographers and whose
standards are linotype machines. Any electronics or

editing is
great to them. This is basically our traditional high cost, high
support, lots of training, highly specialized market that is
Graphics Arts. (Bedford, Northboro folks within DEC)

. OEMs who can take the product and install it in various
organizations say smaller than Moody's to handle the plethora of
applications. This would be a way of getting at the volume.

. the modern office where users have word processors and who want
quality typesetting of all kinds of documents. The trick here is
to identify the classes of documents to be handled and then to go
like hell in a methodical way to get them done. (Would be run as
a layered product on VAX and used by authors at our software
facilities within DEC... and this isn't possible!)

Frankly, I don't think it is a product for the modern office, or if it
is, it should be integrated with the office products strategy. If we
mix the users/markets, it will result in getting nothing!

Recommendation:

0. Focus and stop muddling. Make it profitable.

1. Market the product to the Traaditional Graphics Arts business we
know and love. It's a tiny market, but we can dominate it and command
high prices! Above all, be profitable. Given that we've built such a
good product base, then let's get the reward (profit) that should come
from the work.

2. Have a Product Manager within the Office Program define the
requirements for the typesetting part of the Office. UNDER NO
CIRCUMSTANCES SHOULD THIS PRODUCT DEFINITION BE PART OF THE EXISTING
GRAPHICS ARTS PRODUCT LINE.

3. Investigate DECset, Scribe, and other typesetting systems for
possible use in this market. If feasible on DECset then set about the
enhancement of DECset if necessary, along with the programming of
DECset, to accomplish this task. Then sell it through all possible
DEC channels as part of our office offering in a layerec, high volume
fashion.

4. Actively sell and support other externally developed typesetting
systems that run on our hardware and systems. Our VAX and office
users do need something, and 3 looks like a couple of years away.
This is what EDU is doing, and I hope the Engineering P/L
will do. Inside engineering, we should consider field testing
their products.

5. Focus and sell. Stop trying to do it all.

Again, Congratulations on building a fine language and database
on which some very nice typesetting systems can be built.

"TO" DISTRIBUTION:

BOB MITCHELL DALEY AND MITCHELL BOB DALEY
J.W. FORD

"CC" DISTRIBUTION:

DAVE FERNALD TED JOHNSON BILL
JOHNSON
JULIUS MARCUS GLENN REYER DICK
RISLOVE
BRUCE STEWART DICK STRAUSS

GB2.S5.62
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* d i g i t a l *
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TO: see "TO" DISTRIBUTION DATE: SUN 9 MAY 1982
1:49 PM EDT
FROM: GORDON BELL
cc: see "CC" DISTRIBUTION DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: DECSIM: MAKE VS BUY AND SELLING IT

DOD is going out for bid of a hierarchical simulator covering
logic to machine description ala ISPS. It would seem we
might
have the answer already in DECSIM. At least we ought to get
the
requirements and look at the feasibility if it isn't too
late.
Whether we want to or should bid on this is a question.

I'm certainly all torn up on the issue as a question of make
versus buy. I visited TEGAS and they are selling and
supporting
VAX's like crazy. They are extending TEGAS to be
hierarchical
and we ought to look at this as an alternative to doing our
own,
as I can't see how we can afford to be in this business.
They

are also building a hardware TEGAS that runs at Cray 1 speed. (It's very much like the issue of PWB layout.)

DECSIM's specs are most impressive and we are making progress against the specs. However, having our own, means a continuing investment of several million dollars a year to maintain and enhance, and we could clearly make a lot of money with a great product. How much would we be cutting our throat by competing with our software suppliers? and by providing a state of the art simulator to competitors or potential competitors (eg. Sony)?
Note, TEGAS is widely available in Japan at every site and as it gets better, the question of our lead is mute.

I'd sure like to get a look at this after we find out about the DOD contract and after we've got a better assessment of where TEGAS and others are and are headed.

After we know the state of the art and its direction, then shouldn't we address the long term?
What you folks think?

"TO" DISTRIBUTION:

ARNY GOLDFEIN	PETER SMITH	HARVEY WEISS

"CC" DISTRIBUTION:

BOB KUSIK	DON MCINNIS	PEG:
ROY REZAC	JACK SMITH	

GB3.S5.27

Digital **Interoffice Memo**

Subject: **DECUS and Low Cost Program Distribution Media**

To: Bob Glorioso Date: 29 SEP 76
From: Gordon

Bell
CC: OOD Dept: OOD
Marketing Committee Loc.: ML12-1
Ext.: 2236
Jack Brown
Eli Glazer F/U 10/6
Ted Johnson
Oleh Kostetsky
Ken Olsen
Bob Peyton
Steve Teicher
Ed Wright

I agree. Program generation and distribution is the key to our future. It's especially frightening since TI and HP are providing a way for their users to write programs and get payment (royalty)...the basis of encouraging use and programs. We must revamp DECUS beyond the social club it is so that the users are encouraged to submit high quality programs and fix the bugs. We'll take a cut for the catalog and possibly QC.

Unfortunately, now that DECUS is in the sales budget, the only behavior will be to ask for more % of NOR...not make it a business or really have a goal direction. This will be a further drain, and push status quo.

Could someone make a proposal here to get DECUS to be something other than a big blast and boon-doggle?

Bob Peyton, Oleh, what are the alternatives for low cost distribution media and devices?

GB:ljp

+--------------------------+ ID#333

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Subject: **DECUS Attendance/Participation**

To: OOD

CC: Ed Kramer, MR2-2/A67
Bill Picott, MR2-3/E55

Date: 6 NOV 78
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

follow up 11/9/78

The Marketing Committee is trying to get the number of attendees down by a factor of two.

I would like to review each of your lists briefly at OOD on Thursday. Please make a note beside each attendee as to the number of papers, number of panels, number of panels leading, and number of sessions that each person is planning to attend.

Unless a person is presenting a paper or chairing a panel, I'd like to suggest they not attend.

Please bring, in a memo by each person and/or their boss, their purpose of attending if they do not satisfy the presentation criteria.

GB:ljp

D I G I T A L   INTEROFFICE MEMORANDUM

DIST:

Dick Clayton	ML12-2/E71	Jim Cudmore	ML1-5/E30
Bill Demmer	TW/D19	Ulf Fagerquist	MR1-2/E78
Bill Johnson	ML21-3/E87	John Kevill	ML1-3/E58
John Meyer	ML12-1/A11	Larry Portner	ML12-3/A62
Bob Puffer	ML12-2/E38		
Ed Kramer	MR2-2/A67	Bill Picott	MR2-3/E55

ID#390

| d | i | g | i | t | a | l | i n t e r o f f i c e   m e m o r a n d u m

Subject: **DECUS Attendance Quotas and Control**

To: Ed Kramer, MR2-2/A67
Bill Picott, MR2-3/E55

CC: OOD, Marketing Committee

Date: 11 DEC 78
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

We need attendance guidelines set now while we still have time before papers are due at spring DECUS in New Orleans. I've tentatively set attendance within engineering at no more than Fall DECUS in San Francisco. Can you get me a list of who finally went?

Our guidelines:

1. Presenting a paper.
2. On at least two panels.

Can I suggest you have a form which has some sort of signatory authority (VP-level in engineering) which has:

1. Talks (titles)
2. Panels (titles)
3. Hospitality suite (hrs.)
4. Planned customer conferences (list)
5. Equipment booth duty (hrs)
6. Other
7. Customer visits enroute

Overall, I hope we can have continuing DECUS participation at at least the current level. Even though it's expensive, it gives:

1. the needed customer interaction;
2. incentive to finish and describe products;
3. exposure/composure for presentation;
4. feedback on current products.

I was proud to be part of engineering, having seen and heard professional presentations and talk with customers. I hope more of our managers go.

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

TO:	Ed Kramer	MR2-2/A67	Bill Picott	MR2-3/E55
CC:	Dick Clayton	ML12-2/E71	Jim Cudmore	ML1-5/E30
	Bill Demmer	TW/D19	Ulf Fagerquist	MR1-2/E78
	Win Hindle	ML10-2/A53	Bill Johnson	ML21-3/E87
	Ted Johnson	PK3-2/A55	John Kevill	ML3-6/E94
	Andy Knowles	ML10-2/A52	John Meyer	ML12-1/A11
	Stan Olsen	MK1-2/A57	Larry Portner	ML12-3/A62
	Bob Puffer	ML12-2/E38	Bill Thompson	ML12-1/F41

April 9, 1979

John Edwards
Chariman, DECUS Australia
La Trobe University
Bundoora, Victoria
Australia 3083

Dear John:

Thanks for the kind offer to attend the 1979 DECUS Australia Symposium in New Zealand. As you may know I spent last August visiting customers in Australia, Japan, and within the United States. The unfortunate effect of this was that it created an impetus to make some changes in our basic engineering direction. As a result, I am committed to make these changes and find that I have virtually no time right now, and doubt if the situation will change for the next year.

As you point out, there is a large concentration of VAX users, and it would certainly be good to meet with them. I would like to. However, in the interest of providing better computing to you in the future, I must decline.

The point of interest on human engineering is an important one, and it will be possible for us to provide a speaker. I am asking Dick Clayton, Vice President for our Terminals and Small Systems Engineering, to look into providing such a speaker and presentation in the event that you want to go ahead.

I will also be presumptuous and recommend someone who could attend the Symposium in my place. You should have this name within a few weeks.

Sorry I can't come to New Zealand, but offer it to me another time.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:swh
GB0002/8

CC: Dick Clayton
Bill Picott

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SUBJ: DECUS

TO: Peter Hurley, MR1-2/E37   Date: 1/15/80 Tue
From: Gordon Bell
Dept: OOD
MS: ML12-1/A51   Ext: 223-2236
EMS: @CORE
Follow Up: 1/25/80

Enjoyed the DECUS data. Shouldn't we build heteronets among 10, 20, and VAX versus 20 homonets?

GB:swh

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+---------------------------+                        GB0001/44
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Subject: **Meeting With DECUS Library Group**

To: Peter Conklin, TW/A08   Date: 3/13/79
Chuck Conley, MR2-3/E55   From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

CC: Bill Picott, OOD

Thanks for the discussion with the DECUS Library Board. It seems like we covered the following:

1. Technology isn't going to help that much for now. Video tape and disks should be watched and we'll know a lot more here in the next year. Both these approaches are interesting because they would allow complete libraries to be distributed with documentation, cheaply.

2. Semiconductor memories aren't appropriate now for the job, because they are aimed at small sizes and rarely is this what we have.

3. The group rebels at working the economic issue. This is at variance with my beliefs. I'd like to see the thing operate at break even and with much subcontracting to internal groups for program distribution, library maintenance.

4. One of the most likely technologies is DECnet links and communications line query. Here, a user would query catalogs and have tapes etc. sent out on a demand basis. If a user had a DECnet link then it could be sent out, using a single dial out WATS line at the library to the appropriate, prearranged number.

In this later regard, we should try an experiment and the board suggested that one of the most likely groups to benefit would be DEC Engineering. Therefore, I'd like to see how we could do this on one of the VAX systems because the interest is so high and because various M,S, IAS, and D users are interested in the upgraded possibilities. Peter Conklin discussed this too, apparently, so I'd like to ask: What is the cost to set it up? (We might also look at it for the 10/20.) It seems to me that if the library has any knowledge of real costs, then DECnet is the only way to do it.

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST: Peter Conklin TW/A08 Chuck Conley MR2-3/E55

Bill Picott MR2-3/E55

Dick Clayton ML12-2/E71 Jim Cudmore ML1-5/E30

Bill Demmer TW/D19 Ulf Fagerquist MR1-2/E78

Bill Johnson ML3-5/H33 John Kevill ML3-6/E94

John Meyer ML12-1/A11 Larry Portner ML12-3/A62

Bob Puffer ML12-2/E38

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TO: EMC:

cc: DAVE CUTLER
KEN OLSEN

DATE: MON 6 JUN 1983 1:57 PM DST
FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5202114950

SUBJECT: ARE ANY DECWEST IDEAS APPLICABLE HERE? SOMEWHERE ELSE? GB5.57

Visiting DECwest and talking with Dave, on their organization of 24:

Dave-(writing microcode, worked on O/S, etc., manages group)

Secretary for the group

Bob Friedman- facilities, procurement, also for California,

Reid Brown + Ron Parson in ZK for Product Management

Roger Heinen + 5 programmers for the O/S and SEApascal

3 technical writers for hardware and software (2 for hardware)

all of which have a Xerox STAR for manual production

Larry Coppenrath-interface with manufacturing and service

Peter Schnorr-head of the hardware design and designer

Bob Short and Bruce Butz, engineers

Ken Abramson-simulation and microverify, on board diagnostics

Diagnostics person (hardware and software)

1 technician, 1 technician from Burlington for checkout

1 representative from CSSE

1 Mfg. person

They get help from personnel with what amounts to about 1/4 time, and they're getting their boards layed out in Colorado Springs. Also, Burlington Manufacturing is taking on much responsibility.

SOME OBSERVATIONS:

0. All the effort is directed to their products. Both of which look great! The group size doesn't require meetings and travel for resolution. There are almost no surrogates and "process/staff" folks.

1. Only 5 people, two of which are non-engineering, don't work on the product... for a staggering 79% efficiency! Note, that in a hierarchy with a span of control, s, and number of layers, l, where only the bottom layer works, the loss due to management overhead is

roughly 1/s! The main loss of direct, product output is through the large number of "process" workers: CAD, testing, publishing, etc. versus direct product workers. Within DEC, as one of the overhead, I estimate we lose at least 25% in "management" overhead, that is, only 1/4 have to work because they aren't managing. I'd also estimate we have only 10-20% directly working on products. (This would mean about 600-1200 for all of engineering, of which 19 are in Seattle.)

2. By taking on more responsibility as individuals, and by buying out Process tools, and a chip they're able to DOUBLE what amounts to productivity by NOT having a CAD group! For example, the CAD groups for Venus, Nautilus and Scorpio are at least as large as the group doing the work on the product, immediately halving the group output. (Presumably this is corrected for by inordinately higher productivity of the designers.) I should point out, however, that the Nautilus CAD group of 70, is doing a trivial amount of work compared with the Trilogy CAD group. Also, Nautilus appears to have 2-3 times the designers that Trilogy has for a machine that has about 1/10 the number of gates. (I also think Nautilus is one of our best projects.) We also ought to buy out more of our CAD tools now that startup companies are doing so much in this area!

3. By using STAR workstations to do publishing, the whole manual editing and publishing group is unnecessary. This may give a factor of 3 improvement. The writers always see the page layouts, do all the work, eliminating the publisher (where 1/2 the people are) and this interface time (negotiation, surrogates for both sides).

4. Diagnostics are done mostly by the design team. Here again, there's a large number of people who are often not accounted for in

the project costs, but cost at least as much as the design.

5. Special VLSI is being bought out, reducing the number required, and the associated management requirements.

6. By living small across the board, an extra management layer is eliminated, thus cutting out a whole set of meetings where turf is described, discussed and divied.

7. Note there's only one secretary. We managers require many secretaries to sustain the paper blizzard.

8. There are no draftspersons. This is a major breakthrough, and the way I remember doing engineering, because the documents are the only things that engineers produce.

9. The team had a product and used vision and built it. (We're spending many times that of DECwest on VT chips, and there's only a fuzzy future product vision, and no way to attain it. The effort to produce the UNA at 1/2 the performance twice the cost and 2 years after it had been done outside is legend; and probably the biggest single reason that Ethernet won't come into significant use.)

10. Cray's laboratory has always been about 30 people for supers. In going on to Colorado, I was similarly impressed, and would be curious to see a comparison.

The revelation was that we ought to look at the whole notion of quality and individual responsibility in a different light so that as Dave says- we must drastically raise our expectations as to what can be accomplished by an individual... because they can. In doing this, the quality of the product would get very, very high (never mind the fact that engineering could produce 5 x what it does today). We probably should be trying 5 x as many ideas as we do now, some of which might fail because they're too daring. Those settlers in the west seem to have only one care- getting a product; not their careers, training, processes, tools, interfaces, etc. which we spend our lives worrying about here in New England.

I doubt that we can change the bureaucracy we've created, but I think it's imperative that we try and create at least one more group of the same size and quality because we need more high quality products so that the empire (and the mediocre products) can be sustained.

Any candidates for another remote group?

WPS USERS - Leave HP mode and type <CR>

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* d i g i t a l *

****

TO: DAVE CUTLER
DATE: WED 27 MAY 1981
22:42 EST

FROM: GORDON BELL

cc: BILL HEFFNER
DEPT: ENG STAFF

BILL JOHNSON
EXT: 223-2236

LARRY PORTNER
LOC/MAIL STOP: ML12-1/A51

SUBJECT: RE: PEOPLE FOR DEC-WEST

May be haggling over details. Key is who is going and what their interface and credibilities are with the existing group.

Am delighted about the commitment to growing the group out there, versus only the pressure to take people in the long run who may want to move. Felt that in the initial blast, there should (must) be one person from the area just to start to tie the group there, versus having the people who tie the group here.

You, Roger and Kawell represent an incredibly powerful team. Want to get the new growth started there too.

What is the way to get the connection with that community too when you first move out? One person could be highly useful and very symbollic to the community, especially the computer science group at Washington and Boeing who we know.

GB2.S6.52

GB2.S8.4

NAME	ATTENDING	REPLACEMENT
BUZZ BROOKS	NO	TED WEBBER - SYS. MANAGER
DON BUSIEK	NO	STEVEN PAINTER
DAVE FERNALD	NO	NO
MIKE GUTMAN	YES LAST I HEARD	
DOM LACAVA	SPOKE TO YOU MJ?	
BRUCE STEWART	YES	
WITH BRUCE:		
TRAVIS	POSSIBLE	
DICK DAVIS	YES	
HARDWARE PERSON	POSSIBLE	
STEVE DAVIS	POSSIBLE	
NEW PRODUCTS/RECOMMENDED BY DON BUSIEK		

August 10, 1982

Peter Delehar
Delehar Antiques
146 Portobello Road

London W11, ENGLAND

Dear Mr. Delehar:

Enclosed is the check from Gordon Bell for 460#'s to cover his purchase.

Please package so he can carry it on the plane. I'm not sure what information or forms he will need to get through customs but will check on this. If you already are aware of what is needed and have it available I'd appreciate your putting it with the package.

Gordon will pick up the package at our DEC office. If you would deliver it by September 3 to the following address, it would be much appreciated:

Janet Partridge
Data Center Manager
Digital Equipment Company Ltd.
James Watt House
279 Tottenham Court Road
London, W1P9AA

Tel: 6375200

Thank you for your assistance.

Sincerely,

Mary Jane Forbes
Secretary to Gordon Bell

September 20, 1983

Dr. Burton Smith
Denelcor Corporation
PO Box 31500
Aurora, Colorado 80041

Dear Burton:

I'm delighted to hear that several of your machines are in use and that you're working on the next machine.

Could you please send me information on the machines and any results on applications that exploit parallelism?

Sincerely,

Gordon Bell
Chief Technical Officer

August 18, 1977

Professor Michael L. Dertouzos
Director, Laboratory for Computer Science
Massachusetts Institute of Technology
NE43-105
Cambridge, MA 02139

Dear Mike:

We thoroughly enjoyed the chance to talk with you, about machine ideas. From our viewpoint this discussion has been fruitful by providing us with a challenge about cost, performance, and functionality. I hope we can engage in a closer liaison. It seems there is already progress within the Electrical Engineering Department on being able to use our semiconductor facility. I hope that Multics people will also participate in this because using such a system is also a computer applications problem.

It seems that while we've been working on machines we aren't yet able to provide a personal computer with 0.25 to 1 megawords (PDP-10) of primary memory and 20-30 megawords of secondary memory for $30K by 1980. You outlined five areas we must examine.

1. Is it worth (useful) to microcode machines for LISP? You asserted that it probably wasn't worthwhile. I am attaching the draft of a paper for the special issue of the CACM on Computer Architecture in which I talk about MIT (mainly McCarthy's influence on the PDP 10 for LISP). I think you might have some impact since we might make modifications using microcode.

2. The memory is supposedly 0.25 to 1 megaword. The question is how large as this drastically effects price? Also, I believe we must use a memory hierarchy with CCD's. This relates to issue 4.

3. Should there be a central disk system or should each machine have its own disks which are 20 to 30 megawords (40 to 120 megabytes)? (I favor standalone systems.)

4. Should there be a memory hierarchy? I claim that we have not found a case where the notion of memory hierarchies do not work (i.e., memory locality exists). Your insistence that memory hierarchies do not work for your problems means that we can not reach the cost goals for 2 to 3 years before they could be met in another environment.

5. What should the flow of money be?

We would like to establish a much better relationship with MIT and MULTICS...in fact we would like to approach the relationships we have with Carnegie-Mellon, Cal. Tech., and U. of Pittsburgh. While we didn't go into this, I believe we must begin to understand the benefit to us more clearly if we are to work closer with MULTICS. MIT's unique operating systems on 10's and 11's have insured that there is no software that can be transferred to us or other users of our equipment. Aside from DDT and TECO, I don't know of any other programs that are used outside the MIT environment. (LISP was rewritten by Stanford to run under the 10 operating systems.)

While Multics is concerned with what it can get from DEC, I'd like to re-iterate why I believe we should be interested in each other:

1. I have the impression that you're working on programs that use large memories. Since memory prices are declining rapidly, we should be interested. Here, MACSYMA is the best example. Are there any others that do useful work?

2. Your desires for computer capacity leads others.

3. We listen to your needs and concerns about equipment.

I believe we have a way (factory) whereby your ideas about computation can be utilized quickly and made available to a large community.

4. We simply want to supply the right computers to you and the R and D community.

5. The students who enter MIT are bright and they are exposed to a bright faculty with good computation facilities. We enjoy working with (and trying to hire) these people.

I and Ron Bingham promised to get you a model of component prices so that we could jointly develop (configure) systems that would meet the $30K goal. For now, please extrapolate the data in the attached figures (from a paper on the 10 by me for the CACM) taking the fact that a CCD memory is about 1/3 the cost per bit as a random access memory. (Let me know if you'd like a copy of the paper as it was submitted.) You might also take into account the factor that you buy machines at some discount and the 30K should reflect this. (Maybe a factor of 2 is reasonable here.) While I'm not happy with this model, it can get you going now. I'll try to get you a refined component model soon that's more oriented to high-volume minicomputers.

I'd very much like to get a copy of the text you're putting together on computing in the future.

Again, we enjoyed the interaction. We need to hear about/understand something as to these large memory applications.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:ljp

Attachment

CC: Marketing Committee
Jim Bell
Ron Bingham
Bill Demmer
Rattan Dhar
Ulf Fagerquist
John Leng

Mario Mummolo
Don Nelsen
Ken Olsen
Paul Penfield (MIT)
Bill Strecker

00 CORE DECGRAM ACCEPTED S 003259 O 499 14-JUN-82 16:32:34

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* d i g i t a l *
****

TO: see "TO" DISTRIBUTION DATE: MON 14 JUN 1982 3:38 PM EDT

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION

DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5166445007

SUBJECT: TRAINING FOR NAUTILUS BY DOING REAL DESIGNS

The loading on TW drafting is light I understand now before Nautilus builds up. Ulf has observed that it's important to do designs even if they are not going to be used simply to train the cad folks. We pay them anyway, and the issue is that they have to learn.

I believe we ought to have a backlog of cost-reducible designs that our drafting groups could work on to fill in time. Right now, it is critical that these folks start to do gate array designs and get the process debugged!

In Venus, we learned that every part of the process has to be characterized and debugged before real use and there is a real, learning curve on the order of 20% (each time you double the experience of the number of parts processed, you get a 20% reduction in time to do the work).

I'd like to see us run the various parts of the Nautilus design system including simulation and the links with TI (especially!). We should also get parts back and go through the testing and debugging of boards.

The second thing we learned on Venus is that someone has to be responsible for every step of the process (schematics, simulation, gate arrays, interface to vendors, testing, the whole board process including stuffing and testing). TW doesn't look very good here because it doesn't do that many designs and the designs are all different designs styles. Therefore, we need to characterize the process even more.

Let's use this vehicle to get the process running.

Bill,
Who is responsible for the whole process?
Can we try this to get ready for the Nautilus in a real, meaningful way?
What youse think? good/bad idea?

"TO" DISTRIBUTION:

BRIAN CROXON	BILL DEMMER	BOB KUSIK
BERNIE LACROUTE	DEMETRIOS LIGNOS	FRED LUND
BILL STRECKER	PHIL TAYS	

"CC" DISTRIBUTION:

ULF FAGERQUIST	BOB GLORIOSO	ARNY GOLDFEIN
BILL JOHNSON	JEFF KALB	JOHN MANZO
DON MCINNIS	MAHENDRA PATEL	STEVE TEICHER

WPS USERS - Leave HP mode and type <CR>

00 BURT DECGRAM ACCEPTED S 17502 O 65 21-FEB-81 16:09:01

****
* d i g i t a l *
****

TO: ENG STAFF: DATE: SAT 21 FEB 1981
16:05 EST

FROM: GORDON BELL
cc: KEN OLSEN   DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: MECHANICAL DESIGN ELEGANCE AS THE FAST TRACK TO Q&P

At the OC Woods, Ken asked us to emphasize our mechanical design,
especially packaging. We all know the incredible effort it takes
to design something that is very simple in concept, manufacture
and appearance. Our designs leave a lot of room for improvement.
They are hard to build (some requiring >2 armed robots), heavy to
carry and the customer can't really deal with them in his environment.

It's clear to us all that the new products we are building
have to be mechanically elegant and customer integrateable.
Virtually all 16-bit systems in the early 80's are going to be
modular and buildable by the customer (including Aztec based
ones). Furthermore, a customer should be able to put together a
full blown communications network using NI and Mercurys.   We
should target as much as possible to have modular, Type III
systems whenever possible. (Recall type III is desk, or table
based whose modules should all be independently portable by 1
PERSON, with the ability to be merged by the customer.)

Mechanical elegance must permeate all our designs from the chip up to all options and all systems. I don't know precisely how we start, but it's a clear topic that will come up again and will be looked at very much in the April Woods.

If we go for Quality and Productivity as our work theme these next 2 years, one of the fastest roads to quality is through elegant (simple, few, correctly placed parts) mechanical designs. The product just looks better (and higher quality). Mostly having fewer parts gets us a triple whammy: quality image, lower cost, and higher reliablity.

Any ideas how we really go for this?

GB2.S4.33

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TO: see "TO" DISTRIBUTION   DATE: TUE 4 JAN 1983
9:29 AM EST

FROM: GORDON BELL

cc: JOHN KIRK
GRANT SAVIERS
JACK SMITH

DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5186857016

SUBJECT: QUALITY DESIGN METHODOLOGY FOR YOUR GROUPS NOW

GB4.S1.12

The attached describes what has to be implemented across engineering starting now -- especially in light of the

ECO's in DECMate and the Pro.

The problems (hell) we've gone through in the VLSI, large and mid-range systems due to complexity is similar to the one I see on your projects given the long gestation time (and ECO's). I can only conclude that we aren't being careful enough and are not well enough trained . . . strictly the Old Digital. (I've seen nothing but primitive design aids.)

While we must bring in all available resources to thoroughly analyze and review these designs, it is only a palliative to get them done.

In parallel, I'd like you to introduce the design walk-through
and simulation steps now as a further palliative. John Manzo and others on BJ's staff can describe the design processes.

We have to get to the point where a one board design requires a few months of design and simply works WITHOUT ERRORS.
Let's start today.

GB3.S10.34
00 CORE DECGRAM ACCEPTED S 004159 O 358 06-DEC-82
17:19:20

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TO: see "TO" DISTRIBUTION   DATE: MON 6 DEC 1982
2:21 PM
                                         FROM: GORDON BELL
cc: see "CC" DISTRIBUTION   DEPT: ENG STAFF
                                         EXT: 223-2236
                                         LOC/MAIL STOP: ML12-
1/A51

                                         MESSAGE ID:
5183917657

SUBJECT: SCORPIO: ORGANIZATION REVIEW AND INSTALLING TND/EQDM

At the recent Scorpio Design Review, several issues came up:
.Who's in charge of the system architecture and various
modules?
.Do you specify and characterize the components and
processes?
.What is the design methodology? Who's in charge of it
.Will you use quality walk-throughs? how much simulation?
.How are you doing the training? since engineers will run
programs
.Do you have the machine resources?
.How do you manage across all the sites?

While I don't think you are near VENUS/Jupiter disease
because I see
much more involved and knowledgeable top managment, I would
like to

see how the detailed design is organized, managed and what the
designers know regarding handling a design of this complexity. Also,
we simply can not afford any slips in Scorpio or the BI options... and
I would like to accelerate them, as well as get more modules for the
same effort. Note that quality design increases productivity.

PROPOSAL: LET'S USE THE QUALITIY DESIGN METHODOLOGY...

While this has not been flushed out very well, I'd like to use Scorpio
to define and use it. John Manzo and Sharon Keilor would come in and
help in the definition, and then go on to work on training.

The following slides were given at the State of the Corporation last
week, and what I think we need to have in order to get the job done.

THE NEW DIGITAL (TND): ENGINEERING

THE EDGE IS THE ENGINEERING ENVIRONMENT

where we use our Fifth Generation products based on a homogeneous VAX environment, to learn, bootstrap and build the Sixth Generation

WHERE ENGINEERS, ENGINEER!

products, tools and processes to build products, and components for building products in ALL parts of the World

AND USE THE QUALITY DESIGN METHODOLGY

to drive and exploit engineering learning curves so that as engineers, we do lots of designs in our lifetime!

(The ROI on designs that have a shorter gestation time will be very high because the designs will be much more competitive...)

A PROJECT EXPERIENCE (in the old Digital)

Specify the scehdule: 9...27 months to FCS
Establish a program office to co-ordinate and trade-off:
  Service, Manufacturing, Marketing, Design Processes, Scheduling,etc.
Establish a design group and leave them alone to oranize, argue and
  try to write some sketchy specifications about the product
Occasionally review but concentrate on the periphery, not the product
Predicate design on QUICK DESIGN, BUILD, SEE IF IT WORKS METHODOLOGY
  where a poor, half-done breadboard is somehow built to learn from,
  followed by a redesign (or two) that will be manufactured,
Avoid: understanding, conflict that comes from design trade-offs,
  timing analysis, formal (computer checkable) interfaces,
  verification, design inspections, simulation, etc.
Manufacture and wait for the ECOs

VENUS EXPERIENCE

(an example, of the Quality Design Methodology)

Copy and install the ideas from complex VLSI design and software:

Organize in a hierarchy of chief designer, project leader and box projects (each with chief designer and project leader)... in a team!

Establish clear goals: eg. quality, shipment, performance and cost

Characterize the processes and components (eg. gate arrays, modules)

Be able to understand the "state of the design" automatically

Predicate the design based on the QUALITY DESIGN METHODOLOGY:
  where at each step, there are no errors...
  design it correctly, verify and model it, inspect it, test it via simulation, and then build it (and expect it to operate at power on)

Use the physical hierarchy as a "friend" to segment the design and establish formal contractual boundries among the team

Use the logical hierarchy as a "friend" to segment the design in time and make sure that there is always a "running" (simulated) design!

Repeat on the next design!

TND: ENGINEERING FOR THE FIFTH AND SIXTH GENERATIONS

Highly trained, engineers and managers who understand the competition
by being with customers, at school and technical seminars,
competing with the Japanese, IBM, AT&T (et al), and start-ups

Install and use much improved design tools based on our own
Fifth Generation...the VAX, homogeneous computing environment
(with direct links to all engineering and manufacturing sites)

Tools for technology scaling to allow re-use of designs at least once,
and learned from. Also, tools for automatic, low level design which
will allow creative, higher performance and higher reliable designs

Underlying semiconductor and interconnect technology for designing (by
compiling) all kinds of computers and computer based systems

The Sixth Generation, based on known and evolving ideas about better
communication with humans, thereby creating more use

"TO" DISTRIBUTION:

BILL DEMMER BILL JOHNSON DEMETRIOS LIGNOS

"CC" DISTRIBUTION:

LARRY BORNSTEIN SHARON KEILLOR JOHN MANZO
JACK SMITH BILL STRECKER

"TO" DISTRIBUTION:

BILL AVERY PAUL BAUER JOHN CLARKE
AVRAM MILLER

DEVELOPMENT INVESTMENT BY ARCHITECTURE

(excludes development of modules, storage, peripherals, diagnostics and p/l specific development)

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OF NOR

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FY82
              DEVELOPMENT INVESTMENT BY ARCHITECTURE


(EXCLUDES DEVELOPMENT OF MODULES, STORAGE, PERIPHAERALS,
DIAGNOSTICS AND P/L  SPECIFIC DEVELOPMENT)



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FY82
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OF NOR

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(excludes development of modules, peripherals,           --------
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      FY72                           FY77
FY82
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25 November 1984

Mr. Arnaud De Vitry
41 rue de l'Universite, 75007
Paris, France

Dear Arnaud:

Thank you for the gift to the Capital Campaign and the moral support that helped open the Museum on November 12. I hope it will be one of Digital's greatest achievements.

The physical realization has turned out to be much more exciting than any plan could have communicated. The staff made a very large "stretch" to open a range of galleries. The reviews have been positive and it is easy to spend a half day in productive learning. Knowledgable teenagers are spending their days at the Museum. The most flattering comment to date has been that it is the first American technology museum to be at European standards. Dr. Oliver Strimpel, who did the Museum's Image Gallery has just become the Associative Director and Curator. Oliver was formerly the Curator of the Mathematics Section of The Science Museum, London. The long collecting period and five year breadboard at Digital really paid off in collecting artifacts, building exhibits, doing lectures (ranging from Amdahl to Zuse) and gaining widescale support from computer people and companies.

I want to see this phase aimed at:

- putting a formal educational program in place,
- continued collecting of artifacts (whether letters, films, manuals or machines) in order to record the significant, information processing events, and
- getting broad public support from computer-knowledgeable people who want to learn more about the past and future history of computing.

Again, thanks for the support. I hope you can visit it soon.

Sincerely,

Gordon Bell

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* d i g i t a l *
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TO: see "TO" DISTRIBUTION DATE: TUE 8 DEC 1981

12:48 PM EST

FROM: GORDON BELL
cc: see "CC" DISTRIBUTION
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: OUR VAX STRATEGY (AND THE NEXT DG MACHINES)

All future Dg 32-bitters are TTL or TTL/AS with a very few gate
arrays.

Nebula - size	(2 board)	end '82
780 X 1.5	Comet Pricer	early '83
780 X 3.0	780 Price	Mid '83

We must re-think our product strategy and our product implementations
to live within our basic up-front project planning, technology,
tools,
design discipline and methodology and project management skills
instead of making every machine a research project in one or more of
these dimensions (Venus breaks them all).

Even living within these constraints doesn't insure a timely product
because we may change our mind when the machine is built (eg. Nebula).
Our management record is really poor! I'd like to get the Operations
Committee to review our thinking and our readiness to build and
effectively produce Nautilus, Gemini and Scorpio.

Our design philosophy must also change for VAX. We must look

at basic
design alternatives that trade off chips for regularity. Our old
style design temperament to minimize manufacturing cost is not
relevant for VAX because minimizing cost may increase complexity in
the structure and in microcodes. Also, this style design increases
time to market, manufacturing testing and perhaps field service costs.

Here we need some new ideas.

Operations Committtee: please start by scheduling a review of
Nautilus.

"TO" DISTRIBUTION:

BRIAN CROXON BILL DEMMER DEMETRIOS LIGNOS
DON MCINNIS STEVE TEICHER

"CC" DISTRIBUTION:

DAVE CUTLER JEFF KALB OPERATIONS COMMITTEE:
PEG: BILL STRECKER

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Diary of My Visit to Japan

Gordon Bell — Summer of t

th

July 1 — Arrive Tokyo

My seat mate from Honolulu, Anthony Geber, Director of Economic Policy, Bureau of East Asian Affairs (State Dept., 202—632—9690) elicited some argument from me. (He opened.) We exchanged business cards (I'm practicing for Japan) as it's the only time I've carried cards. (This, according to Reischauer, is the thing to do.) At any rate, his concern is simply that Americans are too lazy to compete. Also it's too hard for us to go after their small markets. Mine is more fundamental —— Japan's growth versus return on investment; the availability of capital; Japan's trade barriers and language/cultural barriers; and the way the Japanese focus on winning in trade —— all serve to scare the hell out of me. Throw in our waste, vis a vis energy, too. I also attribute our regard for science over engineering and engineering over manufacturing as key. The fact that we no longer build, but use tape recorders (especially videotape), radios, TV, high quality cameras (we only built a few — Kodak 35), small cars, is cause for concern.

July 11 — DEC Office + Keio University

Here we lie, watching the news (in English) after a day of running around like mad. Our host, Yu Hata, picked us up at 9:00 AM, took us to the DEC office, gave us a one hour briefing on computers in Japan (a brief history), and then I gave a two hour seminar on DEC products and engineering organization. There was an hour of questions on everything from 50 hertz 100 volt power to multiprocessors. It's clear we have inadequate planning of products for this market. Engineering makes its plans clear. Who's got the responsibility? (GIA-Janzen, CSS-Holman/Martin/Watanabe, the VT100 product here — Halio, or DEC Japan or some P/L for character sets?) This is a mess! For starters, I say GIA had better drive this issue!

We went to a nearby hotel and had to have an international style lunch (versus Japanese) because the Japanese part was full. I intend to assimilate everything —— just like the Japanese, so the food is paramount.

We left at 1:00 PM for a ride to Keio University (CHU affiliate) where I gave a talk onminicomputer architecture, which prompted lots of questions. We left at 5:00 after interaction and a view of their predominantly batch 11/06. Professor Toroko is an assistant professor in hardware. We were shown around by Professor Nori Doi. They would very much like to visit DEC. There was interest in architecture, as they wanted to build a large multiprocessor. Funding is tight as they're a private university with no NSF, ARPA or real industrial support. The main professor wasn't there.

Toroko gave me some papers which I'm sending internally, and Doi gave me a paper on the Fortran they built for the 11/08 patterned after Waterloo's WATFIV. On the return, Hata finished his lesson on the Japanese computer industry vis a vis the 3 pair of groups (Fujitsu — Hitachi, who make 370 compatible), (NEC — Toshika, who're looking for

a mini in Honeywell and used to be with GE) and (Mitsubishi — Oki). Univac (Nippon) is a dominant supplier somehow, based on Mitsui's earlier impetus! (Sept. 76 Datamation explains this quicker and better. The article is attached.)

We were dropped off at the Okura Hotel, I wandered around checking out the baths, water, etc. and finally settled on a swim indoors with a sauna. This let me shed a kilogram quick plus earn dinner. We went to a nearby restaurant Hata recommended and got a reasonable meal for only $30 each. It was quite good, not great, but we muddled through as I almost drank the tempura sauce versus wait for food to dip it in. We returned at about 8:30 and I called Don Frost about our visit tomorrow to NEC. I'm set to see the Director plus the technical management. Since I have a strategy to get a large share of the market, I wanted to check it out. Don said I, objective technocrat, should try it out with them! Basically the theme is: Buy any or all of DEC hardware/software; use it as a standard (just as Fujitsu—Hitachi do with the 370); sell in any/all Japanese/world markets and build a huge 11—based computer business! The Ministry of Trade/Industry (MITI), who controls all, should absolutely love it. The only trick is to get them to invent the idea!

July th - NEC

We had enjoyable talks/visits with NEC. The main purpose was to assure them we'd support them in their effort with the distributed system for the IRS (NTAA) using our machines (DECnet, 11/70, lAS). This was needed because they may view us as a source of technology (DECnet, minicomputers, interactive systems). Actually, technologically they're quite advanced, but probably in the wrong direction as their machines are ECL—based. The high ends are a takeoff of the Honeywell ceramic modules. They've been affiliated with Honeywell for 10 years, and next year the affiliation will be reviewed again. (Honeywell doesn't offer them anything.) The high—end is 635 based; the mid is on some earlier (2000?); and the low is on their earlier machines. Their office machines (100—series) are based on their versiOn of the 8080 —— note it's an upward—compatible (one-way) version!

Their factories (computer and TV) were immaculate. People seem to move around fastei' than in ours, with more to do. The designs and quality of workmanship were quite beautiful. They commented on our reputation for quality and reliability —— which I think we have

but we have to get these better. It's the one sure way to sell in Japan. They like quality/reliability (probably our other customers do too).

I had visited a TV factory; it's like I expected. They make 1,500/day

— 300K/year. They have to make subassemblies because of U.S. import quotas. Their 5 Japanese competitors for U.S. market now have U.S. factories, which means the issue of Japanese products (TV) is solely a capital, manufacturing and design issue — not high labor, for example. Again, I remember buying and giving away a large Zenith portable color and replacing it with a Sony color! (The Zenith

replaced an old GE B/W which was never particularly good.) So in essence, I believe our ability to compete with the Japanese is:

1. A product design: quality/functionality (they adore knobby gadgets just like we do)/reliability.

2. Ability to manufacture it cheaply (and in volume).

As long as we don't forget this, we have a market. When we do forget, we'll be a distributor, just like GE and Zenith! (Incidentally, I recall that as engineers we felt sorry for the 100 TV engineers on Zenith's research group.. .why didn't they design better products? Why not a tape recorder? No American company produces a VTR (yet it was a U.S. invention). This gets back to emphasis of research (science) vs engineering vs manufacturing. I hope we're doing the right thing by pushing more on engineering and manufacturing (to a lesser degree) versus research at DEC.

In the afternoon I met with a number of their people from Central Research. They're largely American trained, where the cost is lower and training is supported by U.S. government. One was trained on MIT Multics. We had no trouble in communicating! My earlier frustration that they wouldn't talk wasn't true. I did have to control the flow, otherwise they'd clean me out of information! The affiliation with CMU turns out to be good, because I can merely quote work there and stay out of DEC's work. The central (non—product specific) R&D is 100 people versus 50 for us.. .or they have)4 x the R&D per NOR since they have roughly 750M in sales!

They're building a very high speed COBOL engine, multiprocessor (just as we're fascinated by them for production reasons), and doing a mass store subsystem. It's hard to compare us because they're more into batch. They build bigger machines, but they'll soon learn, as they build Honeywell's Level 6 mini under license. I sense they have a fairly muddy strategy, building product—by—product as ideas seem to be good. (With our high end VAX/10/2O machine, I think will be a long way to having a clearer product strategy —— although we'll have more products!) A person from R&D was amazed at VAX, and what it had, what it cost.. .he said all those ideas came from large machines. Surprise! I said this in a paper in 1971 on minis!

Speaking of ideas. The Japanese (and we) have about the same regard for ideas.. .they're useless until applied. Once applied, fair game to be modified, taken, etc., within the limits of the law and morality (e.g. patents). I think we need to state as a policy that we do want patent protection on ideas whenever possible, and that we'll take ideas from any source subject to moral/legal constraints! Here's what struck me:

1. The semi—automatic wiring machine that Stocky designed wasn't

patented. We gave it away to be manufactured locally. It was manufactured here as a copy by a Japanese firm. (1 suspect.

they've improved it and maybe we should look into purchasing them

here.)

2. Their low cost Teleprinter was adapted from Extel.

3. Their high speed laser printer was mainly IBM based using some Honeywell ideas.

4. The CML logic on ceramic modules came from Honeywell — although they made them manufacturable.

5. They use Gardner—Denver wirewrap machines and Universal inserters.

6. Manufacturing tools seem to be adapted from Macrodata, Universal, Teradyne (the wirewrap/backplane tester).

7. Their printer came from Versetec, though in a different package!

8. Their Fax machines probably have similar origins!

9. Their new Spinwriter is an adaptation of Interdata's carousel — I have some printout samples. The quality may not be high enough

for word processing use. They're stressing reliability, speed (to c/s) and quality!

10. Cables/connectors come from the U.S. (maybe under license).

11. There are copies of the Tektronix scopes.

On the other hand, aside from our development and dedication to interactive and real time computing, many ideas of our products came from someplace outside (e.g., DECtape, 3M tape, cassette tape, the RKOS, the

DECwriters, the CRT's, the cache) various CPU implementation organizations, APL, BASIC, COBOL, FORTRAN, wirewrap, various LSI and manufacturing tools). We did contribute to computer structures more. In many ways we resemble them.

In the evening we had dinner at a posh, continental style restaurant with Dr. Ishii and Mr. Kitamura of NEC. I reaffirmed our support to them to make the NTAA (IRS) project a success.. .without this MITI will clobber us and our name will be mud. This is merely a reaffirmation of the Operations Committee decision requested by Marcus, GIA, and DEC-Japan.

Ishii was relatively speechless when I laid out the proposition that they standardize on li's and drop the manufacture of the Honeywell Level 6. This gets them a mini right now, without continued investment, and they can backward integrate as they see fit. This theme for the GIA nationalistic companies is the right way to approach the marketplace. Somehow, we have to convince them that we're sincere and believe it to be the way to get into computers. This "sales approach" isn't widely understood/used. We need to formalize it. Japan would be the ideal place to start.

In the afternoon we went to the NEC computer factory and I talked with a number of very bright people from their central research lab. Fortunately they don't understand minis .... or they put on a good act

(they had xerox copies of our VAX documents). Research has 100 people for a company half our size (i4 x the effort). We saw a TV factory complete with multi—height rack burn-in (which we should use for disks).

July th — Fujitsu

We visited the central lab of Fujitsu at Kawosaki (Mr. Kurosaki and Mr. Sato), and then went to Numazau near Mt. Fuji where the computers were built. Fujitsu is the most computer oriented of all the companies because their founder, who died a few years ago, built one of the first relay computers. They ran the relay machine for me at Numazau while it calculated several common functions. They're not especially profitable, but they make beautiful computers and have the necessary technology. We saw their newly announced M200 (1.3 — 1.5 x 3033) multiprocessor using a dual cross—point for reliability. It appears superior to both Amclahl VT and IBM (neither of which believe in multiprocessors (on M200).

Yu Hata and I could have easily had an argument on the relationship between Amdahl and Fujitsu. My view is simple: at IBM, Amdahl had developed a significant set of ideas on how to build 360's/370's. He left there and further enhanced the ideas in the circuits, design aids, packaging, small components assembly and testing areas. He got into financing trouble and Fujitsu bought a significant amount in return for the technology. Fujitsu put up the capital for the factory and made the assembly line work — no trivial feat because there's so much small assembly work. Fujitsu's first machine was not better than Amdahl's, but they took a longer term view (they are not that profit oriented) and produced better design aids and semiconductors, etc., so that their circuit M200 will probably beat Amdahl's V7.

The workmanship and detailed engineering is really fantastic. They have a very good master—slice (gate arrays) and fast (8 nsec) RAMs. In the terminal work, they have an anechoic chamber to get noise level down. They have some color CRT's and a floppy based intelligent terminal and are working on high level forms languages to make them easier tc use. Of course, their disks are reverse engineered copies of IBM's.

Overall, Fujitsu seems the most frightening because of their dedication to quality, and winning. They have the strongest engineering and so far haven't been interested in mini's (PANA FACOM is their brand — a joint venture of PANASONIC (Mitsubishi) and Fujitsu). Also, given their disinterest in profit, they'll be doubly hard to beat.

Probably more important, Amdahl understands IBM mentality and how they strategize. This clearly influences Fujitsu and MITI. In fact, I believe Amdahl influenced MITI, at least indirectly, to build the plug compatible systems!

In visiting the Fujitsu factory, we saw one of the floors of the factory was devoted to programming. They had set up something that

was very much like an assembly line for programmers. I would love to have our programmers look at this kind of environment because, in effect, there was really a sea of programmers. Probably the most impressive part was that they had a great number of line printers all backed up to a conveyor; and as each line printer finished its output, it was cut and stacked. It was cut into the appropriate pile; the pile was put on the conveyor; and the conveyor ran it off. The whole thing appeared on a carousel so that in fact all the programming listings were delivered stacked automatically. Of course, there were no individual offices for the programmers, only a sea of desks.

I guess the other thing that was impressive about the Fujitsu factory was the very clean atmosphere. The custom of removing shoes is very helpful; this is done on entry to computer rooms, temples and tea rooms. It was the cleanest of all the computer companies that we saw. This really pays off when dealing with the large number of contacts, the small coaxial cable, and the way the multi—terminal integrated circuits are sorted at that point under the board.

The Fujitsu M190 and M200 computers also used color CRT's for controlling the computers. KIVIAT graphs are displayed on the consoles so that one can get an idea of what's happening to the various resources. They are used in real time display in the Fujitsu computers.

th

July Q - Electro Technical Lab and University of Tokyo

We visited Dr. Nishino and Dr. Mo of the Electro Technical Lab, which is run by MITI. This is a Central Research group responsible for computer research (the nearest equivalent of ARPA). The lab in a sense looked like many government labs — a series of dusty old equipment with experiments, which can be put into service for visiting dignitaries; some good and some bad work; and a bunch of reasonably intense Ph.D's. I gave a talk on the VAX design and it illicited a number of interesting questions. They're doing a large number of computer structures related work, several projects on multiprocessors and on microprogramming, and various things on language translation. On Dr. Nishino's desk was a well worn copy of the Quantam Sciences forecast on office automation. I asked to see stuff on Word Processing but the stuff I saw was not particularly useful or impressive.

The ETL does have one interesting virtue in that it does very little hardware building. In fact, its main function is to fund various industry groups to do design for a lot of the Japanese minicomputers. Anyway the one that is the equivalent to the DG mini looked exactly like the DG framework, except the workmanship on the console was much better than Data General's.

We went to the Tokyo Hilton and fortunately had Tempura, which is sort of batter fried fish, shrimp, and vegetables (probably the easiest thing for Westerners to accept and digest). It was about our second Japanese meal, because all the other meals were given to us assuming that we could not eat Japansese food. We had sandwiches (with bread

crusts removed, delicately made and presented) at the various companies and had continental food when we went out (especially the elegant NEC meal which was heavily influenced by French cooking).

In the afternoon we went over to the University of Tokyo where I gave a lecture on minicomputer architecture in a very formally decorated room (held about thirty). They apologized for the small crowd because it was vacation. I was with Professor Ashida and Professor Inose, both of whom had spent a great deal of time at BTL. Inose is the father of the time sort algorithms for ESS No. 1 time division multiplex switching, which he did about twenty years ago. The talk was supposed to take one and a half hours with a half hour of questions, but ended up taking about one hour with roughly forty-five minutes of questions. We went to Professor Inose's office, were formally received, and discussed various types of things. The two professors had to leave because they had a dinner meeting of some sort.

We were then shown around the large Hitachi machines by one of the students. It was the Hitachi 8800 and he lamented the fact that Hitachi now was making IBM compatible computers, which he considered inferior to the ones they had currently made. Their other line is almost IBM compatible, derived from the Spectre 70 unit, but has special supervisory call instructions which makes them incompatible. We looked around the computer, which is really a monstrous machine because it was made out of MECL 10K, I believe; but the machine was water cooled.

There was a four processor system, three fast processors and a slower processor. The load was not very heavy. We went over to look at the system resources and I ran a BASIC and FORTRAN program. The BASIC null program really bombed out so I have a feeling the null program took a good deal of time showing that they had some kind of interpretive compiler. The FORTRAN produced good quality code and ran very rapidly.

We left there about 6:00 PM for dinner with Yu Hata, his wife and Don Frost at Yu Hata's son's apartment. We spent a thoroughly enjoyable evening looking at his airplanes. Because he is an avid photographer, he got into building model airplanes for aerial reconnaissance photos. He also built some helicopters. All of this was indeed incredibly impressive. The airplanes are very detailed and take something in the area of six months to one year to build.

July st - Sony

We were picked up early at the hotel, checked out, and went to the Sony Corporation Central Research Lab where we were given a brief introduction to what Sony is working on. Other than that I was able to get no information from the Central Research Lab group. I asked about what was going on in the Systems Research Group, but the only thing we saw was a Sony TV tube (used for Graphics) for which .1 have the specifications.

They also demonstrated with characters but the interlace problem created incredible flickers. I asked about buying monitors but they said I would have to see Mr. Iwama. Having gotten no information from the Central Research Lab, we then went to Sony’s Atsugi plant, where we saw the video tape recorder being made. In contrast to the NEC TV plant, the Sony plant did not do any burn in of parts but in fact used testing to ensure that the product worked when they were all put together.

A large number of the parts were done outside this plant and subassemblies were brought back for fabrication. In all the plants that we saw only about half of the work is done inside. The rest is done by subassembly or contract labor. In the factory only 40% of the 1,100 people were workers. Of course, this was reasonably high considering that in that factory about 250 out of the 1,100 were in the engineering group. This is where they made so many semis.

The semiconductor part used three micron channel width for NMOS. They were the first in Japan to use the Bell Lab license of the transistor, and Mr. Iwama, the President and technical person at the top, insisted that a large number of engineers be hired to do semiconductors and, in fact, he backed Dr. Esaki.

Sony has an electron beam mask maker, which they got from Japan Electric Corporation, which is a copy of the American electron beam mask maker. We saw one of the AM 2900 ion implanters. It was just the fourth or fifth installed there. They pride themselves in owning a great number of the key semiconductor patents and, in fact, have a 10,000 volt transistor patent which is very key to making all solid state TV sets.

We left the factory in time to have lunch with Mr. Iwama, who of course took us to a hotel where we had a western meal; but before this, we looked at three very interesting video recorder projects all of which we have become interested in.

The MAVICARD recorder, which I have brief information on and a carousel version that allows up to five other cards to be loaded automatically, is a scanned device and the card holds up to one hundred images. There was a small video disk which held ten seconds of video on a frame by frame basis, and could be used in freeze frame applications. That system will be introduced this year for sports teaching. I am asking Yu Hata to go ahead and get information on these products. The third device was a small tape recorder, a tiny video disk about three inches in diameter that can store only a few frames of video.

All these products I find extremely intriguing, and all we have to do is figure out how to couple them to DIGITAL recording. Iwama talked about the various forms of pulse code formulation for audio and video (they have got to get into it). We would automatically end up with tape and disks that will allow us to use the video technology in computers.

They make it a point in their advertising of trying to stay away from anything that other people are doing. One can see by their various products and images, just what their approach to life is. Their motto is, “research makes the day”

After lunch with Mr. Iwama, we drove to the train station where we got on the bullet train for Kyoto arriving in Osaka at about 7:15 PM. We were met by the software specialist and were taken to the Osaka Hotel where DEC Japan, Osaka Branch, were having their end-of-the-year party. There were about 75 people there. Don Frost gave a good speech calling for plenty of openness and then I followed up by saying how glad I was to be in Japan, about how impressed I was with the Japanese, and our need for quality.

We finally got back to Kyoto and the Tawaraya, an old-style Japanese Inn, at 11:00 or so. I was glad to lay on a mattress that was flat on the floor and very comfortable, after having lay too soft in Tokyo.

July nd a rd — Sightseeing at Kyoto and Nara

We had breakfast, Japanese style, in our room at about 8:30 AM and then Gen. Narui and Miss Tomioka came for us to go sight—seeing. In Tokyo we had home—made coffee and fruit in the room to gain time, decrease interaction, write, and it's awfully cheap.

In the morning we went to the summer detached palace of the Emperor Shugakuin outside of Kyoto, which included many temples, houses and rice paddies in an extremely beautiful setting. We were very fortunate to get there, and because I was a visiting "dignitary", we were allowed to go. I was glad that neither Yu Hata nor Gen Narui had seen the palace so it was a treat for all of us. Miss Tomioko was in a traditional, elaborate, beautiful Kimono and kept being stopped by U.S. photographers at each site.

We took off on a tour, which was about a two mile walk in reasonably warm climate, up and down the hill in an almost Greek-like setting. Then we left for Araàhi—Tei, a restaurant I think attached to a hotel that overlooked the Hozu River. We had a typical Japanese, probably nine course, luncheon starting off with beer because we were so thirsty after the walk. After lunch we went up the Hozu River and rode the boat down for about 10 miles back to the landing of the restaurant.

Off we went to visit the Nijo—Jo castle in the center of Kyoto. This was a castle of the Shogun, built to impress the Emperor to put him in business. However, neither of them spent that much time in Kyoto because they both lived in Tokyo. The castle was, of course, extremely impressive with moats all made of wood and bambоO.

We came back to the Tawaraya, cleaned up a bit, and went out to dinner at a very nice restaurant. It is hard to remember which is the most memorable part of it, given that there were so many courses. After dinner we went down the main street of Kyoto looking for various souvenirs.

I spent most of my time looking for a knife, having been intrigued with the possibility of slicing vegetables very thin which is one of the specialties of the Japanese salads. I found one, got a few other odds and ends as presents, some more ideas for presents, and returned to the Hotel about 9:00 or so, quite ready to konk out so I could go the next day.

On Sunday morning we were trying to sleep late, given that we were going to take off at 9:30, but our maid/attendant unfortunately decided that we should get up about the same time as the day before and we were out by about 8:30. We met Gen and Miss Tomioka at the railway station and caught the 10:00 o'clock express train to Nara. The train is run by a private company and was extremely comfortable and cool, as are all the Japanese trains. We all got to the Todaiji Temple at about 10:30.

We went on to visit the Taishi Shrine at the same location, walked around, and had a fairly heavy nine—course lunch at an old inn called Tonochaya. We were off by 2:00 and went to visit both the Toshodaiji Temple and the Yakushaji Temple. These were high points of our trip. We were met by a lady who is on the staff there. Miss Tomioka knows her very well and we had an incredible walk through the various temples. The latter temple was probably most impressive because a fire had destroyed the west temple and they are building a new one. We were able to talk to the engineer who is in charge of the new construction. He showed us around and we ended up going into the construction of the temple. It is made of wood with no metal and is about 30 — 40 meters tall. We also went to the site where the wood was being prefabricated. This is being done by a bunch of scholars and an old carpenter. The whole temple is, of course, designed to last 1,000 years and, with the care they are taking, should easily accomplish this. There are about twenty carpenters working on the building. It is thought it will take about three years, or about sixty man years of work, to complete this temple.

The superstructure of the building is built around a wood pole and the temporary structure is made of steel and is quite permanent. After we got through climbing around, we were taken up in another temple that houses some of the Buddhas. All these temples, of course, house Buddhas of various sizes and shapes. The first one houses the world's largest Buddha made of 12th century bronze.

We were presented with various photographs, gifts, good luck charms, and goods to help us on our way. We had tea and cakes with one of the monks at the temple before we left at about 5:15. We got the 5:30 from the station near the temple, transferred to the express at Nara, were back to Kyoto by six, and had dinner at seven.

The five of us had dinner at the Tawaraya - eleven courses. It was a magnificent dinner starting with raw fish, vegetables, and soup. Along about the eighth course we were served with a very heavy tempura as batter—fried shrimp, vegetables, potatoes, and fish. I was hoping things would be over, but in came the next course, which featured the hibachi. Everybody had steak and various vegetables. Somehow I

managed to get through that course, but skipped the next two because it is probably thought bad luck to have an even number of courses. We were all presented with small hibachis. We finished dinner at about quarter of nine which is not necessarily typical, because for some reason, even though food is very lovely and things are in small servings, the Japanese eat very fast. While I am here I am trying to eat slower than normal, otherwise we would finish the meal in probably an hour. I do enjoy the food and the time spent very sociably.

July th - Talks at Kyoto, Osaka, and Kyoto Sanyo University

I gave lectures at Kyoto and Osaka Universities and had dinner with people from Kyoto Sanyo University. (The tape is apparently lost in the Sydney secretarial pools).

July th - NEC

We visited NEC in Kyushu, which is on the island of Okinawa, a place where NEC makes almost 80% of its semiconductors. It is there because of the labor force and because of the supply of water. They make about 5 million pieces a month, 60 million per year (at 80%, this would give the total NEC IC's at 75 million per year). If each is selling for maybe $3.00, because they have a large amount of LSI, NEC's total sales would be at about a quarter billion dollars (which is what we think they are).

Mr. Iwao, Chief Engineer, took us around. He is actually the operator of the plant and is interested in high volume manufacturing. The brochure I took badk has all of this annotated. They started there in September 1969, with only 1400 million yen capital, or at today's prices, about $2,000,000. They employ about 1,750 people there —— 1,250 are direct laborers. They operate two shifts —— 5:30 AM to 1;145 PM, and then the second up to 10:30.

Their history there is one of starting out to do semiconductors for NEC's NTT telephone business, so they have a fundamental interest in quality. Subsequently when they got into the NMOS PMOS calculator, cash register, and computer business, they changed the emphasis to volume, which they have now. In doing this, they never left their concern for quality.

All products are burned in. The NTT products are sometimes burned in for as much as a week, and some products are only burned in half a day. Eight percent of NEC's total sales go outside. It is building

as much as 15 to 20% of these sales for export. Probably a larger

amount is to the United States, although we don't know. They are

making all PMOS 14 calculators and cash registers, and NNOS computer memories, including the 4K plus 16K RAM. They are doing a lot of GMOS for watches, calculators and radio equipment. In addition this NEC plant makes the BIPOLAR CML logic for the high speed computers based on the Honeywell CML logic.

We initially had concern whether we could visit there and they reluctantly agreed to let us. The person who took us around was not

that keen on having us, but was certainly cordial after we arrived. They try to keep their labor force flat. They have taken all of their plating and marking equipment for the two in—line packs to local shops outside. They start with silicon wafers, go through test, then ship. They have a very nice process chart. In fact, virtually like every Japanese company, we were handed a brochure that clearly described their whole process. In this case there are 15 steps. The 16th is shipment, which is by air in specialized containers. From a semiconductor standpoint, they used the 4" wafer on one line in a large two—story building (240 x 40 meters) —— they have about 4 lines and at the one end is the new 4 inch line.

In a small building they have the bipolar line which is low volume for all of the processing areas. The second floor is the pellitization through testing processes, exlcuding the part that is done outside.

Mr. Iwao wanted to know how this compared to TI and to INTEL. I could not tell him (probably because I don't understand semiconductors that well). Frankly I was quite impressed simply because of the incredible cleanliness and the well designed layout they have.

Again, the pressure of the Japanese custom of taking shoes off (leaving them at the door) to enter a building is really helpful to a semiconductor processor, because it means that you don't carry a lot of dirt around. All of' the areas that were part of the factory were marked in terms of class. The workers and the back of the equipment was class F and then everything else was in class C. They had class B and class A rooms. They end up with a failure rate of 1% at burn in, so that they have a very high overall volume rate at customer acceptance.

They own mask making equipment in Tokyo, which is an EB machine. All of the work done by the design and manufacturing production equipment design is done in Tokyo.

NEC has processed SOS wafers, but is not interested in it because of the low volume, low yield, high cost nature of it. They are also looking at and made (it is not clear how) JIL parts apparently for the NTT. (NTT wants it.) Unlike many of the other semiconductor companies, especially Sony, NEC believes that it must bring all of the

manufacturing equipment along. It has formed a wholly owned

subsidiary tester company called ANDO. Of course, being very

patriotic to Japan and themselves, they use the NEC M4 minicomputer, which is a conversion of the Varian machines. The manufacturing complaint, about the difficulty of maintenance of the tester, is traditional with every manufacturing group I have heard.

The ii inch line is one area that we weren't allowed to see. In fact, he studiously avoided us looking at their wafer lines although there were windows into all of the other lines. In the case of the new)4NC wafer line, there were no windows and no hint as to what was inside. He did say, however, they use automatic aligners, and •that through the process up to diffusion, everything was handled as a continuous process. I would guess they have as highly an automated function as

TI's we saw several years ago. Diffusion, and some of the other processes, are batch in production. He longs to have the whole thing be a continuous process.

I was incredibly impressed with the fact that there were graphs of everything everywhere and I suspect even some graphs on semi—log paper somewhere. The graphs were used to plot everything against everything else, so that they really knew what their process was doing and the output. In the case of the secret prooess I asked about, he said that it had considerable computer control and he main reason for doing this was to know what the various steps of the process were doing and what the productivity was. As a manager, since he is not given that much control over his own destiny, he is very concerned about productivity. He does move some of the simple parts outside, but also is concerned with automating as much as possible, and keeping the cost of all the labor force flat while maintaining the various steep increases in volume. He did not say when the 65K/RAM would be built but they are being produced now in Tokyo.


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Subject: **Dibol 8-11 Compatibility and DIBS**

To: Ed Fauvre, MK1-2/E06
Jake Jacobs, MK1-2/H32
Stan Olsen, MK1-2/C36
Larry Portner, ML12-3/A62
Dave Schroeder, MK1-2/H32

CC: Bill Johnson, ML21-3/E87
Bill Keating, ML12-3/A62

Date: 19 DEC 78
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

follow up 1/2/79

Given that we're launching off on significant applications in Dibol for the store, it's essential to have a clear definition of compatibility among Dibols.

Can we get this definition?

Shouldn't the testing of software be done on all Dibol machines?

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST: Ed Fauvre MK1-2/E06 Jake Jacobs MK1-
2/H32
Bill Johnson ML21-3/E87 Bill Keating ML12-
3/A62
Stan Olsen MK1-2/C36 Larry Portner ML12-
3/A62
Dave Schroeder MK1-2/H32

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION DATE: SAT 8 MAR 1980
6:03 PM EST
FROM: GORDON BELL
cc: see "CC" DISTRIBUTION DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1
A51

SUBJECT: DIBS III AND FIXED/PARAMETERIZED/ALGORITHMIC APPLIC

In discussing the so called parameterized applications with Bill Turner and Cliff Neer, I think we came upon a strategy which could enable us to make a really significant contribution
to Applications programs... and get a really great jump on the
market.

Cliff defines 4 levels of variability:
0. Fixed programs
1. Providing variable constants (put in at installation time)
2. Ability to change report titles and headings
3. Processing option selection (alternative algorithms)

4. Computational algorithms (without loops)
(5). General program extensions to existing programs

Based on my understanding of the DIBS packages, we have somewhere
around level 2 amount of variability.

The strategy for doing applications would then be:
0. Enhance Dibol to support the various levels
1. Select field proven applications packages
2. Document, enhance, test, and market the given fixed applications
3. Given, the market use of a package, find out what needs to be variables, parameters and variable algorithms; enhance the package accordingly and rewriting if necessary to meet the market needs. Maintain compatibility with the original documentation
and user interface, and preferrably the file system so as to preserve trainin, documents, and user base, etc.

Note, this takes the risk out of the program and is along the lines of what we do best: evolution based on tried and true ideas.
Also, this is exactly the path that nearly all languages and applications languages follow---they build like crazy on the past!

"TO" DISTRIBUTION:

STAN OLSEN   OLLIE STONE   BILL TURNER
CLIFF NEER VIA TURNER
"CC" DISTRIBUTION:

GERALD T MOORE   IRWIN JACOBS   ROGER CADY
JULIUS MARCUS   JIM WILLIS   ANDY KNOWLES
DAVE SCHROEDER   BILL JOHNSON   JACK MILESKI
BOB DALEY   BILL KEATING

00 BURT DECGRAM ACCEPTED S 3545 O 14 11-MAR-80 14:04:03

****
* d i g i t a l *
****

TO: OPERATIONS COMMITTEE: DATE: TUE 11 MAR 1980
1:59 PM EST
OPERATIONS COMMITTEE: @CLEM FROM: GORDON BELL
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1
A51

SUBJECT: COMMENTS ON A CLEAR CUT APPROACH TO APPLICATIONS

I SUPPORT THE ATTACHED APPROACH BUT GENERALLY NOT THE "WORK WITH" A CUSTOMER TO DEFINE HIS APPLICATION.

ATTACHED: MEMO;59

****
* d i g i t a l *
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TO: see "TO" DISTRIBUTION DATE: SAT 8 MAR 1980
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FROM: GORDON BELL
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KNOWLES
DAVE SCHROEDER BILL JOHNSON JACK
MILESKI
BOB DALEY BILL KEATING

GB1.S2.49
11/30/81 Mon 13:58:55

THE DIGITAL COMPUTER MUSEUM

from The Director's Office

Dateline 1990

After more than a decade of operation, the Digital Computer Museum's collections encompass the entire information processing family. It has evolved to be similar to a well-developed natural history museum, where collections are classified to show entire branches of the plant and animal kingdom and whole societies. The collection of the Digital Computer Museum tells the story of the "natural" history of information processing with exhibits. Because information processing is such a large field, the Museum, like the great Museums of the late-nineteenth century, virtually requires an ark to house all its specimens. In cooperation with the archival projects of the Charles Babbage Institute, the Museum serves the scholar in researching topics in the history of computing.

This monumental achievement can be credited to a well thought out plan and policy articulated in early 1982. The clear identification of the audience, selection of a permanent location and building site, and conceptualization of an interpretive program for the collections provided the necessary direction for communicating the goals and ideas for the future.

Dateline 11/30/81

PROJECTED AUDIENCE

The audience is comprised of three parts. One group is the serious connoisseur of computing history. Exhibits, library facilities, seminars, lectures, and a visiting scholar program are geared to their needs. While their numbers are not large, their participation is absolutely essential to maintaining preeminence in the field. A visiting scholar program provides one way for some of the pioneers of computing, computer historians, and computer artists and musicians to be in residence and add to the richness of the environment.

Another group includes all people who want some understanding of the evolution of computing. Most computer scientists, programmers, engineers and professionals employed in, or being trained for the computer industry belong to this group. Special seminars, lectures, half-day and one-day programs provide overviews of the historic evolution of computing. Members of the IEEE, AFIPS, and other professional organizations, and retirees from the computer field are attracted to exhibits, the library, and the Museum's special programs and facilities.

The third group consists of families of the first two groups, museum goers, and others who are curious about the museum. Experience has shown that these people come and learn from quality exhibits. The Museum's exhibits are designed to communicate the history of computing and not to engage visitors in amusements.

LOCATION

Comparison of four different locations within Greater Boston suggest varying opportunities for the Museum.

Marlboro, in the building in which the Museum started: A pattern of visitors that evolved was never disrupted by moving the Museums location. The location on Route 495, close to the Massachusetts Turnpike, and within an hour of Boston, is isolated from other cultural or educational facilities. The site itself is outside of town and accessible only by automobile. Thus, the facilities must be developed to attract the visitor who will make a special trip and invest a half day in the trip.

Maynard, the home base of Digital Equipment Corporation and the "mini computer" capital of the world: The town is not on any main route, but within 45 minutes of most of the "computer engineering" community of Boston. All sites would be in a "downtown" with some bus transportation.

Route 128, the "high tech" nucleus of the sixties: 128 is the center of the computer community within Boston, and accessible to the interstate highway system. A number of building sites would be possible in the vicinity.

Boston or Cambridge, the center for the cultural institutions. While most students and tourists are confined to these settings with a large number of competiting cultural institutions.

Each location has its inherent attractions and difficulties. The critical decision point is the availability of a building with appropriate financing to make the Museum happen.

MUSEUM BUILDING

A Museum building has very special needs:

At least 120,000 square feet

60,000 square feet of exhibit halls with controlled lighting, temperature and humidity control, divided into at least ten different units ranging in size from 3,000 to 10,000 square feet, and including a theater for about 300 people, small meeting rooms and theaters for 12-100; space for a library,

store; restaurant; workshops for exhibit development; and facilities to allow for a flow of the public.

Parking for cars and buses.

Issues regarding MR-2 (using the present building)

<u>Legal/financial.</u> Two alternatives were considered. 1) Immediate acceptance of the entire building as a gift that would require raising a matching one-third from others for its renovation/endowment (as required by IRS regulations for public foundations). The Museum would lease back portions of the building to Digital or DECUS with their gradual withdrawal by 1989. 2) The separation of the building into three condominiums, each of two floors, to be given to the Museum in three stages: 1983; 1986 and 1989 at which time the Museum owned the entire building. At the time of the acquisition of each portion of the property one-third matching donations of $1.2, $1.5, and $2 million were attracted and divided equally between exhibit renovation and endowment.

<u>Space.</u> The configuration of the building and its associated property into a Museum poses the following issues:

Cost-effectiveness: if the expense to transform it into a Museum would be greater than building anew or looking for another site.

Appropriate timing of major spaces during the 10 year development period.

Establishment of free visitor flow throughout the space to encourage viewing many exhibitions, while maintaining use of part of the building for the other tenants.

Integration and use of computers and technology for interpretation and control of the Museum itself.

<u>INTERPRETIVE PROGRAM</u>

The draft catalog (attached) lists all the artifacts according to one taxonomy. Other classification concepts are useful in building exhibits. The two in conjunction are designed to provide a rich interpretive experience. For example, the first major exhibit, the Pioneer Computer Timeline, is actually based on one of the major chapters of the catalog and features two of the more significant artifacts of the collection: the Whirlwind and the Atanasoff-Berry Computer. The ideas for further exhibitions are listed below.

Interactive computing: The TX-0, PDP-1, PDP-11/45 and other machines capable of running and demonstrating interactive programs.

Super computers: Texas Instruments's ASC, Control Data's 6600, IBM's Stretch, University of Illinois's ILLIAC IV, etc. -- standing as sculpture with associated films, photos and other interpretive materials.

Personal computing: From the LINC, LGP-30, to Altos, ATARIS, etc. with the potential for user interaction.

Evolution of card programmed processing from a working Jacquard loom to a 1950's card room and inclusive of other examples.

Robotics from deVaucauson's automata through the evolution of industrial robots with demonstrations.

Memory devices, tracing the read-only and write-only memory devices through such use as player pianos to current read/write devices.

Computer ancestors in the craft generation, between 1600 and 1800, providing a feeling for the whole technological context of the era.

Computing in the transistor generation during the sixties.

Computer graphics, arts, and music exhibits with permanent listening galleries, halls for changing exhibitions and laboratory demonstrations.

Computing in space -- on-board computers and what they do.

Mechanical calculating -- from the Pascaline to Lehmer's number sieves, with opportunities to operate the calculators.

Games and gambling -- playing with numbers in simple early games, the totalisator machines of the 30s, classic chess programs and other games of skill and chance.

Developing appropriate levels of interpretation through signage and/or a/v materials, and communicating a direction and flow to the exhibit space without a personal tour guide is critical in the development of the exhibition program. The standardized text panels and catalog entries provide scholarly documentation that needs to be supplemented with interpretive story lines. Video equipment and comfortable seating is needed to allow the use of the films

that are being developed.
DRAFT FROM 7/81

THE DIGITAL COMPUTER MUSEUM

date: 1990

from: The Director's Office

After more than a decade of operation, the Digital Computer Museum encompasses the entire information processing family tree with a complementary program, document, photograph and film library. (see fig. 1) Housed in a 120,000 square foot building, historic artifacts of computing, video- and audio- presentations by the engineers and programmers working on historic machines, examples of benchmark computer applications, and a library of relevant books, manuals, photographs, and programs are on display and available for reseach purposes. Classrooms, viewing rooms, and a computer data-base system provides resources for resident scholars, short-term seminars, and lecture series.

The collections have been built up from gifts from industry, universities, government agencies, and individuals. All materials more than 15 years old are considered for the collection. This formula is also The Annals of Computing History to verify collectable materials. The artifact collection started in 1973, grew to more than 500 pieces in 1981, is currently at 5,000 and continues to grow. The film and photo library was inaugerated in 1981 and is now the pre-eminent historic resource collection. The book and program library were opened in full scale on moving to the present site in 1987, although collections began in 1981. The site has sufficient space to expand to double or triple its 120,000 square foot facility.

The Digital Computer Museum is unique. It cannot be likened to Science Museums that emphasize visitor numbers by attraction exhibits, for example the live Muppet show was the outstanding draw of the last decade at Science Museums that then hope the public will also look at serious exhibits. Nor can it be likened to industry-related museums that allow specific companies to outfit exhibits that fundamentally become self-advertisements. Nor can it be likened to experiential museums that attract children and parents to find out and experiment for themselves. The Digital Computer Museum is most like a well-developed natural history museum, where collections are classified to show entire branches of the plant and animal kingdom and whole societies. The collection of the Digital Computer Museum tells the story of the "natural" history of information processing, pieces are added to the story not for their intrinsic value but because they have a place in that history. Because this is such a large field, the Museum like the great Museums of the late-nineteenth century virtually requires an ark to hold its population.

AUDIENCE: The audience is drawn from three levels.

The primary audience is the serious connoiseur of computing history. Exhibits, library facilities, serminars, lectures, and a visiting scholar program are geared to their needs. While their numbers are not large, their participation is absolutely essential to maintaining predominance in the field. A visiting scholar program provides one way for some of the pioneers of computing, computer historians, and computer artists and musicians to be in residence and add to the richness of the environment.

The secondary audience includes all people who want or need some understanding of the evolution of computing. This includes most computer scientists, programmers, and engineers as well as other professionals employed in, or being trained for the computer industry. Special seminaras, lectures, half-day and one-day programs provide over-views of the historic evolution of computing. Members of the IEEE, AFIPS, and other professional organizations, customers of Digital and other computer companies, and retirees from the computer field are attracted to exhibits, the library, and the Museum's special programs and facilities.

The tertiary audience is made up of families of the first two
groups, museum goers, and others who want to find out what the museum is all about. No attempt is made to amuse or attract this audience via low-level fun and games. But,

experience shows that these people come and learn from quality exhibits.

SELECTION OF A PERMANENT SITE

Because Digital Equipment Corporation had the foresight to fund the establishment of the Museum, in 1981 they had the unique opportunity to benefit from planning a site for its long-term home.

A Museum building, itself, has very special needs: large exhibit halls with controlled lighting, theater type areas, and facilities for the public are important considerations.

Considering audience factors, four different sites were evaluated: Marlboro, Maynard, the Bedford/128 area, and central Boston/Cambridge.
From the point of view of what was known in 1981, the best sites seemed to be Maynard or near the Bedford 128 location. The wild card affecting these sites is clearly the availability of a building.

Figure 2 shows the weighting of the site selection criteria, and some scenarios affecting location.

FIG. 2 SITE SELECTION CRITERIA

	Relative Weight		Marlboro	Maynard	Bedford	Boston	Other
AUDIENCE							
DIGITAL							
Primary	5	15	20	10	5	__	
Secondary	4	12	12	16	4	__	
Tertiary	2	4	8	6	2	__	
NON-DIGITAL							
Primary	5	5	10	15	20	__	

Secondary	2	2	4	6	8	__
Tertiary	1	1	2	3	4	__
SUMS			37	56	56	43

FOUR SCENARIOS

Marlboro: Although it was known that the audience would have to be attracted to the site, the Marlboro campus facility of Digital was selected. A special museum building was erected on the site, tied into corporate displays in MR-2 and the use of public spaces in MR-1 and 3, especially after hours. With guest facilities for resident scholars and with on-site classes given by WPI and Northeastern, Marlboro became a center for computer history.

Maynard: , the Marlboro campus facility of Digital was selected. A special museum building was erected on the site, tied into corporate displays in MR-2 and the use of public spaces in MR-1 and 3, especially after hours. With guest facilities for resident scholars and with on-site classes given by WPI and Northeastern, Marlboro became a center for computer history.

Maynard: Two scenarios seemed appropriated: (1) The "Mill" centralized Digital's continued interest/support of the independent Museum, housing it adajcent to Corporate Headquarters, and Engineering. (2) A proper Museum was built in down-town Maynard providing life to the town and its redeveloped center and mall.

Bedford: Site and facility are independent. A site was developed (1) adjacent to Digital's Educational Services facility, (2) near the National Historic Park, (3) on Route 128, based on the following kind of facility, (1) an old shopping center, (2) new building, (3) reclaiming Lincoln Labs, or (4) something else. It became a center of activities for the large number of computer people within a half-hour of the Museum.

Boston: Much to everyone's surprise, the Digital

Computer Museum was given a building in Boston. The following two choices seem to represent the polar possibilities: (1) The site is a well-kept secret, about like the glass flowers, and it is a peaceful oasis for computer buffs. (2) Along with the Aquarium the Museum has become one of the chief attractions in the downtown area although we have not comprimised any historic standards.

Fig. 1: The Collections

```
           Period that the exhibit covers:
        Craft    Mechanical  Electro-mec   Electronic  Transistor
IC
            1600     1810        1900          1950        1960
1970

AUTOMATA----------------------------------------------------------
--------- including robotics

CONTROLS------------------------------------------------------- -
- -
including water clocks and governors

MEMORIES----------------------------------------------------------
---------
including books and magnetics

LINKS & SWITCHES           ---------------------------------------
---------
including telephony anraphy

TRANSDUCERS         ------------------------------------------------
---------
including typewriters and printers

CALCULA       ---------------------------------------------------
- - - -
Including analog and digital calculators

DIGITAL COMPUTERS                          ----------------------
---------
including processors

AUTOMATA----------------------------------------------------------
--------- including robotics
```

December 20, 1980 - OPERATIONS COMMITTEE APPROVED THE

CHARTER OF THE DIGITAL COMPUTER MUSEUM

Preserve artifacts relating to the history of computing;

Carry on a lecture and educational program;

Loan artifacts and consult on exhibits;

Prepare exhibitions and arrange tours;

Provide a resource on computer history;

Develop and sell museum-related products;

Make the Museum a center of interest and activity; and

Investigate non-profit status.

August 18, 1981 - OPERATIONS COMMITTEE MINUTES

The Operations committee approved the proposal to establish the museum as a public non-profit corporation.
Our intent is to support the museum on a continuing, stable basis and to treat it the same way as other important programs of the Corporation.

****

Presented: "Why can the Digital Computer Museum be Number One?"

Today: We are number one in quantity and quality of computer exhibits.

PIONEER COMPUTER EXHIBITS IN MUSUEMS AROUND THE WORLD

Museum	Date & Machine
Science Museum, London replica Smithsonian piece, Boston Museum of Science	1840s Babbage Analytical Engine (partial)
prototype & teletype, DCM	**1939 Bell Labs Relay Calculator**
replica, Deutsches Museum	1941 Zuse, Z3
drum + breadboard, DCM	**1940 Atanasoff-Berry Calculator**
pulley for bedstead, DCM	**1943 Colossus**
Harvard, IBM	1944 Harvard Mark I
Smithsonian, DCM	**1946 ENIAC**
DCM (loan from Science Museum)	**1949 EDSAC**
	1949 EDVAC
Manchester Univ., DCM	**1949 Manchester Mark I**
Smithsonian, DCM	**1950 Whirlwind**
Smithsonian	1951 IAS Computer
Science Museum, London	1950 Pilot ACE

DCM = Digital Computer Museum

ARTIFACTS ON DISPLAY AT THE DIGITAL COMPUTER MUSEUM

*** = WORTH A TRIP
PDP-1 operational with Spacewar
IBM 7030 "The Stretch"
TX-0, first transistor computer
Apollo Guidance Computer
LINC, first personal computer
Enigma, WWII cipher machines

** = WORTH A DETOUR
Bendix G-15
CDC 6600, Serial Number 1
LGP-30
PDP-8
Harold Cohen murals and "turtle"
Powers-Samas card system
Hollerith 1890 census machine (replica)
Texas Instruments ASC
Jacquard Loom Mechanism
Thomas arithmometer
Tinker Toy Computer
Napier's Bones
CDC 160A
Williams tube memory

NUMBERS AND SOURCE OF CATALOGUED ARTIFACTS

(Many computer systems have a large number of separate artifacts that, in fact, can be exhibited or loaned and treated as separate items. In this listing they are treated as one. The entirety of Whirlwind is one item, and a single transistor with its own serial number is also one item.)

	Number	Different Donors	Artifact
	21	14	Computers
	57	21	Computer components
	39	21	Computer options
	52	28	Memories
	57	23	Calculators
	..	48	Photographs and documents
TOTAL	226	*	

* From approximately 150 different donors.

December 23, 1981 - APPLICATION SUBMITTED TO IRS

March 1, 1982, advanced ruling approved, with final determination on June 26, 1984.

Determination will be primarily based on:

DIVERSIFIED BOARD OF DIRECTORS

ONE-THIRD OF THE SUPPORT FROM THE PUBLIC

ACCESSIBILITY BY THE PUBLIC

INITIAL BOARD OF DIRECTORS

Term	
1984	Charles Bachman, Cullinane Associates
1985	C. Gordon Bell, Digital Equipment Corporation
1984	Gwen Bell, Digital Computer Museum
1985	Harvey Cragon, Texas Instruments
1985	Robert Everett, MITRE Corporation
1986	C. Lester Hogan, Fairchild Camera and Instrument
1986	Ted Johnson, Digital Equipment Corporation
1984	Andrew C. Knowles, Digital Equipment Corporation
1986	John Lacey, Control Data Corporation
1986	Pat McGovern, Computerworld
1985	George Michael, Lawrence Livermore National Laboratories
1984	Robert Noyce, Intel
1985	Kenneth H. Olsen, Digital Equipment Corporation
1986	Brian Randell, University of Newcastle
1986	Edward A. Schwartz, Digital Equipment Corporation
1984	Michael Spock, Boston Children's Museum
1985	Erwin Tomash, Dataproducts and Charles Babbage Institute
1984	Senator Paul E. Tsongas

1982-1983 FUNDRAISING

Raise $250,000 to match Digital's FY83 and FY84 budgeted contribution of $500,000 for the FY83 and FY84.

Numbers	Category		Return
50	Corporate Founders	@ $2500	$125,000
300	Individual Founders	@ $250	75,000
400	Corporate Members	@ $125	50,000
1000	Members	@ $25	25,000
	TOTAL		275,000

STRATEGIES

DIRECT MAIL

- 2250 Letters April, 1982-(rec'd 40,300 by May 20)
- 4500 Letters & Reports, June, 1982
- 6000 Letters & Brochures, September, 1982
- 6000 Followups October, 1982

BROCHURE DISTRIBUTION

PERSONALIZED CORPORATE CAMPAIGN

SPECIAL GRANT APPLICATIONS

1982 FUNDRAISING PLAN

MAIL CAMPAIGN		Projected returns
APRIL - 2,250 Letters (750 inside DEC)	200-400	$30,000 - $50,000
JUNE - 4,500 Reports + letters (repeat mailing + list of Annals of Computing History & Digital Press Computer History Book purchasers)	250-400	35,000 - 50,000
SEPT - 6,000 Brochures + letters (repeat mailing + Museum - developed list)	300-600	40,000 - 55,000
OCT - 6,000 followups	300-600	25,000 - 55,000

BROCHURE DISTRIBUTION

In the lobby & at conferences such as DECUS and SIGGRAPH.

JUNE - DECEMBER	200	5,000 - 10,000

PERSONALIZED TARGETTED CORPORATE CAMPAIGN

Including special packet of reference materials and some presentations.

JUNE - DECEMBER

40 Corporations	100,000
100 Corporate Annual members	12,500
50 Individual Founders	12,500

TOTALS - Stated goal 260,000
340,000

FUNDRAISING WILDCARDS

Mail support for inserts or other promotion from:
- DECUS
- ComputerWorld

Large scale grants ($50,000 or more) from:
- AFIPS HISTORY COMMITTEE
- NATIONAL SCIENCE FOUNDATION

EXPENSES	FY 83		FY 84	
Labor (including overhead)	165	(20)	210	(25)
Exhibits and Programs	125	(20)	95	(35)
Store	20		30	
Archives and Publications	65		70	
Other	25	(20)	30	(20)
Total	410	(60)	435	(75)

INCOME				
Digital Equipment Corp	250	(60)	250	(80)
Founders	200		45	
Membership	65		145	
Store/interest/functions	35		50	
	545	(60)	475	(80)
Surplus	145		20	

() Contributions by Digital through the cost center but not necessary to account to IRS.

STAFF ANALYSIS

FUNCTIONS	FY 79 & 80	FY 81 & 82	FY 83
DIRECTOR	GORDON BELL	GWEN BELL--------------------	
ADMINISTRATOR	MARY JANE F.	GWEN BELL -------------------	
SECRETARIAL SUPPORT	MARY JANE------------	SUE HUNT--------------	
CURATOR	GORDON BELL--------	GWEN BELL---------------	
EXHIBIT COORDINATOR	GWEN BELL-----	JAMIE PARKER ----------------	
PROGRAM COORDINATOR	GWEN BELL-----	JAMIE PARKER--	CHRIS RUDOMIN--
COMPUTER MAINTENANCE		JAY MCLEMAN----------	
ARCHIVIST	GORDON BELL------	GWEN BELL--	TRINKAUS-RANDALL
PUBLICATIONS	GORDON BELL---	GWEN BELL --------------------	
FUNDRAISING	GORDON BELL---------	GWEN BELL---------------	
MUSEUM STORE			CHRIS RUDOMIN-----
TOUR GUIDES	GORDON BELL---	4 STAFF + 20 VOLUNTEERS------	
LEGAL COUNSEL			JIM DAVIS-------

COMPARATIVE STATISTICS

MUSEUM	OPERATING BUDGET*	ATTENDANCE	SPACE IN SQUARE FEET Exhibits	Total
Museum of Science Boston, est. 1830	4,000,000	900,000	113,000	279,000
Corning Glass Museum established 1951	3,163,000**	550,000	20,000	40,000
Museum of Science & Technology, Ottawa established 1966	4,200,000	700,000	112,000	140,000
Lawrence Hall of Science Berkeley, est 1968	3,000,000	285,000	30,000	117,000
MIT Museum established 1980	294,000**	4,500	11,000	26,000
Digital Computer Museum				
FY 82	250,000**	10,000	4,000	5,000
FY 83	400,000**		8,000	10,000

* Exclusive of capital funds and acquisitions.

** Exclusive of a number of overhead expenses given "in kind" including rent and maintenance.

SPACE ANALYSIS

SHARED SPACE	
(in lobbies and cafeteria)	4,000 square feet
Pioneer Computer Timeline	
TX-O	
Super Computers	
CREATED SPACE	
Archives 9/1/82	800 square feet
PRIME SPACE (rentable)	
Offices (1/82)	500 square feet
Four Generation Gallery (6/82)	2,000 square feet
Offices (9/82)	500 square feet
Interactive Computing	2,500 square feet
TOTAL	10,300 square feet

FUTURE SPACE NEEDS FY 1985-1986

Primary and Secondary Memories	2,500 square feet
Card computing	2,500 square feet
Archives	1,000 square feet
Analog computing	1,000 square feet
AN/FSQ-7 & other military computers	1,000 square feet
	8,000 square feet

POLICIES

* Preserve the history of computing.

"You must feel like the Director of the Museum of Natural History when he started to collect bones."

Jan Adkins, National Geographic

* Expand "oral" history via lectures and seminars by computer pioneers:

"There is no history, only biography."

Andy Knowles

* Make the machines themselves focal points:

"Well-engineered machines speak eloquently of their own elegance. Museum designers can't equal them."

Frank Oppenheimer, Director
The Exploratorium, San Francisco

* Interpret exhibits for the computer community:

"Hey, this Museum is for us big kids."

George Michael
Lawrence Livermore Laboratories

* Involve the primary audience:

"The Museum does not have to convince the computer community to support the museum because its artists are worthy; they <u>are</u> the artists."

Harold Cohen
Creator of the Museum's murals

STRATEGIES

1979 Built first exhibits; Held first lecture.

1980 Formed collections and exhibit policies;
Opened for viewing by appointment.

1981 Organized the public non-profit foundation.

1982 Open to the public from 1-6 Sunday through Friday.

Raise $125,000 from the "public."

Establish archives.

Start a research program.

1983 Obtain accreditation from American Association of Museums.

Plan an endowment program.

EXPENSES	FY 83	FY 84
Labor (including overhead)	165 (20)	210 (25)
Lectures - 6 per year	25	30
Exhibits (one new gallery)	80 (20)	40 (35)
Store	20	30
Publications (inc. fundraising)	30	40
Archives (start up)	35	30
Office Staff Support (legal, accounting, travel, etc.)	45 (20)	55 (20)
Total	400 (60)	455 (80)

INCOME		
Digital Equipment Corp	250 (60)	250 (80)
Founders	200	45
Membership	65	145
Store/interest/functions	35	50
	545 (60)	475 (80)
Surplus	145	20

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BROCHURE DISTRIBUTION

PERSONALIZED CORPORATE CAMPAIGN

SPECIAL GRANT APPLICATIONS

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a n d u m
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Subject: <>

To: <>

Date: <>
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

follow up <>

FROM: GORDON BELL DATE: WED 17 OCT 1979 8:27 AM EST
DEPT: OOD
EXT: 223-2236
TO: OOD:
OOD: @CLEM
OPERATIONS COMMITTEE:
OPERATIONS COMMITTEE: @CLEM
OPERATIONS COMMITTEE: @MR16
cc: BRUCE RYAN @CLEM

SUBJECT: DIGITAL MORALE

GB0005/6/EMS

Have just enjoyed a visit to Brazilian offices at Rio and Sao Paulo.

Overall, everywhere it seems we have bright, hard-working people. Bruce Ryan, a former IBMer, who heads the Brazil, Mexico, Caribbean, and Japan offices, points out:

1. We are in an incredible position

overall with the computer industry because of:

a. People in all functions
b. Products and product family

2. We apologize too much.

3. We always mention IBM in our talks and offices apologetically - we should never do this. (I'll try this for the next six months.)

4. We spend too much time focused internally.

5. We don't blow our own horn enough.

GB:swh

****
* d i g i t a l *
****

TO: STEVE TEICHER
DATE: WED 13 AUG 1980
9:56 PM EDT

FROM: GORDON BELL
cc: MARCIA KENAH
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: LOOKING AT COMPUTER ENGINEERING ROYALTIES IN RETROSPECT

Given that Craig feels he has been screwed out of what he thinks he should have gotton on computer engineering, I think we have to first understand this. As head of Digital Press, Marcia, can get us some data. Craig's mental model is 10K.

Under no circumstances would we ask DP to pay royalties after the fact, however, we can ask what they would do, given the policies for DEC authors now and what they remember in regard to Computer Engineering. There are several ways to compute it:
1/3 splits, on page counts pro rating all the authors including

the ones who had previously written articles, on the basis of time spent outside of DEC allotted time (eg. all my time was outside of work and all of McNamara's was inside of work and Craig's was mixed.) Marcia can you give us some help here in what is a delicate situation as we want to keep Craig here, happy and productive?

Thanks,
g

GB1.S6.20

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TO: Chase Duffy, BU/E44
Marcy Kenah, BU/E44

Date: 1/6/81 Tue
From: Gordon Bell
Dept: OOD
MS: ML12-1/A51   Ext: 223-2236
EMS: @CORE

SUBJ: **Stern Manuscript**

About 20 pages of comments will follow, but the bottom line:

The book is a factor of 2 too long, takes too much work to read, has all types of errors, draws and presents false conclusions, and delivers far too little insight to any reader I know. We can not publish it unless the issues are attended to.

It should come about R&S in quality and even try to attain Lavington quality, even though it will take another year. The beauty of publishing history is that it's virtually timeless; we have to control to quality, not schedule.

I still think it is an important story that needs telling. We have to set the standards and suggest the approach. Nancy's got most of the facts, let's help her make a great book!

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SUBJ: **Comments on Nancy Stern Manuscript**

TO: Chase Duffy, BU/E44
Marcy Kenah, BU/E44

Date: 1/6/81 Tue
From: Gordon Bell
Dept: OOD
MS: ML12-1/A51 Ext: 223-2236
EMS: @CORE

GENERAL COMMENTS

1. Think a penultimate copy should be complete with table of contents and preface. Don't you require this as the publishers?

2. The book lacks any hard illustrative material that I can dig into: not one time line, table, chart, circuit diagram, flow chart, photograph, patent figure, etc. Both previous books in the series had such materials. Isn't it the publishers job to keep and maintain the standard of the series? These are not secret requirements, but things that have been constantly important.

3. The first chapter is lacking the standard review of the literature. Don't you require authors to say, who else wrote what in order to clearly delineate their own unique contribution? On this point she is fuzzy. Chapter one states that she will assess the judgment of the Sperry Rand Court Case (p. 1-8). Then in the conclusion (p. 9-37) she says "the controversial issues relating to Atanasoff's contribution to Mauchly's works...have all been addressed by Goldstine and others who have written on the history of computing." She backs out of doing one of the things that she says she

will do. As editors you must be responsible that an author delivers what is promised---many people can say they will prove or even assess something, if so it must be done.

4. If the case is to be "assessed" and this is a purpose, then either all sides need to be re-interviewed and the transcript of the case analyzed, or no sides interviewed and only the materials from the transcript reviewed. Her interviews are highly weighted toward Eckert and Mauchly. From reading, the language she uses is highly colored creating sympathy for these two poor lonely men fighting the "establishment."

5. In fact, I find that the manuscript that is produced might properly be categorized as a historical novel...she often imputes how people thought or felt. Her statement is accurate that it is "a case study ...on two men who made very significant technical contributions to the field and on the institution, technological, scientific, and economic problems they faced along the way." At the very least one would expect her to exactly count, categorize, list, the significant technical contributions exactly. I could not find such a statement that did not have a qualifier, i.e., "in part". She should be the expert on Eckert and Mauchly and should be able to reliably tell us just what they did do. But she doesn't and she wanders around and that is why I call it a novel.

6. If the following comments are attended to, then there might be a publishable book. But I really thought that you folks and other reviewers would take care of the details. The subject is worthwhile and could make a decent history of these folks and times.

Chapter 1

1-1 The first sentence is written in such a way that one is led to think the four points are the major achievements and not the four computers. I would like to see a table that lists:

- name of computer
- date of start
- date of completion
- use
- bench mark statistics (speed, size)
- funding agency
- number made
- period of use
- major achievements

If such a table were made then I think that the first paragraph would write itself much more clearly and would also be more interesting.

1-2, p 2. What other aspects make them ideally suited for an indepth historical analysis? These need to be summarized here or the paragraph deleted. It would also be useful to have a chronology of Eckert and Mauchley. A photo of each-- or the nice profile of the two of them together and a page noting the major benchmarks in their lives. An appendix could describe the other folks too.

The list of interviewees in the appendix should contain their position at the time on which they were questioned and perhaps their present status.

1-2, last para. If RCA and Bell were the main corporations from which employees reviewed the progress of the Moore School then this should be a declarative statement. The paragraph goes from a vast unnecessary generalization, "during the war, organizations like the Bell Telephone Laboratories and RCA were actively engaged in government work," true but unnecessary to the story to a specific, "employees from these organizations were frequently called upon to assess the computational work at the Moore School and in some instances to provide assistance." The story would be better told if the sweeping general statements were left out and things just told as they happened. The work would then become clean.

1-3, para 2. It is the amount of funding, the kind of funding, and whether people are producing as agreed upon that sustains a project. What was the amount of money and the agreement? What are the facts?

1-3, para 3. What is the insight? Recent American history is replete with examples of individuals making new high-technology companies. What should we learn? Are Eckert and Mauchly bad businessmen? -- did they have inappropriate technology? -- what is the critical issue? -- or did the bogie man get them? This is old news -- don't rub it in -- just state the facts and don't preach. All ex-cathedra statements need to be eliminated.

1-3, last para. lst sentence. Wrong. Ferranti Ltd was already in the computer business, ERA was working on computers and IBM cannot just be swept away. (See the chart, History of Computers, Science Museum 1975) 2nd sentence. Don't see that this is done. What does "so late" mean? Could it have been earlier? Forrester has made the point that the development of computers was hindered because there were no users -- one had to have computers to be able to use them. Perhaps IBM realized the commercial "potential" quite early, but knew that they had to wait before there were users in order to realize it. Using an early computer was not as simple as going from a typewriter to a word processor.
I would like to see a list of all the purposes of the book (say in the preface), then the research that was undertaken to accomplish these, and finally the results.

1-4, para 2. The words science and technology are not clearly and consistently used throughout the manuscript. Line 6, "the sciences" is a broad use probably encompassing engineering and gunnery and even accounting. On the other hand, the thesis that science and the scientist is different from engineering and the technologist and both are needed is the major point that is being made. (Also, there's our relative, the mathematician.....) If it is, then the use of the word science needs to be appropriately restricted and is again improper in line 10 "scientific problems" for "ballistic calculations." The whole manuscript needs to be combed through and exact issues written in place of the general statement.

1-5, para 2. Is it certain that "Von Neumann's scientific orientation came into direct conflict with the engineering and commercial orientation of Eckert and Mauchly. This led to a bifurcation in computer technology, with some machines being developed exclusively for commercial use and others for scientific use." If this is the major cause of this dichotomy then please prove it. Or is it simply typical of what was happening in the embryonic computer industry? How do you accomplish what you say you will accomplish in the last sentence?

1-5, para 3. Sentence 1 only rubs salt into wounds. Just tell the story...don't whip up the "controversy", it's old news. The whole paragraph can be omitted.

1-6, line 8. Like IBM, and who else?

1-6, last line, 1-7, first line. Atanasoff is a physicist. What do you mean "originally a mathematician".

1-7, para 2-3. Make it clear that you will investigate three issues brought up at the trial. These would be better rewritten so that one can see the whole picture at once--sentence 3, para 2, p 8 really belongs with para 2 page 7. etc.

1-8, para 2. Discussed in the opening remarks.

1-8, para 3. How can you explore "the relationship between John Mauchly and John Vincent Atanasoff" without also talking to Atanasoff?

1-8, last para. The summary statement is really wishy-washy and could be left out. The previous paragraph interwoven with the court issues could be much stronger.

Other comments on the introduction. It is often helpful to indicate what will not be done, what others have done, and how you are going to accomplish your purpose. Try to excise the word "insight" from the manuscript. Provide the insight directly and don't just hold out a promise.

Chapter 2.

2-1, sentence 4. Think of what engineering and science were in the 30s. The whole field was intertwined. Why don't you have a table here of all the computer pioneers and what disciplines they represented. One additional example doesn't make a case. Don't interrupt the story of Mauchley with this example from Von Neumann. The last half of the para fits better much later in the book.

2-2, line 19. leave out the comments about money. They are noise in the history and really don't have anything to do with ideas. Every operation that I've know about has the same claims, oh if there were only more money. But that's not really the case and it just clutters the story, let's show his ideas. The next sentence really tells the story without his "wry comment".

2-3, line 8. should read "digital calculator." The previous page said that he had a digital counting device, but it does not say that he had a memory or a way to store it. Atanasoff put the counter together with a electrostatic memory and used binary arithmetic. In the manuscript it is important to use computer to mean a processor with a memory. Make an appendix of exact definitions that you stick to.

2-3, para 2, line 5. Redundant to qualify "the institution where the ENIAC and later the EDVAC were developed." delete.

2-3, para 3, How many director's of research were there? Might be a good idea to give an idea of the size and scope of the Moore School at the time.

2-4, para 1. How many integrators did the MIT DA have? 6

as noted in footnote 7, or 9 as stated in the text? Why does the reader care if there is tension between the Moore School and MIT? What does this mean? Isn't there always competition?

2-4, para 2. In 1940 was Brainerd an Assistant Professor or Director of Research as stated on the previous page. If he made the change then note this. Perhaps just delete "then an assistant professor".

2-5, line 10. Real estate is hardly an "applied area." Perhaps it is better to say far more interested in "business" or else directly quote Eckert. I'd say this background caused Eckert to be an entrepreneur.

2-7, para 2, last line. If true, then you must prove it. The English might say that code breaking was the single most important impetur to technological development. The generalization is too vast. Try impetus "to the development of the ENIAC."

2-8, para 2, line 1. Unnecessary. Also excise "shed light on" as well as the word "insight." Just give the facts.

2-8, para 2, sentence 2. When stumped with a problem, governments, industry, families, anyone will try anything -- fund anything, and build in lots of redundancy hoping that something will work. This is nothing new. Build up the case steadily and then draw some conclusions. One now might argue retrospectively that there wasn't enough effort.

2-10, last para, Redundant.

2-16. Your use of the conversation is really out of context. The BTL machine was proven and reliably calculating. Another $17K was very little to ask for and your unstated allusion is to contrast such a request with one from the Moore School. It is a kind of specious argument. There had to be shortcuts during the war to get the kind of work done that had to be done. This quote might be interesting, but I don't think it's very useful.

2-26. Para 2. Can't you find a quote from one of the people about the morale of the ENIAC team and then cite that this was also true at Whirlwind. What was the morale at ENIAC? Were they young and bitter? Young and enthusiastic with a high morale? I've observed this around really all groups who build things.

2-27. Sorry all that you have found is that the old men are conservative because they know all the ways that things can go wrong and the young men don't know yet and hence are innovative. The scientific elite had power because it was part of the bureaucracy. Goldstine represented a younger newer part of the bureaucracy that had problems to face and believed in a different solution. You did not really discover a paradox.

Chapter 3

3-2, para 2, last sent. A conclusion. Should be saved until later.

3-2, para 3, 1st sentence is redundant. 2nd sentence unnecessary.

3-5, para 2, More appropriate early in the document.

3-6. para 4, 1st sent. Similar to an IBM plugboard that existed at the time?

3-6, last para. Don't bring up controversies in the generic. Be specific. There is no need to say "Although there has been a good deal of controversy over priority claims", just state the facts. Either go into or don't go into it. This paragraph can be boiled down to a sentence lead in to the quote.

3-10, last para. 5th line from bottom. It should read "they were designed to operate".

3-11, para 2, 2nd sentence. Redundant.

3-11, para 2, 3rd sentence. How can you prove that. Did it proceed faster than Whirlwind? TX-0? Z-4? Wilkes really moved fast; the Manchester MK 1 beat everyone else.

3-11, para 3. A table of times on the ballistic benchmark test -- the standard of the day -- would be appropriate here.

3-12, para 2, line 5. Although there are quotes there is no source and we don't think it was ever called the "ABC computer" but the "ABC" or Atanasoff-Berry Computer.

3-12, para 3, line 1. Ditto.

3-12, para 3. These are only words, nothing is added from before. You need to point out the similarities. Note for example that everyone was wrong on having separate accumulators-- a hold over from the ideas they took from the differential analyzers. It should also be noted that everyone went to direct binary arithmetic eventually, NOT decimal as EM did. Look at or show the circuit diagrams. The circuit diagrams for direct digital computation had been worked out by Atanasoff and were absorbed into the Moore School. Have you ever wondered why Atanasoff didn't bring suit to UNIVAC? Do you really think the whole affair was moral? Considering what Zuse was doing and what Turing was thinking the "idea" was in the air....society is a much greater benefactor because the case was thrown out, but is it the purpose of the book to judge right and wrong? That really could have set computing back.

3-14, end of para 2. At this point the visit of M to Iowa is brought up. You should enunciate what he saw, how long he talked and what he had access to. You have my earlier note on JVA here. You have not treated the issue of JVA fairly! He wasn't even interviewed by you. Don't stand behind Goldstine's report on page 3-15. The ruling of the judge looks right to me too. I make direct digital computation with electronics a key invention. Everything I read says he did it first, damn it. Where is your counter evidence? JVA also invented the regenerative delay line and serial computation. All early computers used this, even though ENIAC erroneously didn't. EM get clear credit for the Mercury delay line. I would challenge this too as it being a mere adaptation of the radar delay lines using the regenerative idea from JVA's electrostatic drum. All physicists built counters and experimented with neon bulbs for storage in the late 30s, and I'm sure Mauchly did too. What bothers me is the lack of actual references from notebooks, or would you have me believe that Mauchly was a really sloppy scientist that didn't keep a notebook?

3-16 last para. The Schumpeter definition of "entrepreneur" seems irrelevant in this context since the common notion generally relates to the business as well as innovative dimensions. Perhaps it fits better when you have EM going into business.

3-17 2nd para. If you claim this, enumerate Eckert's inventions as distinct from Mauchly.

3-19. Previously you made the point that Mauchly took after his father and was a scientist. The popular myth is that scientists are not concerned with costs....now it seems that in fact he has a practical bent. On other accounts, it seemed that E did engineering, M was a scientist that turned more into the conceptualizer and possibly administrator. M also drove the programming it seemed?

3-20, para 5. Did JVA fail? He didn't continue, but he was right. On what grounds can you judge him a failure? Why not ask him?

3-20, para 5, last sentence. Be precise. What do you mean "later years"?

3-21, para 1. In arguing for supporting the ENIAC patent on the grounds that it made important contributions by incremental innovation really weakens your whole argument that it was truly significant. What I mean to say is that it looks like you first discredit JVA en passant, and then do a turn about and say, that even if EM weren't major inventors, what they did as engineers and evolvers was still worthwhile and therefore the patent should be upheld.

Occasionally "right" lines up with the law. You seem to think that EM were right, therefore their patent should hold. I know it is illegal to claim someone else's previous work as an invention. EM claim too much, and as such their patent was and should have been invalidated! It would have been trivial to make a valid ENIAC patent had they not have been so greedy. This continues to come through in all I can read on this case. Three independent groups were out after EM. JVA for not recognizing the direct digital computation, JvN for what is probably erroneously called the stored program computer (which I think EM can probably claim although I could understand how JvN would claim it or think he invented it), and Burks et al who were rightfully inventors of the various parts (try re-reading what seems to me is a careful account of this by Burks).

In short, to the novice you might strike a sympathetic chord, but at this point, you have succeeded in discrediting EM in my mind, although I do have a great deal of respect for them. In particular, without the engineering skill of Eckert, the machine might never have worked and this would have put off the development of the computer several years. I have no trouble in believing that it would have evolved about the same way because of the independent efforts in Germany, the UK (read Lavington), and even at the other universities.

(There's a whole issue surrounding the ERA part of UNIVAC that you haven't dealt with yet. If I had to "judge", I would put it that Sperry's contributions came out of this school, not the EM school. I hope to read about that in a later chapter.)

3-23, para 2. Yes. But should these men then be cited in the patent? Were they sought to be wronged by EM who would reap economic gains from the patent (if they had won) and not shared them? From a moral standpoint, I have lots of trouble with the whole idea of patents when the work is paid for by someone else whether it be the government or a company. I feel patents in this case could belong to either the Government or Penn.

3-24, para 2. Arthur Burks has been introduced, the phrase is redundant.

3-25, quote. What date was Frankel speaking of? For a long time the technology was just not to make that possible. Sounds like a fool's dream or that of a science fiction writer. Hardly seems appropriate for the book.

Chapter 4.

4-1, last sentence. "could" turn their thoughts or "turned" their thoughts... They were still under contract to the army and employed at the university. You imply by the use of the word "could" that it was completely appropriate for them to do so. Other computer pioneers didn't ... they "could" also turn their thoughts to developing the "science" of computing, or other things. The point is that they didn't. Why don't you delete the para, all the points are repeated in the 2nd para of page 4-2.
4-2, lst para. Redundant.

4-2, para 3. Why don't you start the chapter here.

4-16. How can you characterize Mauchly as so amiable when your evidence showed that people wanted to "cut him out." Was he too threatening, too dull, malacious, too-faced, or what?

4-18. What is your evidence that "Eckert depended and relied upon (M" in an inexplicable way." Explain. You have said it and said it. Does Eckert say so.

4-19. para 2 is redundant ... has been said at least 2 times before.

Final comment. If EDVAC were eliminated from that chapter it might become cleaner and tighter. A portrait of ENIAC on inauguration day would be nice.

Chapter 5

5-1. 2nd sentence. Self-serving and unnecessary. Last sentence repeated and questioned at the first time it was written. Suggest the first para be deleted.

5-2-4. This treatment of VonNeumann's life is longer than the treatment of either Eckert or Mauchly. But it is essentially a regurgitation of what others have said. One would like about two or three pages on each E and M to get some insight about them .. that is where the book has potential and where it falls down. Although the expectation was of oral history, very little of the feeling of a Nancy Stern interview and unique approach comes through. The author stands behinds others words too often and seems to parrot phrases over and over.

5-2, para 2. Most interesting because this is Stern's conclusions but the writing is very muddy. Sentence l has two ideas.. the fact "he willingly accepted" the dual roles ... should be stated cleanly. Stern's conclusion, "a dual role was particularly suited to his personality" is more conjectural...the reader has been provided with no study of "his personality". Sentence 2 implies that he was "always right". Sentence 3 states that he had "entrepreneurial attributes" which are distinct from being "enterprising" -- isn't this redundant? The example of being "enterprising" then is that he emphasized the need for written reports. In general this is not an example used for some who is enterprising, but for a good scientist who understands the need for documentation. Then in sentence 4 "delegating authority" is used almost synonomously with "collaboratively" while they are two different administrative styles. If he combined them then the author should show how. Often people who know how to collaborate don't know how to delegate and if he could and did do both, then a good example is needed. Sentence 5 is parenthetical. The antecedent to "such attributes" are the topics of sentences 2, 3, and 5. This is what I call muddy writing and unfortunately happens over and over. Experience tells me that muddy writing is the result of unclear thinking and cannot be cleaned up by a copy writer but most be reasoned through.

5-4, last para. Again muddy thinking. The quote by Fry does not subtantiate the authors allegation that "pure mathematics was at that time usually VIEWED AS TOO ABSTRACT for practical applications." I would delete sentence two and three.

5-5, 2nd para. Only "in an ideological sense"?

5-5, last para. "In short" is not accurate, a new point is being made.

5-7, last para. 1st sentence has been stated before. Delete.

5-14, 1st para, last sentence. Stated before. In addition, who cares that von Neumann is Goldstine's idol -- that should be an aside. How do you prove this? I should have thought in the interviews you would have determined how both E & M felt about von Neumann; what their appraisal was of the meetings with JvN; the book is supposedly about E & M and yet they still remain almost shadow characters in the background whereas JvN is coming alive and even Goldstine is starting to emerge as a real person and in the fifth chapter there is yet no good grasp over the reactions of E & M or any plunge into their interactions and reactions.

5-14, last para. essentially a repetition. Delete.

5-15, Paras 2 and 3 are confusing. Straighten out the chronology, the afterwards and befores. Does it go --

teamwork during the war, followed by a honeymoon with JvN, followed by conflict and individual self interest?

5-31, para 1, sentence 2. Be precise. It is not JvN's attention to "publication" in this case, but his making sure that the work was "written". He did not submit the draft report for "publication", but was providing a record. By omissions in this manuscript, E & M come off as very sloppy project administrators; they should have had notes and reports that could have been circulated as WW did. You cannot impute this as a difference between "engineers" and "scientists". It is the difference between a thorough job and a more sloppy one.

All one should state as a rule: engineers produce things, and usually do not publish externally; scientists produce knowledge, as such publication is essential. Both engineers and scientists perform experiments, keep records and build operational theories.

5-31, para l, sentence 4. must read "Eckert and Mauchly built the first, U.S., full-scale, operational electronic digital computer"; plugboard or general-purpose could be added. Each declarative statement on this subject must be evaluated for precise use of terminology. Also there should be an appendix where precise definitions are given (eg. calculator, computer, integrator, da, dda).

By this same token, JVA invented and built the first, electronic digital computer using direct operation, serial, binary arithmetic and the first serial, regenerative memory.

5-32, para 1, last line. Repeat of a statement that has been challenged. Yes, it represents a bifurcation but not of "computer development." How do you then explain WW, IBM, Z4, the St. Paul group, etc.? This is a non-supported ex-cathedra generalization with no data.

5-32, last para, lst sentence. Not substantiated by the reference. This is a sort of "oh wow" statement that is just not needed.

5-33. lst para. The allegation is that JvN almost blackmailed IAS. You must present your source for this.

5-35. last para. Don't understand? What was JvN's impropriety? It seems much less than E & M who were collecting a salary on the project while they were applying for their own patent and planning to "market" for their own personal wealth what they had done. Academic propriety is pretty clear about not collecting a salary for one thing while one is really working for something else. The whole approach of JvN to cooperate with industry -- with the scholar getting his reward (tenure, acclaim by peers, etc.) and industry getting theirs (economic gain) is something understood by many academic administrators and fosters the best kind of symbiotic relationship allowing the complementary forces of science and industry to grow. And on not citing others work surely E & M, especially M for not citing JvA, should be very harshly criticized. JvA was an academic and not out to get his own fortune on the invention of the computer and should always have been cited by M when describing ENIAC. Apparently there was a period when M talked about an Atanasoff-type machine. Do you have any records of this?

5-39. I read the differences as real. The operative sentence in the quote from Eckert is "get a lot of commercial money behind it." (And we know he meant behind E & M with their patent personally.) JvN had RCA as a one-third partner and maintained his independence -- thus he could write things up that would be widely available.

Chapter summary. List von Neumann's contributions in direct sentences. The first sentence says nothing. The last paragraph is superfluous.

In general this chapter could be tightened -- little detail is needed on the IAS machine. It more or less detracts from the story. What is needed is a very good time line; month by month showing when EDVAC was proposed; when the IAS machine was proposed; when the various memories were incorporated (known about); where JvN was; when Penn released the patent, etc. The narrative (the way it is organized) moves around too much in time and the reader needs a roadmap (I think the author does as well.)

Chapter 6

6-1, para 1, last line redundant. omit

6-2, para 2, last sentence. Overstatement. "The departures served to disperse THE existing expertise in the computing field..." maybe alot of the, but not all of it.

6-4, line 5. "disclosure" is a word often used for revealing information that should be kept secret. It is loading the dice against JvN. Tone your writing down. Alernatively you may be reontract with to have an NBS source for this.

6-13, first full sentence. E&M may have wanted to protect their patents and not talk, but almost everyone else seemed very willing to publish and talk. Your second reason, the lack of vehicles for publication probably has much more weight. Who else beside E&M didn't speak because they were protecting patents?

6-18, The Ravetz quote and preceding paragraph just add noise to the story. Delete.

6-19. Last para and on to 6-20. A preachy statement. Delete.

6-21. 2nd para, last line. What's the antecedent for "several years before" --- is that point relevant -- or would it be more to the point to say that NPL was the base for development of one line of early British computers.

6-21, 3rd para. Irrelevant. Delete.

6-21, 4th para. could also be deleted.

6-22-26, This section could be reduced to about a paragraph... the concluding sentence reads like a novel. Just be precise and give the facts.

6-27, line 11. Why not tell the facts. The Census Bureau had a competition for the design of a tabulating machine and Hollerith won. He was then funded. (But get the exact story.)

6-30, para 2, 2nd sentence. Delete. Irrelevant. Government had a "need" and were funding E & M.

6-30, para 2, 3rd sentence. Too sweeping a generalization. They supported E&M to do a job that they needed to have done.

6-35, summary para and quote. Not needed. No reason to put down Goldstine; nothing new added.

6-45, line 10. Need you repeat "the young and less prestigious Moore School group" over and over.... Delete.

6-45, last sentence of lst para, Delete "In addition" and use it to start the next para.

6-45, last sentence. Reference needed.

6-46, lst sentence. Leave out all extra verbiage like "of course".

6-46, lst para, last sentence. unnecessary and conjectural.

6-46, para 2, 3rd sentence. Introduce computer pioneer's once. I believe Aiken has been introduced, then stop identifying them.

6-47, para 2. The conclusion is that the Census bureau had a real need -- something that you have never addressed. A need that was as all-consuming as a war-effort and had to have a machine. The committee did not point out an alternative way. They had hope with EM, and no hope going the way of the committee.

Chapter 7

7-1, lst para unnecessary

Not "THE STATE OF THE ART IN 1947" You don't talk about the technology, separate the groups working on true lst generation computers from the electro-mechanical machines. The heading is really who is working in the field of computing.

7-2, line 4. Not, "like Harvard." Their machines were not relay computers, but really mechanical.

7-2, line 6. Is 5 numerous? Be precise.

7-2, line 7. IBM's 603 was on the market.

7-3, 3rd para. In England, Collossus had been built and in operation for cryptography and was classified. The ACE proposal had been written by Turing, and the NPL, Manchester, and Cambridge machines were being built and were not classified.
Read Lavington. Actually the Manchester MK l was the first operational stored program computer, not EDSAC. This needs to be changed when it is referred 19. Last to later.

7-3. 3rd para. Last two sentences, delete. Don't keep making such conclusions. Let the reader judge a few things for himself...just try giving the facts.

7-3-4, last para and to top of next page. Repeated from previous chapter. In fact all the material to page 7-5, "THE BINAC" is essentially redundant and can be omitted from the chapter.

7-5, last para. Delete. Start the section with the date on which E&M signed the ch Northrup. If EM had gotten, 2nd para. last sentence is very awkward. Try writing simple sentences with few parenthetical phrases that break up the main thought.

7-6. * This footnote can be a footnote and does not have to interrupt the story. (It is actually wrong.)

7-7. last sentence unnecessary

7-8, photo and diagram of BINAC would be nice.

7-9. last para. Sophomoric writing. Line two, rewrite to "an encoded magnetic tape." Delete "with magnetized spots representing characters." Next sentence: Output was produced either on a "modified" electric typewriter or on tape. What kind of typewriter was it? Are you sure that it was not a teletype of some kind? Be precise.

7-9, last para. delete 3rd sentence.

7-10, lst full sentence. Who made the tapes? Where did they get them? Why didn't EM hold these as a proprietary patentable idea? When did the Raytheon and WW tapes come for example? Where did EM get their ideas for using tapes in the first place.

In general it would be very good to have a complete listing with dates of all the contributions of EM. Maybe show the ones in contention.

7-10, line 8 need to change to "converted to binary for processing."

7-10, 3rd para. Explain specifically. What sorting algorithm was it? Why did you signal this? There had to be many things that were done first by EM, this is rather trivial one. Is it referred to in the literature? Did someone else claim it? Unless you understand what you are talking about don't write about it.

7-12, last para. If you are going to make a comparison, do it thoroughly. See Lavington p. 125. A table like this would be useful. The comparison should be with MK 1. The Lavington book is really good, clean and clear.

7-13, 2nd para. Delete.

7-22, 2nd para. A repeat. delete.

Chapter 8

8-1, para 1 - delete, a repeat.

8-2, Delete from first full sentence to the last para.

8-18. Why didn't you interview General Doriot? He generally has very good insight about why he funds and does not fund projects. It was ten years later that he funded Digital, and hardly relevant to this story.

8-19. Footnote 51 is missing.

8-23. last sentence. An implication is made that is not necessary. Suggest deletion.

8-24. Please, please have a table showing the characteristics of the ENIAC, EDVAC and UNIVAC for comparison. There are too many words and too much imprecision in your descriptions.

8-24, para 2. UNIVAC had 18,000 germanium diodes. Did ENIAC have any diodes? When did the diode first exist? Were the tubes in the ENIAC and UNIVAC the same? Was the density of the tubes for UNIVAC higher? What are the comparative specs?

8-24. 2nd para, last sentence. My references say UNIVAC had 5400 tubes.

8-24. A picture of a UNIVAC would be good.

8-24, para 3. By 1951, the mercury-delay-line memory had also been successfully utilized on Pilot ACE and Whirlwind. (Also on SEAC?)

8-25,line 8, rewrite to: The 2.25 megahertz pulse rate of the UNIVAC...

8-25, para 2, Sentences 5 and 6 are redundant. Delete.

8-25, para3 could be eliminated if you had a table. That is hard to read and not very interesting. But for the interested it is good material to have in a table.

8-29, line 5. You don't literally mean purchase from "Eckert and Mauchly" -- were they selling these on the side?

8-31. para 3. UNIVAC is not an "invention". It happened at a breaking point -- about 1950 was a revolution throughout the industry, but UNIVAC was not central to this. From 1940 to l950 one has the gestation period of the computer industry with many seeds planted. UNIVAC was the first computer oriented to commercial data processing and in this domain alone it was revolutionary.

8-31, para 3, line 4. two years before the 701 (did it have tape? and was it used for commerical purposes?) or four years before the 702 which clearly was competitive.

8-35, para 3. I'm convinced at this point that Henry Halladay's statement is right, and not one bit ironic. I don't see how you come to the conclusion that you do.

8-36, sentence 2. What about ERA? NCR? IBM? Burroughs? Leo? Elliott Brothers? Ferranti? British Tab Machines?

8-36, last sentence. True. But you have said this before.

CHAPTER 9

9-1, 2nd para. l idea. write as one sentence.

9-1, 3rd para. Don't understand lst sentence. What is antecedent of "such devices."

Delete from 9-1 to 9-5. Mix up accusations about corporations and government. No new facts.

9-5. If you are going into this area then read von Hipple at MIT. His work feels a lot better than the ones you use.

9-7. lst full sentence. If you really want to be technical, the date is 1906 (the deForrest triode -- which was theory and implementation of a valve), 1919 the date of the flip-flop was only a circuit diagram -- no real theory (science). You neglect Turing and all the formal representation of algorithms that were really necessary for the computer. These were after 1919.

You need a glossary of working definitions that you use for this book, otherwise you can't use the words that you do all the time. How do you use science, technology, calculator, computer, etc. etc.?

Actually for publication by DEC Press in its special history series that last chapter should be deleted. It is clearly a reptrospective cross cutting the facts from an historians perspective. It looks at various historic theories. But our readership is not interested in this. In moving from a dissertation to a book it is important to leave out such chapters which could have great meaning for achieving a degree, but are not appropriate for commercial publishing, especially within the dimensions of our series.

If this is left out and the other sections omitted as suggested the book will also get down to a better size. I want computer hardware and software engineers to read the history series. For this reason, I expect that the editors at Digital Press will insist that all the books have tables, charts, or photographs. Only if, all these suggestions are made, then we might have a publishable work.

GB2.S1.8

DIGITAL STANDARD BUSSES AND INTERFACES

Speed	Bus Name	Use	Cable	Dist.	I/C type
	COMMUNICATIONS INTERFACES				
110, 300, 1.2K, 2.4K	Asynch. Comm.	C-nT	3 std.	L,B	D,N
2.4K, 4.8K, 9.6K, 19.2K 38.4K 56K	Synch. Comm.	C-nT	2 std.	L,B	D,N
9.6K- 39K	DEC APT COMM ASYN	C-nC	2 twp	B	N
56K	DEC DATAWAY	C-n(T or C)		coax	L or B D or N
to 56K	IBM SDLC	C-n(T or C)		EIA	L,B D,N
to 56K	X.25	C-n(T or C)		ISO	L,B D,N
	COMPUTER TO COMPUTER(S)				
1M	DMP Pt.-Pt.	C-C	coax	L,B	D,N
56k,	DMP Q Multidrop	C-nC		L,B	D,N
1M	DMP U "	C-nC		L,B	D,N
8M	PCL	nC	x-coax	R	C
10M	NI=Ethernet II	nC	coax	B	N
70M	CI=ICCS	nC	2x2coax	R	C

EMS 26-MAR-79
19:31:48 100 1

To: John McNamara, Craig Mudge
From: Gordon Bell
Date: MON 26-MAR-79 19:31:48 EDT
Subject: Permissions to Reprint from Computer Engineering

Heidi has got me in bind with Dan (and myself). Dan wants to reprint about
120 pages from CE in Dan's redo, circa 80-81 of Computer

Structures. He's
asking for 16 pages misc, incl ch 1,2,3. ch s 7, 16, aapend x 1 and the
structural levels of pdp-8 (I and Dan wrote).   What do you guys think?

I', sort of holding until I get reviews back from the McGraw Hill reviewers
and see what they say. It may be academic caus the reviewers may raise hell
...and delay the book making the issue of such a large part of this book
academic.

Command:

EMS   27-MAR-79 10:51:08 520 1
To: Gordon Bell
From: John McNamara
Date: TUE 27-MAR-79 10:51:08 EDT
Re: Permissions to Reprint from Computer Engineering
         From: Gordon Bell   Date: MON 26-MAR-79 19:31:48 EST
         Message ID: EMS   26-MAR-79 19:31:48 100 1

I think that the first three chapters are part of the basic meat of the book.
The Seven Views, Technology Progress, and State of the Art Line discussions
are a major contribution to the literature and a good reason to buy the book.
I'm opposed to any reprinting at this time. 1980-1981 is too close and may
adversely impact sales just as we should be hitting our peak.

Command:
September 2, 1980

Richard Buxton

North European Regional Support
Digital Equipment Co. Ltd.
42-44 Portman Road
GB-Reading, Berkshire RG3 1JW
ENGLAND

Dear Richard,

Thanks for the information on the PDP8 serial no. 2. The Museum now has a table top 8 on display and has no money. However, 8's are in demand as museum pieces -- we've supplied one to the British and Canadian science museums. I suggest that you store it -- don't throw it out -- since I believe there are going to be more and more requests for these in museums. If you want to ship it to the US, then we can store it here.

I'm enclosing a copy of our latest newsletter and brochure. Do hope that you get the chance to see the Digital Computer Museum.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:swh
GB1.S6.28

Enclosures: Museum Newsletter + Brochure

April 1982 Direct Mail Campaign

Results through May 20, 1982

	Numbers			Dollars
	Sent	Received	(Percent)	

TOTAL	2250	188	8.3%	40,525

Outside Digital

TOTAL	1500	129	8.5%	

Members @ $25	81	2,250	
Corporate @ $125	9	1,125	
Founders @ $250	29	7,250	
Corporate @ $2,500	10		25,000

Inside Digital

TOTAL	750	59	8%	5,300

Members @ $25	42	1,050
Founders @ $250	17	4,250

April 1982 Direct Mail Campaign

Results through May 10, 1982

1500 Letters outside Digital

	Numbers Predicted	Actual	Dollars Predicted	Actual
TOTAL	257	117	43,750	22,950
$25	200	73	5,000	1,875
$ 125	20	9	2,500	1,125
$ 250	25	30	6,250	7,500
$ 2,500	12	5	30,000	12,500

750 Letters inside Digital

TOTAL	137	49	6,125	4,600
$ 25	125	34	3,125	850
$ 250	12	15	3,000	3,750

2250 LETTERS TOTAL

TOTAL	337	166	49,875	27,550

(27,710)

00 BURT DECGRAM ACCEPTED S 9586 O 91 12-DEC-79 21:08:00
FROM: GORDON BELL   DATE: WED 12 DEC 1979
9:04 PM EST
DEPT: OOD
EXT: 223-2236
TO: DICK CLAYTON
    BRUCE DELAGI
    BILL DEMMER
cc: STEVE TEICHER
    PETER VAN ROEKENS
    BILL STRECKER
    DAVE RODGERS
    GEORGE PLOWMAN
    GEORGE HOFF
    HERB SHANZER
    SAM FULLER
    WAYNE ROSING
    JESSE LIPCON @MR16
    JIM KING @MR16
    S JENKINS

SUBJECT: MY UNDERSTANDING OF THE DIRECTION AND NEED FOR BI

We (MSD,CSD and DCG engineering an Product Management) met today to relook at where we are in the interconnect implementation versus the strategy put forward last May.

It is clear that the design has gone upward in either a real or perceived sense because there has been no involvement by DCG or CSD in the spec or understanding the implementation of BI. Also, it is clear that everyone believes the NI is the hope for the future in nearly every dimension. It is clear to me, and I am asking that we disavow the NI as being the answer to

all the problems faced in building current and future systems...therefore,
I assume we are going to have to build systems as we currently know them
and love them, at least until such time as we can show that NI does indeed
allow us to build systems at no cost or performance penalty, with no software
and with hi fi+ ease of interconnectablility, etc. Therefore, the bottom
line is: WE HAVE TO MAKE BI WORK AND BE SUITABLE FOR BUILDING DCG-TYPE
PRODUCTS, AND TO HAVE THEM BE COMPETITIVE WITH THE MULTIBUS APPROACH OF
INTEL. This means that CSD/DCG take over the responsibility for the BI
spec to insure its applicability and do it based on knowledge, by implementing
options and systems now. MSD would then adapt designs (Comet BI adapter,
Hg options and CPU, and Nebula) to the revised (if any specs).

NI can easily get into the same fix. In order to avoid this, someone(s)
from CSD/DCG must be part of the spec team and also concurrently implemenat
a breadboard for theQbus.

The way I look at this is then:
1. We are still proceeding with the original interconnect strategy, however
we are directing the BI to meet the goals (actually constraints) imposed by
CSD/DCG instead of being allowed to drift up into a higher performance place
that I don't knw who (including Venus) wants.

2. Q bus is really evolved to have 22 bits.

3. BI is really the follow on to the Unibus, but with the cost of the Q bus

so that it can be the successor to both busses.

4. NI is really the follow on way to build lower cost systems, and we have to
make it happen...even though it isn't essential to building a system. It is
essential to building a distributed processing network however.

5. BI will be used by our TOEMS eventually as incremental expansion, and
to do multiprocessing if and only if the need really develops this way.

6. BI as being redirected will be equally useful for a memory and I/O
interconnect. The initial use will be as I/O interconnect in both MSD and LSG. Mercury will use it as its memory/I/O bus (really a test case for bus and for multicomputer use). CSD/DCG
require BI for a high performance version of Jaws as Q22 is too
slow, a multiple set of Q's too kludgy, and another bus inevitable to realize Jaws' performance potential. CSD/DCG also
require BI as a bus for VLSI VAX.

I hope this captures the meeting direction and output. I assume there
will be full minutes.

Command >

00 BURT DECGRAM ACCEPTED S 2770 O 59 08-FEB-80 10:23:36
FROM: GORDON BELL DATE: FRI 8 FEB 1980 10:22 AM EST
DEPT: OOD
EXT: 223-2236
TO: BILL PICOTT @MR16

cc: DICK CLAYTON
GERALD V BUTLER
BOB GLORIOSO
WAYNE ROSING

SUBJECT: SOME DIRECTIONS TO TEWKSBURY RE GRAPHICS

The folks at Tewksbury are working like crazy to build a bit map in time to demo at Stratton. It will run a display and a Canon Printer. The next phase is to do the processor so that it will be breadboard by June. There are a few problems How can there be a better interface with the A/D and products development parts of LE and Terminals? Should they move to the mill?

There are major communications required vis a vis compatibility with the Regis architecture.

Who will ultimately do the product? (It's going to be somewhat expensive to start, especially if it is hi res color. (One version is this way.) The candidates are:
You
MSD
CSS

I vote for later, just because they have people in the mfg. and eng. space already...and could have this charter.

Could you convene us on just when and where we are going if the graphics area?

GB1.S1.64

DISCIPLINE AND ENVIRONMENT **DISCIPLINE (CULTURE BASED)** **INDEPENDENT**

DEPENDENT

SPECIFIC

ENVIRONMENT

(organization)

SPECIFIC

INDUSTRY

(e.g., power)

SPECIFIC

FUNCTIONS

(e.g., "INTELLECTUAL GENERIC

accounting, BASE" (e.g., (e.g., communications, word

electrical business, engineering) processing, mail, copying,

engineering) filing

LOW ~ HIGH LEVEL

LANGUAGE INTERFACE

(NO USER PROGRAMMING)

LAYERS OF (PROGRAMMING) LANGUAGES WITHIN A DISCIPLINE AND ENVIRONMENT

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+---------------+
! d i g i t a l !   i n t e r o f f i c e   m e m o r a n d u m
+---------------+
```

Subject: DISK AND CRT AREA

To: John Kevill
Bob Puffer

CC: Ed Corell

Date: 3 MAY 78
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

When Bob Puffer had his office on the third floor of one there was a ritual that the area was cleaned up every Friday afternoon; now with him on 12-2, this apparently doesn't happen.

Ken reported that he was up on 1-3 some time around lunch hour and the area was very depressed looking and half empty. Maybe this is just because we are going to Colorado, but he was concerned that in fact we had become a little bit sloppy.

His proposal right now is that at one of the next Board meetings we show them through engineering.

GB:ljp

Digital **Interoffice Memo**

Subject: **Disk Controllers**

To: Grant Saviers

CC: Dick Clayton
John Levy
Demitrios Lignos
Jesse Lipcon
Bob Peyton
Bob Puffer

Date: 20 SEP 76
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

F/U 9/28

I was recently asked:

How can I get the resources, such that we can build good, low cost, disk controllers? It was postulated that the disk people are only interested in the drive, and not the logic.

It doesn't seem like a matter of $, but of capability. I'd like to get a critique from people inside and outside if necessary to solve this problem by having others look at design alternatives. Also, should we still reconsider moving the controller design back to the CPU groups?

Note the floppy system is not only ridiculously expensive, but it doesn't work...to be in the low end, these designs are critical!

Bob, can you please see if we indeed do have a competitive (cost) problem here, and indicate the size of it by getting someone to measure (e.g., count chips) and compare us with competitors for various features?

GB:ljp

EMS 27-NOV-78

21:53:51 370 1
To: John Kevill
CC: Bob Puffer, Larry Portner

From: Gordon Bell
Date: MON 27-NOV-78 21:53:51 EDT
Subject: My priorities in understanding the disk crisis

Larry reported that I wasn't concerned about the high end and mid range disk
problem that is coming on us very fast. Nothing could be further from the
truth. It is somewhere there with my concern about hydra as 1 or 2 on my
priority list.

John, I think you should come forward quickly with any requirements for
more $ or resources just as soon as you've laid out the alternatives to save
our ass in this area. I think it is the # 1 compteititve problem in the
next 6 months and we really need a protptye such that we ould announce if
necessary at that time.

I think you should give a pitch to the marketing committee by mid December
on the problem and what the alternatives are.

Command:

EMS 23-JAN-79
15:35:14 010 1
To: John Kevill
CC: Grant Saviers
From: Gordon Bell
Date: TUE 23-JAN-79 15:35:14 EDT
Subject: disk priorities

I would like to meet with you and Grant on friday after your meetings in
order to get an idea of what we are going to do in the mid range systems
where it is becoming increasingly clear we will have a major competitive

problem.

I see us as having the 11/24, 11/44, Minnow, Nebula, and Comet all sitting
the there with a need for more than an RL02 due to the fact that the system
software is big! Furthermore, all our competitors are coming out with
reasonably large disks of the 50-60 mbyte level and the pres are the same as
what we offer for the RL and RK products.

To me, this is probably among our highest priority, as it represents such a
large systems base (eg. targetted by IBM via the Series 1, System 38 and 8100,
all of which have the above disk). Now, with the RP07 and 08 being feasible
and reasonably cost-effective and holding the line in our 11/70, 2020,
adVAX/780 systems, it is time to worry about the heartland. With the risks in
the r80, it seems like the path you suggest is reasonable: 1. Make uda have
first the 9762 interface and use the CDC 63MByte unit we hav on the Massbus
be used there. This also gets us access to 9762 interfaced drives. The cost
is right versus the rm02 and rk07 2. Get the r80 on uda 3. Get the r80 on
Massbus 4. Get HSC50 eventually, eventhough we don't need it except for
Dolphin and Hydra. These can wait since Dolphin can stand the price of
massbussesa and the delay. Hydra can't use it at fcs due to the added work we
aren't read

to do yet anyway.

Let's get the settled and going.

Command:

C O M P A N Y   C O N F I D E N T I A L

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+---------------------------+                                GB0001/47
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a n d u m
|   |   |   |   |   |   |   |
+---------------------------+
```

Subject: **Alternative Disks for Medium Systems**

To: Bill Demmer, TW/D19
Bernie Lacroute, TW/A08

CC: John Kevill, ML3-6/E94

Date: 3/16/79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

follow up 3/30/79

Is there a way you could breadboard (try) the CDC 9762 interface to the Unibus (CSS has one, I believe) and explore using the plethora of external and internal disks interfaced this way as an alternative to the current disks? This would probably give us a much better system's price, get rid of many of the configurations, etc. It might apply to 11/44, Nebula, and Comet.

The CDC disk used as part of RM03, is already in-house and might be considered because it would save on spares, incoming inspection, etc. The RM80 has this interface (as used with the Massbus) and CDC has a storage module 60 Mbytes (fixed), evolving to 120 Mbytes. Other vendor disks use this interface, including a 600 Mbyte disk from CDC to come.

GB:ljp

ID#324

```
+---------------------------+
|   |   |   |   |   |   |   |
| d | i | g | i | t | a | l |   i n t e r o f f i c e   m e m o r a n d u m
|   |   |   |   |   |   |   |
+---------------------------+
```

Subject: **High-End Mid-Range Disk Strategy and Architecture**

To: Bill Demmer, TW/D19
Ulf Fagerquist, MR1-2/E78
Bill Johnson, ML21-3/E87
John Kevill, ML1-3/E58

Date: 31 OCT 78
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

I'm feeling very uncomfortable now with the disk effort vis a vis the high end, the impending products of IBM using the Winchester technology in fixed disk systems, and the underlying architecture of the NDS. Somehow they all seem coupled, and if one could be fixed, maybe all of them could be.

It seems that the RP07 would have been all right if it had been on time and if it had an RP08 follow-on. Given that these conditions have changed, then it seems like we need to rethink our direction. We're on the threshold of getting creamed in the high end systems businesses (2020's, 11/70's and 780's).

The Massbus price continues to be a big source of problems in cost and pricing. We have to get off it, and if we bite the bullet now and planned for no new products as of now, we might be better off. The de facto plan is to have a new disk interface, but yet that takes incredible changes in our software to support it, and I worry about when we can get there. Also, with this interface, like the Massbus, the systems group is captive to our internal supply. A way around this is perhaps to get multiple suppliers on board with disks immediately, so we can buy disks as commodities. In this regard, I think it is time for the base hardware groups to start worrying about disks, because that's where the cost problem is. John, your threat to Bill that there would be trouble with building a Unibus interface to the new disk interface worries me. Since there's so much diagnostics built into the disk, I fail to understand the concern. In short, we need more parallelism in the design. Other groups have to help.

NDS has always been a concern and I have been ineffective in communicating the exact nature. Now, I'll try again. I see all these systems coming down in price and I see the price of NDS as significant in all but the 780 and 2040 and above class machines. I don't see it as being applicable to Hydra because it is most likely too expensive and it introduces another system component type in the system and this adds to the unreliability, and makes the architecture unclean and inhomogeneous. (I realize that it may be necessary for the functionality, but I still don't like it). Therefore, the product has a limited market, and with such memory design resource limits, I wonder if we should be going to a system that will take more resources in what I think will turn out to be an unbounded fashion. This is also my concern about the migration of software to the Colorado Operating System. If the architecture were more in line with current operating systems, there would be a natural migration to a special system; or, said more simply, if the disk traffic gets really high, then one or more of the standard system component in Hydra would be dedicated to Memory/File/Record/Database work, rather than having a special system components that only deals with physical records and that is somehow extended to the other levels on an ad hoc basis. In short, I do not like the architecture of the system and I feel uncomfortable with it. Only immediately after I talk with the NDS group do I ever feel very good but that passes with time. In this instance, I must ask the architecture group for alternative structures, because there must be better alternatives.

The issue of caching is bad too. I wanted to build the Massbus cache to get some experience which I think we badly need and in doing what I think will be the only reasonable way to cache disks. Let me relate the story on the 11/45.

> I tried to get a cache in the 45, but the complexity was too great for the project. Fortunately, a fast bipolar option was put in and a few users bought it. We ultimately offered an all bipolar version in the 55. The real winner is the 70 with the cache, because users need not worry about what is cached and what is not. In doing the 70 the alternatives were to do software caching in the bipolar memory, but this is impossible even though the software people and hardware people said we could do it in software.

Right now, every system has a disk cache in software. A major part of TRAX and its complexity is disk caching. Again, this whole effort is largely nonsense. The memory group could have solved the problems by a disk cache. Now, NDS is the only way we can have a disk cache, and it is only for the high end. Again, it is software, but in the NDS. I believe there needs to be some provision for caching simply at the disk interface so that it can enhance all systems.

The bottom line: we have some nice opportunities for consolidation and we need to look at our systems architecture quite quickly as we pour money into what may turn out to be the biggest White Elephant around.

Let's get together for a way to segment the problems and proceed.

D I G I T A L INTEROFFICE MEMORANDUM

DIST: Bill Demmer TW/D19 Ulf Fagerquist MR1-2/E78
Bill Johnson ML21-3/E87 John Kevill ML1-3/E58

ID#353

| d | i | g | i | t | a | l | **i n t e r o f f i c e m e m o r a n d u m**

Subject: **A General Approach To Displays**

To: Dick Clayton, ML12-2/E71
Bob Glorioso, ML3-2/E41
Len Halio, ML1-2/H26
Roy Moffa, ML5-2/E93
Stan Pearson, ML12-2/E71
Charlie Rupp, ML3-2/E41
Tom Stockebrand, AB

Date: 16 NOV 78
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

follow up 12/5/78

We seem to have the potential to need many displays very soon as the competition will get more aggressive. Somehow, our R and D ought to be aimed at getting us in a position so we can make the greatest number of products with the smallest development and manufacturing changes. This would let us key off of the production base. This is a technique that we have used in our computers and that the TV industry uses.

I don't know what the basic modules are, but the parts that we have already identified include the package, power supply and module frame. Could we identify an approach so that we can evolve:

1. current screen to higher resolution for a full page of text (here, I believe that the 66 lines are important so as to see the page

2. current screen to higher resolution graphics to 1000 line graphics

3. black and white graphics to color

What are the right evolutions and components?

D I G I T A L INTEROFFICE MEMORANDUM

DIST: Dick Clayton ML12-2/E71 Bob Glorioso ML3-2/E41
Len Halio ML1-2/H26 Roy Moffa ML5-2/E93
Stan Pearson ML12-2/E71 Charlie Rupp ML3-2/E41
Tom Stockebrand AB

3 January 1983

James N. Bardsley
Professor of Physics and
Chairman, Committee for Academic Computing
University of Pittsburgh
Pittsburgh, PA 15260

Dear Professor Bardsley:

Thank you for your frank letter of 17 December. Since I just returned from Australia, I was delighted to find that we are proceeding to discuss the distributed computing network with you. In fact, I'm impressed with the proposal by Bob Pierce and George Pandelios.

I believe Dieter and Bernie are proceeding to meet with you through the local office in this regard, and I hope to visit Pittsburgh in the next few months too.

Sincerely,

Gordon Bell

Vice President, Engineering

cc: Chuck Eichenlaub
Bernie Lacroute
Dieter Huttenberger

GB4.S1.3

WAYS TO DISTRIBUTE PROCESSING (AND MEMORY, TRANSDUCTION, ETC.)

<u>SMALL ORGANIZATIONS (E.G. BUSINESS, HOME)</u>

- INDEPENDENT (DECOUPLED) COMPUTERS
- INDEPENDENT COMPUTERS WITH INFORMATION TRANSFERS VIA
    - MAIL/MANUAL
    - COMMON CARRIERS
    - COMMON CARRIERS AND INFORMATION INDUSTRY

<u>LARGE ORGANIZATIONS</u>

- LARGE, SHARED MULTI-TERMINAL SYSTEM
- ORGANIZATIONALLY: CENTRAL, GROUP, INDIVIDUAL
- BY A FUNCTION FOR MANY ORGANIZATIONS (E.G. ORDER PROCESSING)
- FOR COMPUTER'S CONVENIENCE: FILE SERVICE, PRINTING, SWITCHING

<u>The Central Facility</u>

Large, shared data base

Archiving for personal or organizational computing

Program facility for a few, distributed users

Quality printing (typesetting) and special facilities

Very High Performance Processing

General facility for casual users

Group Level Facilities

Shared, project data base

Specialized facilities (eg. microprocessor debug)

Programs run in common for group

Intra-group communications

Communications with Central and Personal Computers

High Performance Processing

Personal computing for many of the group

Personal Level Facilities

Personal data base (usually transient)

Communication with one or two, link to home, link

to higher level machine

Fast response, high quality terminal

Program environment for entering new programs

Processing sufficient for an individual, and

compatible with every other level

00 BURT DECGRAM ACCEPTED S 20811 O 363 29-MAY-81
16:29:17

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION DATE: FRI 29 MAY 1981
15:35 EST

FROM: GORDON BELL
cc: BERNIE LACROUTE DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: DISTRIBUTED SYSTEMS HARDWARE DEVELOPMENT IN NEW HAMPSHIRE

I have committed to Bernie Lacroute and Bob Savell that they can

continue to keep a hardware development group in Merrimack,
occupying the 20K ft space they now occupy, and staffing as they
desire within the limits of that space as long as there is
any significant amount of development activity of any kind
taking place in Merrimack.

Should the development activities currently located in Merrimack
be moved to another New Hampshire location, the same commitment
applies.

Larry and I are particularly sensitive to the need for stability
of people's work location and are committed to improving that
stability.

In this particular situation it was very clear that a formal,
irrevocable commitment be made.

"TO" DISTRIBUTION:

BOB DALEY DIST. GROUP VIA LACROUTE BRIAN FITZGERALD
BILL JOHNSON JULIUS MARCUS STAN OLSEN
LARRY PORTNER

GB2.S6.53

UDK FOR MAIL TICKLER GB2.S13.11

LP to create a result record list, then LP for tickler result
in readable form.

BRING OUT RECORDS TO FORM NEW LIST:

LIST: _____
SPEC: _____
FORM: _____
RESULT/LIST: _____

MAIL TICKLER RESULTS:

LIST: _____
SPEC: _____
FORM: _____
RESULT: _____

LP RET D RET LIST RET SPEC RET FORM RET RESULT RET O RET GO RET GOLD MENU
( ) ( ) ( ) ( )

LP RET D RET LIST RET SPEC RET FORM RET RESULT RET O RET GO RET GOLD MENU
( ) ( ) ( ) ( )

00 BURT DECGRAM ACCEPTED S 3541 O 55 22-JAN-80 11:49:35
FROM: GORDON BELL DATE: TUE 22 JAN 1980
11:44 AM EST
DEPT: OOD
EXT: 223-2236
TO: OOD:
OOD: @CLEM
cc: JOHN F SMITH @CLEM

SUBJECT: JOB DESCRIPTION - FOLLOW UP: 2/1/80

JOB DESCRIPTION

DOCK MERGE/CUSTOMER MERGE/PROGRAM MANAGER

To "work with/manage" across engineering and manufacturing and then to sell the changes and benefits to P/L's. This person will define and accelerate dock and customer merge of systems along the lines needed by the current programs (e.g. Comet, Nebula). The program must get and maintain high visibility. The current hi volume system (Nebula, Comet) have moved a significant distance, but much work is required to co-ordinate and to get the details worked out which are at a stand still. We must get the right partitioning of system components (e.g. cabinet mounted RL's) to the high volume plants. Also, the critical communications options are not dock mergeable. We must have a continuous monitoring of where we are and what's left to do.

Folks, we ain't making it although there's lots of progress. There's nothing here that's very hard, but there's lots to do. I think a person, reporting to Larry and I is needed even though I'm not anxious to take on any more. The payoff, one less FAT plant is so high, that I think we need to do it. What do you think?

GB1.S1.29
<<lci>>

The Computer Museum
One Iron Way
Marlboro, MA 01752

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Description

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1. That The Computer Museum will give this(these) item(s) every reasonable care using standard museum practices to protect and preserve it(them). The Museum does not assume responsibility for insuring the item(s) against loss through

theft, damage, or destruction.

2. That is the responsibility of the lender to make arrangements to have the item(s) removed from the collection or renewed at the end of the loan period. In lieu of this the lender may turn the loan into an unrestricted gift to The Computer Museum, a non-profit organization under the Internal Revenue code 501(c)3.

3. That this loan shall be for <>days, months, or years and shall terminate on <>(in the case of years the loan shall terminate on December 31 of the last year). The loan may be renewed for a similar period with the consent of both parties and subject to a statement on the condition of the article by The Computer Museum.

Name and Address of Lender

Gwen K. Bell, Director
The Computer Museum

Date
<>
<<dc>>

The Computer Museum
One Iron Way
Marlboro, MA 01752

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The Computer Museum

Date

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<>
<<lco>>

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Name and Address of Borrower

Gwen K. Bell
Director
The Computer Museum

Date

<>

<<al>>

Dear <>:

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The <>is an outright, unconditional gift to The Computer Museum, a non-profit, publicly supported organization under section 501(c)(3) of the Internal Revenue Code. You may take a tax deduction to the extent allowable under the law.

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Thank you for your recent gift and your support of the Computer Museum.

Cordially,

Gwen Bell
Director
The Computer Museum

<date>
<>

FROM: GORDON BELL DATE: THU 1 NOV 1979 3:38 PM EST
DEPT: OOD
EXT: 223-2236
TO: JIM BELL
cc: BILL KEATING
SAM FULLER

SUBJECT: DOD ADVISORY BOARD FOLLOW UP: 11/16/79

GB0005/47/EMS

Jack Schwartz, NYU, is setting up an Advisory Body to Dave Fisher, who heads DOD software, and would like a candidate who could serve (about 8 days) next year.

The interaction with other advisors would be valuable to us.

Could we agree and then get brief biographies/papers and work?
I view Ike Nassi, Earl vanHorn, George Poonen, and Bill Keating as possibilites. Anyone else?

GB:swh

GB0004/49

| **d** | **i** | **g** | **i** | **t** | **a** | **l** |

i n t e r o f f i c e m e m o r a n d u m

Subject: **Doing Advanced Development**

To: Jim Marshall, TW/A03
Nat Parke, TW/B02

CC: Bill Demmer, TW/D19
Craig Mudge, ML4-3/T34
Wayne Rosing, TW/C03
Steve Teicher, ML4-3/T34

Date: 9/13/79 Thu
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

Follow Up: 9/28/79

I talked with Craig, and was dismayed that we still don't have the Cal Tech designed color CRT's working. Now they have to be done by the VLSI A/D group.

The color CRT should have been a good test on our capability here. If we can't turn around a simple design quickly, what hope is them of doing sessions A/D in hardware? I see lots of paper and talk there, but... The personal VAX is comparatively hard to do, how are we going to change? Get organized? Hire?

GB:swh

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<>

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DEPT: OOD
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cc: BILL KEATING
SAM FULLER

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GB:swh

GB0004/49

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Date: 9/13/79 Thu
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

Follow Up: 9/28/79

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GB:swh

ID#414

| d | i | g | i | t | a | l | i n t e r o f f i c e m e m o r a n d u m

Subject: **Dolphin and Venus**

To: Bill Demmer, TW/D19
Ulf Fagerquist, MR1-2/E78

CC: Per Hjerppe, MR1-2/E78
George Hoff, MR1-2/E47
Bernie Lacroute, TW/A08
Dave Rodgers, TW/C04

Date: 10 JAN 79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

follow up 1/23/79

Just got a glimpse of costs and time to market of these alternatives. Can only think of three more alternatives before we propose the direction.

1. An MCA version, based on Comet to get product cost down. Venus seems too expensive. Also do Dolphin 32/36.

2. Dolphin 36 and both Venus for 780 and multi-Venuses connected to Dolphin bus for performance.

3. Do #2 except use the lower cost COMET-based MCA processor of #1 as the Dolphin components.

Am worried about understanding ECL as it relates to KL and MCA. We must have high availability.

The development costs for the alternatives seem low. Here, can we get total costs of KL and 780 including software support of special hardware and the options, etc. that these programs have triggered (e.g., 2040 ~ 2060, MA780, DR32)? Let's get at what planting a base system seed cost in terms of software support, hardware branches, options. Also, we should get some handle on demonstrators, software development machines, manufacturing, services and sales fixed and variable costs as a function of volume. Namely, it looks so cheap to do all machines, yet I know about all these other resources (I'd guess $25M+/machine within engineering alone). That's why understanding KL and 780 is critical to projecting the future.

In terms of comparing cost and performance let's use system configurations and system performance (in terms of the number of users) to plot the cost-performance "plates" (areas) that the System Analysis Group has started using.

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST: Bill Demmer TW/D19 Ulf Fagerquist MR1-2/E78
Per Hjerppe MR1-2/E78 George Hoff MR1-2/E47
Bernie Lacroute TW/A08 Dave Rodgers TW/C04

EMS 18-NOV-78 14:29:38
430 1
To: Ulf Fagerquist
From: Gordon Bell
Date: SAT 18-NOV-78 14:29:38 EDT
Subject: Dolphin vs Minnow
----
pnother reason I didn't list waas that if the rumours of the impending H series
in a 1 or 2 ~ear time frame running at 20 mips is true, then we are going to be
in trouble...particularly if the price is 1.8 million. dolphin/vax/10/20 will
be about the highest priority projects around. A hot, lower cost 360/370
would re-establish the comp centers, and discourage the buyers from gettin
their own minis (ie VAXs and 10/20's t that off load the 370.

Command:

EMS 10-MAR-79 12:47:46
130 1
To: Ulf Fagerquist
From: Gordon Bell
Date: SAT 10-MAR-79 12:47:46 EDT
Subject: Dolphin Dilema

Want to move quickly, agree with you. Maybe it would help at this time to
posit alternatives...this will ease anxiety.

Follow-on 10/20's--- Minnow, KL cost reduction and MCA izing for cost and
performance, while building on the support structure already existing.
What about MCA'd kind of minnow that would use ICCS and only be a processor
and memory with no channels or not have peripherals. ICCS would provide all
of these. This would get the system more in line with the homogeneous network
and would have to be a part of it. In this way we would mix 10's and VAX's
and have thm share the same files, etc. Would we make Donphin differently if
it were just an ICCS inteface, a Processor and Memory, and no multiprocessor,
except fortje HYDRA-type strucuture. Actually several processors on the bus
might not be bad (or hard), but it does raise a bunch of problems that might
otherwise be not worth solving. A structure like this could be really cheap,
I would guess.

I'm enamoured with the CMU proposal and this would let us focus onthe
homogeneous network strucutre by getting a breadboard environment that
includes 10's, vAX's (the migration problem), plus interfaces to other
machines. Jorgenson's analogy to Israel makes sense here. If we didi it, I
would believe that you should manage the interface with a project and put
some people there and here to really push this. That would be a major
program focus!

Disks and controllers are nneded and I see that in here somehow, a although
the disk group says no vehmently

Personal VAX.

Langauuges.

Technical products. Here FFT, clearly the languages, etc.

let's talk about the arease .

Command:

EMS 28-JAN-79
17:50:05 370 1
To: Ulf Fagerquist
From: Gordon Bell
Date: SUN 28-JAN-79 17:50:05 EDT
Subject: Priorities

I can see that you have the same problem I have...namely there is a very long
list of things to do.   The systems insight seems to be coming along fine,
but can't you get Flynn and Shanzer to do the work and insighting under your
direction? This one looks like a good one to get down on the list. The
highest priority just has to be the settling, if we can, of the Dolphin and
Venus...or the notion that we will wait for more information. In this way,
everyone can go ahead, but in a very unsettling way.   I talked to Win on this
and his goal is: 10/20 customers don't feel mad at us. We don't lose any of
the 10/20 group...and of course we make money. He doesn't care about where
the machine is positioned in the 250-500K space. I mostly care that we do all
this really fast to avoid the wear and tear on the people. Can you get a list
of the stuff youa'e into, and then drop some for now so as to just

concentrate? I will help here. I think the key in the product positioning is
what the software will look like and just who we are supporting. From a
corporate profit viewpoint, given that we are now growing at less than 41 %
(Namely 26%), and that we are really expanding into the low end (a la store,
micros, etc.) , it seems like the implication that all grops will compete for
NOR (production) resource s   such that the net effect will be much oorer
performance which we may be seeing now. Namely, we have too many product
families in now this faster market. The solution would be to start a
phaseover now. What do you think? (The strategy posited by Bernie and Per
for doing both seemed wrong in light of constrained market need, and
especially that the 10/20 wasn't positioned to go after new business... and
George agrees too.) Let's talk on the phone.

Command:

October 25, 1976

Mr. Don McCoy
Manager, Advanced Systems Development
U. S. Steel Corporation
Pittsburgh Service Center
1509 Muriel Street
Pittsburgh, PA 15203

Dear Don:

It was nice talking with you and Ron Richards again on

Wednesday, and to greet Mr. Beeken. I believe it would be worthwhile to visit Maynard and to pose some of the problems you feel will limit our continuing (start-up?) relationship. I agree with Joe Monihan that DEC can most likely provide you with computers and an applications software base (i.e., tools); but, the interface of what services (help) is available, its price, and how much DEC is going to invest initially has to be decided. Getting your applications to work successfully is probably the first order of business.

Your assistance to us about interfacing to U.S.S., and to larger customers, in general, would hopefully be welcome. I believe we learn rapidly and can change unnatural policies...provided we know what's wanted. Could you write down some of those problems (e.g., the $35 syndrome)? I'll try to fix the problem you had with our software distribution center.

The reputation among U.S.S. and other users you know that "DEC has very good products, but is hard to deal with" is a frightening concept to me. While I tended to agree, as a customer, the alternative suppliers appeared to be about the same. Could I enlist your support in parameterizing this interface, and then ranking the companies? (Just a gut feel on the back of envolope in 10 min...no big survey although it would be worth seeing if its a universal feeling at U.S.S.)

Although I believe there are significant gains to be made through using computers in control, I'm quite concerned about several aspects that may be troublesome:

1. Having come from a fundamentally batch orientation, there may not be enough understanding of resource constraints. With batch, a program is written, executed, and then machines are ordered depending on the needs. A real time or transaction processing application only exists if it can meet resource constraints. Somehow we have to work better to understand how to define the problem a priori. We also have to learn how to help our users define and solve these problems.

2. Working without a structure for specifying the problem in successive details versus using the solution (i.e., the program) will not yield predictable (manageable) results. (I think we do software engineering here versus art now, and it might be worth discussing this with you and some of your colleagues when you visit.)

3. The Factory Data Collection will help significantly, but it won't be a panacea, and the problem experienced on the application giving poor response time will still be possible unless there is a deep understanding of the problem.

4. I really wonder whether we know how to support you in the manner which IBM may have made you accustomed? (I'm sure we can provide better products at lower prices, but you may not feel so good). Also, I suspect we can probably work effectively with a more engineering oriented group. Quite possibly our Commercial Group would be a better interface? This really prompts me to be skeptical of any of our marketing plans to the larger IBM (especially batch) oriented customer. While you suggest that the interlude was profitable for Burroughs, it seems like you still went back to IBM. Do you have any thoughts on this conclusion?

It was good to discuss some computing with you again. I believe if we can get to the point of being a reliable supplier it will be worthwhile.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:ljp

CC: A. D. Beeken, III

Bruno Durr
Chuck Eichenlaub
Win Hindle
Ted Johnson
Joe Monahan
Charlie Spector

ID#0262

d i g i t a l **i n t e r o f f i c e m e m o r a n d u m**

Subject: **Calibration of the Dot Matrix Simulator with Real Output**

To: Ed Corell, Bob Glorioso, Bill Zimmer

CC: Jim Bell, Ulf Fagerquist

Date: 8 SEP 78
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

follow up 9/22/78

We have (supposedly) a simulator for making dot matrix printed output. Would you please compare output from our 7 and 11 wire heads with the simulator? I'd like to see it immediately. My recollection is that we're 6 months behind on a 3 month project. What was the scheduled completion of the original project?

GB:ljp

Attachment
November 25, 1984

Mr. Doug Drane
Drane Associates
231 Boston Post road
Wayland, MA

Dear Doug and Sandra:

Thank you for the gift to The Capital Campaign and moral support that helped open the Museum on November 12.

The physical realization has turned out to be much more exciting than any plan could have communicated. The staff made a very large "stretch" to open a range of galleries. The reviews have been positive and it is easy to spend a half day in productive learning. Knowledgable teenagers are spending their days at the Museum. The most flattering comment to date has been that it is the first American technology museum to be at European standards. Dr. Oliver Strimpel, who did the Museum's Image Gallery has just become the Associative Director and Curator. Oliver was formerly the Curator of the Mathematics Section of The Science Museum, London. The long collecting period and five year breadboard at Digital really paid off in collecting artifacts, building exhibits, doing lectures (ranging from Amdahl to Zuse) and gaining widescale support from computer people and companies.

I want to see this phase aimed at:

- putting a formal educational program in place,
- continued collecting of artifacts (whether letters, films, manuals or machines) in order to record the significant, information processing events, and
- getting broad public support from computer-knowledgeable people who want to learn more about the past and future history of computing.

I hope we can have another assault on Rochester, but based on the attempts to call there, I can understand your frustration. Kodak has a number of artifacts that I'd like to see collected, so we somehow have to establish a connection with them.

Again, thanks for the support. Please let us know when you can come for a personal tour and dinner.

Sincerely,

Gordon Bell
January 20, 1981

Prof. Francis Lee
Massachusetts Institute of Technology
Electrical Eng. & Computer Science
36-576
Cambridge, MA 02169

Dear Francis:

I've just described your book project to Jack MacKeen and he's quite enthusiastic to support you.

Rather than being a "switcher" in this project, I think it's best to go ahead and meet with Jack directly. At that time you can sign a non-disclosure agreement and then proceed to learn about our future products, including our one-chip processor. Also I'd hope you can influence our product direction based on your experience. If you haven't visited our Hudson Semiconductor Facility, then you might also plan to do this when visiting Jack at Marlboro.

Jack's expecting your call and is ready to proceed. If there's anymore I can do, please call me.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:swh
GB2.S1.24

CC: Jack MacKeen
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* d i g i t a l *
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TO: JACK MACKEEN DATE: MON 12 JAN 1981
11:48 AM EST

FROM: GORDON BELL
cc: see "CC" DISTRIBUTION DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: DP-MICROPROCESSORS LSI-11 BOOK BY FRANCIS LEE (MIT)

Francis asked me for advice on whether he should devote some energy into writing a book on microprocessors for real time control. The LSI-11 is used as his laboratory and a pedagogical carrier.

His approach is top-down design, starting with problem statements written in PASCAL. He uses the first problem that can be solved this way. Then he progresses to add the real time primitives, descend into selective use of Macrocode, then to microcode, and finally the addition of hardware in order to handle the real time problems of speed control of a motor.

He believes in the 11, RT11, and Pascal as the right way to solve these problems. His demos in class use an 11. His lab, which we helped him build, is very impressive.

I strongly encouraged him, and asked what he needed:

.Some occasional guidance from RT11 group on some of the subtleties.

.Disclosure of future products so he can write in our products, and also test them. He has questions too from time to time.

He also
would like to influence them because he is buying some of his parts
(clocks, A/D) from the independent market. He doesn't consult with
anyone else...maybe we should get him to consult with us in the
micros area too? (He'd sign a non-disclosure.)

.He'd like to get his RT license extended from 1 to 9.

I also encouraged him to think of Digital Press, but he thought it was
premature. If we have a WPS, maybe we ought to contact him and
encourage him. Marcy, you might have your acquisitions person contact
him.

Jack, can I have your support and suggest he come visit you to get at
the nitty gritty? (I said I'd call him back.)

GB2.S1.18

"CC" DISTRIBUTION:

DICK ECKHOUSE	MARY JANE FORBES	FU 1/16
MARCIA KENAH	KEN OLSEN	GIL STEIL
MIKE TITELBAUM		

GB0005/27

d i g i t a l **interoffice memorandum**

Subject: **DP Brochure and Presentation to BOD**

To: John Adams, ML5-5/E97
Jim Bailey, PK3-2/M88
Bill Demmer, TW/D19
George Plowman, ML5-5/E97
Mike Weinstein, ML5-5/E97

Date: 10/23/79 Tue
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

Follow-Up: 11/9/79

Bill Demmer is going to go to the board on November 26 to discuss Distributed Processing and our strategy to it. A major issue that prompted this was the fact that Ken (and I when I found out) wants a brochure or brochures that describes this. It has been promised. Let's make damn sure that a draft with pictures, writing, etc. is available by that time. I don't want us to continue to be nailed for these basics.

George, please let me preview when ready.

GB:swh

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* d i g i t a l *
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TO: MARCIA KENAH
3:09 PM EDT

DATE: SAT 12 JUL 1980

FROM: GORDON BELL
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: SOME QUICK (AND OTHER) QUALITY ACQUISTIONS

Having thought some more about the dilema of how to make a
few
fast, good bucks:

Cheap calendars are also bad because your order processing
will
eat you alive. You are set up to ship 20$ items, the
calendar

would kill you. Don't know what it is, but look for 50$ items.
Do you understand whether you are selling to individuals or to
institutions?

Why not reproduce the 45 Computer Art Murals that we will be exhibiting in September as part of the ASTC (Amer. Science and
Tech Center) road show? This could be a packet of posters or a
coffee table type, quality book. Note, there is no book here and
the exhibit travels to other museums and you might have a market
per se. There is a person who put the show together who could be
the one who got the book together. It could be quick and quality.

What ever happened to getting the Computer Encylopedia of Ralson's? Anyone want to sell it to us?

I thought we had agreed to immediately go out and get the Eames
book from Harvard University Press that is out of print. Could
you please do it? The book is now beginning to be appreciated
and it would also fulfil the quick, quality rule. Also, it will
be a massive service to the field. The reproduction should be
bigger though so that the pictures stand out and the print is larger. PLEASE, PLEASE, TODAY!

The Ten Pioneer Computers book is soon, now targetted for shipment to you on 2/82. This is made up of the DCM lectures by:
Wilkes, Stibitz, Forrester/ Atanasoff, Zuse, Wilkinson (for ACE),
Eckert/ Bigelow (IAS), Hopper-Salton-Brooks? (Mark I),

Kilburn
(Manchester)... finishing in 12/81. Given that you have seen the
lectures, what do you recommend as the format? Substantive suggestions are needed now (ie. photos of people, machines, footnoted, extra reprints of original, thick, thin, big etc.).

Please put Generating Computer Generations in your pipeline with
an unclear delivery to you. It will be built on a bottom-up basis for sometime in order to get the ideas together, based on a
series of essays and lectures. Given that you have all read it,
feedback is necessary. Who should it be written for? How would
you sell it if is merely a filled out version with lots of examples (photos, cartoons, diagrams, etc.). How long? Easy
reading or scholarly (lots of references that are drudged up)?

GB1.S5.49
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* d i g i t a l *
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TO: MARCIA KENAH DATE: TUE 2 SEP 1980
11:41 PM EDT

FROM: GORDON BELL
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: INTRODUCTION TO OFFICE AUTOMATION

Really don't have time to do a proper review. Suggest you get
Jack Gilmore to do one and also someone from Al Crawford's shop. Try Ken Mayers or Claire Messier (who's writing a long

range plan for OA) and also we have someone there who has written a good questionaire about what should be in systems over time.

From reading it hurriedly, 1/2 hr., and while attending a meeting in parallel I found I didn't learn much of anything except some random facts about there being an unreasonably large number of microfiche standards... hence no standard at all. I learned what they are. I didn't get at the point of why microfiche system haven't been useful and what it taks to make them so and where they might be useful.

It is an easy book to dislike or not get very attached to. I feel there may be more there and with the tables and pictures it might be a reasonable book for someone who wants an overview
of the possibilities. It ain't for the academicians! Possibly
for dp or office manager types. It is very detailed (eg. micro-
fiche), yet very superficial. I think it could be be made to be useful as a handbook, something along the lines of Christy's
book on Dist. Data Proc. Note you have my notion of levels of
architecture about how these systems are structured internally
as a comparison, but it isn't the type of thing to give to an office manager. Also, it doesn't get into the subtelties of WPS that mean that people are actually programming, albeit called by something like list processing or math or sort. This
should be delt with, also it would be nice to get into some of
the ergonomics and anthropometrics so that people know what they are trading off when they look for various systems. Some
of the stuff in Martin's book would be appropriate here, plus there are others.

Specifically, it starts with a bunch of terms it never proceeds

to define on page 6, like office automation- what now exists is possible and practical... This is enough to make anyone hate
the book! the defs, p12 are poor and sloppy. The communications
primer could be simplified and the jump rope removed and even the whole thing put in an appendix. (data, text, information,
tables, words, messages, etc. all must have precise definitions
that weren't in the non existent glossary... but they should be
defined in passing too. He ain't knowledgeable about bandwidth
(eg. tv channel is about 4.5 mhz, not 300 mhz!) In many cases
he could simply give some tables of pros and cons, not bury it
in text. Overall, things seem to text-bullety, not crisp tables
with explanatory text.

Overall, I would pass it to several people like Claire and some
of our marketing folks in Buzz's group for review to see if the
world could get anything from it. Somehow I think they know a
lot of what's in it. On the other side, the Office Automamtion
conference by the ACM which Morgan from Penn presented along with other academicians, was extremely thin. It isn't clear that there is any depth on the whole issue that can be discussed
other than details of implementation and features. (It doesnt
say how to buy a machine or run a benchmark or measure it or introduce it or write a procedure or how to get a system installed
or....

Frankly, I would say dont publish unless there is support for

a readership (I don't know them or who they would be or claim that they don't exist). If you do publish it, it will take major
revisions and at that point, please get a clear readership along
with what the pople are expected to know, and then I would review
it in the context of a rewrite.

If you want Mary Jane to review it, I would run it by her, cause
she really is good at knowing what's available and what various
users know and need. (note there is a lot of crap from consultants
that looks about like this) nancy seabold got raves in MK, so
you also might try her.

Let me know if I can be of further help,
Sorry I couldn't be of any more use.
gordon

GB1.S6.50
The following three slides are needed for Dist. Processing
talk in albequerque:

The Central Facility

Large, shared data base
Archiving for personal or organizational computing
Program facility for a few, distributed users
Quality printing (typesetting) and special facilities
Very High Performance Processing
General facility for casual users

Group Level Facilites

Shared, project data base
Specialized facilities (eg. microprocessor debug)
Programs run in common for group
Intra-group communications
Communications with Central and Personal Computers
High Performance Processing
Personal computing for many of the group

Personal Level Facilities

Personal data base (usually transient)
Communication with one or two, link to home, link
to higher level machine
Fast response, high quality terminal
Program environment for entering new programs
Processing sufficient for an individual, and
compatible with every other level

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* d i g i t a l *
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TO: MARCIA KENAH DATE: MON 11 MAY 1981
21:00 EST

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: COMMENTS ON STRATEGY AND MINI SERIES

Haven't had a lot of time to look at this. On the first reading,
I got these impressions. Probably we ought to discuss this as
this would force me to read it more carefully. Would like
lots more numbers, review of charter (in appendix, etc.)

The Strategy
First off: going from an expense relief of 400K to 527K in FY82
is ridiculous! I think DP ought to be closed down if it can't
get to a position of making money. It sounds like that the more
we sell, the more we lose... this is a hell of a way to run a
business. It is inconceivable to me that Jack Shields would want
you to operate this way! I don't.

There are classical solutions to the losing money problem. Why
not raise prices by say 20% along the same rates that other
publishers have raised their prices over the last few years?
Could you sell more? Why not get your various author
organizations to put up front money? The royalties sound awfully
high, given you are losing money and given that several authors
get nothing. What's the story? Alternatively, what about a
paring of the staff to get to a breakeven point? There is a 1
week summer course for DEC Managers that you might attend at
Cornell on running a business.

I would think you ought to plan on what is fundamentally an
opportunistic approach for several books, like Knuth. However,
instead of losing money, there has to be a way of getting support
and up front money. Univac should have paid for Stern, Mitre for
Redmond and Smith. British Computers was worked into a deal,
since MU printed it. Did it make money?

As far as the strategy document is concerned, I didn't get a very
good feel of where DP is, or where it came from. I really wanted

to see it's whole history financially, and what the prospects are
for the future. It seems like only enough was given to get through the FY82 budget cycle; if you slide by this time, it would be a bad thing. Again, I don't see investing our money in this area. My goal for DP has always been a press that supports our beliefs in computing and that makes money.

I'd like to see a graph that shows the investment for each book
and when the breakeven point is. You have to get someone to help
you with this financial work! (What is engneering as an expense
line? what is inventory as it relates to a P&L?) BURP would let
you get at this, for example, or you could use one of the myriad
of Visicalcs to get the work done. You must get to a business
understanding of publishing and whether it can operate within DEC!

Some Specifics
Why do you care if there is more than 1 DEC book per year?
(assuming they are good and make money)
I'd put profitablity first on the criteria.

The Mini Series
It would seem that you ought to give up on this, given the difficulty of doing it, until some person materializes who wants
to do it. We aren't especially together in the marketing or product area now, so I can't see it as essential there. Also,
the needs will probably be more based on a PPG approach when it
comes, thus you can't make money on it. The series would also be
riddled with problems: existing publishers, lots of freebie articles appearing all the time, no mailing list or way of

selling the books, a different set of readers, etc. You might
contact some of the internal folks: Si Lyle, Avram Miller, Peter
Conklin, Mike Weinstein, Ollie Stone (Applications), Glen Reyer
and Jack Gilmore (office). It would seem like a better strategy
would be to get really good (classical) books in these areas,
such as that by John McNamara, even though the areas are changing
rapidly. Also, note that we have been successful as a company
selling to the more sophisticated users.

25th Anniversary Book
There was a discussion at Operations Committee as to whether we
would allocate $30 per book for the 25th anniversary. We voted
not to, but would wait until a book was written that could be
reviewed. Gwen is meeting with the 25th folks tomorrow and may
get a better idea. You might call her on this. Fundamentally,
the book makes me a bit ill. I want to get a writer FIRST, let
him propose and work on it, then let's decide what to do with it.
In general, I think I'd rather see something that has more
general utility, appeal, quality. I really think this book
should be the ANNUAL REPORT of 82! These sort of books make me a
bit ill, but not quite as ill as the history of GM by Sloan, or
the history of P&G in 3 volumes. It would seem that the best
place to stay is far away, except to help out in the publication
and be a channel for sales of the book (if anyone would want to
buy one)... I reserve comment until I see the text.

NCC
Did we get any sales there in the booth? or at Univac? or at the
history meeting? What was the interest? Any new authors there?

Factor of the Future Book
Don't know it. It feels like a new topic. Let's publish it if
it has the quality and/or potential sales.

Stern Book
Perused the Edvac report and like the look of the pictures.
Hope the text is better too. Need a copy to JV Atanasoff.

GB2.S6.41
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* d i g i t a l *
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TO: BERNIE LACROUTE DATE: SUN 29 MAR 1981 19:54 EST

FROM: GORDON BELL
cc: BILL DEMMER DEPT: ENG STAFF
LARRY PORTNER EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: CONGRATULATIONS, GOOD LUCK, AAND YOU HAVE OUR SUPPORT

Again, let me offer our combined congratulations on this job. I also
look forward to you contributing to the engineering staff.
Communications and networks are about our hardest challenge now.
Seeing what you've written down, it already feels better. Although
it's too much to expect getting the act together before April, it is a
nice target. Certainly we should aim to have the issues outlined by

then, showing what is really firm, and what needs to be worked out.

It feels like we should be using gateways NOW as the way to get at x25 and sna and also perhaps some of the terminal emulators. Instead of making the module be outboard to a system and attached to a Unibus, I can not understand why we don't use one of the Micros products and have it be a totally self contained piece of hardware that is either in a box or rack mountable. Micros is working on a Tiny with memory on a dual, and this with maybe only 1 or two other duals is all that is required in such a system. If we took this approach, then we could get the gateways started before we have to get into the complexity of NI.

NI for now should just be aimed at getting a decent interface to our various large systems, and at the same time getting the concentrator built. We have yet to have a concentrator. For now, it would seem we should declare victory and use the existing one we have that has been used for years on the 10/20, but modified to do the virtual terminal work via DECnet. Here, Scott Davis is near making the experiment in VMS that indicates how much processing is required when the terminal handler is moved to another system. We must have this data before we can get very far. I've been waiting patiently.

Kotok has been working with Stan as a consultant across the

board. I
hope he'll continue to work here, albeit at an accelerated rate.
Savell and McNamara have done some first rate analysis that should
form the basis of a competitive hardware strategy. We have recently
lost Telephone business because of our comm. products.

You have notes and thoughts from me on European Engineering... ie. do
it like Colorado, evolve as the competence develops. Don't Honeywell
it, moving the product and charter to Tulsa only to find the
developers are still in NE. Fortunately for us, we were able to offer
them jobs and start a mass storage group.

Am also worried about the hardware vis a vis using competitive micros.
The boards, with intelligence, sure look expensive, impossible to
program and kludgy. My guess is that the 16 (actually 22 bit) micros
are the answer here by using substantial amounts of VLSI for cost and
easier programming. Also, I feel we should be using higher level
languages, possibly decision tabel-type languages to specify the
protocols. Again, we need some experiments.

Am certainly concerned about the transition from conventional comm, to
the point where all comm is on the NI. My fear is that we are
planning the transition too soon, and have not worked out the numbers.

Metrics are the key to knowing where we are in this space. Right now,
I don't understand it as a whole, nor do I think anyone else

does. We
need the type of treatment Riggle and Sills have given Mass
storage.
The cost metrics should be clear for the hardware, and then
we get
into what is essentially cost when we trade-off cost of the
interface
for performance in the host. For example, I suggest that
the comm
interface harware should be no more than 10% of the system
cost.
Here, you must add the percentage of the cpu that you use for
it. A
terminal costing 1500, should spend no more than 150 for the
comm part
including the modem. At the other end, take another 150
because of
symmetry. Here, if the cpu of a 250K VAX is required 0.1%
per line
before the characters get to the job, then the cost is
another 250$.

Thus, soon, we had better get metrics (including modems, line
costs,
switching like Gandalf or ma bell) to know where we are.
Then we
ought to get the competive data.

Again,
comm and networks are clearly about the most important
product set we
are doing. The needs are voracious. Only clear thinking and
hard
work are going to pull us through.

I'm available and would like to meet with you and your staff
within
the next month. I have the highest regard for your staff and
the
people doing the work are really competent, having given us
some
really strong products in the form of DECnet, together with a

strong
base using Ethernet. All I think we need is product targets, stability, leadership and all our support.

You have mine,
Gordon

GB2.S5.31
October 6, 1981

Mr. Steve Abbott
181 West Orangethorpe
Suite F
Placentia, CA   92670

Dear Mr. Abbott:

Enclosed is a copy of a frank appraisal of our product WORD 11, by Patty Seybold and my secretary. I understand you're building a similar product for VAX.

We are hoping to derive a significant amount of business from WORD 11 and I'm worried. Is it possible that we could meet soon and discuss our joint plans in this area?

Sincerely,

Gordon Bell
Vice President
Engineering

Enclosures - 2
GB3.S1.5

cc: Bill Johnson
Glenn Reyer
Bruce Stewart
David Stroll

FROM: GORDON BELL   DATE: WED 26 DEC 1979 9:54
PM EST
DEPT: OOD
EXT: 223-2236
TO: MARY JANE FORBES
    GEORGE PLOWMAN
    MIKE WEINSTEIN

SUBJECT: MORE ON THE DEINITION OF DP

DP matches computer system s to needs on a geographical or organizational basis, AND interconnects individual computers into a single network

The objectives of dp are:
1. to allow effective matching of resources to needs

2. to allow both local and autonomy and central control of the various distributed parts
3 to provide an evolving , openen ended system so that development of ditributed parts can proceed at their own, pace in a quasi independent fashion
4 to allow purchase and installation of computers in a most timely cost-effective wasy, taking advantabte of reduced (with time) hardware costs
5 to build on and communicate with existing , more central systems, fully dispersed systems, and emerging personal computers
6 to provide computing , control and storage of information nearest the need.

(sorry about the spelling/wording but the ems editor ant this ti terminal are not up to coping with my typing.)

..

Command >

****
* d i g i t a l *
****

TO: MARCIA KENAH DATE: SUN 4 JAN 1981
2:27 PM EST

FROM: GORDON BELL
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: THE STERN BOOK: HOLD THE PRESS ...

About 20 pages of comments will follow, but the bottom line:

The book is a factor of 2 too long, takes too much work to read,
has all types of errors, draws and presents false conclusions,
and delivers far too little insight to any reader I know. We can
not publish it unless the issues are attended to.

It should come about R&S in quality and even try to attain
Lavington quality, even though it will take another year. The
beauty of publishing history is that it's virtually timeless; we
have to control to quality, not schedule.

I still think it is an important story that needs telling.
We have to set the standards and suggest the approach.
Nancy's got most of the facts, let's help her make a great book!

GB2.S4.15
July 10, 1984

Dr. Irwin Dorros

Executive Vice President
Technical Services
Bell Communications & Research
290 West Mount Pleasant Avenue
Livingston, NJ 07039

Dear Irwin:

The Computer Museum is opening in downtown Boston on November 14 after operating successfully for five years within a Digital Equipment Corporation building, the last two as a non-profit, public Museum. The Museum wants AT&T to become a major supporter!

A first-rate team is designing the exhibits, including Dr. Oliver Strimpel, curator of the Science Museum in London and Dr. Paul Ceruzzi, a young history of computing scholar. In addition to the exhibits with historical artifacts, two major interactive galleries are being built for PC's and on the Computer and the Image. Predictions are that we should have attendance of over 200,000. This world-class, international Museum should be a major attraction and asset for the computing community. The enclosed brochure describes the Capital Campaign, and several reports give an idea of the Museum's activities.

The Museum has started communicating with the AT&T Foundation. Bob Everett asked Robert Lucky to help, who in turn sent the request to Ms. Esther Novack, Vice President of Cultural Programs. In talking to Ms. Novack, the Museum fits within the Foundation's frame of reference, but she needs to understand how The Computer Museum would benefit AT&T. Now I want to enlist your support to:

1. work with us to prepare an appropriate proposal to the Foundation. As AT&T becomes a significant computer supplier, it will increasingly benefit from The Computer Museum. George Stibitz was one of our first speakers and would like to contribute in a major way, but never reaped many rewards from his contributions to computing and as he said in his last letter, is facing one or two lingering illnesses. He has given many of

his papers, made the Museum a model of his first relay adder, and when he can, he comes to Museum functions on the bus from Dartmouth. We show the first transistor and need to incorporate software more prominently in our exhibits.

AT&T might want to name a lecture series recording its contributions which have benefitted computing including: programming, UNIX, C, speech and music, graphics, semiconductor technology, communications etc. We also want critical artifacts for the collection and the possiblity of assigning this important function to us. We continue to need an unlimited supply of working computers for various exhibits.

We are looking for a complete, AT&T sponsored package that would amount to $400,000 or $100,000 per year. DEC gives $600,000 per year!

2. become a personal "core" contributor ($4K over 4 years) or foundership, ($250); (The founding period is just closing.)

3. contribute your own important artifacts; (The Museum will act as a repository for things that would otherwise be forced to be scrapped.)

I will call you to discuss these activites and how we can be responsive to AT&T's needs. Even though it's not open, I'd be honored to give you a tour and a meal.

Sincerely,

Gordon Bell

Enclosures
GB13.44
July 9, 1984

Dr. John R. Pierce
Professor of Engineering Emeritus
California Institute of Technology
Pasadena, CA 91109

Dear John:

The Computer Museum is opening in downtown Boston on November 14 after operating successfully for five years within a Digital Equipment Corporation building, the last two as a non-profit, public Museum. The Museum wants AT&T to become a major supporter!

A first-rate team is designing the exhibits, including Dr. Oliver Strimpel, curator of the Science Museum in London and

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2. become a personal "core" contributor ($4K over 4 years) or foundership, ($250); (The founding period is just closing.)

3. contribute your important artifacts, for example, I recall the report you wrote on natural language translation -- we need a copy for the time line; (The Museum will act as a repository for things that would otherwise be forced to be scrapped.)

4. give a lecture at the museum on a topic of your choice.

I will call you to discuss these activites and how we can be responsive to AT&T's needs. Even though it's not open, I'd be honored to give you and your wife a tour and a meal.

Sincerely,

Gordon Bell

Enclosures

GB13.52
July 10, 1984

Dr. Richard W. Hamming
Professor of Computer Science
Navl Postgraduate School
Code 52HG
Monterey, CA 93940

Dear Dr. Hamming:

The Computer Museum is opening in downtown Boston on November 14 after operating successfully for five years within a

Digital Equipment Corporation building, the last two as a non-profit, public Museum. The Museum wants AT&T to become a major supporter!

A first-rate team is designing the exhibits, including Dr. Oliver Strimpel, curator of the Science Museum in London and Dr. Paul Ceruzzi, a young history of computing scholar. In addition to the exhibits with historical artifacts, two major interactive galleries are being built for PC's and on the Computer and the Image. Predictions are that we should have attendance of over 200,000. This world-class, international Museum should be a major attraction and asset for the computing community. The enclosed brochure describes the Capital Campaign, and several reports give an idea of the Museum's activities.

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3. contribute your own important artifacts; (The Museum will act as a repository for things that would otherwise be forced to be scrapped.)

4. give a lecture at the Museum.

I will call you to discuss these activites and how we can be responsive to AT&T's needs. Even though it's not open, I'd be honored to give you a tour and a meal on your next trip to Boston.

Sincerely,

Gordon Bell

Enclosures
GB13.50
7 April 1983

Drs. Francis Thurman and
Donald Elliot
St. Anthony Central Hospital
4231 W. 16th Ave.
Denver, Colorado 80204

Dear Drs. Thurman and Elliot:

The trip back to Massachusetts was uneventful and rapid. I find it's good to be home despite the fine care at St. Anthony's.

Having been home now for two weeks, and recovering on schedule, I continue to be thankful for the operation and care under your direction at St. Anthony's.

For the last week, I've spent several hours a day reading and looking at interesting work-related projects, and have visited with colleagues at home 1-2 hours each day. My hand exercises are now centered around a word processor, and terminal for electronic mail. I've also gotten a classic Atari video game to educate me and to help improve manual dexterity, but find that it's easy to generate a high pulse rate unless great care is taken.

Again, thank you.

Sincerely,

Gordon Bell
Vice President, Engineering

GB5.4

July 6, 1978

Mr. Peter Dulchinos
17 Spaulding Road
Chelmsford, MA 01824

Dear Peter:

Thanks for your vitae. I've turned it over to John Meyer, head of our Personnel organization. He'll circulate it.

Since I'll be away until September, please contact John.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:ljp
ID#0156

CC: John Meyer

Marie Berndtson

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|   THE COMPUTER MUSEUM      |
|       MEMORANDUM           |
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TO: <> Date: <>, 1982
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From: Geri Rogers
Dept: Computer Museum
MS: MRO2-1/A4 Ext: 231-4443
EMS: @MR16

Accounting	2.4
Clerical	4.5

Exhibits

1110.66

Accounting
Clerical
Exhibits

NOW IS THE TIME FOR ALL GOOD MEN

To come to the aid of their country

now is the time for all good men to come to the aid of their country.

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|   THE COMPUTER MUSEUM     |
|       MEMORANDUM          |
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Marie Berndtson

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Accounting 2.4
Clerical 4.5

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1110.66

Accounting
Clerical
Exhibits

<u>NOW IS THE TIME FOR ALL GOOD MEN</u>
To come to the aid of their country

NOW IS THE TIME FOR ALL GOOD MEN TO COME TO THE AID
NOW IS THE TIME FOR ALL GOOD MEN TO COME TO THE AID
YOU GO HOME
NOW IS THE TIME FOR ALL GOOD MEN TO COME TO THE AID
NOW IS THE TIME FOR ALL GOOD MEN TO COME TO THE AID
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now is the time for all good men to come to the aid of their country.

June 6, 1979

John Cullen
Vice President, Engineering
EI Dupont de Nemours & Company, Inc.
Louviers Building
Room L1220
Wilmington, Delaware 19898

Dear John:

Thanks for giving the keynote speech at our annual engineering seminar at Stratton Mountain. The message was well received.

Another handbook on our view of Distributed Processing has been recently published which I enclosed. I hope it will be of use to you.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:swh
GB0003/45

Enclosure

CC: George Plowman, ML5-5/E97
Joe Fabrizio, PH

ID#414

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Subject: **Dolphin and Venus**

To: Bill Demmer, TW/D19
Ulf Fagerquist, MR1-2/E78

CC: Per Hjerppe, MR1-2/E78
George Hoff, MR1-2/E47
Bernie Lacroute, TW/A08
Dave Rodgers, TW/C04

Date: 10 JAN 79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

follow up 1/23/79

Just got a glimpse of costs and time to market of these alternatives. Can only think of three more alternatives before we propose the direction.

1. An MCA version, based on Comet to get product cost down. Venus seems too expensive. Also do Dolphin 32/36.

2. Dolphin 36 and both Venus for 780 and multi-Venuses connected to Dolphin bus for performance.

3. Do #2 except use the lower cost COMET-based MCA processor of #1 as the Dolphin components.

Am worried about understanding ECL as it relates to KL and MCA. We must have high availability.

The development costs for the alternatives seem low. Here, can we get total costs of KL and 780 including software support of special hardware and the options, etc. that these programs have triggered (e.g., 2040 ~ 2060, MA780, DR32)? Let's get at what planting a base system seed cost in terms of software support, hardware branches, options. Also, we should get some handle on demonstrators, software development machines, manufacturing, services and sales fixed and variable costs as a function of volume. Namely, it looks so cheap to do all machines, yet I know about all these other resources (I'd guess $25M+/machine within engineering alone). That's why understanding KL and 780 is critical to projecting the future.

In terms of comparing cost and performance let's use system configurations and system performance (in terms of the number of users) to plot the cost-performance "plates" (areas) that the System Analysis Group has started using.

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST: Bill Demmer TW/D19 Ulf Fagerquist MR1-
2/E78
Per Hjerppe MR1-2/E78 George Hoff MR1-
2/E47
Bernie Lacroute TW/A08 Dave Rodgers
TW/C04

EMS 18-NOV-78 14:29:38
430 1
To: Ulf Fagerquist
From: Gordon Bell
Date: SAT 18-NOV-78 14:29:38 EDT
Subject: Dolphin vs Minnow
----
pnother reason I didn't list waas that if the rumours of the
impending H series
in a 1 or 2 ~ear time frame running at 20 mips is true, then we
are going to be
in trouble...particularly if the price is 1.8 million.
dolphin/vax/10/20 will
be about the highest priority projects around.   A hot, lower
cost 360/370
would re-establish the comp centers, and discourage the buyers
from gettin
their own minis (ie VAXs and 10/20's t that off load the 370.

Command:

EMS 10-MAR-79 12:47:46
130 1
To: Ulf Fagerquist
From: Gordon Bell
Date: SAT 10-MAR-79 12:47:46 EDT
Subject: Dolphin Dilema

Want to move quickly, agree with you. Maybe it would help at this time to
posit alternatives...this will ease anxiety.

Follow-on 10/20's--- Minnow, KL cost reduction and MCA izing for cost and
performance, while building on the support structure already existing.
What about MCA'd kind of minnow that would use ICCS and only be a processor
and memory with no channels or not have peripherals. ICCS would provide all
of these. This would get the system more in line with the homogeneous network
and would have to be a part of it. In this way we would mix 10's and VAX's
and have thm share the same files, etc. Would we make Donphin differently if
it were just an ICCS inteface, a Processor and Memory, and no multiprocessor,
except fortje HYDRA-type strucuture. Actually several processors on the bus
might not be bad (or hard), but it does raise a bunch of problems that might
otherwise be not worth solving. A structure like this could be really cheap,
I would guess.

I'm enamoured with the CMU proposal and this would let us focus onthe
homogeneous network strucutre by getting a breadboard environment that
includes 10's, vAX's (the migration problem), plus interfaces to other
machines. Jorgenson's analogy to Israel makes sense here. If we didi it, I
would believe that you should manage the interface with a project and put
some people there and here to really push this. That would be a major
program focus!

Disks and controllers are nneded and I see that in here somehow, a although
the disk group says no vehmently

Personal VAX.

Langauuges.

Technical products. Here FFT, clearly the languages, etc.

let's talk about the arease .

Command:

EMS 28-JAN-79
17:50:05 370 1
To: Ulf Fagerquist
From: Gordon Bell
Date: SUN 28-JAN-79 17:50:05 EDT
Subject: Priorities

I can see that you have the same problem I have...namely there is a very long
list of things to do. The systems insight seems to be coming along fine,
but can't you get Flynn and Shanzer to do the work and insighting under your
direction? This one looks like a good one to get down on the list. The
highest priority just has to be the settling, if we can, of the Dolphin and
Venus...or the notion that we will wait for more information. In this way,
everyone can go ahead, but in a very unsettling way. I talked to Win on this
and his goal is: 10/20 customers don't feel mad at us. We don't lose any of
the 10/20 group...and of course we make money. He doesn't care about where
the machine is positioned in the 250-500K space. I mostly care that we do all
this really fast to avoid the wear and tear on the people. Can you get a list
of the stuff youa'e into, and then drop some for now so as to just

concentrate? I will help here. I think the key in the product positioning is
what the software will look like and just who we are supporting. From a
corporate profit viewpoint, given that we are now growing at less than 41 %
(Namely 26%), and that we are really expanding into the low end (a la store,
micros, etc.) , it seems like the implication that all grops will compete for
NOR (production) resource s   such that the net effect will be much oorer
performance which we may be seeing now. Namely, we have too many product
families in now this faster market. The solution would be to start a
phaseover now. What do you think? (The strategy posited by Bernie and Per
for doing both seemed wrong in light of constrained market need, and
especially that the 10/20 wasn't positioned to go after new business... and
George agrees too.) Let's talk on the phone.

Command:

October 25, 1976

Mr. Don McCoy
Manager, Advanced Systems Development
U. S. Steel Corporation
Pittsburgh Service Center
1509 Muriel Street
Pittsburgh, PA 15203

Dear Don:

It was nice talking with you and Ron Richards again on

Wednesday, and to greet Mr. Beeken. I believe it would be worthwhile to visit Maynard and to pose some of the problems you feel will limit our continuing (start-up?) relationship. I agree with Joe Monihan that DEC can most likely provide you with computers and an applications software base (i.e., tools); but, the interface of what services (help) is available, its price, and how much DEC is going to invest initially has to be decided. Getting your applications to work successfully is probably the first order of business.

Your assistance to us about interfacing to U.S.S., and to larger customers, in general, would hopefully be welcome. I believe we learn rapidly and can change unnatural policies...provided we know what's wanted. Could you write down some of those problems (e.g., the $35 syndrome)? I'll try to fix the problem you had with our software distribution center.

The reputation among U.S.S. and other users you know that "DEC has very good products, but is hard to deal with" is a frightening concept to me. While I tended to agree, as a customer, the alternative suppliers appeared to be about the same. Could I enlist your support in parameterizing this interface, and then ranking the companies? (Just a gut feel on the back of envolope in 10 min...no big survey although it would be worth seeing if its a universal feeling at U.S.S.)

Although I believe there are significant gains to be made through using computers in control, I'm quite concerned about several aspects that may be troublesome:

1. Having come from a fundamentally batch orientation, there may not be enough understanding of resource constraints. With batch, a program is written, executed, and then machines are ordered depending on the needs. A real time or transaction processing application only exists if it can meet resource constraints. Somehow we have to work better to understand how to define the problem a priori. We also have to learn how to help our users define and solve these problems.

2. Working without a structure for specifying the problem in successive details versus using the solution (i.e., the program) will not yield predictable (manageable) results. (I think we do software engineering here versus art now, and it might be worth discussing this with you and some of your colleagues when you visit.)

3. The Factory Data Collection will help significantly, but it won't be a panacea, and the problem experienced on the application giving poor response time will still be possible unless there is a deep understanding of the problem.

4. I really wonder whether we know how to support you in the manner which IBM may have made you accustomed? (I'm sure we can provide better products at lower prices, but you may not feel so good). Also, I suspect we can probably work effectively with a more engineering oriented group. Quite possibly our Commercial Group would be a better interface? This really prompts me to be skeptical of any of our marketing plans to the larger IBM (especially batch) oriented customer. While you suggest that the interlude was profitable for Burroughs, it seems like you still went back to IBM. Do you have any thoughts on this conclusion?

It was good to discuss some computing with you again. I believe if we can get to the point of being a reliable supplier it will be worthwhile.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:ljp

CC: A. D. Beeken, III

Bruno Durr
Chuck Eichenlaub
Win Hindle
Ted Johnson
Joe Monahan
Charlie Spector

ID#0262

d i g i t a l **i n t e r o f f i c e m e m o r a n d u m**

Subject: **Calibration of the Dot Matrix Simulator with Real Output**

To: Ed Corell, Bob Glorioso,
Bill Zimmer

CC: Jim Bell, Ulf Fagerquist

Date: 8 SEP 78
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

follow up 9/22/78

We have (supposedly) a simulator for making dot matrix printed output. Would you please compare output from our 7 and 11 wire heads with the simulator? I'd like to see it immediately. My recollection is that we're 6 months behind on a 3 month project. What was the scheduled completion of the original project?

GB:ljp

Attachment
November 25, 1984

Mr. Doug Drane
Drane Associates
231 Boston Post road
Wayland, MA

Dear Doug and Sandra:

Thank you for the gift to The Capital Campaign and moral support that helped open the Museum on November 12.

The physical realization has turned out to be much more exciting than any plan could have communicated. The staff made a very large "stretch" to open a range of galleries. The reviews have been positive and it is easy to spend a half day in productive learning. Knowledgable teenagers are spending their days at the Museum. The most flattering comment to date has been that it is the first American technology museum to be at European standards. Dr. Oliver Strimpel, who did the Museum's Image Gallery has just become the Associative Director and Curator. Oliver was formerly the Curator of the Mathematics Section of The Science Museum, London. The long collecting period and five year breadboard at Digital really paid off in collecting artifacts, building exhibits, doing lectures (ranging from Amdahl to Zuse) and gaining widescale support from computer people and companies.

I want to see this phase aimed at:

- putting a formal educational program in place,
- continued collecting of artifacts (whether letters, films, manuals or machines) in order to record the significant, information processing events, and
- getting broad public support from computer-knowledgeable people who want to learn more about the past and future history of computing.

I hope we can have another assault on Rochester, but based on the attempts to call there, I can understand your frustration. Kodak has a number of artifacts that I'd like to see collected, so we somehow have to establish a connection with them.

Again, thanks for the support. Please let us know when you can come for a personal tour and dinner.

Sincerely,

Gordon Bell
January 20, 1981

Prof. Francis Lee
Massachusetts Institute of Technology
Electrical Eng. & Computer Science
36-576
Cambridge, MA 02169

Dear Francis:

I've just described your book project to Jack MacKeen and he's quite enthusiastic to support you.

Rather than being a "switcher" in this project, I think it's best to go ahead and meet with Jack directly. At that time you can sign a non-disclosure agreement and then proceed to learn about our future products, including our one-chip processor. Also I'd hope you can influence our product direction based on your experience. If you haven't visited our Hudson Semiconductor Facility, then you might also plan to do this when visiting Jack at Marlboro.

Jack's expecting your call and is ready to proceed. If there's anymore I can do, please call me.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:swh
GB2.S1.24

CC: Jack MacKeen
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*****************
* d i g i t a l *
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TO: JACK MACKEEN
DATE: MON 12 JAN 1981 11:48 AM EST

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION

DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: DP-MICROPROCESSORS LSI-11 BOOK BY FRANCIS LEE (MIT)

Francis asked me for advice on whether he should devote some energy into writing a book on microprocessors for real time control. The LSI-11 is used as his laboratory and a pedagogical carrier.

His approach is top-down design, starting with problem statements written in PASCAL. He uses the first problem that can be solved this way. Then he progresses to add the real time primitives, descend into selective use of Macrocode, then to microcode, and finally the addition of hardware in order to handle the real time problems of speed control of a motor.

He believes in the 11, RT11, and Pascal as the right way to solve these problems. His demos in class use an 11. His lab, which we helped him build, is very impressive.

I strongly encouraged him, and asked what he needed:

.Some occasional guidance from RT11 group on some of the subtleties.

.Disclosure of future products so he can write in our products, and also test them. He has questions too from time to time.

He also
would like to influence them because he is buying some of his parts
(clocks, A/D) from the independent market. He doesn't consult with
anyone else...maybe we should get him to consult with us in the
micros area too? (He'd sign a non-disclosure.)

.He'd like to get his RT license extended from 1 to 9.

I also encouraged him to think of Digital Press, but he thought it was
premature. If we have a WPS, maybe we ought to contact him and
encourage him. Marcy, you might have your acquisitions person contact
him.

Jack, can I have your support and suggest he come visit you to get at
the nitty gritty? (I said I'd call him back.)

GB2.S1.18

"CC" DISTRIBUTION:

DICK ECKHOUSE	MARY JANE FORBES	FU 1/16
MARCIA KENAH	KEN OLSEN	GIL STEIL
MIKE TITELBAUM		

GB0005/27

| **d** | **i** | **g** | **i** | **t** | **a** | **l** | **interoffice memorandum**

Subject: **DP Brochure and Presentation to BOD**

To: John Adams, ML5-5/E97
Jim Bailey, PK3-2/M88
Bill Demmer, TW/D19
George Plowman, ML5-5/E97
Mike Weinstein, ML5-5/E97

Date: 10/23/79 Tue
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

Follow-Up: 11/9/79

Bill Demmer is going to go to the board on November 26 to discuss Distributed Processing and our strategy to it. A major issue that prompted this was the fact that Ken (and I when I found out) wants a brochure or brochures that describes this. It has been promised. Let's make damn sure that a draft with pictures, writing, etc. is available by that time. I don't want us to continue to be nailed for these basics.

George, please let me preview when ready.

GB:swh
****
* d i g i t a l *
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TO: MARCIA KENAH
DATE: SAT 12 JUL 1980
3:09 PM EDT

FROM: GORDON BELL
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: SOME QUICK (AND OTHER) QUALITY ACQUISTIONS

Having thought some more about the dilema of how to make a
few
fast, good bucks:

Cheap calendars are also bad because your order processing
will
eat you alive. You are set up to ship 20$ items, the
calendar

would kill you. Don't know what it is, but look for 50$ items.
Do you understand whether you are selling to individuals or to institutions?

Why not reproduce the 45 Computer Art Murals that we will be exhibiting in September as part of the ASTC (Amer. Science and Tech Center) road show? This could be a packet of posters or a coffee table type, quality book. Note, there is no book here and the exhibit travels to other museums and you might have a market per se. There is a person who put the show together who could be the one who got the book together. It could be quick and quality.

What ever happened to getting the Computer Encyclopedia of Ralson's? Anyone want to sell it to us?

I thought we had agreed to immediately go out and get the Eames book from Harvard University Press that is out of print. Could you please do it? The book is now beginning to be appreciated and it would also fulfil the quick, quality rule. Also, it will be a massive service to the field. The reproduction should be bigger though so that the pictures stand out and the print is larger. PLEASE, PLEASE, TODAY!

The Ten Pioneer Computers book is soon, now targetted for shipment to you on 2/82. This is made up of the DCM lectures by:
Wilkes, Stibitz, Forrester/ Atanasoff, Zuse, Wilkinson (for ACE),
Eckert/ Bigelow (IAS), Hopper-Salton-Brooks? (Mark I),

Kilburn
(Manchester)... finishing in 12/81. Given that you have seen the
lectures, what do you recommend as the format? Substantive suggestions are needed now (ie. photos of people, machines, footnoted, extra reprints of original, thick, thin, big etc.).

Please put Generating Computer Generations in your pipeline with
an unclear delivery to you. It will be built on a bottom-up basis for sometime in order to get the ideas together, based on a
series of essays and lectures. Given that you have all read it,
feedback is necessary. Who should it be written for? How would
you sell it if is merely a filled out version with lots of examples (photos, cartoons, diagrams, etc.). How long? Easy
reading or scholarly (lots of references that are drudged up)?

GB1.S5.49
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* d i g i t a l *
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TO: MARCIA KENAH   DATE: TUE 2 SEP 1980
11:41 PM EDT

FROM: GORDON BELL
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: INTRODUCTION TO OFFICE AUTOMATION

Really don't have time to do a proper review. Suggest you get
Jack Gilmore to do one and also someone from Al Crawford's shop. Try Ken Mayers or Claire Messier (who's writing a long

range plan for OA) and also we have someone there who has written a good questionaire about what should be in systems over time.

From reading it hurriedly, 1/2 hr., and while attending a meeting in parallel I found I didn't learn much of anything except some random facts about there being an unreasonably large number of microfiche standards... hence no standard at all. I learned what they are. I didn't get at the point of why microfiche system haven't been useful and what it taks to make them so and where they might be useful.

It is an easy book to dislike or not get very attached to. I feel there may be more there and with the tables and pictures it might be a reasonable book for someone who wants an overview
of the possibilities. It ain't for the academicians! Possibly
for dp or office manager types. It is very detailed (eg. micro-
fiche), yet very superficial. I think it could be be made to be useful as a handbook, something along the lines of Christy's
book on Dist. Data Proc. Note you have my notion of levels of
architecture about how these systems are structured internally
as a comparison, but it isn't the type of thing to give to an office manager. Also, it doesn't get into the subtelties of WPS that mean that people are actually programming, albeit called by something like list processing or math or sort. This
should be delt with, also it would be nice to get into some of
the ergonomics and anthropometrics so that people know what they are trading off when they look for various systems. Some
of the stuff in Martin's book would be appropriate here, plus there are others.

Specifically, it starts with a bunch of terms it never proceeds

to define on page 6, like office automation- what now exists is possible and practical... This is enough to make anyone hate
the book! the defs, p12 are poor and sloppy. The communications
primer could be simplified and the jump rope removed and even the whole thing put in an appendix. (data, text, information,
tables, words, messages, etc. all must have precise definitions
that weren't in the non existent glossary... but they should be
defined in passing too. He ain't knowledgeable about bandwidth
(eg. tv channel is about 4.5 mhz, not 300 mhz!) In many cases
he could simply give some tables of pros and cons, not bury it
in text. Overall, things seem to text-bullety, not crisp tables
with explanatory text.

Overall, I would pass it to several people like Claire and some
of our marketing folks in Buzz's group for review to see if the
world could get anything from it. Somehow I think they know a
lot of what's in it. On the other side, the Office Automamtion
conference by the ACM which Morgan from Penn presented along with other academicians, was extremely thin. It isn't clear that there is any depth on the whole issue that can be discussed
other than details of implementation and features. (It doesnt
say how to buy a machine or run a benchmark or measure it or introduce it or write a procedure or how to get a system installed
or....

Frankly, I would say dont publish unless there is support for

a readership (I don't know them or who they would be or claim
that they don't exist). If you do publish it, it will take
major
revisions and at that point, please get a clear readership
along
with what the pople are expected to know, and then I would
review
it in the context of a rewrite.

If you want Mary Jane to review it, I would run it by her,
cause
she really is good at knowing what's available and what
various
users know and need. (note there is a lot of crap from
consultants
that looks about like this) nancy seabold got raves in MK,
so
you also might try her.

Let me know if I can be of further help,
Sorry I couldn't be of any more use.
gordon

GB1.S6.50
The following three slides are needed for Dist. Processing
talk in albequerque:

The Central Facility

Large, shared data base
Archiving for personal or organizational computing
Program facility for a few, distributed users
Quality printing (typesetting) and special facilities
Very High Performance Processing
General facility for casual users

Group Level Facilites

Shared, project data base
Specialized facilities (eg. microprocessor debug)
Programs run in common for group
Intra-group communications
Communications with Central and Personal Computers
High Performance Processing
Personal computing for many of the group

Personal Level Facilities

Personal data base (usually transient)
Communication with one or two, link to home, link
   to higher level machine
Fast response, high quality terminal
Program environment for entering new programs
Processing sufficient for an individual, and
   compatible with every other level

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* d i g i t a l *
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TO: MARCIA KENAH   DATE: MON 11 MAY 1981
21:00 EST
                                                FROM: GORDON BELL
                                                DEPT: ENG STAFF
                                                EXT: 223-2236
                                                LOC/MAIL STOP: ML12-
1/A51

SUBJECT: COMMENTS ON STRATEGY AND MINI SERIES

Haven't had a lot of time to look at this. On the first
reading,
I got these impressions. Probably we ought to discuss this
as
this would force me to read it more carefully. Would like
lots more numbers, review of charter (in appendix, etc.)

The Strategy
First off: going from an expense relief of 400K to 527K in FY82 is ridiculous! I think DP ought to be closed down if it can't get to a position of making money. It sounds like that the more we sell, the more we lose... this is a hell of a way to run a business. It is inconceivable to me that Jack Shields would want you to operate this way! I don't.

There are classical solutions to the losing money problem. Why not raise prices by say 20% along the same rates that other publishers have raised their prices over the last few years? Could you sell more? Why not get your various author organizations to put up front money? The royalties sound awfully high, given you are losing money and given that several authors get nothing. What's the story? Alternatively, what about a paring of the staff to get to a breakeven point? There is a 1 week summer course for DEC Managers that you might attend at Cornell on running a business.

I would think you ought to plan on what is fundamentally an opportunistic approach for several books, like Knuth. However, instead of losing money, there has to be a way of getting support and up front money. Univac should have paid for Stern, Mitre for Redmond and Smith. British Computers was worked into a deal, since MU printed it. Did it make money?

As far as the strategy document is concerned, I didn't get a very good feel of where DP is, or where it came from. I really wanted

to see it's whole history financially, and what the prospects are
for the future. It seems like only enough was given to get through the FY82 budget cycle; if you slide by this time, it would be a bad thing. Again, I don't see investing our money in this area. My goal for DP has always been a press that supports our beliefs in computing and that makes money.

I'd like to see a graph that shows the investment for each book
and when the breakeven point is. You have to get someone to help
you with this financial work! (What is engneering as an expense
line? what is inventory as it relates to a P&L?) BURP would let
you get at this, for example, or you could use one of the myriad
of Visicalcs to get the work done. You must get to a business
understanding of publishing and whether it can operate within DEC!

Some Specifics
Why do you care if there is more than 1 DEC book per year?
(assuming they are good and make money)
I'd put profitablity first on the criteria.

The Mini Series
It would seem that you ought to give up on this, given the difficulty of doing it, until some person materializes who wants
to do it. We aren't especially together in the marketing or product area now, so I can't see it as essential there. Also,
the needs will probably be more based on a PPG approach when it
comes, thus you can't make money on it. The series would also be
riddled with problems: existing publishers, lots of freebie articles appearing all the time, no mailing list or way of

selling the books, a different set of readers, etc. You might
contact some of the internal folks: Si Lyle, Avram Miller, Peter
Conklin, Mike Weinstein, Ollie Stone (Applications), Glen Reyer
and Jack Gilmore (office). It would seem like a better strategy
would be to get really good (classical) books in these areas,
such as that by John McNamara, even though the areas are changing
rapidly. Also, note that we have been successful as a company
selling to the more sophisticated users.

25th Anniversary Book
There was a discussion at Operations Committee as to whether we
would allocate $30 per book for the 25th anniversary. We voted
not to, but would wait until a book was written that could be
reviewed. Gwen is meeting with the 25th folks tomorrow and may
get a better idea. You might call her on this. Fundamentally,
the book makes me a bit ill. I want to get a writer FIRST, let
him propose and work on it, then let's decide what to do with it.
In general, I think I'd rather see something that has more
general utility, appeal, quality. I really think this book
should be the ANNUAL REPORT of 82! These sort of books make me a
bit ill, but not quite as ill as the history of GM by Sloan, or
the history of P&G in 3 volumes. It would seem that the best
place to stay is far away, except to help out in the publication
and be a channel for sales of the book (if anyone would want to
buy one)... I reserve comment until I see the text.

NCC
Did we get any sales there in the booth? or at Univac? or at the
history meeting? What was the interest? Any new authors there?

Factor of the Future Book
Don't know it. It feels like a new topic. Let's publish it if
it has the quality and/or potential sales.

Stern Book
Perused the Edvac report and like the look of the pictures.
Hope the text is better too. Need a copy to JV Atanasoff.

GB2.S6.41
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* d i g i t a l *
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TO: BERNIE LACROUTE DATE: SUN 29 MAR 1981 19:54 EST

FROM: GORDON BELL
cc: BILL DEMMER DEPT: ENG STAFF
LARRY PORTNER EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: CONGRATULATIONS, GOOD LUCK, AAND YOU HAVE OUR SUPPORT

Again, let me offer our combined congratulations on this job. I also
look forward to you contributing to the engineering staff.
Communications and networks are about our hardest challenge now.
Seeing what you've written down, it already feels better. Although
it's too much to expect getting the act together before April, it is a
nice target. Certainly we should aim to have the issues outlined by

then, showing what is really firm, and what needs to be worked out.

It feels like we should be using gateways NOW as the way to get at x25
and sna and also perhaps some of the terminal emulators. Instead of
making the module be outboard to a system and attached to a Unibus, I
can not understand why we don't use one of the Micros products and
have it be a totally self contained piece of hardware that is either
in a box or rack mountable. Micros is working on a Tiny with memory
on a dual, and this with maybe only 1 or two other duals is all that
is required in such a system. If we took this approach, then we could
get the gateways started before we have to get into the complexity of
NI.

NI for now should just be aimed at getting a decent interface to our
various large systems, and at the same time getting the concentrator
built. We have yet to have a concentrator. For now, it would seem we
should declare victory and use the existing one we have that has been
used for years on the 10/20, but modified to do the virtual terminal
work via DECnet. Here, Scott Davis is near making the experiment in
VMS that indicates how much processing is required when the terminal
handler is moved to another system. We must have this data before we
can get very far. I've been waiting patiently.

Kotok has been working with Stan as a consultant across the

board. I
hope he'll continue to work here, albeit at an accelerated rate.
Savell and McNamara have done some first rate analysis that should
form the basis of a competitive hardware strategy. We have recently
lost Telephone business because of our comm. products.

You have notes and thoughts from me on European Engineering... ie. do
it like Colorado, evolve as the competence develops. Don't Honeywell
it, moving the product and charter to Tulsa only to find the
developers are still in NE. Fortunately for us, we were able to offer
them jobs and start a mass storage group.

Am also worried about the hardware vis a vis using competitive micros.
The boards, with intelligence, sure look expensive, impossible to
program and kludgy. My guess is that the 16 (actually 22 bit) micros
are the answer here by using substantial amounts of VLSI for cost and
easier programming. Also, I feel we should be using higher level
languages, possibly decision tabel-type languages to specify the
protocols. Again, we need some experiments.

Am certainly concerned about the transition from conventional comm, to
the point where all comm is on the NI. My fear is that we are
planning the transition too soon, and have not worked out the numbers.

Metrics are the key to knowing where we are in this space. Right now,
I don't understand it as a whole, nor do I think anyone else

does. We
need the type of treatment Riggle and Sills have given Mass storage.
The cost metrics should be clear for the hardware, and then we get
into what is essentially cost when we trade-off cost of the interface
for performance in the host. For example, I suggest that the comm
interface harware should be no more than 10% of the system cost.
Here, you must add the percentage of the cpu that you use for it. A
terminal costing 1500, should spend no more than 150 for the comm part
including the modem. At the other end, take another 150 because of
symmetry. Here, if the cpu of a 250K VAX is required 0.1% per line
before the characters get to the job, then the cost is another 250$.

Thus, soon, we had better get metrics (including modems, line costs,
switching like Gandalf or ma bell) to know where we are. Then we
ought to get the competive data.

Again,
comm and networks are clearly about the most important product set we
are doing. The needs are voracious. Only clear thinking and hard
work are going to pull us through.

I'm available and would like to meet with you and your staff within
the next month. I have the highest regard for your staff and the
people doing the work are really competent, having given us some
really strong products in the form of DECnet, together with a

strong
base using Ethernet. All I think we need is product targets, stability, leadership and all our support.

You have mine,
Gordon

GB2.S5.31
October 6, 1981

Mr. Steve Abbott
181 West Orangethorpe
Suite F
Placentia, CA 92670

Dear Mr. Abbott:

Enclosed is a copy of a frank appraisal of our product WORD 11, by Patty Seybold and my secretary. I understand you're building a similar product for VAX.

We are hoping to derive a significant amount of business from WORD 11 and I'm worried. Is it possible that we could meet soon and discuss our joint plans in this area?

Sincerely,

Gordon Bell
Vice President
Engineering

Enclosures - 2
GB3.S1.5

cc: Bill Johnson
Glenn Reyer
Bruce Stewart
David Stroll

FROM: GORDON BELL DATE: WED 26 DEC 1979 9:54
PM EST
DEPT: OOD
EXT: 223-2236
TO: MARY JANE FORBES
GEORGE PLOWMAN
MIKE WEINSTEIN

SUBJECT: MORE ON THE DEINITION OF DP

DP matches computer system s to needs on a geographical or organizational basis, AND interconnects individual computers into a single network

The objectives of dp are:
1. to allow effective matching of resources to needs

2. to allow both local and autonomy and central control of the various distributed parts
3 to provide an evolving , openen ended system so that development of ditributed parts can proceed at their own, pace in a quasi independent fashion
4 to allow purchase and installation of computers in a most timely cost-effective wasy, taking advantabte of reduced (with time) hardware costs
5 to build on and communicate with existing , more central systems, fully dispersed systems, and emerging personal computers
6 to provide computing , control and storage of information nearest the need.

(sorry about the spelling/wording but the ems editor ant this ti terminal are not up to coping with my typing.)

..

Command >

****
* d i g i t a l *
****

TO: MARCIA KENAH   DATE: SUN 4 JAN 1981
2:27 PM EST

FROM: GORDON BELL
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: THE STERN BOOK: HOLD THE PRESS ...

About 20 pages of comments will follow, but the bottom line:

The book is a factor of 2 too long, takes too much work to read, has all types of errors, draws and presents false conclusions, and delivers far too little insight to any reader I know. We can not publish it unless the issues are attended to.

It should come about R&S in quality and even try to attain Lavington quality, even though it will take another year. The beauty of publishing history is that it's virtually timeless; we have to control to quality, not schedule.

I still think it is an important story that needs telling.
We have to set the standards and suggest the approach.
Nancy's got most of the facts, let's help her make a great book!

GB2.S4.15
July 10, 1984

Dr. Irwin Dorros

Executive Vice President
Technical Services
Bell Communications & Research
290 West Mount Pleasant Avenue
Livingston, NJ 07039

Dear Irwin:

The Computer Museum is opening in downtown Boston on November 14 after operating successfully for five years within a Digital Equipment Corporation building, the last two as a non-profit, public Museum. The Museum wants AT&T to become a major supporter!

A first-rate team is designing the exhibits, including Dr. Oliver Strimpel, curator of the Science Museum in London and Dr. Paul Ceruzzi, a young history of computing scholar. In addition to the exhibits with historical artifacts, two major interactive galleries are being built for PC's and on the Computer and the Image. Predictions are that we should have attendance of over 200,000. This world-class, international Museum should be a major attraction and asset for the computing community. The enclosed brochure describes the Capital Campaign, and several reports give an idea of the Museum's activities.

The Museum has started communicating with the AT&T Foundation. Bob Everett asked Robert Lucky to help, who in turn sent the request to Ms. Esther Novack, Vice President of Cultural Programs. In talking to Ms. Novack, the Museum fits within the Foundation's frame of reference, but she needs to understand how The Computer Museum would benefit AT&T. Now I want to enlist your support to:

1. work with us to prepare an appropriate proposal to the Foundation. As AT&T becomes a significant computer supplier, it will increasingly benefit from The Computer Museum.   George Stibitz was one of our first speakers and would like to contribute in a major way, but never reaped many rewards from his contributions to computing and as he said in his last letter, is facing one or two lingering illnesses. He has given many of

his papers, made the Museum a model of his first relay adder, and when he can, he comes to Museum functions on the bus from Dartmouth. We show the first transistor and need to incorporate software more prominently in our exhibits.

AT&T might want to name a lecture series recording its contributions which have benefitted computing including: programming, UNIX, C, speech and music, graphics, semiconductor technology, communications etc. We also want critical artifacts for the collection and the possiblity of assigning this important function to us. We continue to need an unlimited supply of working computers for various exhibits.

We are looking for a complete, AT&T sponsored package that would amount to $400,000 or $100,000 per year. DEC gives $600,000 per year!

2. become a personal "core" contributor ($4K over 4 years) or foundership, ($250); (The founding period is just closing.)

3. contribute your own important artifacts; (The Museum will act as a repository for things that would otherwise be forced to be scrapped.)

I will call you to discuss these activites and how we can be responsive to AT&T's needs. Even though it's not open, I'd be honored to give you a tour and a meal.

Sincerely,

Gordon Bell

Enclosures
GB13.44
July 9, 1984

Dr. John R. Pierce
Professor of Engineering Emeritus
California Institute of Technology
Pasadena, CA 91109

Dear John:

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We are looking for a complete, AT&T sponsored package that would amount to $400,000 or $100,000 per year. DEC gives $600,000 per year!

2. become a personal "core" contributor ($4K over 4 years) or foundership, ($250); (The founding period is just closing.)

3. contribute your important artifacts, for example, I recall the report you wrote on natural language translation -- we need a copy for the time line; (The Museum will act as a repository for things that would otherwise be forced to be scrapped.)

4. give a lecture at the museum on a topic of your choice.

I will call you to discuss these activites and how we can be responsive to AT&T's needs. Even though it's not open, I'd be honored to give you and your wife a tour and a meal.

Sincerely,

Gordon Bell

Enclosures

GB13.52
July 10, 1984

Dr. Richard W. Hamming
Professor of Computer Science
Navl Postgraduate School
Code 52HG
Monterey, CA 93940

Dear Dr. Hamming:

The Computer Museum is opening in downtown Boston on November 14 after operating successfully for five years within a

Digital Equipment Corporation building, the last two as a non-profit, public Museum. The Museum wants AT&T to become a major supporter!

A first-rate team is designing the exhibits, including Dr. Oliver Strimpel, curator of the Science Museum in London and Dr. Paul Ceruzzi, a young history of computing scholar. In addition to the exhibits with historical artifacts, two major interactive galleries are being built for PC's and on the Computer and the Image. Predictions are that we should have attendance of over 200,000. This world-class, international Museum should be a major attraction and asset for the computing community. The enclosed brochure describes the Capital Campaign, and several reports give an idea of the Museum's activities.

The Museum has started communicating with the AT&T Foundation. Bob Everett asked Robert Lucky to help, who in turn sent the request to Ms. Esther Novack, Vice President of Cultural Programs. In talking to Ms. Novack, the Museum fits within the Foundation's frame of reference, but she needs to understand how The Computer Museum would benefit AT&T. Now I want to enlist your support to:

1. work with us to prepare an appropriate proposal to the Foundation. As AT&T becomes a significant computer supplier, it will increasingly benefit from The Computer Museum. George Stibitz was one of our first speakers and would like to contribute in a major way, but never reaped many rewards or was recognized for his contributions to computing and as he said in his last letter, is facing one or two lingering illnesses. He has given many of his papers, made the Museum a model of his first relay adder, and when he can, he comes to Museum functions on the bus from Dartmouth. We show the first transistor and need to incorporate software more prominently in our exhibits.

   AT&T might want to name a lecture series recording its contributions which have benefitted computing including: programming, UNIX, C, speech and music, graphics, semiconductor technology, communications etc.

We also want critical artifacts for the collection and the possiblity of assigning this important function to us. We continue to need an unlimited supply of working computers for various exhibits.

We are looking for a complete, AT&T sponsored package that would amount to $400,000 or $100,000 per year. DEC gives $600,000 per year!

2. become a personal "core" contributor ($4K over 4 years) or foundership, ($250); (The founding period is just closing.)

3. contribute your own important artifacts; (The Museum will act as a repository for things that would otherwise be forced to be scrapped.)

4. give a lecture at the Museum.

I will call you to discuss these activites and how we can be responsive to AT&T's needs. Even though it's not open, I'd be honored to give you a tour and a meal on your next trip to Boston.

Sincerely,

Gordon Bell

Enclosures
GB13.50
7 April 1983

Drs. Francis Thurman and
Donald Elliot
St. Anthony Central Hospital
4231 W. 16th Ave.
Denver, Colorado 80204

Dear Drs. Thurman and Elliot:

The trip back to Massachusetts was uneventful and rapid. I find it's good to be home despite the fine care at St. Anthony's.

Having been home now for two weeks, and recovering on schedule, I continue to be thankful for the operation and care under your direction at St. Anthony's.

For the last week, I've spent several hours a day reading and looking at interesting work-related projects, and have visited with colleagues at home 1-2 hours each day. My hand exercises are now centered around a word processor, and terminal for electronic mail. I've also gotten a classic Atari video game to educate me and to help improve manual dexterity, but find that it's easy to generate a high pulse rate unless great care is taken.

Again, thank you.

Sincerely,

Gordon Bell
Vice President, Engineering

GB5.4

July 6, 1978

Mr. Peter Dulchinos
17 Spaulding Road
Chelmsford, MA 01824

Dear Peter:

Thanks for your vitae. I've turned it over to John Meyer, head of our Personnel organization. He'll circulate it.

Since I'll be away until September, please contact John.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:ljp
ID#0156

CC: John Meyer

Marie Berndtson

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From: Geri Rogers
Dept: Computer Museum
MS: MRO2-1/A4 Ext: 231-4443
EMS: @MR16

Accounting 2.4
Clerical 4.5

Exhibits

1110.66

Accounting
Clerical
Exhibits

<u>NOW IS THE TIME FOR ALL GOOD MEN</u>

To come to the aid of their country

now is the time for all good men to come to the aid of their country.

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Marie Berndtson

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Accounting
Clerical
Exhibits

<u>NOW IS THE TIME FOR ALL GOOD MEN</u>
To come to the aid of their country

NOW IS THE TIME FOR ALL GOOD MEN TO COME TO THE AID
NOW IS THE TIME FOR ALL GOOD MEN TO COME TO THE AID
YOU GO HOME
NOW IS THE TIME FOR ALL GOOD MEN TO COME TO THE AID
NOW IS THE TIME FOR ALL GOOD MEN TO COME TO THE AID
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NOW IS THE TIME FOR ALL GOOD MEN TO COME TO THE AID

now is the time for all good men to come to the aid of their country.

June 6, 1979

John Cullen
Vice President, Engineering
EI Dupont de Nemours & Company, Inc.
Louviers Building
Room L1220
Wilmington, Delaware 19898

Dear John:

Thanks for giving the keynote speech at our annual engineering seminar at Stratton Mountain. The message was well received.

Another handbook on our view of Distributed Processing has been recently published which I enclosed. I hope it will be of use to you.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:swh
GB0003/45

Enclosure

CC: George Plowman, ML5-5/E97
Joe Fabrizio, PH

INTRODUCING

SYSTEMBUS 80

BENEFITS

- Spans system family from $10K - up

- Common bus between 16 and 32 bit architectures.

- Preserves the UNIBUS and QBUS software and hardware investments.

- Optimizes new hardware and software investments thru the eighties.

FEATURES

- 32 bit I/O addressing.
- Support of large memory on both 16 bit and 32 bit
- Peripheral interchangeability between 16 and 32 bit
- Greater range of peripherals at low end
- Greater reliability and serviceability (e.g. parity)

FEATURES (CONTINUED)

o OEM

- Ease of interface
- Multi-processor interrupt structure
- Variable transfer lengths
- Assignable priorities
- Economical form factor

GB0001/21

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Subject: **Next EBOD Go Around Data**

To: Paul Bauer, ML3-3/B91
Mike Gutman, ML3-6/E94
Per Hjerppe, MR1-2/E78
Bernie Lacroute, TW/A08
Jack Mileski, TW/C10
Stan Pearson, ML12-2/E38
Dave Quimby, ML12-2/E38
Mike Tomasic, ML12-2/E71

Date: 3/6/79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

CC: Ebod, OOD

The data this first go around was superb...especially at this early stage in the process. I almost feel like we have cuts that we could live with for several years.

Dave Quimby's last minute slides cut by activity and size really gave me (and I hope others) a great deal of insight. However, the next go around I would like to change the cuts to make them price factors of 2.5 so that we can have bands that should be viable over a long time period. There is also a notion that we should only have a single product in a price band, but the product would be extensible, by options, over the band. At first glance, it appears that the bands are pretty much determined by the availability of a particular kind of mass storage device. Note that in the case of IBM and the 360 (only because I know it best) had factors of 2 separation in price and factors of 3 separation in performance (note not Grosch's law). In this case 3 bands would give us a factor of 15.625 versus 16 if we used a factor of 2 for 4 bands to cover the same range.

These price bands would be:

mid Micro	160	400	Boards and small terminals
high Micro	400	1K	
small Small	1K	2.5	Current Terminals
mid Small	2.5	6.25	Beginning pre-programmed terminals and intelligent terminals, minimal memory
hi Small	6.25	16K	Low end systems- bounded by floppies; desk based
small Medium	16K	40	Medium systems: traditional DEC; cabinet based
mid Medium	40	100	
hi Medium	100	250K	
small Large	250K	625K	Hi end systems
mid Large	625K	1.6K	

Note, that the number of numbers we would deal with in a given context using this approach would be 3 and then 4 someday as we get to Micros. As we descend in detail, we pick up only 3 more categories per range of 16, for a total of 9 (actually 10 above, only 7+ of which are really active).

I'd like the three systems areas to also plot their systems using the same graph sizes (but not the same scales) in the space of System price versus Mass Memory size with either separate plots for the product available at various times including FY 82, or if it isn't too cluttered put the systems on one page and note the introduction date. (Do we have too many introductions?) The scale should be agreed to by the system size groups, but the plots are basically those shown in the MSD section. Note, the specific applications oriented terminals like the 162 and the recently announced (by AT and T) bubble memory editing terminal would show up in the small to mid Small areas. The object of a design will be to evolve to the next lower band.

GOSPEL

Next, given that we have these system plots, I want to generate: GOSPEL-the Good, One Sheet Product/Environment Log, as shown in the attached sketchy first one I tried the night before to EBOD. Most generally this is just a plot of system size with correlated "sections" for each level of integration: base system, mass storage, and software. It would be extended as needed to other software and other levels including chips. It would also be the base for other activities such as R and D, tools, standards, etc.

It has the 4 decades of system price corresponding to the above against which base hardware systems prices, complete storage subsystems, and the base operating systems are plotted.

1. In the base hardware part of it, there are segments for the 8, 11, VAX-11, 10/20, LA and VT. Each system is plotted as a price line, or point if

there are no options (e.g., LA34).

2. There is a corresponding part for mass storage cost, where we can see the very rough correlation (be careful, it ain't written in the stars, but is only a "rule of thumb") between cost and system price. This is ratio of a 4x markup and the fact that the mass store is about 40% of the system cost, hence the total systems price is roughly 10 x the cost of the mass storage subsystem (ie. both the disk and tape or at the low end just the removeable, backupable media). This would be plotted in parts corresponding to the hardware systems, or by device classes (RX, RP/TU,etc.) or preferably memory size starting with bubbles at roughly 10K bytes, in factors of 10 going up to 1 gigabyte. Note only legal subsystems would be plotted (ie. a fixed disk with no backup or distribution media would not appear unless we figure out a way to have the network doing memory backup and program distribution).

3. There are lines for each of the operating systems which correlate with the hardware ranges showing which operating systems run on which base hardware systems. The separated lines would include: OS8, RT11, RSX11S-M-D-IAS, SCS, TRAX, RSTS, VMS, T10, T20. Possibly this should be intermingled with base hardware to show complete hardware/software systems for each.

4. I suspect we need a corresponding set of charts showing the interconnections which are now tending to be >10% of the system cost.

5. Finally, we need a way of showing the development that is for particular market areas so that we can better make policy decisions without getting to a project basis. This is really the outer most levels of integration. Thus, product lines could show their systems lined up against this and then select which lines they're going with. Here, there would be lines both showing:

Systems for each of the product groups and product lines

There could be other plots against the system size, which would show the distribution of NOR and development expenses in each of these ranges at various units of time. These fixed price bands would then be the methods of measuring the allocation of resources and the NOR. Here we would make investment decisions based on the expected revenue, product needs to get us to competitive or more profitable, etc. Dave Quimby's plot on activity vs price (a section of GOSPEL) would show where we are spending.

Summary

Overall, let's get to a highly structured approach to planning so that we can easily fill out the plans without having to continually reinvent ranges, collect data in different way, etc. This would get us history and understanding. Also it would provide healthy targets and containment. But basically, I hope you agree that I am not proposing anything radical, but merely saying:

1. There is a set of fixed price bands for products which is the dominant measure. I want to try these this round. Also, let's have a set of standard plots for each systems area. Let's use the MSD log-log systems price versus mass storage size. Also, we should get the common "plates" plots of number of users versus system price.

2. Mostly we are positioning products in

these bands, and there will be sections corresponding to the levels of integration from mass storage, communications options, base systems, base software, group and market level products.

3. We will look at revenue and spending in these two dimensions, but mainly in the price one.

4. We will look at revenue and spending in the market dimensions and eventually be able to pin point just how much is base, group and particular product line. Otherwise, we'll continue to spend it all on base systems.

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST:				
	Paul Bauer	ML3-3/B91	Mike Gutman	ML3-6/E94
	Per Hjerppe	MR1-2/E78	Bernie Lacroute	TW/A08
	Jack Mileski	TW/C10	Stan Pearson	ML12-2/E38
	Dave Quimby	ML12-2/E38	Mike Tomasic	ML12-2/E71
	Dick Clayton	ML12-2/E71	Jim Cudmore	ML1-5/E30
	Bill Demmer	TW/D19	Ulf Fagerquist	MR1-2/E78
	Bill Johnson	ML3-5/H33	John Kevill	ML3-6/E94
	John Meyer	ML12-1/A11	Larry Portner	ML12-3/A62
	Bob Puffer	ML12-2/E38		
	Bruce Delagi	ML12-1/F41	Andy Knowles	MR2-2/A52
	John Leng	MR1-1/A65	Stan Olsen	MK1-2/C36
	Julius Marcus	MK	Jack Shields	PK3-2/A58

THE ENCORE PRODUCT/COMPANY ARRAY (GB View on 21 Jan. 84)

CHIP, BOARD WITH BASIC SOFTWARE

MIPS CO. (with VC's) Stanford MIPS chip doubles cost/performance

BASIC SYSTEM COMPANIES

TERWSCO -CHARLE' RUPP's CO. for terminals evolving to workstations

Silicon Graphics (Buyout to get high end and workstation software)

Symmetric Computer Systems - 25% to 100% ownership

HYDRA- for all OEMs and Technical End Users, responsible for integrating PC and Terminals with appropriate buyouts

LAMP- for high performance and building a TP system

SOFTWARE

FOUNDATION - Ally, Commercial Systems, Office Products (3 div) perhaps doing a Transaction Processing type systems on lamP

ECE: Encore Computing Environment, our network company

APPLICATION PRODUCT COMPANY

Takes any of the above products and outside software to address very specific markets such as CAD/CAM, Typesetting, AI, etc.

Perphaps this is multiple companies or multiple divisions.

ECE: THE ENCORE COMPUTING ENVIRONMENT COMPANY
(IE. THE NETWORK COMPANY)

WE <u>MUST</u> HAVE A SEPERATE COMPANY TO ADDRESS THE INTEGRATION OF THE BASIC PRODUCTS BEING BUILT AND TO BUYOUT SOFTWARE WHICH WILL TIE ECE to other environments. This company could also have responsiblity for buying out the terminals and PCs. Ideally it would provide concentrators, gateways and servers for printing and specifying addresses (Name Server). The range includes LANs, Wide Area Nets, SNA, x.25, PC-net etc. The group would buyout a very large portion of hardware and software. ECE should provide product during FY84!

Some alternatives:

1. Julius Marcus would start this up
2. A group from Gould is now available to startup or join

3. Other engineers who have approached me
4. Try to buy a fraction of a very competent local group who
   build DECNet and SNA gateways
5. Network Research Corp. gateways to XNS and TCP/IP
6. Existing company such as Interlan
7. Other startup if we can find one

NETWORK COMPANIES WE MIGHT INVEST IN OR BUY PRODUCTS FROM

PLEXUSNETCO
Bob Marsh proposed that we form a network company that would sell and continue to develop the PLEXUS-developed distributed software. This software is an excellent starting point for our LAN-based cluster oriented systems. It would compete with TNC (The Newcastle Connection) and other clusters such as the LA based company of Gerald Popeck.

The company would start with the key engineers from Plexus. Perhaps we would take on the software marketing role with the emphasis on makin this a standard. We would put money into this along with VC funding.

Even though it would appear that Plexus would be giving up technology, I think this is a clear case of "either make the standard or follow the standard". In this case there's not a standard yet except the networking software inside of Berkeley 4.2, which could be considered to be the breadboard for this type of software. In fact, the position of Plexus and Gould, for example is to use System V architecture and add ideas from 4.2 where they don't violate the architecture. (System V is AT&T blessed and the version V.2 still doesn't have virtual memory. Berkeley 4.2 has significantly better file performance, virtual memory and nice networking primitives.)

Our interest would be: making money, getting a standard sooner, getting somehting to sell now in order to engage in the market.
However it would: cost money and time and might not become a standard. We could also buy it if it's right.

Plexus interest would be: making money and getting their standard to be the standard.
Plexus would: give up some people and a proprietary product.

We need to get back to Bob next week.

NETWORK RESEARCH CORPORATION
Steve Emmerich introduced me to a super group of networking software engineers. They want someone to handle their field support and marketing so they can concentrate on product. They want to increase their investment in order to accelerate some product introductions. They have products that we could market now and get a jump on our 85 revenue. Steve is preparing a bigger writeup.

STU WECKER'S COMPANY IN SUDBURY
Stu has a very competent group of 25 engineers who do the following:

teach courses twice a year
simple consulting
engineering large, systems
building standard products (They now have DECnet gateways on UNIX
and are building SNA gateways. We could market these now.)

GOULD DISTRIBUTED PROCESSING AND NE GROUPS
Greg Hopgood said the Nashua New Hampshire group is being cut because the new VP of engineering doesn't like engineering outside of his single site. This group of 11 has a few UNIX folks, but is oriented to making SEL products into Workstations by buying the Raster Tech product (which he says is excellent).

Things are still chaotic in the UNIX/Distributed Processing Group. Joe Haney is in charge. Their divisional VP and Sales person quit. The UNIX sales are really booming and may overtake the old, promising to be 20M. Greg believes that all the cost cutting is aimed at getting Gould or SEL in a position to sell.

PORTABLE SOFTWARE INC

This group is selling The Newcastle Connection which permits distributed processing clusters to be formed on UNIX systems.

THE ENCORE CONTINUUM: A MULTI-BASED COMPUTING ENVIORMENT

C. Gordon Bell[1], Henry B. Burkhardt III[1], Steve Chapin[2], Steve Emmerich[1], Russell Moore[2], Isaac Nassi[3], Charle' Rupp[3], David Schanin[2]

1. Encore Computer Corporation, Wellesley Hills, Mass. 02181
2. Hydra Computer, an Encore Company responsible for Multimax, Natick Mass.
3. Resolution Systems Inc., an Encore Company, Marlboro, Mass.

SUMMARY

The Encore Continuum is a complete, UNIX compatible, computing environment designed to provide a range of computing styles covering distributed workstations and central, host computers in the minicomputer price class, and all interconnected via a Local Area Network. Encore's Multimax is a new, computer structure formed from multiple, microprocessors sharing a common memory. The "Multi" offers a new level of performance, price/performance, and reliability. Furthermore, a single Multi can be used to cover a complete price and performance range. While the "Multi" will be used for traditional multiprogramming, we believe it will soon lead to parallel processing.

ENCORE CONTINUUM OVERVIEW

Figure 1 shows the Encore Continuum, composed of the following elements:

- Multimax, multiple, microprocessor computers. Multimax spans a processing performance range of 1.5 to 15 Mips in expandable increments of 1.5 million instructions per second (Mips). Input/Ouput throughput can be expanded in increments of 1.5 Mbytes/sec. to 15 Mbytes/sec. Memory can be expanded in increments of 4 Megabytes to 32 Megabytes.

  Multimaxes can be interconnected whereby all processors, input/output channels and primary memory to form a single multi.

- Annex concentrator and gateway computers - for Ancillary Network EXchange computers. All terminals and Personal

Computers attach through Annex concentrator computers. Annex gateway computers enable communication with public networks (x.25) and IBM SNA facilities.

. Resolution R100 Host Stations and R500 Workstations. The R100 is a high resolution, large screen, multiple window, multiple host access station designed for host-based computer access. The R500 is a compatible Workstation with local processing and mass storage.

. Interconnection with other computer vendors which support the TCP/IP LAN protocols.

. Local Area Network (LAN). Ethernet (IEEE 802.3) LAN is used to interconnect all computing elements and provide computer to computer intercommunication, common gateways to other computers and public communications networks, and common access to terminals and Personal Computers.

. UMAX 4.2 and UMAX V. Two, software environments are provided which are derived from the University of California/ Berkeley BSD 4.2 and AT&T Unix. These are for technical and commercial applications use, respectively.

GOALS AND CONSTRAINTS OF THE ENCORE CONTINUUM
The principle design goal of Continuum is to provide a continuous and very wide range of computing, utilizing Local Area Networks for:

. choice of where and how to compute ranging from terminals and Personal Computers accessing shared, Multimax host computers to compatible, fully distributed Resolution Computing Stations

. choice along these five, computing resource dimensions:

  . processor performance for traditional multiprogramming and revolutionary parallel processing ranging from a single processor to multiple processors

  . memory size for arbitrarily large virtual memories, large file caching and input/output buffering

  . input/output performance with multiple computers and disk channels for high data rate input/output (eg. video)

  .human interface through Resolution Host and Workstations

  . arbitrary communication via the LAN and ANNEX concentrator and gateway access computers for terminal and Personal Computer access and other computers and communications networks

. choice of system availability through redundancy and use of a small set of components to provide the range

The principle constraint of the Encore Continuum is compatibility based on Industry standards to provide:

. compatible products that all work together, permitting the location of function to occur both statically (at purchase and configuration time) and dynamically (while programs are running) based on cost, performance, reliability, security and physical needs

. compatibility with other vendors, enabling communication with existing programs and migration of existing programs to Continuum

. compatible products that work with all other UNIX products and facilitate the use of UNIX and traditional software applications

Hardware independence utilizing industry standard LAN's, microprocessors, data formats (eg. IEEE floating point), languages, and operating systems must be supported. The transportable C programming language is used as the lowest programming interface, and no assembly language programming will be used or provided externally.

Users benefit from standardization in several ways:

. competition and alternative source of hardware

. reliance on a single hardware vendor in a "locked in" fashion

. longevity of stable, system interfaces

. a very large flow of compatible, competitive software from many sources. By having a single, standard interface (principally the C language), applications software can be written that runs on all hardware rather than just a single vendor.

CONTINUUM HARDWARE

Multimax

Multimax's power is derived from the Nanobus™ used to interconnect the Multimax options within a backplane card holder for 20 cards which is about 12" long, and corresponds to a transmission time of approximately one nanosecond (see Figure 2). Every 80 nanoseconds a 32-bit address (corresponding to an ability to access up to 4

Billion bytes of memory) and a 64-bit data word can be transmitted from card to card plugged in along the bus; thus Nanobus has a data carrying capacity of 100 Million 8-bit bytes per second. (By comparison, standard and emerging busses for Multi's are one-tenth to one-fourth as fast.)

At least one of each type of the following four card-type options is required:

- Dual Processor Card (DPC100) - two, National 32032 processors have a common 32 Kilobyte cache. A high performance floating point option utilizing special VLSI chips is provided for arithmetic intensive applications. Encore rates this processor at 0.75 Million instructions per second. With 10 DPC100's, a single Multimax can process up to 15 Million instructions per second.
- Ethernet/Mass Storage Card (EMC100) - interfaces to Ethernet and to disks. This card contains a 32032 for managing input/output transfers and diagnostics. It has sufficient capability to operate as a LAN-based file service computer. Up to 11 DPC100 or EMC100 cards can be placed in one system.
- Shared Memory Card (SMC100) - 4 Megabytes of memory, organized in two independent banks with error detection and correction codes and utilizing 256Kbit memory chips. Eight SMC100 cards can be placed in a single system, providing up to 32 Megabytes of memory. A local computer allows the card to be completely checked and diagnosed on an offline or standalone basis.
- System Control Card (SCC100) - continually monitors, provides diagnosis, and communicates with an operator and a remote console.

<u>Reliability and Maintainability</u>
All of the above cards have microprocessors which can operate standalone and carry out a complete, self-diagnosis of the card.
.... more to follow....

<u>Peripheral Options.</u> In addition, Multimax offers: battery backup; fixed and removable disks of 520 and 300 Megabytes respectively; and 1600/6250 bpi magnetic tape options.

<u>Longevity.</u> The Nanobus provides the key to product longevity by being able to accept new, higher speed processors that will be evolve with CMOS VLSI. Real time data can be processed at up to full bus bandwidth (100 Mbytes per second) using all known methods

of interfacing including: interrupts (? events per second), direct program control (? events per second) and direct memory access (DMA).

The Local Area Network

Encore currently uses the most accepted Local Area Network standard, IEEE Standard 802.3 (Ethernet), to interconnect its computing nodes at a rate of 10 million bits per second. Other standards will be adopted in response to market requirements. The function of the LAN in the Ensemble is for:

- computer to computer communication for distributed processing, file transmission, and virtual terminal access among computers,
- common access to other networks i.e. a gateway,
- common access from terminals and PC's i.e. a terminals concentrator,
- formation of a fully distributed computing environment using Encore's powerful, single user workstations.
- connection to existing personal computers, minicomputers and mainframes

A LAN is not required for system operation.

ANNEX Terminal and Personal Computer Access (Concentrator) Computer

Each ANNEX Concentrator Computer attaches up to 16 terminals and printers along the LAN in a fully distributed fashion, permitting up to several thousand terminals to access all computers within a single LAN. Five ANNEX's can be connected to a single LAN port, or it can be directly connected to a Multimax if there is no LAN. ANNEX roughly doubles the processing power in the Ensemble since roughly one is used per additional Multimax processor. Wiring is simplified by distributing the physical connections to the LAN with the terminals and Personal Computers that require access, unlike past connections which require all terminal lines to be connected to a particular computer. A terminal can access all computers since the LAN is used for switching.

ANNEX is a compatible, distributed computer utilizing a National 32016 microprocessor with 128 Kilobytes of memory. ANNEX is programmed to reduce host work and allow orderly migration of time-consuming functions such as character echoing and screen updating which require no host or central database interaction.

ANNEX has options for both asynchronous and synchronous communications and direct and modem connections. Standard terminals and Encore Host Stations communicate with hosts at up to 38.4 Kilobaud transmission rate per terminal.

Hard copy options include a 200 character per second matrix printer and 800, 1200 and 1800 lines per minute printers.

ANNEX Gateway Computer

The ANNEX Gateway to the LAN and provides gateway access to various communications and industry networks using protocol conversion hardware and software. The protocols include: IBM SNA, IBM Block Mode Terminals (3270), IBM PC, and X.25.

RESOLUTION COMPUTING STATIONS

The Resolution Stations use a 19" screen size to give an unscaled, ledger sized 11" x 14" page at high resolution using 1056 x 864 pixels. A ledger sheet of 176 columns and 86 rows can be displayed. Keyboard and pointing device (e.g. mouse) input are provided. The Stations (without keyboard) occupy a desk space of 16-1/2" square.

Text and graphics protocols are provided which allow existing and future software to be run without modification, including: VT100, ANSI 3.64, Tektronix 4010/4014, Regis, and VDI for GKS.

The stations are designed to address a variety of applications including: the station of choice for the professional programmer; text and typographic input; engineering; business and accounting where computational power and large screens are required; and special functions such as translation where side-by-side text is required.

Resolution Host Station - R100

The R100 is a single, but universal Host Station because it can communicate with as many as three computers through separate windows. For example, the R100 can simultaneously access Hydra, a traditional host (eg. IBM 370 or VAX-11), and a PC AT for personal computer software. All the functions of the R100 are carried out under the program control of a National 32016 microprocessor. The R100 is also designed to be used as a remote, slave station to conventional workstations (i.e. a user can have a workstation at home or a second office).

The R100 can be upgraded and become an R500.

Resolution Workstation - R500
The R500 is self-contained computer system with a primary memory of two megabytes and disk memory of 20 Megabytes. The processor, a National 32016, is completely compatible with other computers in the Encore Continuum. Thus, software can be run either within the Workstation, among Workstations, or among Host Stations and Multimaxen(s?) in a completely flexible and transparent fashion.

THE UMAX 4.2 AND V DISTRIBUTED SOFTWARE ENVIRONMENT

CONCLUSIONS

APPENDIX 1. THE MULTI, A NEW COMPUTER CLASS
(This is taken from the Hydra Architectural Summary)
Notes
tm Digital Equipment Corporation
tm AT&T
tm Encore Computer Corporation

FIGURES
Figure 1. The Encore Continuum, a distributed processing and multiprocessor computing environment.
Figure 2. The Encore Multimax, multi(ple) microprocessor computer.
Figure Configurability ... either a space or the planes from my multi paper
Figure Price/Performance ... could be a dimensionless graph which shows Hydra against VAX, but doesn't name either or put price or performance dimensions.

GB9.56

THE MULTI - A NEW COMPUTER CLASS

The Multi (for multiple, microprocessor) is an emerging computer class made possible by recent, powerful micros that have the speed and functionality of mid-range super minicomputers. A Multi is scalable, permitting a single computer to be built which spans a performance range, in contrast to computer families implemented from a range of technologies. The Multi is a significant alternative to conventional micros, minis, and mainframes.

Multis can be used today - without redesigning or reprogramming of applications - because computer systems operate on many independent processes. With Multis, it is possible to operate on many of these processes in a parallel fashion, each on an independent processor, transparent to the user. Most importantly, the Multi is likely to be the path to the Fifth Generation based on parallel processing.

This Preface briefly summarizes the generic Multi - what it is, why it has come to be, and how it is applied - to better prepare those unfamiliar with this new concept for the Multimax design discussions which follow.

THE MULTI - ITS HISTORICAL AND TECHNOLOGICAL BASIS

Computer systems with multiple processors have existed since the second generation (the Burroughs B5000, a dual symmetrical processor, was introduced in 1961). Most mainframe vendors and some minicomputer suppliers currently offer systems with two to four processors. However, these structures have been expensive to build - due to the high cost of typical processors - and hence have found application mostly for high-availability computing (e.g., communications, banking, airline reservations).

The modern 32-bit microprocessor's function, performance, size, and negligible cost are creating a new potential for multiprocessors. With 32-bit addressing, hardware support for paged, virtual memory, and complete instruction sets with integer, floating, decimal, and character operations, these chips offer performance levels comparable to mid-range superminis such as the VAX™-11/750.

The Multi is a multiprocessor structure designed to use these new micros to advantage. It employs an extended UNIBUS™-type interconnect, whereby all arithmetic and input/output processor modules can access common memory modules. Cache memories attached to each processor handle approximately 95% of its requests, limiting traffic on the common bus. With these local caches, an order of magnitude more processors can be attached before saturating the common bus.

With proper attention to design of critical elements (e.g., the common bus), large multis using current-technology micros can outstrip high-end superminis, and even some mainframes, in total performance. This advantage should continue to grow. The performance of MOS and CMOS microprocessors has improved (and is expected to continue to improve) at a 40% per year rate, while the TTL and ECL bipolar technologies (on which most traditional minis are based) have shown roughly a 15% per annum improvement.

When compared to traditional uniprocessor designs, the Multi delivers improved performance, price, and price/performance.

- **Configurability Range** - through modular design, the Multi allows the user to "construct" the correct level of performance or price, without having to choose among a limited number of computer family members.

- **Availability** - the Multi has inherent reliability through redundancy because it is built from a small number of module types (typically, four). With appropriate software support, faulty modules which are replicated can be taken out of service - allowing continued operation with minimum downtime.

- **Designability and Manufacturability** - because the Multi is comprised of multiple copies of a small number of modules, instead of the large number of unique boards in a typical minicomputer, it is faster and less expensive to design. Individual module types are produced in larger volumes, producing improvements of 30% in manufacturing costs due to a learning curve over conventional uniprocessors.

APPLYING THE MULTI

Multis will be widely used for many applications because they can provide the most cost-effective computation unless the power of a single, large processor is required today on a single, sequential program. Because of the rapid rate of microprocessor evolution, the percentage of applications requiring single-stream performance in excess of that delivered by each of the Multi's processors is already quite small and will continue to shrink. On the other hand, we believe the emergence of the Multi will lead to parallel processing.

We can better understand where Multis may be applied by classifying the degrees of parallelism achievable. Grain size is the period between synchronization events for multiple processors or processing elements. Synchronization is necessary in parallel processing to initialize a task, parcel out work, and merge results. The Multi exploits the Coarse- and Medium- grain parallelism within an application, not the Fine-Grain, which is the focus of vector, pipelined computers (e.g. Cray 1) on wide word microprogrammed array processors. Groups of Multis and conventional Workstations can interact over networks to implement Very Coarse granularity.

Grain Size	Construct for Parallelism	Synchronization Interval (instructions)	Encore Computer Structures to Support Grain
Fine	Parallelism inherent in single instruction or data stream	1	Specialized Processors (e.g., Systolic or Array) added to Multimax
Medium	Parallel processing or multi-tasking within a single process	20-200	Multimax
Coarse	Multiprocessing of concurrent processes in a multi-programming environment	200-2000	Multimax
Very Coarse	Distributed processing across network nodes to form single computing environment	2000-1M	Multiple Multimaxes, Encore workstations, and other machines, on Ethernet

As all modern operating systems are multiprogrammed, whereby each job in the system is at least a single process, and many support multi-tasking or sub-processes, most current applications are already designed to take advantage of the Multi at the Coarse-Grain level. Also, when used in a timesharing or batch environment, each processor of a Multi can be assigned to a separate job to exploit the parallelism inherent in the work load. The UNIX™ pipe mechanism allows multiple processes to be used concurrently on behalf of a single user or job to achieve parallelism in reading a file, computing and output to one or more files. Transaction Processing is inherently a pipeline of independent processes.

The Multi can be a more efficient multiprogramming computer than the traditional uniprocessor, because the number of context switches (and hence lost time) is dramatically reduced. Additional parallelism is in the operating system itself. Execution of operating system code often accounts for 25% or more of available processing time, when file, database, and communications subsystems are included. By restructuring the operating system internals, multiple, independent system functions can be executed on independent processors.

When reprogramming of subsections of the application is possible, Multis permit additional parallelism to be realized, at the Medium-Grain level (i.e., parallel processing), by segmenting a problem's data for parallel manipulation by independent processors. This has been shown to be quite effective on simulation, scientific modeling, and analysis problems (such as matrix operations, linear programming, partial differential equation solution, etc.) which permit data elements to be processed in segments.

Finer granularity of parallelism is achievable in the framework of the Multi through specialized processors installed into its common bus. This is most effective when the algorithms are known a priori, such as in certain signal processing applications.

We believe multiprocessors, augmented by both programmable pipeline, i.e., systolic, and specialized processors for Fine-Grain parallelism, will cover the widest range of problems of any computing structure.

. Evolutionary Technology Upscaling with appropriate design, Multis allow long-term performance upscaling through evolution. As key components of the processor and memory cards improve over time, the computer can be upgraded without replacement in an evolutionary fashion. In addition, increased cache sizes through denser parts and improved cache management disciplines will permit substantially greater numbers of processors to be installed without saturating the common bus (provided the bus design has allowed for this performance growth).

All of this will permit graceful and cost-effective evolution in processor performance, input/output throughout and memory size over a range of one to two orders of magnitude over a ten-year period.

GB9.57

July 24, 1979

Ian Hugo
European Communications Consultants Limited
30-31 Islington Green
London NI 8DU
ENGLAND

Dear Ian:

Enclosed is a copy of the book that came out of some of the lectures. Thanks for the material. I'm not doing any writing for awhile.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:swh
GB0004/18
Enclosure: book - Computer Engineering
On Sunday, the Globe noted that no one wants to buy concepts, only products. Have talked to several potential investors and then looked at the PPM again, it looks like we are selling a risky concept: parallelism. On the other hand, we don't sell our real strenths.
Given that we are going for direct private funding, bypassing the normal venture capital cycle, we have an incredibly difficult sell. It is only a concept, but the important parts aren't there. Somehow, we have to strengthen the story for our salesman because the PPM just looks like a way to get them in trouble.

The focus is on parallel processing, which comes out in the first paragraph ... which doesn't exist and is hard. For example, my investment advisor, Tony Pell said he wanted to know much more about this. This is crazy because Tony doesn't even know what processing is. (This is like a marketing guy that used to sell the fact that we had a Syntax Directed Compiler, but didn't know what a compiler was.) All that's known about parallelism is that it isn't done now and hence is risky. With the Trilogy slip (expect another 9 months), people will be leary of anything that has a risk. We almost need a card that says we are doing NO parallel processing, we are using multiprocessing for independent tasks, because NO ONE knows how to do parallel processing to any degree. If we get this round, the next one is going to be harder because DEC will have a 64 processor out by then. (They delivered a 4 processor system for early breadboarding of software to Livermore as scheduled.) They will also have a system that will compete with Hydra in terms of performance and probably price. Our pitch is going to be harder with competitors out there.

AN OPERATING VENTURE COMPANY OR A MULTICOMPANY STARTUP
Conceptually, we need a name to market. Since Venture Capital funds are still selling, then we might better position ourselves as the ultimate of a VC company, except that:

- we know the business
- we can help the companies
- the product companies are focussed
- we have economy of scale in distribution
- our products are complementary, not competitive
- we have a full product line, not just a single product

A FULL PRODUCT LINE, NOT A ONE PRODUCT COMPANY HAS TO BE THE REAL SELL
We are NOT a one product company as the PPM seems to imply, but a full product line of EIGHT, independent companies to spread risk, amortize software over in a compatible fashion and get economy of scale in field. This should provide exponential growth of 8 times a single company. The full line includes:

- HYDRA- mini-class supermicro, but wider range of products (a Sequent, or megaframe division of CT)
- lamP- basis for high performance and TP products (a Synapse, but without risk associated of building high availability)
- Terwsco- a company that will compete with SUN, et al in transitioning to the fully distributed processing generation, if people believe that minis are dead. (A SUN or one of 123 Workstation companies.)
- NETco- tying all the systems together and to other companies. This also distributes and interconnects PC's and Terminals. (Interlan, etc.)
- Tabletop systems for distributing processing (NCR Tower)

- Commercial Software Products and Computing Environment-- probably this includes the integration of Office Automation software
- Technical Computing Environment (integration of external software)

- MIPSco- chip... probably only worth hinting about

OTHER THINGS TO SELL

What we are selling:

- Proven ECC helpers who can go in and solve virtually any marketing, engineering or manufacturing problem in a product company. It has critical industry links to influence direction. This is already in operation. This can't be done by a VC or board structure.
- A proven field organization that can grow at arbitrarily high rates to absorb products. (In visiting 10 companies in January, 3 had superb product, but will probably not get off the ground to any degree due to sales.)
- A structure that is attractive to product producers because the expected reward reflects the fact they are able to win by just designing and building great products. They don't have to risk the field/distribution problem. The maximum reward is less than by standing alone, but when you look back at minis where only 2 won by themselves, the best they can hope for is a successful merger down the road. Thus, for starters, multiply the business plan by say 5%-10% to get the <u>expected</u> reward. We should have a story, with numbers that shows just how people are going to make out when you add in the bonus! (Then we have to educate them that money is just as good as equity.)
- Redundancy in our product companies. We intend to have enough so that any one or two can hiccup and we still make the plan. This also helps the product company sale because there are others to help.
- Anti-sell to make having the incompatible hodge podge that will result from buying out from all the burgeoning CT-like companies and merging with the old line a loss.

Somehow the message of what we offer didn't get through too well in written form from what I can tell. This puts all the pressure on personal selling. Given our inherent selling capability within ECC and by two banks, is it possible to train more than two people to sell?

I hope this worry by me and my friends is ill-founded and not just another case of error in my gut feel or being poorly informed about how the investment community behaves. Since there are plenty of experts, I hope you'll indulge in teaching.

THE ENCORE COMPUTING ENVIRONMENT

PROVIDE A COMPLETE, BROAD, COMPATIBLE PRODUCT LINE

WITH A CHOICE OF <u>WHERE</u> AND <u>HOW</u> TO COMPUTE:

.ULTRA-PERFORMANCE, MULTI-PROCESSOR
.ULTRA-RELIABLE, MULTI-COMPUTER OR MULTI-PROCESSOR
(MAINFRAME PRICE AND SYTLE MANAGEMENT)

.LARGE, APPLIED, MULTI-PROCESSOR
(MINICOMPUTER WITH VERY LARGE PRICE RANGE: $40K TO >$400K
USING A SINGLE BASIC COMPUTER)

.SERVERS FOR TERMINALS, NETWORKS AND PC'S

.TERMINALS, EVOLVING INTO FULLY DISTRIBUTED, CLUSTED WORKSTATIONS
(PERSONAL COMPUTING)

.LOCAL AREA NETWORK AS THE BASIS FOR A COMPLETE INTERCONNECTION

.FRAMEWORK FOR A VARIETY OF PRODUCTS AND COMPANIES.

MAIN GOALS AND CONSTRAINTS FOR ENCORE PRODUCTS

ACKNOWLEDGE AND ADHERE TO PRODUCT-SEGMENTED, STRATIFIED BY LEVEL-OF-INTEGRATION INDUSTRY
(STANDARDS DETERMINE THE STRATA)

STRICT ADHERENCE TO INDUSTRY STANDARDS VERSUS VANITY INTERFACES

TIME TO MARKET (CONCENTRATE ON PRODUCT UNIQUENESS, NOT COST)

BROADEST POSSIBLE PRODUCT LINE OF FULLY-COMPATIBLE PRODUCTS

MAXIMIZE ABILITY TO COMMUNICATE WITH OTHER SYSTEMS (EG. IBM, DEC)

PERFORMANCE/COST (INCLUDING COST OF OWNERSHIP AND USE)

FUNCTIONALITY AND IMPROVED HUMAN INTERFACE

PERFORMANCE

MAINTAINABLITY (ASSUMES WE HAVE NO SPECIAL HARDWARE MAINTAINENCE)

MANUFACTURABILITY

COST

ENCORE USER DOCUMENTATION

We need an ECE Brochure Right Now!
We need a <u>list</u> of ALL the ECE/ECC Product Manuals Now!
(Hydra's June 24 list needs <u>ratification.</u>)

Overall ECE Organization (followed by levels of integration)

Hardware overall

Hydra Programmer's Manual (We need this right now)

Hydra hardware organzation for OEMs

DLA
DLA/EFE
DLA/Gateway

Resolution Terminals
Resolution Network Terminals
Resolution Workstations
Resolution Servers

Essence

Encore Unix Manuals

Languages

Utilities

Databases and Ally

THE ENCORE COMPUTING ENVIRONMENT AND ITS PRODUCTS

PROVIDE A COMPLETE, BROAD, COMPATIBLE, STANDARD-BASED PRODUCT LINE

WITH A CHOICE OF <u>WHERE</u> AND <u>HOW</u> TO COMPUTE:

.LARGE, APPLIED, MULTI-PROCESSOR - HYDRA

(MINICOMPUTER WITH VERY LARGE PRICE RANGE: $40K TO >$400K

USING A SINGLE BASIC COMPUTER)

.SERVERS FOR TERMINALS, NETWORKS AND PC'S

.TERMINALS, EVOLVING INTO FULLY DISTRIBUTED, CLUSTED WORKSTATIONS

(PERSONAL COMPUTING FOR PROFESSIONALS)

.LOCAL AREA NETWORK IS THE BASIS FOR A COMPLETE INTERCONNECTION

.ULTRA-PERFORMANCE, MULTI-PROCESSOR EXTENDING HYDRA

.ULTRA-RELIABLE, MULTI-COMPUTER OR MULTI-PROCESSOR

(MAINFRAME PRICE AND SYTLE)

.FRAMEWORK FOR A VARIETY OF PRODUCTS AND COMPANIES.

GOALS OF THE ENCORE COMPUTING ENVIRONMENT

AND ENCORE PRODUCTS

0. ALL PRODUCTS MUST PROVIDE THE MOST COST-EFFECTIVE COMPUTATION

1. MASTER "MULTI" TECHNOLOGY:

TIMESHARING AND TRANSACTION PROCESSING -> PARALLEL PROCESSSING

EVOLUTION TO FAULT-TOLERANT COMPUTING

EVOLUTION TO SPECIAL, HIGH PERFORMANCE PROCESSING

2. BE INDUSTRY STANDARD FOR COMPATIBILITY AND MAKE-BUY FLEXIBILITY.

(EXPLICIT DECISIONS ABOUT VANITY STANDARDS)

PORTABILITY ACROSS CHIP AND OPERATING SYSTEM FOR FLEXIBILITY

GOALS OF THE ENCORE COMPUTING ENVIRONMENT AND ITS PRODUCTS continiued

3. PROVIDE PRODUCT COMPATIBILITY TO OPTIMIZE LOCATION OF COMPUTATION

A USER'S PROCESS CAN BE LOCATED OR MIGRATED AMONG

TERMINAL, WORKSTATION, FRONT-END, AND MAIN COMPUTERS

4. MASTER LAN TECHNOLOGY:

SEPARATIONS OF HUMAN INTERFACE AND COMPUTE SERVER

DISTRIBUTED PROCESSING

SEPARATION OF COMPUTATION AND COMMUNICATION VIA THE LAN TO AVOID

COMBINATORIALS OF PROTOCOLS AND PHYSICAL INTERCONNECTIONS

PROVIDE FOR FUNCTIONAL DECOMPOSITION ALONG THE LAN VERSUS TIME

5. INTERCONNECTION WITH:

UNIXES (LIKE SYSTEMS)

ESTABLISHED VENDORS: IBM, DEC, ...

COMMUNCATIONS SUPPLIERS: X.25, PABX

PC'S

WHY ENCORE CAN WIN

ENCORE IS PREDICATED ON ENTREPRENURIAL ENERGY DRIVEN INDUSTRY WHICH IS

.STRATIFIED BY LEVEL-OF-INTEGRATION (BASED ON STANDARDS)

.SEGMENTED BY PRODUCT

INDIVIDUAL PRODUCT EXCELLENCE AND VERY LARGE PRODUCT RANGE

MASTERY OF "MULTI'S" WITH EVOLUTION TO PARALLELISM

MAXIMUM INTEGRATION OF PRODUCTS FOR SYNERGY AMONG PRODUCTS

MASTERY OF LAN'S FOR DISTRIBUTED PROCESSING

COMMODITY SILICON FOR LOWER INVESTMENT AND ARCHITECTURE INDEPENDENCE

STANDARDS TO

.LEVERAGE OUTSIDE DEVELOPMENT AND REDUCE TIME-TO-MARKET, AND

.GET ACCESS TO A BROAD CUSTOMER BASE

CAPITALIZE ON ENTREPRENURIAL ENERGY DRIVEN INDUSTRY WITH

SMALL COMPANIES, DIRECT REWARD

CAPITALIZE ON ONLY ECONOMY-OF-SCALE: COMMON FIELD-SALES COMPANY

February 16, 1982

David A. Patterson
University of California
Berkeley, California 94720

Dear Dave:

You had a great first draft. Here's my slight revision to it.

Having recovered from the shock, I'm looking forward to writing the talk now.

Thanks,

Gordon Bell
Vice President,
Engineering

GB:mal
GB3.S2.21

Eckert-Mauchly Award

Gordon Bell is given the Eckert-Mauchly Award for his contributions to designing and understanding computer systems. He blends both the academic and commercial world, and is hereby cited:

For the contributions in the formation of the minicomputer as embodied in the PDP-5 and PDP-8. The PDP-8 demonstrated that minimal computers could be created and applied to a wide variety of tasks including: control of real time and laboratory equipment, personal computing and timesharing.

For the architecture and implementation of the first commercial, interactive timesharing computer, the PDP-6, the forerunner of the DECsystem 10/20 computers.

For his architecture and PMS structure contributions to two of the most widely used computer families, the PDP-11 and VAX.

For pioneering work in the field of hardware description languages. PMS and ISP have had a major impact on our ability to express and understand computers.

For being a co-author of classic reference books on computer architecture and computer engineering.

For being a founder and curator of the Digital Computer Museum, which seeks to further understanding the evolution of computing.

February 1, 1979

Professor Doug Jensen
Carnegie-Mellon University
Department of Computer Science
Pittsburgh PA. 15213

Professor Jack Lipovski
University of Texas
Department of Electrical Engineering
Austin, Texas 78712

Dear Doug and Jack,

Enclosed is information that Jack asked me for in regard to the Eckert-Mauchly Award. In the event that I do not receive the award, I would like the right to withdraw my name from further consideration. In any case, I would like not to have my name in your files more than another year.

I or someone from my immediate family would be available to accept the award.

The award process could be revised. The notion of applying for this is disconcerting, and you will not get the quality nominations that I would hope should exist. For example, Cray would be at the top of my list, yet I can't conceive of him nominating himself. Let me suggest that for starters the Collusus team, Wilkes (and possibly other members there), Kilburn (and possibly other members), the team of Amdahl, Blauuw and Brooks, and Cray should be given awards. Certainly Cray and the Manchester Groups have the clearest, longest record of achievement.

Sincerely,

C. Gordon Bell
Vice President, Engineering
Professor, Computer Science and
Electrical Engineering
Carnegie-Mellon University, on
leave

GB:ljp
GB0001/5

February 1, 1979

Professor Doug Jensen
Carnegie-Mellon University
Department of Computer Science
Pittsburgh PA. 15213

Professor Jack Lipovski
University of Texas
Department of Electrical Engineering
Austin, Texas 78712

Dear Doug and Jack,

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Sincerely,

C. Gordon Bell

Vice President, Engineering
Professor, Computer Science and
Electrical Engineering
Carnegie-Mellon University, on
leave

GB:ljp
GB0001/5

Gordon Bell
ML12/A51

Professor Doug Jensen
Carnegie-Mellon University
Department of Computer
Science
Pittsburgh PA. 15213

Gordon Bell
ML12/A51

Professor Jack Lipovski
University of Texas
Department of Electrical
Engineering
Austin, Texas   78712

May 3, 1982

Professor Dave Patterson
University of California
573 Evans Hall
Berkely, CA   94720

Dear Dave:

Thanks for the very nice introduction for the Eckert-Mauchly Award.

I enjoyed your paper and follow RISC. When you get an operational system, I'd like to really understand it because I think you're just operating on a different point on the space/time curve and this may "cost" time or space somewhere else... whether this is important or not is strictly an engineering question at the time. There's also the issue of data-types when a machine is built for gp use.

Right now I'd like to understand the use of a constant "C" compiler in performing the evaluation since we went to extremes to make sure nearly all statements in scientific and commercial languages computed into one instruction. Such a

compiler may reduce all machines to a common subset. Clearly the procedure call (and resulting time) is a major factor which RISC seems to address. The good use of a cache might have a similar effect. The registers may have an effect somewhere else - I know not where now. For example, a stack machine encodes certain problems efficiently. I've erroneously evaluated stack performance independent of implementation. In particular, a stack machine with only a top can easily take three (or more?) memory references. Having helped on George, an interpreter which is the first stack machine that English Electric built as the KDF9, I designed one which is approximately the HP3000. The PDP-6 was a reaction to it and I remember when Nico Habermann's Algol 60 on the 10 outperformed the
B5000 - for about the same technology and memory size. Hence my inherent distrust of all stack machines and the difference between architecture and implementation.

What might be interesting is a recompilation on our new C compiler which is reported to run several times faster and targets VAX. Could you see how it compares and then do a "hand" recompilation using it for RISC?

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:mal
GB3.S4.10
May 6, 1982

Professor Jack Lipovski
Department of Electrical Engineering

The University of Texas at Austin
Austin, Texas 78712

Dear Jack:

I really enjoyed the Ninth Annual Symposium on Computer Architecture. Many thanks for the award and having me give the keynote and participate on the panel.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:mal
GB3.S4.24
January 27, 1981

Mr. Bob Barton
Vice President, Research
Burroughs Corporation
16701 West Bernardo Drive
San Diego, CA 92127

Dear Bob:

Would you be willing to 2nd my nomination of Wesley A. Clark for the Eckert-Mauchly Award?

Enclosed is my nomination. Recommendations are due to Harold Stone by 1 February 1981:

Prof. Harold Stone
University of Massachusetts

Computer Center
Graduate Research Center
Amherst, MA 01003

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:swh
GB2.S1.2

January 9, 1981

Prof. Jerome R. Cox Jr.
Washington University
Chairman, Computer Science Dept.
St. Louis, MO 63100

Dear Prof. Cox:

Would you be willing to 2nd my nomination of Wesley A. Clark for the Eckert-Mauchly Award?

Enclosed is my nomination. Recommendations are due to Harold Stone by 1 February 1981:

Prof. Harold Stone
University of Massachusetts
Computer Center
Graduate Research Center
Amherst, MA 01003

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:swh
GB2.S1.2

January 5, 1981

Mr. Frank Hart
Bolt Beranek and Newman, Inc.
50 Moulton Street
Cambridge, MA 02138

Dear Frank:

Would you be willing to 2nd my nomination of Wesley A. Clark for the Eckert-Mauchly Award?

Enclosed is my nomination. Recommendations are due to Harold Stone by 1 February 1981:

Prof. Harold Stone
University of Massachusetts
Computer Center
Graduate Research Center
Amherst, MA 01003

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:swh
GB2.S1.2

January 5, 1981

Mr. Ivan Sutherland
125 Wadsworth Avenue
Santa Monica, California 90405 (213-399-1113)

Dear Ivan:

Would you be willing to 2nd my nomination of Wesley A. Clark for the Eckert-Mauchly Award?

Enclosed is my nomination. Recommendations are due to Harold Stone by 1 February 1981:

Prof. Harold Stone
University of Massachusetts
Computer Center
Graduate Research Center
Amherst, MA 01003

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:swh
GB2.S1.2

January 5, 1981

Mr. Larry Roberts
President
GTE Telenet Communications Corporation
8330 Old Court House Road
Suite 400
Vienna, Virginia 22180 (703-827-9200)

Dear Larry:

Would you be willing to 2nd my nomination of Wesley A. Clark for the Eckert-Mauchly Award?

Enclosed is my nomination. Recommendations are due to Harold Stone by 1 February 1981:

Prof. Harold Stone
University of Massachusetts
Computer Center
Graduate Research Center
Amherst, MA 01003

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:swh
GB2.S1.2

January 5, 1981

Prof. Harold S. Stone
University of Massachusetts
ECE Dept.
Amherst, MA 01003

Dear Harold:

I'm writing to nominate Wesley A. Clark for the Eckert-Mauchly Award. Wes has made many direct and indirect contributions to architecture via DEC and other persons and organizations, including sponsorships and consultation.

Direct Contributions

.Design of the MIT Lincoln Laboratory TX-0 (first transistorized computer) designed to test large memory, the first transistor circuits, for the TX-2, and had built-in 10" x 10^{-1} scope.

.TX-2 architecture, (Clark, 1957) a large scale computer used for interactive computing research including Sutherland's sketchpad, Roberts' graphics research, and the first computer network research that led to ARPAnet. The TX-2 had an important set of ideas, the most important were addressable tape (which IBM ultimately adopted in the mid 70s) and the multiple sequence mechanism. The multiple sequence mechanism provided the basis for multiprogramming by permitting 32 separate program counters, thus giving 32 independent computers. Honeywell used this idea in the 800 and we used it in the PDP-1 in 1960. It is also the basis for the multiprogrammed PCPs of the CDC 6600.

.LINC - the Laboratory Instrument Computer (Clark and Molnar, 1964) was the first truly personal computer (12-bit word) for the scientist. It had 2 scopes, a personal file system using addressable tape (with 256 Kbytes), and ability to directly interface to laboratory experiments and equipment via analog/digital channels.

.L-1 (circa 1960) a very small 9-bit word length really minimal computer for data gathering and data communication application. An extremely innovative design that was truly, a "minimal" computer.

.Macromodules (Clark 1967) were a method of building digital systems of virtually unlimited size based on a modulo 12-bit word length. In designing this basic scheme, the team at Washington University discovered and solved the timing problem inherent in building modular systems by using asynchronous logic. This early work was the basis of the asynchronous logic work.

.Basic understanding about Integrated Circuits (Clark 1980)

Indirect Contributions via DEC

His designs are extremely clean, clear, noteworthy and examplary. He and his designs have influenced me, others at DEC, and our computers directly.

.PDP-1 was an 18-bit computer growing out of the TX-0 work. The PDP-1 Sequence Break System was an improvement on the TX-2 Multisequence mechanism.

.PDP-5...PDP-8 used concepts in LINC and the CDC 160. (LINC also used concepts from the 160.)

.The notion of minimality for the PDP-5 was derived from the L-1 design.

.LINC, LINC-8, and PDP-12 were implementations of the basic LINC architecture.

.DECtape was an adaptation of the basic LINCtape.

.Register Transfer Modules (PDP-16) came out of the Macromodules. While neither RTM nor Macromodules were directly influential, Fairchild did build a version of PDP-16s as IC's. Later bit and byte slice IC's did build on and use the fundamental primitives they introduced.

Sponsorship, and Consultation (that I know of)

.Lincoln Laboratory FX-1, designed to test 50mhz circuits and high speed circuit techniques (James Forgie)

.Lincoln Laboratory theses surrounding the TX-2. See above.

.Lincoln Laboratory was established for designing the SAGE computer. As such, it affected IBM's designs.

.Washington University, Programmed Console for ECG analysis via phone line control (Dr. Jerome Cox). Note that under his sponsorship the glitch phenomenon (Charles Molnar) was validated (Clark, 1980).

.ARPAnet Architecture and Interface - I believe there was significant involvement in the early conceptualization of the design. (Dr. Larry Roberts)

.BBN's, IMP, and TIP and other communications processor designs. Frank Hart, Vice President of BBN can describe the extent of this involvement. Wes has been a consultant to BBN on these and other systems.

.University of Vermont PROMIS System (Dr. Larry Weed)

.CALTECH Visiting Fairchild Fellow (Profs. Carver Mead and Ivan Sutherland)

.Burroughs Corp. (Robert Barton)

.Xerox Corp. (George Pake, Chief Scientist)

Wes has contributed much to computer architecture. It is time we recognize him.

Sincerely yours,

Gordon Bell
Vice President, Engineering
Professor, Computer Science and Electrical Engineering
Carnegie-Mellon University, on leave

GB:swh
GB2.S1.2

References

Clark, W.A. The Lincoln TX-2 Computer Development. Proc. WJCC, 1957, pp. 143-145.

Clark, W.A. and Molnar, C.E. The LINC: A Description of the Laboratory Instrument Computer. Ann. N.Y. Acad. Sci. 115: 653-668, July 1964.

Clark, W.A. Macromodular Computer Systems. Proc. SJCC, 1967, pp. 335-336. (Introduction to a series of papers on macromodules)

Clark, W.A. From Electron Mobility to Logical Structure: A View of Integrated Circuits. ACM Computing Surveys 12, 3 (Sept. 1980), pp. 325-356.

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GB0002/18

| d | i | g | i | t | a | l | i n t e r o f f i c e   m e m o r a n d u m

Subject: **Getting the Poop on ECL for Venus**

To: Don Busiek, PK3-2/S17
George Hoff, MR1-2/E47

Date: 4/11/79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

CC: Brian Croxon, TW/C04
Bill Demmer, TW/D19
Ulf Fagerquist, MR1-2/E78
Andy Knowles, ML10-2/A52
Dave Rodgers, TW/C04

follow up 4/30/79

The thought of building a high volume machine in Venus and having it behave like the KL10 in terms of RAMP is quite frightening. There seems to be a superstition associated with ECL stemming from several product failures. Most recently, the 303x series has suffered from some bad design. However, the early ECL 10K had very poor margins in terms of power and temperature. On the other hand, the 158 and 168 are reliable, and the Amdahl and Fujitsu machines are very good...quite possibly because they are so beautifully cooled. Burroughs is supposedly giving up CML for TTL, but I would expect poor performance because they are the sole source of their own technology, and hence may not have the learning experience to get the reliability.

I'd like to get some real data on our experience with the failures in the KL10 processor and compare it with a TTL/S machine such as the 11/70. It seems that we can get this data with only a couple of phone calls and a large back of the envelope. This simply entails calling the repair centers. Since we know the population and the number of modules per machine, we can get the failure rate per module and per dip. These should then be compared with the theoretical rates when we make the final decision. I would certainly be biassed toward any chip designs which have accumulated failure rate data so that we know just what we are getting into. Selecting Siemens or one of the Japanese arrays would be an advantage because of this data.

Could you carry this little analysis out and have it part of the selection criteria for Venus technology?

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST: Don Busiek PK3-2/S17 Brian Croxon TW/C04
Bill Demmer TW/D19 Ulf Fagerquist MR1-2/E78
George Hoff MR1-2/E47 Andy Knowles ML10-2/A52
Dave Rodgers TW/C04

ID#364

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Subject: **ECL Power Supply**

To: Brian Croxon, TW/C04
Bill Demmer, TW/D19
Ulf Fagerquist, MR1-2/E78
George Hoff, MR1-2/E47
Alan Kotok, MR1-2/E47
Henk Schalke, TW

Date: 27 NOV 78
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

follow up 12/11/78

The Cray 1 power supply is fairly unique in that it is a three stage affair with a 150 KW MG-set to get power to 400 cycles, followed by a solid state AC-DC converter and in the machine there are final voltage regulators. Since ECL is a constant load, only inductors are used. There are no capacitors. What kind of supply are we looking at for the Dolphin? Are we looking at buyouts?

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST: Brian Croxon TW/C04 Bill Demmer TW/D19
Ulf Fagerquist MR1-2/E78 George Hoff MR1-2/E47
Alan Kotok MR1-2/E47 Henk Schalke TW GB0003/36

The Loire Valley represents one of the greatest system balancing problems known to man for in a combined distance of only X Km. There are a combination of y-restaurants with a combined value of z-Michelin rated rosettes (see figure 1). Bicycle touring, is the ideal solution to burning calories, and meeting aerobic requirements while seeing the countryside, and its chateaus as the conveyance among the restaurants. Although one would ideally like to have maximum flexibility to accommodate the weather, terrain, spontaneous menus, and ones muscles it is necessary to plan ahead. This particular tour took only 10 days, covered y Km, z restaurants (with r rosettes), sightseeing in chateaus in t towns at an average star-rating of 2.1 and staying in h hotels.

Planning consisted of defining the itinerary in an eco-gastronomical fashion to burn-off 4000 calories/day by covering an average of 30 Km/day and then making the essential airline, bicycle, hotel, and restaurant reservations. Although this east-west tour was chosen to flow with the 100M fall of the Loire river, we neglected the fact that the prevailing winds were y, which required more calories - which, of course, were easily available at all meals. The standard 1:200000 map while adequate doesn't have the topographical lines of the 1:100000 variety that warn of the hill climbing.

Bicycles can either be carried as standard air travel luggage; but we simply rented them in Paris for about $2.50/day for convenience and especially to avoid introducing non-standard bicycles to the Loire. Bicycling requires minimal special clothing and luggage. Panniers Kirtland (of Boulder Colorado) a pair of rubber-enpregnated nylon saddlebags, to go over the rear carrier hold from x to x' cubic inches or y to y' lbs, and a handlebar mounting/over the shoulder bag holds about y cubic inches. These saddlebags turned out to be beautifully designed for packing and protection against rain. The small bags, very loosely packed are adequate, as the tendency to take too much will be discouraged. In fact, the ideal solution is simply filling the bags with credit cards and money, purchasing necessities to meet the weather, and dress codes. Since EMS who supplied the gear, didn't have adequate dress to fit the panniers, and meet the dress codes, a Brooks Brothers work and wear suit was used while women wear seems natuarally made to roll-up and still look well when worn. Double knit could probably be used to good advantage in the fall if one is capable of wearing it. Two extra changes of mini-underwear (masqueradable as an extra pair of shoes, several long-sleeved shirts including a swim suit), warm woolen one and a pair of long pants can suffice. All clothes should be the rapid-dry type both for overnight cleaning and also because they dry rapidly after being rained on while worn. Of course, good foul-weather gear (including rubbers and rain pants) is a must in the spring and should be selected for the lowest wind drag profile to avoid being a sail. Standard biking ponchos are not recommended.

If our tendency to be prepared by having a complete tool kit, corkscrew, cutler's lotion, solarcaine, hot water heater, extra camera batteries, too much film, too many clothes changes, too many paperback books is characteristics is normal it should be curbed. All the extras go into a weight and size and more wind loss. However, a good 6" crescent wrench and a swiss army knife are essential!

Having redecided that a 3 speed, versus 10 speed bike was adequate and preferred because we wanted to see where we're going, and then how handlebars and brakes made it essential to always be bent over, bikes, we rummaged through a collection of green, ---- brand bikes settling on numbers ---- and ----. These had working brakes, lights, bells - one of which later fell off, relatively flat tires which we inflated and more or less working gears. We collected a complete tool and tire-repair kit from many of the other bikers, because, we rationalized, they weren't needed in the light cycling around Paris and would get stolen anyway just as ours had.

The train to Bloise left from nearby Austerlitz station, and since we hadn't the foresight to get a schedule, we luckily arrived with one half hour before the express left. This proved barely adequate as we ran around like crazy trying to get the bikes on the train - ultimately they were accepted by the baggage department of the railroad - an independent enterprise.

We arrived about 6:20 in Bloise and proceeded on our first 2 hour 24 Km leg over relatively hilly terrain. The distance should have been only 20 Km since we left town on the wrong road through no fault of our excellent map and very well marked roads! Fortunately, enough daylight was with us because we weren't sure the generators worked nor did we want to introduce anymore drag on our bodies. Contrary to friends suggestions, we did not "get in shape" before cycling, instead, we did on-the-job getting into shape because we saw no point in getting tired and sore until we absolutely needed to. This proved to be a good decision, but we might have found that our range was only 15 Km/day. It's recommended that cyclists have some rough idea of their capability.

The Domain des Hauts de Loire in Onzain where we stayed the first night was fully worth being sore for, and worth its two stars. We were only able to have a very quick warm bath prior to dinner starting with asparagus with mouselline sauce and their own cured ham. Although a fish course is really basic, especially in the Loire, we went right on to breast of duck with green pepper sauce and quail. The duck was so large that for the first few bites there was some question as to whether we hadn't gotten an order of chantenbraud? Fresh apricots were used for the tart and we had cheese last so we could finish off, so to speak, with port. The Loire is famed for Chavrignon (chav) a goats cheese, but generally we ate cheese from other regions. We had a non-descript red wine of the Loire recommended by -----. At this point a 10 hour sleep was called for.

We got off to a relatively late start after toasted brioche that really melted in our mouths and croissants to return to *** Bloise. The *** chateau on the hill was closed when we arrived, so we decided to eat fruit and pastries near the river and to go on the short distance on the south side of the Loire to Candee, where we had reservations at a newly *'d country inn called the Hostellerie de in Guillere. The inn was full for lunch, taxing the kitchen and service to the limit, so our decision to not lunch there was a good one. Dinner was a strain for the staff but it was well prepared. We had a 75 Vouvray with crab and white fish tourine and asparagus in puff pastry. Salmon and sole filled with salmon and carrots were the main course. Both included a spinach and egg timbale. A chicory salad was eaten in lieu of the meat course and we went onto cheese. This time we tried a diversity of new kinds and we marvelled at how well we did by pointing with no knowledge of the language and little knowledge of the cheeses. We subsequently observed that most Frenchmen get their cheese by pointing too. Again we had fully opened port. The desserts of carmelized Charlotte and strawberries with creme frisch were the high point.

The next day's travel, partially in the rain was via Chaumont where we dined at the Hotel de Chateau across from the ** chateau. But first it was necessary to earn the calories. The chateau was a pleasant walk by a tree lined hill, the guide said little, the Green Guide and handout they supplied was adequate. The ** chateau's, particularly those in a small village, have several outstanding virtues: they are less crowded than those with *** and the guides are less pretentious and less likely to ramble in their relatively narrow ways.

The lunch was superb. Our waiter guided us through the fixed menu of duck gallantine, grilled/fresh river fish with spinach, cheese and rhubarb tart and floating island. He also recommends a 78 Sauvignon bottled by Maurice Barbon at

Oisly as we were in the Touraine region.

As we left the rainy Chaumont on a full stomach and proceeded up the hill from the Loire? crossing over the Cher? we began to feel the pain of travelling under these circumstances. For real cyclists there are probably rules and we vowed to get a rulebook. We also learned that the bikes had little or no braking capability when used in the rain, making travelling a triple thrill; being dampened by the rain; no vision; not being able to stop except.

The ** castle at Chenonceux was our destination for the day and we checked in at the Hotel de Bon Laoureur at de Chateau. By now the rain had stopped, and riding the last few minutes in the wind and sun had a nice, drying effect. The chateau was operated by Merrier? of the French chocolate company. Chenoncenx is built over the water and turned out to be our favorite because of its scale and simplicty. The Mellier? company does an excellent job of operating it as people are free to wander through the rooms at their own pace...the French government would do well to copy private enterprise. Also they operate a very tastefully done cafeteria with high quality and relatively low prices.

The restaurant recommended a specially bottled cremant. The soup was poor but crayfish quenelles more than made up the start. We had a reasonable grilled chicken and better veal medallions for main course with homemade chips. For dessert we had pear embedded in almond paste and cherry tarts.

The next day we travelled to the ** Chateau d'Artigny at Montbazon to spend two days, which included 4 spectacular main meals and wines. Of all the places, we found the staff the most pleasant and the food up to its ** rating. Since most people arrive in Mercedes or better, we were something of an anomoly, although not unique. They allowed as how maybe a half dozen people who arrived by cycles every year. The wine steward was part English, originally from Brittany who was also writing articles on wines and interested in promoting Loire wine. The menu was small, though entirely adequate and fixed, no doubt for a long period of time.

The first lunch was light as we had our eye set on a full 6 course dinner! It included a 74 Vouvray (clos du Boung), Chateau salad (artichokes, lettuce, tomatoes, pate', mushrooms, triffles, asparagus, beans, finely chopped spinach with vigagette). Dessert was individually baked rasberry souffles and they always pushed a plate of bon bous at us which were difficult to reject.

Fortunately there was a swimming pool, but on entry it proved to be what we thought was 65 degree which was too cold for us, but we did do several laps. On exit, the 65 degrees air seemed hot.

Dinner (at only $45.00 not including the wine) was the first meal we had in France and a bargain. We had a '62 Chinon decanted and by the end of the meal the wine was essentially sweet! The touraine of veal sweetbreads a (duck pate' started us off). The fish course included salmon in a lemon sauce with decorated tomotoes adoninus and lotte (river fish) and small onions. A rasberry sherbert and lean liquer were served to clean the palate. We then had pigeon, pear-shape pototoes and salad; and breast of duck with a small carrot souffle sewing a colorful with spinach layer.

Our vows to never eat again were broken when the breakfast arrived! It included four breads: the usual croissants, and rolls toasted biroche that melted in our mouths; and the finest bread. Gwen thought that it was a dreary day though a warm heated room, the only thing to route us from bed to bed! There must be a reason why European beds, even in ** chateus are really soft, bumpy, and generally awful for American backs. Possible Europeans are stronger or possibly all the back nerves are concentrated in the palate. To add insult to injury there are two kinds of pillows: one is rolled up like a giant sausage and fixed under the head; the variable pillows are large and heavy, quite possible for pillow fighting to reduce on after a meal! At any rate, the Michelin company might consider giving a bed rating for hotels as well!

We did lunch with Chinon Rose, artichokes mouselline and green beans, and a dessert of supposedly flaming strawberries and purce which the avartress didn't get to flame, poured over sherbert. Dinner was also relatively light. The first wine was '62 St. Nicholas (des valles) of de Bourgueil for noiseltes of lamb and for beef. We had spectacular vegetable puff pastry pies of leak, tomotoe and mushrooms. We did a repeat on the rasberry souffle, this time with a sec Vouvray.

The next day, there were large, photogenic clouds and we were off by nine for Langeis. At a critical junction we chose to go up to visit the village, which specialized in weaving rush function, baskets, etc. The results were good, but fortunately we had no room to buy and carry tales and baskets, so we settled on photographing them. About noon the photogenic clouds got together and produced rain just at a time we were on the hill heading back to the Loire. Fortunately, on arrival at * Housten in Langeais we found the heat, on so we took baths to warm up and dry out and put our critical clothes on the radiator. Hosten is right around the corner from the *** chateau. Housten is operated by the ? family and the food was up to the rating. They started by offering us a prime wrapped in bacon and a cheese tart. Although we dived lightly, there whole cooked, small duck special was quite good, especially with the 74 Vouvray. The salad and hot cold sewed asparagus with sour cream weren't memorable. The dining room was cozy and small, and like many dining rooms didn't have adequate airflow to remove the smoke put out by the majority of the diners! Europe has more smokers, and non-smokers are tolerated. Still overfed from Chateau d'Artigny we had a straight shot of 58 Km along the Loire to les Rosiers. This took 5 hours and we stopped at ? to visit the wine caves which bottle sparkling wines using the champagne process. We also visited a care set up as a museum which exhibited mushrooms growing.

The chef, Albert Augerean, and his family operated the Auberge Jeanne de Laval. The small hotel was pleasant and so the chef was very proud and hospital. The dining room was small and 3 women and a young man waiter did a better job that many of the larger places which had twice the number of waiters per guest! We should have canned out a simple experiment to correlate *'s, size, kitchen, dining room staff, and ownership...but we didn't take the data! (Anyway that's the subject of a scale study next time.) We had a local Gratien and Meyers cremant that was excellent especially with the small pork tart they handed us to start with. The first course was eggs and triffles and a collection of creusse, pickled zucchini, pate', mushrooms also greek, and standard pea and carrot salad. We had sandre with plain butter sauce and crayfish in what seemed to be a creole sauce. Strawberries and creme frisch topped the meal off.

The next morning it was raining - hard. We'd observed that large clouds collect during the day and then it rains in early afternoon; or it rains all morning and then it clears a bit. As a backup, we could take the train at 1:30 to Angers, but were reluctant to. At 11, the rain changed to a light sprinkle and we left on the remaining 30 Km journal of our 250 Km, eight day trip.

We backed a strong head wind as the unsheltered highway went right next to the Loire. Though beautiful, we didn't enjoy the headwind and we did stop once to get out of the downpour.

*** Angers has an incredible chateau that held 400 feet of 12th Century tapastery. Since we hadn't reservations, we settled on the last room of a small hotel near the station. For dinner we listened to one of the hoteliers convenience us not to go to one of the two * restaurants. He was wrong, but we did have a spectacular dessert of meringue and shaved chocolate.

The next day we and our bikes went back to Paris. The final thrilling hours of bicycling consisted of riding from the Montparnasse station back to Paris velo near Austerlizt station. Fortunately, it was Sunday and lunch time, so we made it back safely.
August 17, 1982

Jean-Daniel Nicoud
Ecole Polytechnique Federale De Lausanne
Departement D'Electricite

Laboratoire de microinformatique
16, ch. de Bellerive
CH - 1007 Lausanne

Dear Jean-Daniel:

It was nice to hear from you again and I've forwarded your letter to Sam Fuller, who heads our research group and to Forest Baskett. Sam will discuss your request to visit the Laboratory with Forest.

Since the Lab is quite small, and quite goal directed, it may not be feasible to visit there next year. Sam or Forest will contact you regarding the September visit.

Gwen says Rick is bringing over his SMAKY.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB3.S7.5

January 16, 1979

Editor, Harvard Business Review

Dear Sir:

I would like to submit this to the Harvard Business Review for publication.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:ljp
ID#<>

January 16, 1979

Editor, New York Times,
Sunday Magazine Section

Dear Sir:

I would like to submit this to the Harvard Business Review for publication.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:ljp
ID#<>

January 16, 1979

Editor, New York Times Financial Section

Dear Sir:

Dick Berube, Head of our Public Relations Department, suggested I send this to you. Are you interested in publishing it?

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:ljp
ID#<>

January 16, 1979

Editor, Wall Street Journal

Dear Sir:

Dick Berube, Head of our Public Relations Department, suggested I send this to you. Are you interested in publishing it?

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:ljp
ID#<>

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Subject: **Editors and Forms Languages: Not the End, But Just the Beginning?**

To: OOD
Jim Bell, ML3-2/E41
George Berry, MK1-2/E09
Dave Cutler, TW/D08

Date: 9/21/79 Fri
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

Bruce Delagi, MR2-1/M64
Joe Ford, MK1-2/B11
Jack Gilmore, MK1-1/J14
Bob Glorioso, ML3-2/E41
Bill Heffner, TW/E10
Pete Hurley, MR1-2/E37
Jan Jaferian, PK3-1/M40
Bill Keating, ML12-3/A62
Tom McIntyre, ML5-5/E76
Bill Segal, ML3-5/E82
Dick Snyder, MR1-2/E37
Bob Travis, MK1-1/J14

I know you thought you'd never hear me say it, but...we need a different approach to editors (and their continued creation). This feeling has come about based on the following:

0. Everyone has a very personal feeling about editors and wants minor or major changes to any given one.

1. There are many different editing tasks to perform that can use different editors.

2. Observing two editors for creating attribute:value kinds of information for our BURP (Financial Product Measures) and for the creation of entries to the MUSEUM data base. We got <u>big</u> factors (2-4) in productivity over a standard text editor by having the editor check the fields, duplicate, and skip fields and otherwise have highly specialized knowledge, about what was being edited. Also these were question (editor) driven. I don't think a FORMS language such as FMS comes close enough to what's needed or can be done here. Here the system actually paces and checks the user!

3. Reading and believing in the approach used in M.I.T.'s EMACS as given in their paper.

4. Watching EMACS being used for LISP, PL/1 and text. In the various programming languages, it "knows" the language and automatically fills in keywords, identifies, etc. and handles indentation and punctuation. For text, it appeared considerably better than WPS.

5. Discussion with Nico Habermann at CMU who has used the C editor and is doing a research project on this.

6. InterLISP advocates who provide a similar environment.

Overall it seems like a move sound approach to design, used by EMACS (or TECO) and our command languages is:

1. Provide (hardwire) a set of primitive functions in the editor;

2. Provide a control structure to extend the editing language and define/tailor further capability.

What I'd like to see:

1. Bring in EMACS on the 20 and evaluate it.

2. Consider using it plus the language-based extensions as a product (especially for COBOL).

3. Convert it to VAX.

4. Take this more general approach for future editor design.

GB:swh

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION

DATE: SAT 19 DEC 1981 5:49 PM EST

FROM: GORDON BELL

cc: SAM FULLER

DEPT: ENG STAFF

EXT: 223-2236

LOC/MAIL STOP: ML12-1/A51

SUBJECT: GOING INTO THE COMPUTER ENGINEERING EDUCATION

BUSINESS

I'm on the panel of Computer Science and Technology Research Board of the National Research Council and we just looked at the problem of training people in computer technology.

The big problem is that there's only 200 phd's per year coming
out and this isn't enough to build computer science departments.
There are all sorts of hang-ups in the university/federal science
picture: universities are overloading the faculty and they leave
to go to industry, the fed funding is controlled by the regular
science establishment and they won't divert money to CS from physics and chemistry, the CS departments won't give up the teaching of any of the courses (causing their overload) because
they believe that only they can teach computing, etc., etc.

I was initially against Wang Institute as I thought the universities
should be doing this work. Now, I'm worried that the ponderousness
of the university and scientific funding system will not meet the challenge. On the other hand, a number of CS faculty believe that CS could be taught in 2 year colleges and technical
schools very effectively.

The question I have:
Is there a business here for us, especially since we are already
teaching quite a lot already and must continue for our own and others?

Should we be supporting others somehow?

In the far future, I believe that CS will become CS rather than

the teaching of Programming. A pure CS dept. will look very much
like a math or physics dept. All depts will teach the variety
of computer engineering they need to incorporate the computer into
their discipline as a tool or component of the systems they build.

"TO" DISTRIBUTION:

DICK ECKHOUSE	WIN HINDLE	DEL LIPPERT
KEN OLSEN	JACK SHIELDS	

GB3.S2.54

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* d i g i t a l *
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TO: KEN OLSEN DATE: TUE 18 MAY 1982
8:57 PM EDT
FROM: GORDON BELL
cc: see "CC" DISTRIBUTION DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: RE: ENGINEERING SUMMER SCHOOL

Ken has an excellent point, we want engineering managment to run the Burp program and spend a few hours with it to get an idea of the sensitivity analysis that it has. Let's take his situation as a home problem that we as everyone to have looked at before they come to the course!

We have made light years of progress since the time we used to bring in products, open the boxes, run and wear them out on systems, fix em and then ship them and hope they were not broken again in shipment. This took 2-3 months at least.

Now we ship from vendor to staging area, and we still have 1-2 months of inventory.

Ken suggests we ship labels to vendor and they ship direct. This is great. Everyone should understand the numbers. Let's
set up the example, run it through and say compare it with the old historical stuff and the situation if we made it. This is an excellent way to learn by example that we can ALL do now... as an entrance to going to the course.

OTHER MATERIAL
This instils the notion of timeliness. We want to do the same analysis and the effect of getting the Xerox printer there earlier (A burp capability too).

Responsibility and simple management are the other key messages of the course.

I want some of the course to be devoted to the problem of getting LESS output when you have TOO many people! This is understood from reading about Software Engineering from Brooks. EVERYONE SHOULD READ "MYTHYICAL MAN-MONTH" EVERY YEAR OR TWO. THIS IS REQUIRED COURSE READING!!!! There are a few papers too that show the numbers too.

"CC" DISTRIBUTION:

ROBERTA BERNSTEIN LARRY BORNSTEIN CHRIS MACGRATH
JACK SMITH

GB3.S5.42
****
* d i g i t a l *
****

TO: ROBERTA BERNSTEIN DATE: WED 12 MAY 1982 10:59 PM EDT
OPERATIONS COMMITTEE: FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: MANAGMENT IIA: WHAT IS IT?

The preview of what the attendees of Management II will suffer next week was awful. It brought out the tremendous waste of human resources spent in listening to ill informed historical sociologists present poor and erroneous case data (note the one on the computer industry) to middle aged, illiterate, folks who think they missed something in their youth (US) and the misguided, potentially creative youth (the MBA candidate who may have had substantive training in a useful profession such as engineering) who is seeking a micro-veneer that allows him to look at real live cases in an equally superficial way. He is spared the hard work of content, and can suvive by hit and run as an advisor to corporate leaders who, by now, are equally unskilled in content and must rely on process and the glib superficial analysis of another bright body to illuminate!

Why an hour videotape of the author, Quality Is Free? This is a relatively poor quality book, certainly violating my basic definition of quality (CLARITY, MEASURABLE AND NO EXCESS). Why deal with the immitation when we could get the great person, Demming either in person or on tape? Read Demming.

THE CASE STUDY METHOD TAUGHT TO US REALLY IS BAD
There's a branch of sociology that looks at society by analyzing garbage dumps. In the case selection, it appears that by looking at British Steel, Philips, Ampex, Zenith, we are looking at only the old bottle section.

The only thing I've learned from cases is that TI had an incredibly complex decision making system called OST.

Reading the case said it was good. Talking to them I knew it was killing them and a few advances occurred in spite of it. They flushed it last week and could now be a competitive threat if they haven't lost all the creative people.

Having written several books that used cases both real and generated, I believe in cases for analyzing complex systems with two provisons: the principles come first, and the cases are only a verification that the principle is correct. Giving how to do it really right is better than trying to enumerate a few of the ways to do it wrong. There are always more wrong ways than right ways. The reason the professors give the stupid cases is because they can poke fun at others.

We may have been presented a vinette of some principle we were supposed to learn from by watching a movie to add some drama and to break the boredom of reading those dreary cases:

1. It takes all kinds to make a world
2. Different people have different management styles
3. It's important to match the person to the job

The follow-up on the principles was awful in terms of giving us some real depth into what we were supposed to learn. If it was item 3, then the framework for doing a good job probably takes more than a few hours.

In short, would you want your son to get a Harvard MBA?

WE NEED TO CONTINUE A POSITIVE MESSAGE TO THE ORGANIZATION
It seems to me it has to be based on statements and stories by
Ken regarding responsibility. I don't think this has changed any
despite the amguity that you folks tried to introduce today.
It's individual initiative and responsibility, much more "he who
plans does", focus on your own work to get the output we need
("engineers engineer, manufacturers build, marketers market and
salespersons sell"). Minimize layers and cross functional no
sayers such that the proposers (engineer, marketer, country) get
a direct answer to their proposals.

It's vital to have a good message here after the announcement
because we need the engineers to keep engineering to get the
product out, the builders have to help us, there's lots of work
in the marketing world to handle the products and of course the
salesmen have lots of orders to get in. WE HAVE TO KEEP THIS
ORGANIZATION HIGH... IT REALLY IS NOW!

WE DO NEED A MANAGEMENT PROGRAM
There has to be something substantitive that can be taught about
management, including techniques and games that we can play
(Roger Cady and I tried to beat everyone making Greeting Cards).
I want a really good one for engineering this summer to teach
basic management (especially self reliance), quality and for
several areas how to manage complex projects that result from
some of our big products and big chips. I really appreciate the
one Puffer and Ed Roberts of the Sloan School did years ago.

Looking at dinosaur bones and tracks in an unstructured fashion
sure doesn't look like the way to learn. It may allow one to

build an organization to sell soap, but I don't see that it has
much to do with managing a high technology company!

WINNING AND THE JAPANESE
The Japanese companys are really fun to work with because
discussion is about innovative products: how to build them, what
they are and who might use them. The selling of them is a detail
they leave to Fred and his friends of Xerox. They work the
content (substance). We work the process (form). Content which
you hold and use sells better every time.

GB3.S5.30

00 CORE DECGRAM ACCEPTED S 000217 O 1 04-OCT-82 1:31:57

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION DATE: MON 4 OCT 1982 12:06 AM EDT

FROM: GORDON BELL

cc: KEN OLSEN DEPT: ENG STAFF

EXT: 223-2236

LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5177410266

SUBJECT: MIT LIFETIME EDUCATION PROGRAM DEVELOPMENT AND US!

On Saturday I attended a conference on Lifelong Education at MIT
celebrating the EE/CS department. The program is predicated on
the fact that the US is not doing the necessary preventative

maintainence on its engineering talent due to the expoential knowledge explosion. They are also concerned with the faculty
keeping up too. Fano tried to differentiate training and acquistion of know-how (which can be purchased) versus knowledge
which is dynamic and must be nurtured and acquired. The prescription is a strong program between industry and academe.

HP- John Young of HP got many points by being one of the sponsors
of the Stanford/HP connection for continuing education. In particular, Prof. Jim Givens, is credited with TVI (Tutored Video
Instruction = 6 students at a video tape with an "approved" tutor/student who learn together). TVI has better performance
than with conventional classes. HP taught 48 courses at 46 universities. HP is giving $6M in forgivable loans for PhDs training for teachers. MIT is also designing chips for them and
using their VLSI process lines.

The MIT "proposed" program is going to their faculty. It is to
make TVI a reality so that industry students can get MS or ME degrees without full-time residency.

MY AGREEMENT WITH MIT
Joel Moses said there has to be a local, strong leader and Digital is the only candidate. I concured and agreed, but with
the proviso that MIT and Ken also agree we should do it. I have
absolutely NO reservation about continuing education. We must
have it... to the tune of about one course per year. A massive
upgrade of many of our engineering groups is long overdue!

My only reservation is the roteness of a program because I

think
there are people who can actually learn without the necessity of
taking a course and working to a degree. (Some folks have to have merit badges and degrees for motivation and security that
they are learning.) Other forms of learning should be recognized
and applicable: teaching, writing, even reading, etc. For example, I was overjoyed to learn that Dan Dobberpuhl's book with
Prof. Glasser on advanced VLSI was in progress... easily worth a
PhD's worth of merit badges in terms of usefulness and knowledge!

For now, I want help to work with MIT on building a first class
Lifelong Education program. We need it for collective survival.

"TO" DISTRIBUTION:

LARRY BORNSTEIN EMC: SHARON KEILLOR
DEL LIPPERT PEG: DEL THORNDIKE

GB3.S8.57
****
* d i g i t a l *
****

TO: AVRAM MILLER DATE: SUN 16 MAY 1982 2:04 PM EDT

FROM: GORDON BELL
cc: see "CC" DISTRIBUTION DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: EDUCATIONAL COMPUTER; EDU MARKET PLAN, PRODUCT AND

PC SERVER

Ken is pushing us to define a computer that would be let us get the education market, or some segment of it. I'd like to get together asap and address this.

THE PC SERVER
My cut (bias) is still that the highest priority need we have in
EDU is a PERSONAL COMPUTER SERVER! I've tried to get this considered in EDU for the last year and I can't even get a response to a request!!! This is something that the P/L could
have and should have been doing as their highest priority! That is, we have in the past established ourselves as the system
to control the various other systems including networks. All programming for the peripheral computers is really done on our
machines. We've let the price drift up for these machines and we
should have gotten in there to control this base.

THE EDUCATIONAL COMPUTER is also worth persuing while at the same time we demand the education group provide, for once, decent products. Ken, will you please ask the Edu folks to come and describe their plans for the entire educational market, at least as a way to get it clear what it is
we are talking about? and where it fits (eg. home, industry, primary, secondary, college, trade school)?

I'm a little bit sanquine about getting involved this way because I remember trying to affect their thinking on GIGI. In no way are we going to operate a golden rule project...

Avram,
Will you convene us here and see what we can do?

"CC" DISTRIBUTION:

BILL AVERY	WIN HINDLE	KEN OLSEN
JACK SMITH	BOB TROCCHI	

ATTACHED: MEMO;28

****
* d i g i t a l *
****

TO: GORDON BELL
14:44 EDT
WIN HINDLE
cc: ECS M/C:
KEN OLSEN

DATE: FRI 14 MAY 1982
FROM: BOB TROCCHI
DEPT: ED COMP SYSTEMS/GIA
EXT: 231-4350
LOC/MAIL STOP: MR1-1/M40

SUBJECT: EDUCATIONAL COMPUTER

ECS will assign Bill Wise and Charlie Rose to do this task.

We are anxious to get started. The approach is very consistent with ideas we have evolved over the past several weeks.

Gordon, please contact either Bill Wise, Charlie Rose or myself with the name(s) of your representatives.

Regards,
Bob

14-MAY-82 15:26:29 S 01999 MLCG
MLCG MESSAGE ID: 5163306276

GB3.S5.32

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION
7:22 AM EDT

cc: WIN HINDLE
KEN OLSEN

DATE: TUE 18 MAY 1982
FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-

1/A51

SUBJECT: EDUCATIONAL COMPUTER: IDEA, CUT AND REQUEST FOR REQUIREMENTS

As I understand it, the CT base that Wim, Hampton et al put together for the contest and is a front runner for the VT201 has also microcode space that could be used for the user!

Is it possible that this is the very low cost educational computer that Ken wants?   Wim gave a demo of it running in a swapping mode over a serial line.

Given that we are going to produce these as terminals in high volume, then it stands a good chance of being the right base.

My cut at an educational computer would require graphics, would operate in a cluster, would have some romable programs, would alternately be a terminal.

Avram has suggested an Atari maybe modified to have a T in it, and running both DEC and Atari software.

Rather than waiting for a meeting, Bob, why don't you simply put your goals (what you'd really like) together with some weighting for them, Constraints (what you MUST have) and some objective function (how a user would evaluate such a computer)
on EMS by 5 tonite to start this ball rolling? (It clearly shouldn't be much more than a page or so)!

"TO" DISTRIBUTION:

BILL AVERY AVRAM MILLER CHARLES A ROSE
BOB TROCCHI

GB3.S5.38

MESSAGE

THE ORIGINAL MINI

MARKET

EXISTING USER BASE

BASIC HARDWARE

PROVIDE COST-EFFECTIVE SYSTEMS AS LONG AS BASE USERS WILL BUY

THEM.

BASE OPERATING SYSTEEMS

NO ENHANCEMENTS

TERMINALS LANGUAGES/APPLICATIONS

MIGRATE WP BASE TO 11'S?

COMMERCIAL LANGUAGES/APPLICATIONS

STAY IN DEC COMPATIBLE LANGUAGE (GUARANTEE THESE MUST RUN ON 11'S

TOO!)

TECHNICAL LANGUAGES/APPLICATIONS

NOT USED

ELECTRO-MECHANICAL GENERATION

The critical inventions for the electro-mechanical generation were fundamentally in place by 1900. These include the use of electro-magetics, electric-driven motors, battery-driven circuitry, and relays. Links and switches with telegraphy and telephony were developed throughout the mid-nineteenth century. Power for the early telegraphs was generated in conjunction with the railway system. Most early systems were point to point, with simple mechanical exchanges.

The Hollerith tabulator and sorter developed for the 1890 census provides an example of a truly significant project leading to a new generation. Its first commercial application was not until 1895, when a version was installed for accounting at the offices of the New York Central Railroad. (Randall 1973, p. 126). The 1900 census saw improvements in the system with the addition of automatic card handling mechanisms. In 1901 the first patent application for a motor-driven calculator was made. (No. 726,803 "The Universal Accountant" issued to Frank C. Rinche, April 28, 1903). The electric motor driven calculator was not produced in quantity until the 1920s (Chase 1980).

The infrastructure of electricity generation and transmission systems was essential to transform these devices to useful tools. On September 4, 1882, the first American power company, the New York Edison Illuminating Company, started generating electricity at the Pearl Street Station (Stein, 1976, p. 244). Edison and others had difficulty raising money for these capital intensive projects and electrification had to be established as the infrastructure to support the use of electric-mechanical devices. Like the adaptation of card-driven looms, once the systems were installed and available, the application diffused widely and rapidly. By 1900, electricity was available in many U.S. cities and towns.

DIGITAL CALCULA

TWO REGISTER

KEYED WHEEL

"Olivetti" Olivetti, 15x15x30 cm, Plexi-glass, Metal, Paper Tape, (B86.79).

3-4 REGISTER

MOTOR-DRIVEN WHEEL

P "Friden Calculator Model D-8", Friden, 38x26x20 cm, (B12.76).

"Marchant Electric Calculator", Marchant, Gift of Professor Robert Floyd (D235.81).

"Marchant", Marchant, 1950 c, 40x25x31 cm, Metal, (B62.80).

"Monroe Electric Calculator No. 1", Monroe Calculating Machine Co., 38x31x24 cm, (B10.76).

"Monroe" Calculator, Monroe Calculating Machine Co., 15x30x26 cm, Gray, 8 Digit, (B40.79).

"Monroe No. 1", Monroe Calculating Machine Co., 20x25x30 cm, Metal, (B90.79).

COMPLEX

ACCOUNTING TABULATOR

THE 1890 U.S. CENSUS SYSTEM

Working as a statistician at the United States Census Bureau, German-American Hermann Hollerith first conceived of using punched cards as data carriers for the 1890 census. The 1880 census had taken over seven years to complete, the population then numbering over 50 million and increasing rapidly.

Hollerith's solution was to introduce a rectangular card divided into 240 squares, in each of which a hole could be punched according to a code. Each square corresponded to a question; a punched square represented the answer "yes", an unpunched square a "no". In that way one card could contain information about a person's age, sex, ethnic background and so on. The significant innovation that Hollerith developed, over that of the other two entrants in the competition, was a reading device in which there was parallel processing, counting the total number, registering the number in a particular state, and sorting the data card on yet a third category.

Hollerith developed his methods further and started a company which, in the following decades, was to provide the business world with a whole family of punched card machines for bookkeeping and statistics. Hollerith's company flourished and became one of the cornerstones of IBM, founded in 1912.

<u>The Hollerith Electric Tabulating System</u>, Reproduction by Roberto Guatelli, 1890 (1981), tabulator 75x120x90 and sorter 90x35x75 cm, Brass, Oak, Glass, (D231.81).

Cards were read by the machine. The card was placed on small containers holding mercury, one container for each row of holes, and then the die with electrically conducting pins was brought down upon the card. The holes permitted contact between the pins and the mercury containers, and the coded information was registered by the comptometer - the dials on the front of the machine. The upper left dial counted the U.S. total, and the others corresponded to the state total in which the particular "card" lived. An additional characteristic could be hard wired into the sorting device so that an appropriate lid would open for depositing the card.

<u>Keyboard Punch (Hollerith)</u>, Reproduction by Roberto Guatelli, 1890, 10x40x50 cm, (D242.81).

Blank cards were punched by using a enlarged pantograph of the layout that could be easily read. Locating the correct whole on the template and punching it then transferred a punch onto the card.

THE POWERS-SAMAS SYSTEM
- to be entered -

MEMORY

WRITABLE OR READABLE
MECHANICALLY STABLE
RANDOM

Paper Tape for Facom, Fujitsu, 72 hole unit paper tape, Gift of F. Kurosaki (D76.79).

TRANSDUCTION

TYPEWRITER (see Mechanical)

"IBM"

IBM, 26x44x40 cm, Gray, Justowriter Corp On Motor Housing, (D16.76).

TELEGRAPHY

Telegraphy has played a significant, but not central, role in the deveopment of computers. Teleprinters were the first effect easily interfaced human to computer devices.

Early in the nineteenth century, two Englishmen, Cooke and Wheastone proposed the principle for electric telegraphs. But Samuel B. Morse in the United States and Werner Siemens in Germany were the first to translate these ideas into workable electrical hardware capable of providing telegraph service. Although Siemens' needle telegraph operated, the simple code of Morse based upon an on-off (binary) principle, was to become the industry standard for many years. Communication at the time, Morse and Siemens were operating in the US and Germany depended on the length of time of an ocean crossing with tranfer to rail and horse-carraige transport. Their two projects could be thought as taking place simultaneously. Morse first demonstrated his system in 1837 (Everitt 1976). The first system, funded by a government grant to connect the 37 miles between Baltimore and Washington, was operational in 1844. Werner Siemens patented the needed telegraph in 1847 and installed the first system, funded by a government grant to connect the 300 miles between Frankfort and Berlin, in 1849.

MORSE TYPE KEYS AND SENDERS

Telegraph Sender & Receiver, Bunnell?, 1870'S, 45x30 cm, Brown, Metal & Wood, Receiver in box on stand, Gift of Rodney Banford (D229.80).

Telegraph Key, Electric Specialty Mfg Co., Cedar Rapids, Ia., ca 1900, 7x8x18.5 cm, black, metal, (B151.81).

"Signal Telegraph Instrument," Telegraph Keys and Sounders, Signal Electric Mgf. Co., ca 1920, USA, 11x10x16 cm, Wooden base, brass, and other metals (B164.81).

NEEDLE TELEGRAPH

In October of 1847, a week after Werner Siemens founded what was to become Siemens Company, he received a patent for the needle telegraph. He wrote his brother on 11 October 1847, "I have already spend 8 days in the new building. Above me there is already a lot of filing and rasping going on. Halske lives two floors up. We still badly need machine tools." A year later the company received an order to set up with minimum delay a communications link between Berlin and Frankfort so the the high level political decisions of the First German National Assembly in Frankfort could be discussed as soon as possible in Berlin. On 28 March 1849, the election of King Frederick William IV of Prussia was transmitted electrically over 500 km in the same hour as its announcement. (Weiher and Goetzeler 1977)

Needle
Telegraph, Telegraphen-Bau-Anstalt von Siemens & Halske, 1847 Loaned by the Simens Compnay. (X19.81).

Use. The piano key-type letters activate the impulse with the aid of a Wagner-Neef hammer to automatically maintain an electrically controlled synchronism between transmitter and receiver.

PRINTING TELEGRAPHS

CODE
PRINTERS

Printing
Telegraph Receiver, #7640, L.M. Ericsson & Co., ca 1890, Sweden, 36x41x17 cm, Brass, Wood, Bevelled Galss, Key Brass Spool, Paper tape and receiver, (B118/80).

Printing
Telegraphy, #12145, Siemens Brothers & Co., London, ca 1900, England, Wood and brass, Does not work, (B175.80).

KEYBOARD
PRINTERS

Clary
Printer, (adding machine adapted for computer output), Martin Marietta Corp, 1960, 45x35x45 cm, Gray, Metal, Keyboard covered, Gift of Clyde Still (D208.80).

Western
Union Teleprinter, Teletype Corp, ca 1930, 35x30x30 cm, Green, Metal, Model 2-B, Loaned by Ed Luwish (X8.80).

VOICE TRANSCRIBERS

Ediphone, Utility Shaver, Voice Recorder, Edison, 1900, 30x30x90 cm, Black, Metal, Gift of Dan

Leblanc (D121.80).

Dictaphone, Shaver, Transcriber, Columbia Graphophone Co, 1910, Black, Metal, (D123.79).

DMCAT1.5

ELECTRONIC GENERATION

In 1950, the computer era had been established: at least seven orations had announced their intent to build computers -- Zuse AG, anti, Elliott Brothers, Ltd., J. Lyons and Co Ltd., UNIVAC, and -- and the ERA 1101 was on the marketplace. (Science Museum, 1975)

Industry itself and its leaders had been changed by the nological advances of the war period. Goldstine states:

In my opinion, it was Thomas Watson, Jr. who played the key role in moving IBM into the electronic computer field. When he came out of the Air Force in 1945 his experience as a pilot had apparently convinced him of the fundamental importance of electronics as a new and prime technology for our society. He therefore exerted considerable pressure on IBM..." (Goldstine, 1972, p. 329)

COMPUTER

LGP-30 - Librascope General Precison Computer (X14.81)

Word Length: 31 bits, including a sign bit, but excluding a blank spacer bit

Memory Size: 4096 words

Speed: .260 milliseconds access time between two adjacent physical words; access times between two adjacent addresses 2.340 milliseconds.

Clock Rate: 120 Khz

Power: 1500 Watts

Arithmetic

element: Three working registers: C the counter register, R the instruction register and A the accumulator register.

Instruction format: Sixteen instructions using half-word format.

Technology: 113 vacuum tubes and 1350 diodes.

Number Produced: 320-490

First Delivery: September, 1956

Price: $47,000

Software: ACT I (Fortran type compiler)

Successor: LGP-21

Achievements: With the Bendix G-15 the first of the desk-sized computers offering small scale scientific computing. Revolutionizing the computer industry with the potential for low-cost distributed processing.

The Maniac

"The Maniac", Los Alamos Scientific Laboratory, 1957, Color, 3/4" videotape, 29 min. running time (V5.81).

This 1957 production describes the MANIAC computer's architecture and operating principles for a general audience. The Los Alamos-designed machine features cathode ray tube memory and binary-coded-decimal input by punched paper tape.

COMPONENTS

LOGIC MODULE

Deuce Arithmetic Logic Element, English Electric Co, 1955, Gift of Professor Murray Allen, University of New South Wales (D4.75).

IBM 650 Logic Module, IBM, 1955, Gift of Professor Murray Allen, University of New south Wales (D12.75).

G15 Logic Module, Bendix Computer Corp, 1955, (D109.80).

READABLE & WRITABLE MEMORY

WAVE STORAGE

CYCLIC

Mercury delay line.

Mercury was used to propagate an acoustic wave and hold information. A two meter tube held about 1000 bits, with a delay time of approximately one millisecond with a bit separation of about one microsecond or two millimeters. Early computers such as the Pilot ACE, EDSAC, and Bureau of Standards computers used both long and short delay lines.

Deuce Mercury Delay-line, English Electric Co, 1955, Short register, 64 bit, 64 microsecond delay line. Gift of Murray Allen, University of New South Wales (D3.75).

ELECTRIC CHARGE

RANDOM

Maniac Electrostatic Memory & Williams Tube, Atomic Energy Commisssion, 1949, Gift of Dale Sparks, Los Alamos Laboratory (D214.80).

MAGNETIC FLUX

RANDOM

Illiac 54x128 bit Core Memory, Gift of Clifford Carter, University of Illinois (D19.75).

? RCA Selectron Tube-from JOHNNIAC, RCA, 1950, Gift of John Postley (D215.80).

One of forty RCA Selectron tubes installed on the Rand Corp JOHNNIAC Computer in 1950. The tubes constituted the 256 word 40-bit memory that operated the machine. In 1954 a 4000 word magnetic core memory replaced the tubes.

? Mark IV 64 bit

Magnetic Shift Register, Aiken-Harvard, 1944, Gift of Bob Trocchi (D6.75).

Digital **Interoffice Memo**

To: Rony Eliashaoul
Date: 4 OCT 76
From: Gordon Bell
CC: Lorrin Gale
Bill Green
Dept: OOD
Loc.: ML12-1
Ext.: 2236

I like your model, starting from the computer. Given this, what are the volumes of the various parts (comm options, terminals, cpu's, memory, etc.) so that you can prioritize on volume (roi) or performance? Sell, based on need not want for customers to come--you may get wrong ones.

GB:ljp

ID#391

| d | i | g | i | t | a | l | **i n t e r o f f i c e m e m o r a n d u m**

Subject: **Reducing FA&T and Warranty Costs**

To: Win Hindle, ML10-2/A53
Date: 12 DEC 78
From: Gordon Bell
CC: Dick Clayton, ML12-2/E71
Dept: OOD
Ulf Fagerquist, MR1-2/E78
Loc: ML12-1/A51 Ext: 223-2236
Bob Flynn, ML12-2/E81
Per Hjerppe, MR1-2/E78
Dave Knoll, ML1-4/P14
Bernie Lacroute, TW/A08
John Leng, MR1-1/A65
Julius Marcus, MK1-2/C37

Herb Shanzer, ML21-1/E81
Jack Shields, PK3-2/A58
Jack Smith, ML1-4/A54

Ulf has agreed to be OOD's rep to work the issue of Program/Product/System Management such that we maximize the standard system and minimize the FA&T content and not increase field integration/warranty costs. The following people will attend your meetings and follow your leadership:

Bernie Lacroute	Mid
Per Hjerppe	High
Dick Clayton (or delegate)	Low
Herb Shanzer	System's Configurations
Bob Flynn	Formerly of Packaged Systems

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST:	Dick Clayton	ML12-2/E71	Ulf Fagerquist	MR1-2/E78
	Bob Flynn	ML12-2/E81	Win Hindle	ML10-2/A53
	Per Hjerppe	MR1-2/E78	Dave Knoll	ML1-4/P14
	Bernie Lacroute	TW/A08	John Leng	MR1-1/A65
	Julius Marcus	MK1-2/C37	Herb Shanzer	ML21-1/E81
	Jack Shields	PK3-2/A58	Jack Smith	ML1-4/A54

Architecture and Implementation in Generating the Computer Generations

Basic Model of GCG. Emphasize revolution, not simple evolution.

.Architecture without implementation ala Babbage is dull

.Definition of roles: architecture (quote Brooks, Stretch), implementer, engineers, master builder and city planners

The process: start, continue (looping) and halting.

.The test at each step: proceed, loop, suspend, or evolve

.Architects may have impeded computing more than any other factor. It's caused perhaps a factor of 2 in spending (say Z80/8080 and 6502; recent comments by people who would not just build and use the Manchester Dataflow machine. We should have had a factor of 2 or 10 less. The belief, "quote Saul Dinman", editor of Computer Design, was that architecture was the creative part. Architecture is the last resort of change.

Set up the problem: create goals, constraints, ideas & obj.

fcn.
   .Stds. are great constraints, use em
   .Technology is a constraint. Use it or do it over.
   .Goals
   .Obj. fcn. approx.= use and need. Are you the average user and is your experience valid (Wilkinson) and GB average man. Have someone, not somebody (1 customer) as archetype. The benchmarks can be misleading ala early 11. Criteria are simple ala MCF.

Copy or Evolution, revolution or death: Control of big process
   .Beware of changing tech, arch and use. Don't change all at once
   .If you copy, do it exactly (eg. 360/370),
   .Unless you want to catch and then entrap (Z80/8080, FIV/FV, all the Basics)
   .One more bit ain't a reason to deviate (eg. ddp 19 vs pdp 1)
   . Know when to stop evolving (card, address space, data-types)

When you do the first one, it will look quite complex!
(Deuce, Arithmometer, CDC 6600 refrigerator)

BASIC PRINCIPLES OF DESIGN
   .Quite likely ideas will be copied from our own models of organizations ala Conway's observations. Committees don't invent. For this it is quite natural that we invented the Unibus and Ethernet; IBM invented SNA and tree structured uniprocessor. Another reason why multiprocessors are unnatural to us.
      .Another form of Conway's law. N people mean N boxes or N passes.
   .Know the good ideas and use them. Build on others.
   .If you ever have good ideas use them, document them so others can too.
   .Do it right or do it over. Don't ignore symmetry. The European standard modem of 1200 baud/75 baud is a good example of breaking this and Conway's law. They are getting

1200/1200.

.Don't try to foil others (the rumour is that by picking fsk frequencies, the telephone company discourages acoustic couplers on 1200 baud. The result, on a crappy line, only the non-compatible acoustic coupler will work. The standard won't.

.Keep it simple, stupid. (Deuce, leave it out. First micro was designed to a chip size and won against a special purpose K.) The languages such as Algol 68, and various airplane designs all fly off into the sunset and are never used.

.KISS leads to the ultimate in simplicity, the stack. But who is it simple for: architect, users, compilers, the machine implementers, sales person. Cite the glea of winning against the B5500. Stack based machines don't represent something one would recommend to their friends.

.Be elegant. Every feature contributes 2 benefits. Every part contributes two functions. A way to insure that a part is left out. Architects say Less is more.

.Generalization is the ultimate in elegance. The stored program, the n-state, the general register, Unibus and Ethernet are all examples of this. It's interesting that the ring and Ethernet provide exactly the same function, yet we each perceive them as different in terms of being forced to work to a common goal and being allowed complete autonomy. IBM and token passing requires a central authority.

.Too much elegance is trickery. The two's complement (ala Comptometer) versus one's complement many be an example. We went ultimately to 2's

.Decide what to do and then encode it. Form Follows Function.

.Sometimes, Function follows form as in VLSI. Let the Si tell you. Also, note Hoff quote of having experience on the 8 to do the 4004 (the famous ad). If ted had first programmed the 360, it would have been several years before the micro would have been invented.

.Flexibility and generality have to be bound sometime. The trick is to decide when to do it. When building something, do it asap so as to get on with the design. We have all sorts of examples of poor binding times: microcode and user microcode; operating systems in rom; particular languages; isp's; B1700 was a really bad idea as it let float an especially uninteresting design choice: the isp by allowing

complete flexibility to the bit level.
.often time the trick is deciding what it has to do. orthogonality, the important data types, etc. risc vs a large set. This means you do the i/o too as in algol... otherwise it'll get screwed up by a committee.
.Pick a small number of primitives and then design with them. Cray uses 2 ic's; vlsi allow's too many... regularity is great. Poor designers always think they can design more by redesigning someone elses stuff. microcode, gate arrays, vlsi, rom, etc.
.Make the design small, but extensible for all you forgot. "Hoare quote". in address and data types. because
.a good design can be extended at least once.
.Don't use all the ideas. Enumerate the possiblilites: capabilities, Huffman coding, multiprocessors, new undefined language (ADA), ... Know when to stop adding. Less=more. 432 is a good example.
.Of course the ultimate in generalization is one more turn of the wheel of reincarnation. Use Pio's, ala 360, 370, 6600 etc.
.God is in the details.

Now Built It
.Forrester story on implementation at univerities and problems.
.Do it yourself and don't let go. Don't seperate arch and
implementation. Quote FB on arch and implementers. The greatest designs are in one head. The iteration process is clear and tightly coupled. Fortran, Pascal, the first Basic are all good examples. Also, all Cray machines are this way. Note, the designers all warmed up on small systems: Algol W, the Cray machine where they learned design.
.If seperated, the coupling has to be clear and the conflict is enormous. Apl, VAX.
.The biggest kludges come from committees because they contain no implementers as implementers are doers and not committee goers. PL1 and Cobol. And the biggest committee of em all may be the defense department! An example of the worst designs are the evergrowing number of communications protocols as opposed to the day when it might have been done by some competent person in an org. ISO did a great think in

putting fort a model, it had enought sense to say it couldn't do a design. The communications interfaces to deal with data switching are so baroque and bazar that I fear we'll be set back many years just implementing it. The attendees should have implemented something AND to propose, the protocol should be in operation somewhere. We can clearly understand why comm protocols are poor since the problem is not able to or allowed to be put in a single head. Need to recognize Conway's law (and that Computers are an extension of our culture) don't have any international languages for communications al x25. Also why it took ? years to get direct dialing after the dial was invented and after it was operating at the country level for 15 years. There's an enormous market for translators in computing among x25 protocols, DECnet to SNA, SNA to SNA, etc.

.Now when partitioning to build it, the organization can dictate the design as in Conway. npasses, n functional boxes.

.Final segmentation is a way of limiting comlexity as long as it is being partitioned. MAke it work for you.

.Hardware software segmentation is a good example of making a good segmentation. Maybe this is a better place to talk about binding the variable as in user microcode, rom o/s,

Produce It

Use It

.A machine can't be programmed until it exists.

.HW follows SW (need and use)

.SW follows HW on occasion

.Advesary designs create opportunites and ideas (1 level store)

.the way to be humble and self critical (show evolution of the pentel pencil from old drafting pens to wooden pens to rotary)

.the o/s and applications are the ultimate test, not the diagnostics. Having specialists here is bad.

Finally, describe it. Go around again.

September 1, 1983

Steve Emmerich
13 Dwight Street
Boston, MA 02118

Dear Steve:

I'm pleased to offer you a position as Consulting Engineer with Encore Computer Corporation at an annual salary of $40,000, commencing September 5, 1983.

You may purchase 20,000 shares of Encore stock for a price of $.20 per share, subject to the restrictions.

Please join us.

Sincerely,

Gordon Bell
Chief Technical Officer

cc: John Ludden

GB7.15

```
00  BURT  DECGRAM ACCEPTED  S 4060  O 64  18-OCT-79  17:46:58
FROM: GORDON BELL                 DATE: THU 18 OCT 1979
5:04 PM EST
DEPT: OOD
EXT:  223-2236
TO: BRUCE DELAGI
    MIKE TOMASIC
    KEN KING
    STEVE COLEMAN
    JACK GILMORE
    GLENN REYER
```

DICK STRAUSS
AL CRAWFORD
JAN JAFFERIAN
MARKETING COMMITTEE:
MARKETING COMMITTEE: @CLEM
OOD:
OOD: @CLEM

SUBJECT: EMS (VS. WPS) AND OUR FUTURE PRODUCT

Subject: EMS (vs. WPS) and Our Future Product: The Way to Computing in the Office?

GB0005/18/EMS

The more one considers Electronic Mail, the more it seems to be the clear vehicle to get computers into the office. It stands to be more important than Word Processing because the cost savings are greater by being able to get rid of paper, the carrying of paper and filing it. The direct use versus via a secretary will increase. We'll all have terminals just as we have telephones, and the terminal is likely to have the phone built in.

For DEC, I see a problem because of the approach we have taken in our EMS design. We have based the program on MUMPS, and it's file system; and MUMPS runs stand-alone, or as a special system on VMS at some undetermined future time, cost and performance. I think we want EMS to be written as a standard applications program and have it work with a standard file system. EMS is the first application program for the office, and the editing of these memos or messages (which I'm claiming may be the bulk of word processing) could be a close second or could even be considered to be part of EMS. After these one or two applications, the frequency of programs used will fall off rapidly, but we will need a common user interface and file format and lots of communication among EMS/WPS and the myriad of applications that follow:

tickler, meeting scheduler, telephone manager (call back, look up and dial, etc.), retrieve address, for insert into a letter, fill out expense account, simple file box, arrange goals and objectives, pick-up/distribute the mail on other systems, fill out and check a particular form, retrieve information in organization chart form, submit a purchase requistion and get all the appropriate approvals (note if not signatures, what is it?), order travel tickets, check a computer configuration validity, ask for a computer quotation to be printed out or submitted to a customer, etc.

Note, these are variable in size, the list is open ended, and it looks very much like what customers use computers for, except that there is not the usual intermediary key pucher or data entry person! Coding will be done in a myriad of languages (especially COBOL) because many will be based on interfacing to some existing system.

In summary, it seems likely that the office computer system will grow out of EMS (and the text creation of mail...call it Word Processing if you want). Subsequent applications will be numerous, varied (in terms of data they access, computational need, and program size), and should be written in a language(s) running on a general purpose system we support. Compatibility among the systems is a key. Every attempt should be made to keep a strong file standard such that there is not a different file type for every program.

We aren't going this way internally, and given the amount we are spending (when you consider all the users of the system and the amount invested in their training), I think we ought to clean up our act quick! The market will be upon us and we'll have to catch-up.

GB:swh

FROM: GORDON BELL DATE: WED 31 OCT 1979
4:48 PM EST
DEPT: OOD
EXT: 223-2236
TO: GEORGE THISSELL
BILL JOHNSON
JACK GILMORE
AL CRAWFORD

BOB TRAVIS

SUBJECT: EMS DESIGNER AND MUMPS PROJECT LEADER

GB0005/51/EMS

I'd like to meet the EMS designer and MUMPS project leader to understand the compatibility and transferability of MUMPS/EMS to VMS and accessability of files, etc. within VMS - by other languages.

GB:swh

Request for Distribution List

Name of List (as you wish it to appear on the system):

OOD

Members of the List (may be user names or names of existing lists):

Password	Name*	Cost Center	Mail Stop
bell	Gordon Bell	383	ML12-1/A51
clayton	Dick Clayton	383	ML12-2/E71
cudmore	Jim Cudmore	331	ML1-5/E30
demmer	Bill Demmer	383	TW/D19
fagerquist	Ulf Fagerquist	312	MR1-2/E78
johnson	Bill Johnson	32J	ML21-3/E87

kevill John Kevill 383 ML1-
3/E58

meyer John Meyer 65B ML12-
1/A11

portner Larry Portner 383 ML12-
3/A62

puffer Bob Puffer 383 ML12-
2/E38

Requested by: Gordon Bell Date: October 24,
1978
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-

Ext. 223-2236 LOC/Mail Stop: ML12-1/A51
------------- ---------------------------------
-

Dept. Office of Development
----

*Plus, please add to the system as individual users. Also send each an instructions/information packet.
****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION DATE: MON 25 AUG 1980
8:46 AM EDT

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION DEPT: OOD

EXT: 223-2236

LOC/MAIL STOP: ML12-1/A51

SUBJECT: BASING THE MAIL SYSTEM ON VMS, NOT EVERY SYSTEM

This is to confirm the discussions at MK on friday, and in particular the agreement that Glen Reyer and I made... which I believe he is now responsible for closing with the Product Lines.

The EMS per se will be designed to explicitly run on VMS, although it may be possible at some future time to move it to other operating systems. The critical design issue is time to market and having it have to be runnable on every system can seriously affect this parameter, together with making it unnecessarily restrictive. Mail, will come in the OFIS program through some other method, most likely as a virtual terminal via some other system. It is assumed that we will use every available tool and facility of VMS that's available (eg. teco, edt, mumps, datatrieve,...) in order to build the product.

In short, design it to run on VMS, don't worry about or have meetings about how it might run on some other system at some later time.

Let's get it!
gordon

PS.
I would like this confirmed before the Marketing Committee meeting because I want it clear(er) what we are and are not doing in OFIS! (This is part of a growing program I am personally conducting to remove features from our future systems in order to get some alignment with what I think we can deliver. I trust you all support me in this aggressive program!) I want to return to getting some sleep about where we are in this area, and I assume that you folks would like to sleep too. If you are resting comfortably now, then maybe we should talk.

"TO" DISTRIBUTION:

BOB DALEY GLENN REYER DIANE STANNARD
BRUCE STEWART BOB TRAVIS TOM VLACH

"CC" DISTRIBUTION:

TOM CHISHOLM BILL JOHNSON JULIUS MARCUS
LARRY PORTNER

****
* d i g i t a l *
****

TO: BOB TRAVIS
DATE: MON 25 AUG 1980
10:20 PM EDT

FROM: GORDON BELL
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

cc: see "CC" DISTRIBUTION

SUBJECT: RE: RE: BASING THE MAIL SYSTEM ON VMS, NOT EVERY SYSTEM

Ok by me. Let's make sure we know how to say this so our customers understand and we don't get trapped or imply someetthing we can't deliver on.

Let's get what amounts to a current requirements document under a formal process of eco prior to going into Phase 0. Please join me in my pruning process that each week cuts something out to converge on what I think the architecture is and what it will support with what we are comitted to. I.e. I see a big expectations gap in terms of what I know to be the internal architecture and what people want. You work on convincing me we can build anything and I will proceed to cut back on the features that have been sold to the p/l's. Hopefully we will converge in a few months.

Now, I have little confidence in our ability to architect, design and build any software in this area! It is clear that our customers have been sold a lot (by us) and want much. Frustration is correlated with this difference!

"CC" DISTRIBUTION:

BOB DALEY GLENN REYER DIANE STANNARD
BRUCE STEWART TOM VLACH

GB1.S6.42
00 BURT DECGRAM ACCEPTED S 17048 O 368 01-AUG-80 20:18:24

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION DATE: FRI 1 AUG 1980 8:06 PM EDT

FROM: GORDON BELL
cc: see "CC" DISTRIBUTION DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: COMMENTS ON YOUR COMMENTS:

1. PROPOSAL STATES EMS IS TO BE WPS COMPATIBLE. SURE LOOKS GOOD TO ME.

2. MUMPS ISN'T SUPPORTED, BUT DOES IT NEED TO BE? WHY NOT VIEW IT AS AN INTERPRETER ON VMS THAT IS NOT ACCESSIBLE? (LEASING MUMPS PROBABLY ISN'T SO BAD EITHER - IF PRODUCTIVITY IS AN ISSUE.)

3. WHY NOT USE A WPS TERMINAL ON A RSTS SYSTEM AS A VIRTUAL TERMINAL?

4. WHY NOT USE WPS ON VAX (WHEN IT GETS THERE) TO TRANSMIT INTO EMS?
(THIS LINK WOULD HAVE TO EXIST IN EITHER SYSTEM.)

5. TRUE. THIS SOUNDS GREAT TO LIMIT EMS THIS WAY AND TO

BEGIN

BEGIN TO GET OUR USERS ON VMS. LET'S HAVE RSTS USERS STAY ON RSTS MAIL AND HAVE THEM USE POST OFFICE.

6. DEC MAIL (NOT YET THROUGH PHASE 0) WOULD BE COMPETITIVE. HOWEVER, I'D LIKE TO NOT MARKET IT WITHOUT DEC INTERNAL FIELD TEST. (THE ENGINEERING NETWORK COULD DO IT). MY GUT SAYS DEC MAIL IS TWO YEARS OLD AND AT LEAST TWICE AS EXPENSIVE. (HOW MUCH HAVE WE SPENT TO DATE?)

THE TWO REASONS I DO UNDERSTAND:

1. IT DOESN'T RUN ON RSTS -- BOTH GOOD AND BAD.

2. IT IS GOING TO BE DIFFICULT TO INTERFACE TO THE FILE SYSTEM IN MUMPS . . ., BUT I'M NOT SURE WHY ONE WANTS OR NEEDS TO EXCEPT THROUGH A WELL DEFINED PORT.

OVERALL, I THINK WE SHOULD NOT RULE THIS PROPOSAL OUT SO HASTILY. I WANT EBOD OR THE MARKETING COMMITTEE TO REVIEW THE TWO ALTERNATIVES AT THE PHASE TRANSITION.

"TO" DISTRIBUTION:

TOM CHISHOLM KALIN VIA TRAVIS PAUL PASLASKI

"CC" DISTRIBUTION:

BUZZ BROOKS BOB DALEY PAUL DICKSON
JACK GILMORE BILL JOHNSON BILL KEATING
ANDY KNOWLES SI LYLE JULIUS MARCUS
JERRY MELNICK STAN OLSEN LARRY

PORTNER
JOEL SCHWARTZ DIANE STANNARD BRUCE
STEWART
BOB TRAVIS TOM VLACH WILLIAMSON
VIA STEWART

ATTACHED: MEMO;64

****
* d i g i t a l *
****

TO: PAUL PASLASKI DATE: THU 31 JUL 1980
4:13 PM EDT
FROM: TOM CHISHOLM
cc: see "CC" DISTRIBUTION DEPT: COMMERCIAL
MARKETING
EXT: 264-7657
LOC/MAIL STOP: MK1-2/N38

SUBJECT: EMS PRODUCT PLAN 7/18/80 BY PASLASKI

THE PLAN IS REASONABLE AND WOULD SATISFY A LIMITED NUMBER OF CUSTOMER REQUESTS. HOWEVER, IT IS OUR (COMMERCIAL GROUP) BELIEF THAT USERS WILL WANT TO INTEGRATE EMS, WPS, AND DP OVER TIME WITHOUT A MAJOR RETRAINING EFFORT; WE BELIEVE THAT EMS SHOULD NOT BE RELEASED AS A PRODUCT AND THAT WE SHOULD WAIT FOR DECMAIL.

REASONS:

1 EMS HAS LITTLE COMPATIBILITY WITH WPS TODAY.

2. THERE IS A MINIMAL SUPPORT STAFF IN THE FIELD FOR A MUMPS BASED PRODUCT. MUMPS IS NOT A MAINSTREAM COMMERCIALLY ACCEPTABLE LANGUAGES.

3. THERE APPEARS TO BE NO CONVENIENT WAY FOR A WPS USER ON A SHARED RESOURCE SYSTEM TO USE HIS TERMINAL FOR EMS (ASSUMING THE TERMINALS ARE LINKED DIRECTLY TO THE PROCESSOR.)

4. A HYBRID EMS/DATA PROCESSING CAPABILITY WOULD BE AVAILABLE ON VAX; WPS WOULD NOT BE AVAILABLE ON THE SAME SYSTEM EXCEPT THROUGH VT278'S.

5. A RSTS HYBRID WORD/DATA PROCESSING USER COULD NOT USE EMS UNLESS HE HAS A DIAL UP TERMINAL.

6. EMS TAKES AS LONG AS DECMAIL TO GET OUT AND THE COST IS ABOUT THE SAME.

I BELIEVE THAT WE DO HAVE LEADERSHIP WITH EMS AS WE KNOW IT IN HOUSE.
HOWEVER, WE SHOULD LEVERAGE OUR EXPERIENCE BY PROVIDING A SUPERIOR
PRODUCT.

NOTE***TRAVIS AND STEWART - PLEAST GIVE COPY OF MEMO TO KALIN AND WILLIAMSON. THANK YOU.

"CC" DISTRIBUTION:

GORDON BELL	BUZZ BROOKS	BOB DALEY
PAUL DICKSON	JACK GILMORE	BILL JOHNSON
KALIN VIA TRAVIS	BILL KEATING	ANDY KNOWLES
SI LYLE	JULIUS MARCUS	JERRY MELNICK
STAN OLSEN	LARRY PORTNER	JOEL SCHWARTZ
DIANE STANNARD	BRUCE STEWART	BOB TRAVIS
TOM VLACH	WILLIAMSON VIA STEWART	

GB1.S6.13
00 BURT DECGRAM ACCEPTED S 006958 O 797 14-JUN-83 19:55:35

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.___.___.___.___.___.___.___.
!   !   !   !   !   !   !   !
! d ! i ! g ! i ! t ! a ! l !          I n t e r o f f i c e
M e m o
!___!___!___!___!___!___!___!
```

TO: AL CRAWFORD   DATE: TUE 14 JUN 1983
7:51 PM DST
JULIUS MARCUS   FROM: GORDON BELL
cc: see "CC" DISTRIBUTION   DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

MESSAGE ID:
5202931378

SUBJECT: MASSIVE PRODUCTIVITY FOR EMS USERS

GB6.6

If we really looked at EMS productivity, it may be much less than what
we expect because the response time of shared system is so poor due to
overload. Clearly, limiting the number of lines is needed. However,
there's another way.

We must go to unattended operation that will work with DECmate, PRO,
Rainbow, and Personal VAXen.

I envision having a PC that would call a system at a specified time
(e.g. off peak hours) and send mail. Many would do this now, i.e.
simply having a command file to send EMSes. Similarly, it would call
up to pick up mail.

Maybe this is easily doable by extending command files in the PC (we
ought to try it in VAX first where clock and command files are
available.

We should be prototyping and using this in house now. How about it?

"CC" DISTRIBUTION:

HENRY ANCONA BOB DOCKSER BARRY JAMES FOLSOM
RON HAM BOB HUGHES JOHN KIRK

00 BURT DECGRAM ACCEPTED S 6037 O 01 23-JUL-80 00:15:42

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION DATE: TUE 22 JUL 1980 11:34 PM EDT
FROM: GORDON BELL
cc: see "CC" DISTRIBUTION DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: EMS PRODUCT PLAN 7/18/80 BY PASLASKI

Believe you have the job of responding to the proposed EMS project. Paul Paslaski wants a response by August 1... which sounds tight.

My reading of the plan:
.it's an aggressive, but doable schedule based on the past performance of the group

.technically and architecturally it sounds great, by being compatible with wps and building on what we have by tuning

.its on vax, allowing us to focus on the product strategy and get into the market in a controlled way. (I see no reason to have this product on all systems in the short run, or perhaps even in the long run. We can use a simpler system for message transmission, if such a facility is needed on these other systems.)

.the team who did the original is doing the tuning, hence there
is the greatest productivity and shortest time to market

I still think EMS is an important product need. We do have the leadership with EMS as we know it in house and use it. This uses the programs as is and refines it for ease of use and compatibility.

Furthermore, this would free other resources in the development
area to work on the WPS area for the 11 which we also badly need.

All in all, I believe this is most likely the best way to go!

When can we get this looked at? The decision should be at least reviewed by EBOD and perhaps even the Marketing Committee.

PS
It pre-empts a proposal I was going to make to have CSS take the
EMS product as is and to offer it in limited configurations to
various customers in order to get experience with real users who
aren't computer companies.

"TO" DISTRIBUTION:

BOB DALEY BRUCE STEWART TOM VLACH
WILLIAMSON VIA STEWART

"CC" DISTRIBUTION:

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BILL JOHNSON KALIN VIA TRAVIS BILL KEATING
ANDY KNOWLES SI LYLE JULIUS MARCUS
JERRY MELNICK STAN OLSEN PAUL PASLASKI
LARRY PORTNER JOEL SCHWARTZ DIANE STANNARD
BOB TRAVIS

GB1.S5.59
Bob'll send information on computing environment they're trying to build. They're switching to Ethernet, having played with old Ethernet and Chaosnet. It seems like everyone's wanting to go to personal machines - mainly because of the long history of machine service overload. He sees: super terminals or workstations ala SUN, HP, or? where graphics, editing and possibly small LISPS are run. This environment has to be compatible with big machine environment where bigger problems are run. He wants 750's for this. He's not enamoured with the 730 for this due to CPU. I think he may be wrong - or at least I hope he is. HP's putting (has) LISP on a 68,000 at Utah.

The LISP conference will be a place to get much info as everyone's trying to get their machines benchmarked. (3 x 780's = KL = scheme chip = 4 x 68,000) The 2060's the benchmark - thus, we could have a really nice LISP-server when we can get the 2080 built! The fact is: the community is out of cycles and needs a very high performance machine for attacking new problems.

Neal Goldman will be in Boston next week. He mentioned their software for multichip projects. IBM's sending someone there to visit.
January 12, 1982

A.B. Crawford, Jr.
Corporate Manager, DIS
Digital Equipment Corporation
129 Parker Street
Maynard, MA 01754

Dear Al:

This is in response to your query regarding my observations on the impact of our internal EMS implementation.

As you well know, EMS with word processing has become an essential part of my office and work habits and a key to improving the productivity of both myself and my secretary. The "rough spots" resulting from your early pilot and productive service were well worth the payback, in my opinion.

I can attest that our internal EMS has become a vital communications means used by all senior officers and managers in the company. It is particularly valuable as an alternative to the telephone -- short, informal messages with a time urgency -- with the ability to easily broadcast a message to multiple addressees.

Further, the lessons your people have learned from their pioneering efforts have directly contributed toward our being able to offer a better, more timely EMS product to the external market place in the form of DECMail.

The synergy of our product development staff working with your Information Services people has truly been of great benefit to the company.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:mal
ID#GB3.S1.49

I'm not able to come to your meetings.

I think you're doing great without me!

We must drive like crazy for the Two Board Scorpio Processor (gemini) systems! (Congratulations on a masterful piece of thinking!) This first system should come out concurrent with Aztec! Is it also SUVAX? The OC would like an update on the aggressive plan.

With a much more supportive service and manufacturing environment and the risk of a Venus or Scorpio slip, I believe we can cheaply introduce, systems.

I agree: Introduce then cost reduce!

Ward McKenzie has agreed to co-sponsor a review of the 16-bit product set. The CT folks should present their work too. The purpose is to look at the complete set for the next 5 years. It should include:

chips,
the use of II to get low cost 1 board systems,
Unibus options,
4 versions of the Qbus options together with its evolution,
all the CTs (can we use Micros boards in any systems?)
and the Systems evolution (Unibus, Qbus, Pluto, and the CX systems). What disk/cpu combinations and packaging.

The software review should include:

RSX, RSTS, RT, IAS and MUMPS,
support of UNIX,
CTAB and how it is compatible with the overall architecture,
special systems for Pluto and HSC, and

File and Print Servers (here, we ought to encourage the
talented, M group to propose doing this work.

I'm concerned about the systems overlap, the inability to use board level designs to build systems (how can our customers do it?), inability to easily field upgrade Unibus systems when J is there, and the competitiveness in the DOOMESDAY SCENARIO [all hardware is standardized to 1 or 2 ISP's (8086 and 6800), software is UNIX, and there is a standard bus (Multibus)]...
to name a few.

It would be nice to keep this review small.

Can you get together with Ward and propose the review?

EMS 13-JAN-79 14:46:33
340 1
To: Al Crawford, Claire Messier
CC: Len Halio
From: Gordon Bell
Date: SAT 13-JAN-79 14:46:33 EDT
Subject: mail and junque mail

I've been seeing some junque mail floating around in the system which I would
sometimes just as soon not get, on the other hand now I see a real need for it
Len Halio and I were talking about the fact that he hadn't goten any mail
yet (his bss isn't a member, nor his his group). Thus, 1 need for junque mail
is to keep the subscribers tuned in so they can be into the system, even if
the rate of letters is low.

Occasionally I don't use the system because I'm afraid that the subscriber
will now look in his mail box or the person isn't on the system so I will have
to put out a memo anyway. To me, there are these 2 critical

needs: 1. If a
person isn't readin his mail, at least dump to him the fact that there is mail
there. This could be done once a week. Preferrably, he can (at his option)
have the mail dumbed too in the interfoffice stasck so theres no need to
read it. If this is the case, then the message shouldnt be recorded as
destroyed, since he may just be getting around to reading it before the mail
is delivered, but on the other hand, it should be placed in a file that is
different from the unread file (eg, sent by surface mail file). 2. If a
personisn't on the system, we need a way toget the mail put into the surface
mail. This is an oldy. B

Note both of these would get the utilization up ahell of a lot... and make
the system indespensable. Ie it would alwasy send mail to a person not at
their option (like surface mail) and it would get to people outside the
subscriber list. This first point was at variance with Claire re privacy,
but I think it is critical for the users who send messages to feel the same
way about it they do about surface/interoffice.

PS the editor is poor.

Command:

EMS 2-APR-79 17:46:15 410 1

To: Pete Briggs
CC: Jack Mileski, Al Crawford, Dave Palmer, Chuck Turley, Gordon Bell
From: Peter Christy
Date: MON 2-APR-79 17:46:15 EDT
Re: MUMPS Product Stability Information

From: Pete Briggs Date: MON 2-APR-79
11:42:18 EST
Message ID: EMS 2-APR-79 11:42:18 440 1

My opinion, biased as it may be.

We would be insane to build corporate EMS on MUMPS.

What EMS needs can be supplied more than adequately with RMS multi-key files,
with the code wirtten in PL/I, Bliss, fortran, basic, etc.

I would be happy to expand myopinion in detail, in person, at any time.

Command:

EMS 2-APR-79
20:03:17 020 1
To: Peter Christy
From: Gordon Bell
Date: MON 2-APR-79 20:03:17 EDT
Re: MUMPS Product Stability Information
From: Peter Christy Date: MON 2-APR-79
17:46:15 EST
Message ID: EMS 2-APR-79 17:46:15 410 1

I agree with Peter. We aren't going to push it. Sorry I let this go so far
without comment. Jack Gilmore is ultiamtely going to provide thei and we
probably should go with him. I would say either stick/muddle by with what we
have or help Jack make his the one in 2+ years or so. Let's not pick the road
to nowhere that this would be.

Command:
The Computer Science Research Board of the Nat. Res. Council reviewed the situation in Robotics on Friday. Pat Winston, MIT AI Lab. and someone from the Schlumberger Robotics lab (formerly of IBM Research) gave position papers. I was

impressed with the work and the level of Robotics. The direct use and indirect effects to real time control, vision, image processing, languages, inspection, and various transducers may be more important than the products built in the short term. (For example, much of the processing is on arrays and they need both special purpose and general purpose instructions. Most likely lots of the functions will be built into special chips such as a vision chip that does a 2 dimensional cross correlation with a filter to do blurring so as to find surface lines on an image.)

Pat Winston presented a depressing picture regarding Japan. They are absolutely committed and are working very hard. They are building a really advanced LISP machine, are assimilating our most advanced language (Stanford's AIL), and they are structured to form an engineering discipline based on software. In the past they have systematically seeded every US research lab to train their PhD's, while using their own universities to train Master's students. The PhD's then head the teams that do the work. (I've observed this too!) Hitachi has a machine for wire coating inspection and lead bonding control. They are about to release a machine to work in their factories for solder blob and PWB inspection (something we've been after for years!). In general, their work follows an engineering, versus science approach. They do little to advance the overall state of knowledge, but they take the current ideas and apply them in a systematic fashion. (Sort of like DEC in this regard.) I enjoyed the discussion with Pat and got an invitation to spend a day there... despite the fact he complained about the number of visitors in their labs.

The Board's position was:
We believe that Robotics Research is a vital part of computer science and we are particularly concerned about recent advances of Japanese robotics research and products. Furthermore, we would like to sponsor a review to assess the state of the art here versus Japan at the National Academy of Engineering meeting next October. It appears that there is better coupling between American robotics research laboratories and Japanese companies than to American companies. The level of American products versus the

Japanese is lagging and we believe that both research and coupling to research is the key to competitive robots.

The work going on at the universities and our work is important in order to ultimately develop and apply robotics. The direct- and side-effects will be quite large.

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|   |   |   |   |   |   |   |              M E M O R A N D U M
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TO: DISTRIBUTION
CC: DISTRIBUTION

Date: 9/16/81
From: GORDON BELL
Dept: ENGINEERING
MS: ML12-1/A51

Ext: 2236

EMS: @CORE

SUBJ: RX50B, TEAC/RX50, AND ENGINEERING IN JAPAN

I say go with TEAC for the RX02 compatible version (RX50B). This would be used to get 5" disks for media transfer. Then let's work at a version that plugs directly into the 278 bus that uses the RX50 drive as an alternative to the RX50B.

Let's examine the $750K cost. It may be the basis for having a really good engineering group in Japan.

According to the Xerox experience, their Japanese engineering out perform both by a factor of >2 in time (3 years vs 7 years) and are able to design products a factor of 2 lower cost.

IBM also claims significant performance from its Japanese lab.

TI, Intel and others do engineer these.

DISTRIBUTION		CC DISTRIBUTION	
SI LYLE	MK1-2/C36	KEN OLSEN	ML10-2/A50
BILL AVERY	ML12-2/E71	JOHN ROSE	ML12-2/T54
PAUL BAUER	ML1-3/T62	PEG	
DICK LOVELAND		ML1-2/T29	

25 November 1984

Mr. Erich Bloch, Director
National Science Foundation
Washington, DC 20550

Dear Erich:

Thank you for the support at IBM and your personal support to the Capital Campaign that helped open the Museum on November 12.

The physical realization has turned out to be much more exciting than any plan could have communicated. The staff made a very large "stretch" to open a range of galleries. The reviews have been positive and it is easy to spend a half day in productive learning. Knowledgeable teenagers are spending their days at the Museum. The most flattering comment to date has been that it is the first American technology museum to be at European standards. Dr. Oliver Strimpel, who did the Museum's Image Gallery has just become the Associative Director and Curator. Oliver was formerly the Curator of the Mathematics Section of The Science Museum, London. The long collecting period and five year breadboard at Digital really paid off in collecting artifacts, building exhibits, doing lectures (ranging from Amdahl to Zuse) and gaining widescale support from computer people and companies.

I want to see this phase aimed at:

. putting a formal educational program in place,

. continued collecting of artifacts (whether letters, films, manuals or machines) in order to record the significant, information processing events, and

. getting broad public support from computer-knowledgeable people who want to learn more about the past and future history of computing.

Since the Museum is quite unlike the plan you saw, I hope you can visit the Museum with me on your next trip to Boston and see the transformation. The perspective you now have would also be beneficial. If you have time, I hope you could join Gwen and I for a meal.

Sincerely,

Gordon Bell

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION DATE: TUE 30 SEP 1980
11:16 AM EDT

FROM: GORDON BELL
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: STEALTH MIRAGE FEASIBLITY APPROACH AND GOING FORWARD WITH EMS/VMS

Here's the approach I was interested in using to try and understand when or whether we might get DECmail.

Given that EMS/VMS is here, and there is no understanding or idea
whether the Steatlth Mirage (DECmail) is feasible, and at what
cost or time scale, I believe it is worth going forward with EMS/VMS.

"TO" DISTRIBUTION:

BOB DALEY	BILL JOHNSON	BILL KEATING
GLENN REYER	BRUCE STEWART	TOM VLACH

GB1.S7.22

****
* d i g i t a l *
****

TO: GLENN REYER DATE: TUE 30 SEP 1980
11:05 AM EDT

FROM: GORDON BELL
cc: see "CC" DISTRIBUTION DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: RE: RE: LDP'S EMS VS THE STEALTH MIRAGE (DECMAIL)

EMS/VMS is an exact functional equivalent of DECmail, so why are we doing a product when we already have one that is working well and can be evolved and meets the exact functional
needs? You might note that getting PL's to a VMS only position was the first step in being able to use EMS/VMS.

The thing that shook me up was really based on facing the immense
workload associated with building this product. There has been
NO OUTPUT of the group to date, nor have they gotten to anythig
resembling a phase 0. It has no management, no identifyable output in terms of an internal architecture, a list of unknowns
about 1 page long, people inexperienced at DEC and in this kind
of programming, no feasibility arguments which I have repeatedly
ask for (like size of program, number of instructions that have
to be programmed, etc. ... something you should be applying as
a sanity test to check the commitments and expectations you set
when you jointly sell a product). I do count the people as enthusiastic, but then again I don't see them working 70

hours
a week, and hence they are not that enthusiastic. They are bright,
but that can only carry one so far. However, I've yet to see
a really clever approach necessary to address the large amount
of work they have to do.

I want the expectations set in line with what we have demonstrated
or can plan. So far, I have not seen any output to convince me
that I'm wrong. What is the greatest puzzlement to me is why you
believe this is doable? I asked you and Bob to give me the
arguement some time ago. ... I will resend the request!

We have a big credibility and communications gap here, and I would
like us as managers to close it. It will only be closed with
data and performance not words. I am patient and will wait for
DECmail, but not to the exclusion of a product (particularly one
I consider on a better basis and having a better chance and being
one by a better (more experienced and dedicated) group). Alternatively
you can show me that it is viable by a schedule (plan) that faces
all the naughty issues and details like getting the code written and
defining the file structure, etc. The group has been in operation
for several years and the schedule is always a year away. Why isn't
the best prediction of their output to say that the product is
always one year away?

Please, let's understand this. I consider it a management
morass. Unfortunately I also have a dirty mind and ask if

this project is typical of others there?

"CC" DISTRIBUTION:

BOB DALEY BILL JOHNSON JACK
MILESKI
BRUCE STEWART TOM VLACH

WPS USERS - Leave HP mode and type <CR>

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* d i g i t a l *
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TO: see "TO" DISTRIBUTION DATE: TUE 30 SEP 1980
11:16 AM EDT

FROM: GORDON BELL
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: STEALTH MIRAGE FEASIBLITY APPROACH AND GOING FORWARD WITH EMS/VMS

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cost or time scale, I believe it is worth going forward with EMS/VMS.

"TO" DISTRIBUTION:

BOB DALEY BILL JOHNSON BILL
KEATING
GLENN REYER BRUCE STEWART TOM VLACH

WPS USERS - Leave HP mode and type <CR>
00 BURT DECGRAM ACCEPTED S 1517 O 69 08-OCT-80 06:43:51

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* d i g i t a l *
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TO: GLENN REYER   DATE: TUE 7 OCT 1980
8:36 PM EDT

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION

DEPT: OOD

EXT: 223-2236

LOC/MAIL STOP: ML12-1/A51

SUBJECT: MAKING EM/VMS AVAILABLE VERSUS WAITING FOR DECMAIL

Just came from a local sales meeting where we are losing to Prime at mit, harvard and first church. Since these are not in Fortune 500 we can give em up according to the folks in marketing. Frankly, I'm greedy! I don't want to give up these
customers (reasonably ours now) to Prime! This is just the tip
of the iceberg, and we have to say something, rather than lose
the customer. I say go out on a very straightforward basis (no
cost) with ems/vms. I can not see why this is not compatible with our future product. Let's find out what the real needs are by doing this rather limited user test. Am still concerned
about DECmail availability and whether it is going to be any better than ems/vms. The data so far indicates ems/vms is better.

This decision as to whether we have some limited availablity of ems/vms should be a P/L or Marketing Committee decison.
Can we discuss it as such?
How do we bring it up? (Andy, Marc, Bill, Joe)

I think we may have screwed up in not going out with ems/vms instead of bringing in Word 11. We could totally confuse the marketplace by selling ems/vms, which I think is really leadership,
versus introducing Word 11. At a personal level, I believe there is much more productivity and functionality with ems/vms
coupled with our current wps products versus adding another wps product oin the wps area (word 11).

"CC" DISTRIBUTION:

BOB DALEY	BILL JOHNSON	BILL KIESEWETTER
ANDY KNOWLES	JULIUS MARCUS	JOE MEANY
JACK MILESKI	BRUCE STEWART	TOM VLACH

GB1.S7.42
LOW END was the main topic. We want to continue winning with lower cost competitive terminals (and also getting the high functionality VT200) AND we want to get a lower cost CT for the OFFICE products that are coming. The goal is to have the strongest possible CT offering. There's a seperate memo on this.

We discussed the issues on the Office and CTAB software vis a vis compatibility and have to report back on our plan. In the review on Thursday evening with the developers, I think we may be ok. The critical issue now is make sure the goals are right and then support the plan! I think it is quite good and we can win, assuming a few of the details are reconciled. We have more compatibility of languages, files and interfaces than any competitior. Furthermore, the OFFICE specs look great and we can win there too! But we have to implement.

Personal Computing Clusters and various Servers are not yet moving fast enough. Why can't our hot M team to get into this?

PRODUCT RESPONSIBILITY AND PROFITABILITY IS TO BE IMPLEMENTED:

.one person must be responsible for a product, and
.Engineering has the profit responsibility for a product.

We must stop introducing products that have below average profit
... because we are responsible for product success (ie. profit)!
In the event products are planned (or have no plans) which violate the profit goals, we must ask the Operations Committee for guidance as to whether to introduce. We must review:
.VT278, pending and ideas(278T, 278RL, 278 Mini floppy, CT278)
.11/23 RL package
.CTs in all the desired versions
.Robin

PRODUCT AND PRODUCT AREA REVIEWS. There is a proposal that there be a major review of all products and product areas. Note that, Jack Shields' staff reviews the service plan for the 50 majors.

Ward McKenzie agreed to co-sponsor a review of the 16-bit products from chips to systems.

Marcus was concerned about not being informed of the move to Reading of the Office Program. We screwed up and have to report back to OC on this now regarding the status. BJ's plan is ON!

We got the offer of support from Ken, Julius, Si, Win and Ted to discuss the importance of CT and OFFICE with the development groups. Avram and Bruce, feel free to schedule any of us to talk about the importance of these programs.

LOW END MASS STORAGE AND REMOVABILITY IS OF MUCH CONCERN! Grant must lead us through the morass of possibilities. We have lost the low end COEM business by high markups, but I'm still concerned about getting the straight story here about total cost (including DEC storage and transshipment, FOB charges, handling, portability, high cost of backing up with either floppies or RL's, etc.) of alternatives. How viable are the RL's? What are we going to do on the CT?

THE USE OF SOFTWARE ENGINEERING AND PRODUCTION TECHNIQUES ON HARDWARE ENGINEERING

The Fifth Generation Product transitions are going to require major transitions in the way we engineer and introduce hardware products. This is similar, if not identical, to the transition that occurred within Software Engineering in the mid 70's as we built more complex (100,000 instruction) programs.

SOFTWARE ENGINEERING UNDERSTANDING TO AID HARDWARE DESIGN

The Engineering Strategy Overview lists some transitions, but these will be difficult without major changes in thinking. About ten years ago, there was a major awareness that software was getting very complex and the response within the software community was to deal with this by treating the design and construction of software as an engineering discipline; hence several concepts were introduced:

- The Discipline: Software Engineering, together with the Software Factory and methods and environment for building software (eg.Programmer's Workbench)
- Design Methodologies: Structured design, Softech's SADT Structured Analysis and Design Technique, Yourdon's top down structured design and implementation, various notations for specifying the design independent of the implementation, code walk throughs, continued integration (bottom-up) versus full system test, HIPO
- Organizational structures: chief programmer team, program librarian, software quality assurance,
- Tools: Development Support Library, High Level Languages, Automatic Documentation, Structured Testing Aids,

At Digital, we have evolved to be out of control in our hardware engineering as evidenced by stetched product gestation times and the inability to predict the outcome of a design in terms of function, cost, quality and schedule. It is exacerbated and masked by the size and structure of

Digital, but nevertheless it can be observed at our leading edge products in VLSI and in large systems where the organizations are small and focused!

The application of software engineering techniques will be described elsewhere.

THE ENGINEERING FACTORY

It isn't clear whether software engineering benefited by a name change, or there was ever a software factory, but we do need some concept around which we can rally, that signifies the enormenity of the task ahead.

Although I don't want to distract from our product focus, we must increase our emphasis on engineering processes, tools development and overall factory management. Thus, the notion of a factory (eg. auto build, machine job shop) may be a fine idea because it connotes managing:

. workers who use the machines (i.e. designers). This implies training workers how to use the machines, and the use of learning curves so as to maximize output by doing many designs.

(In a recent paper, I argued that by specializing to design gate arrays, we gained a factor of 2-4 in terms of designs/person by not having the system logic designers do gate array design. This also applies to the way we practice module layout.)

. machines, such as a CAD program, a computer or testor, giving us process step capabilities that are symbolized by capital equipment expenditures. Note, a new machine should be well characterized in terms of its cost, capability, capacity, and set-up time. We should be able to examine the tradeoff of capital versus labor and make versus buy to get a particular job step capability.

(There should be no broken machines or tools as we do designs that can never be finished on a particular machine.)

. an assembly line characterized by a sequence of process steps. A line would mostly be used to build a set of components (eg. modules) which form a system.

(Note, while a car assembly line is set up to make several hundred Kilocars, WE SET UP A LINE TO BUILD ONE CAR! We lash together a bunch of machine tools, which are not very well characterized, and then proceed to build one design with the process. In the building, we often break each machine.)

. the total set of machines may create one or more well understood assembly lines that characterize the factory output. A factory can be tuned to give any result in terms of throughput and turnaround (response time). U. S. high volume factories may have poor turnaround, whereas job shops are built for flexibility and are aimed at having good turnaround.

(The engineering factory must be aimed at fast response. This implies having spare capacity so that work doesn't stand in queues.)

. production control of one or more assembly lines. When a set of processes are set up to produce a particular design (eg. a complete module), there must be someone responsible for the flow of work through the well-defined assembly line. Computers are ideal for shop floor control.

(We tend to distribute this control function of work back to the designer (factory worker) or his manager who must push something like a module through all the steps. This incredibly trivial function of expediting should be completely automated! Anyone connected with any part of a project should be able to query a production control machine and get the complete status of all parts of a design! Here, we should be able to use an automated shop floor control system for job shops.)

. a discipline that allows no building to take place without a specification

. the whole notion of quality and quality control. (Currently, engineering feels that the notion of quality does not apply to it. In actuality, managing engineering like a factory would make it clear that to get output, we must have quality output at each stage in order to avoid the massive incoming inspections that now occur among all organizations (eg. DMT, module producibility).)

. production metrics.

(For designers, it's clearly something like good boxes (transistors, gates, registers, microwords) that we design per unit of time.)

. a complete organization aimed at the design and operation of the factory as distinct from managing the factory workers who carry jobs from machine to machine in order to get work done. We need process engineers, assembly line engineers and managers for the process steps and assembly lines.

(We have tool builders, and process step managers. We do not have assembly line designers and assembly line managers! We do not have a production control system! The act of both finding the assembly line and then moving work through the complete assebly line is left as an exercise to the creative designer!)

I believe we have to completely revamp the way we engineer along all fronts. I'm now confident the two disciplines of software engineering and production management can be helpful in our redesign. I want to try out some of these ideas now.

What you think?

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Subject: **Getting Organized in Engineering and Manufacturing Limits to Face Our Future Competitors**

To: Jack Smith, ML1-4/A54

CC: Andy Knowles, ML10-2/A52
Will Thompson, ML1-5/E30
OOD

Date: 10/26/79 Fri
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

I'm feeling good about our current and next few years of products; but I'm terrified about '83-'90 because I think we'll enter a more cost sensitive, commodity oriented market. The challenge will be great in products-, process-, and manufacturing-engineering.

The three competitors of concern are IBM (everywhere), TI (only at low end and as a supplier) and the Japanese (Hitachi, Fujitsu, and NEC; also maybe others). Although each have some unique strengths and weaknesses, they have the following ordered strengths in <u>common</u> [our position is given []]:

1. Strong discipline in their engineering and manufacturing processes with relatively few, and aimed at volume. [Poor, lots with incremental evolution and freedom to define alternatives vs. use standard.]
2. High degree of plant automation. IBM has the best understanding of robots and Japan is second. Also increased focus on productivity. [Poor, no activity outside of test. No automated material flow. No good measures of productivity.]
3. Very good internal source of semiconductors; all but IBM supply externally. [We only make a few of our needs.]
4. Very good disks (except TI). [Need better mid/high end.]
5. Basic understanding of all kinds of materials. [Little or no work.]
6.

Very large research groups. [Weak. External R+D to couple to.]

7. Aggressive engineering and product positioning. [Ok; many products.]

8. Strong emphasis on quality (here, I exlcude TI). [Ok; improving.]

9. Willingness to change and move rapidly whether it be product, pricing, or market method (e.g. channel of distribution) and manufacturing. [We're strong; getting older and conservative?]

10. Understanding of learning curves, market share and use of forward pricing (including IBM). [Ok; except too many products?]

There are selective strengths and weaknesses(-) no particular order:

IBM

1. Very strong CAD/CAM tools and effort.
2. Disciplined processes and engineers who use a small number of PCB, Backplane, and common semiprocesses rather than evolving every possibility to get slight gains.
3. An incredible customer base and sales force capable of devouring most of any product.
4. Highly automated assembly lines with independent test and production flow controls.
5. (-)Many competing architectures and problems to evolve networks.
6. Applicators programming knowledge.

Japan

1. Ability to quickly assimulate products or processes from others.
2. Experience with low cost products like TV sets that will be model for terminals, small business system, etc.
3. Strong concern for standards as a way to the market.
4. Large population of engineers, including manufacturing engineers.
5. (-)Channel of distribution.
6. (-)Programming.

TI

1. Semiconductor strength.

2. Good terminal and low cost product base.

3. (-)Programming.

Our Strengths

1. The best general architecture/product position potential.

2. Product lines to focus on various users and channels of distribution.

3. Rapid turn-around, dedication of individuals to their plans. (Are we getting older and more lithargic?)

4. Strong Systems Programming to orient to generic, profession and other applications.

I'm not sure I've assessed things correctly, but I'd sure like your opinion and our staff's too. Then, let's get together and discuss whether we might want to change direction.

GB:swh

****
* d i g i t a l *
****

TO: ENG STAFF:
DATE: FRI 29 MAY 1981 14:27 EST

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: PROPOSED ENGINEERING PROCESS BASED ON QUALITY & PRODUCTIVITY

A project is being organized in LSG to build a one week

turnaround for
correctly stuffed PWB's from SUDS input. The project crosses several
organizations: LSG, LSG-Manufacturing, Physical Interconnect,
Semiconductors, etc.

As we start to implement a one week fast turn-around project, the
greatest use of capacity and hence, hinderance to turnaround, seems to
be the correction of errors that should not exist at a particular
stage, especially in design.

Currently it seems we have:

- too many changes on the first pass, indicating an incomplete design which we rush because turnaround is so poor because it's fixing too many errors

- too many passes to get FCS

- too many ECO's

Already it's clear we could change our processes to significantly
improve productivity and turnaround by:

- doing it right first where it's the least costly; and
- checking the output before forwarding the results to the next stage versus having front-end checks at each step (group) to filter for and correct earlier errors.

The steps of the entire process would thus be:

Design Engineering -

- Design using a functional specification and enter design into SUDS
- Check design (logic against functional spec) using either a structural walk-through or separate checking with full sign off by an independent designer or product support or diagnostics or quality organization
- Simulate the design
- Submit test data (topology, DC, AC tests, etc.) for testing final board

Drafting (beginning of one week turnaround) -

- Accept SUDS drawing, for PWB layout, subject to having a correct design with the two sign-offs by designer and design checker

- Layout PWB with guidelines from designer. Accept NO changes at this stage
- Using PWB checking rules, check PWB for manufacturability
- Prepare plot and drill tapes, check tapes and drills against SUDS

Manufacturing -

- Prepare plot, checking plotter if necessary
- Build boards

. Check board continuity against SUDS
. Burn-in and 100 percent check all IC's
. Insert chips into PWB and inspect
. DC test modules
. AC test modules
. Send correct module to designer

While these are major changes from how we do things today, I would like to start now to make them as I see our designs deteriorating under increasing complexity and module loads. We are hurrying to submit poor designs because the system is choked correcting designs.

In case of modules made using wirewrap or multiwire, I believe we must keep the same checking discipline: Design it right, check the design, build it right, then give it to the designer to verify that his design was correct! Now we're using these early breadboards to do the design!! We have to eliminate the old style designs which are done by wire guns!

Fundamentally, the proposal is simple:

.do it right the first time and check it...otherwise don't go to the next step; and
.stop building breadboards we know are wrong and will not work and that have to be changed.

I propose we start this today, and in no case do I expect it to not be in effect, September 1, 1981!

What do you think?

GB:swh
GB2.S6.20

WPS USERS - Leave HP mode and type <CR>

00 BURT DECGRAM ACCEPTED S 23551 O 47 12-JAN-82 02:28:51
****
* d i g i t a l *
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TO: RICK CORBEN   DATE: MON 11 JAN 1982
8:35 PM EST
    GVPC: FROM: GORDON BELL
    PEG: DEPT: ENG STAFF
    JACK SMITH   EXT: 223-2236
                                                   LOC/MAIL STOP: ML12-
1/A51

SUBJECT: ENG. PROJECTS STRUCTURING (DRAFT), PLS COMMENT

Everyone has their own priorities and agenda for MOCW. I'd hope
we can segment our thinking into various kinds of issues ranging
from schedule slips of products we intend to introduce in May to
strategic questions as to how we're going to compete with the Japanese 5th Generation systems.

Let's minimize the review of current projects simply to allow the
people to continue to work "flatout". Status only reports.

There may be tactical, mid-course corrections to 1-3 year
projects underway that we should deal with.

Finally, there are some very important decisions that will affect
products over the next 10 years such as VAX physical
interconnect. I believe the most important issue is our basic
ability to design competitive (timely, cost-effective) products.

Here's my list, relatively prioritized, by category:

PROJECT STATUS AND UPDATES (0-2 years)

1. Local networking (NI, Pluto, gateways, broadband)
2. Large clusters (CI, 2080, HSC, 780, Atlas, HYDRA)
3. VT's (which one next?), LA, CT, Suvax, and LCP's for May
4. Nebula
5. J-11
6. Venus

TACTICAL CONCERNS (1-4 years)
1. Scorpio (project organization, process, CAD)
2. Nautilus (time to market versus product cost)
3. Low end mass storage and tapes
4. CTAB/OFIS and small OFIS CT

STRATEGIC OPPORTUNITIES (0-10 years) in priority
1. Engineering Capabilities to design and introduce products
    a. Designer skills for complex systems eg. Venus, Scorpio
    b. Semiconductor capability and effectiveness
    c. Competitive, timely engineering process for std. products
    d. CAD capability and effectiveness by site
    e. Physical interconnect evolution
    f. Packaging
2. VAX- vs Scorpio and J
3. VAX busses, packaging, options and PMS structures (eg. BI)
4. PC's and PCC's (Clusters of Personal Computers)
    a. Ethernet vs a standard HDLC multidrop for cluster I/C
    b. PCC software for CTAB, Ofis and servers
    c. PC servers for foreign PCs
    d. Competitiveness of 17+ bit, PDP-11 architecture
5. Lo end disk area make versus buy
6. Big VAX
7. Competitive Communication Components
8. Providing systems in a commodity hardware/software environment
9. 5th Generation computing

I'd sure like to make certain these issues do get addressed.

Could I get some feedback here as to completeness and priority?

GB3.S2.55

Engineering Staff Secretaries Updated 7/20/81

Winnie Anketell	ML12-3/A62
Marilyn Arbuckle	ML12-1/T32
Barbara Burnham	LJ/D1
Iris Deluca	ML2-2/H33
Mary Jane Forbes	ML12-1/A51
Pat Higgins	ML3-6/E94
Dottie Houck	ML12-2/A16
Sandy Leah	HL1/R02
Brenda LeSage	ML12-2/A16
Sally Light	ML12-3/A62
June MacArthur	ML23-2/T36
Peg MacMillan	ML12-2/E71
Marie Mangan	HL1-1/G05
Cheryl Maynard	TW/A08
Janet Miller	ML12-1/T39
Ann Peskin	MR1-2/E78
Faith Scire	ML12-3/A62
Geri Shiring	ML12-2/T54
Callie Spence	ML12-1/A11
Vicki Travis	TW/D16

Winnie Anketell	Bruce Delagi
Marilyn Arbuckle	Larry Portner
Barbara Burnham	Will Thompson
Iris Deluca	Sam Fuller
Mary Jane Forbes	Gordon Bell
Pat Higgins	Grant Saviers
Dottie Houck	Dick Hough
Sandy Leah	Steve Teicher
Brenda LeSage	Dick Clinton
Sally Light	Pete VanRoekens
June MacArthur	John Holman
Peg MacMillan	Si Lyle

Mari Mangan
Cheryl Maynard
Janet Miller
Ann Peskin
Faith Scire
Geri Shiring
Callie Spence
Vicki Travis

Jim Cudmore
Bernie LaCroute
Rick Corben
Ulf Fagerquist
BJ
John Rose
John Meyer
Bill Demmer

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Lu Abel	ML3-2/E27	Kami Ajgaonkar	ML5-5/E97
Hank Allard	ML5-2/E93	Phil Arnold	Colorado
Al Avery	TW/A08	Paul Badum	DV (Boulder)
Ted Baker	MR1-2/E69	Vince Bastiani	MK1/M37
Paul Bauer	ML10-1/B91	George Beason	ML5-2/E93
Bob Beck	ML21-3/E87	Jim Bell	ML3-2/E41
Leo Bennett	ML4-4/E99	Dave Best	TW/A08
Dick Best	ML3-3/H14	Ron Bingham	MR1-2/E85
Joe Bitto	PN	Rowland Brandwein	MK/2D3
Alyce Branum	ML12-2/E71	Mary Breslin	ML5-5/E97
Dick Brewer	ML5-3/E12	Norm Brimhall	ML5-5/E39
Reid Brown	TW/C10	Bert Bruce	ML1-1/E24
Ralph Byrd	ML12-2/A16	Joe Carchidi	ML3-

4/E88
Peter Christy ML12-3/A62 John Clarke ML1-
2/E60
Dick Clayton ML12-2/E71 Dan Clont ML5-
5/E97
Walter Colby ML12-2/E71 Ed Corell ML5-
2/E93
Dave Cotton ML5-3/E12 Don Crowther ML5-
5/E72
Brian Croxon TW/C04 Jim Cudmore ML1-
5/E30
Bob Daley MK Bill Demmer
TW/D19
Michel Depeyrot ML1-4/E30 Dezi Dezzani ML5-
3/E12
Frank Digilio ML1-3/E62 Mike Donnelly ML3-
3/E54
Harry Drab WS Al Dziejma ML5-
3/E12
Dick Eckhouse ML3-2/E41 Mike Elkins CX
Ulf Fagerquist MR1-2/E78 Ed Fauvre
MK/2C36
Bryan Fifield ML21-1/E81 Heinz Findeisen ML1-
3/E63
Jim Fleming ML4-2/E27 Bob Flynn ML12-
2/E71
Don Freniere TW/C03 Kurt Friedrich ML5-
5/E76
Sam Fuller TW/A08 Lorrin Gale
TW/D19
Wayne Galusha ML1-3/E58 George Gerelds ML5-
3/E22
Abe Gershnow ML1-3/E62 Jim Gillett PX
(Phoenix)
Richard Glantz MR1-2/E37 Brad Glass ML5-
5/E76
Bob Glorioso ML3-2/E41 Dick Gonzales ML6-
2/E66
Roy Graham ML5-5/E97 Bill Green ML1-
4/B34
Ian Gunn MD Steve Gutz ML3-
5/E82
Len Halio ML5-2/E93 Ron Ham ML5-
5/B35
Jim Hamilton ML3-3/E54 Don Haney ML1-

2/E65

Jim Harnedy MK/2E6 Frank Hassett

TW/C10

Bill Heffner TW/C10 Steve Heiser MR1-

2/E37

John Hess ML1-3/E63 Dick Hill MR1-

1/M54

John Hittell ML21-3/E87 Per Hjerppe MR1-

2/E78

George Hoff MR1-2/E47 Marv Horovitz ML21-

4/E10

Bill Howerton ML12-3/A62 Carol Hubler ML3-

4/E88

Jim Hughes ML3-5/E82 Bob Jack ML1-

3/E58

Peter Jessel ML21-1/E81 Bill Johnson ML21-

3/E87

Charles Johnson MK1-2/D3 Glenn Johnson ML21-

4/E10

John Jorgensen MR1-1/M74 Bill Keating ML12-

3/A62

Justin Kelleher ML5-5/E76 Bill Kelly ML3-

6/E95

Ed Kenney ML3-5/E35 John Kevill ML1-

3/E58

Dave Kiarsis MR1-1/M74 Lynn King ML5-

2/E93

Lou Klotz ML1-2/E60 Oleh Kostetsky ML5-

5/E39

Mitchell Kur ML12-2/A16 Jim Lacey ML21-

4/E10

Bernie Lacroute TW/A08 Jim Lawrence ML8-
4/E86
Demetrios Lignos ML3-6/E94 Remi Lisee MK1-
1/M37
Tomas Lofgren MR1-2/P95 Richard Loveland ML5-
5/E97
Peggy Maas ML5-3/E12 Joe Madden ML3-
6/E23
Julius Marcus MK2/C37 Jim Marshall
TW/A03
Suresh Masand MK Art McCray ML5-
5/E76
Ed McDonough ML1-4/A97 Don McInnis
TW/A08
Ray Melanson ML4-2/E90 Jim Melvin
AC/E48
John Meyer ML12-1/A11 Jack Mileski
TW/C10
Jim Mills MR1-2/E37 Bob Misner MK1-
2/B6
John Miville MR1-2/E78 Mary Helen Modeen MR1-
2/E78
Gene Mondani ML1-5/E30 Bill Moran ML5-
2/E77
John Morgan MK/2H3 Bill Munson ML5-
5/E76
Paul Nelson ML5-3/E12 Ken Nisbet
TW/D19
Carl Noelcke ML3-3/H14 Tom Northrup
TW/C04
Nathan Parke TW/B02 Stan Pearson ML12-
2/E38
Laura Persily ML12-2/E71 Bob Peyton ML1-
3/E63
Charles Picariello ML4-4/E99
Richard Pietravalle MK/2D3
Ralph Platz ML3-6/E94 George Plowman ML5-
5/E97
Larry Portner ML12-3/A62 Roger Pothier MR1-
2/E74
Terry Potter ML3-3/E67 Mike Powell
TW/C02
Horace Prindle MR1-1/M74 Bob Puffer ML12-
2/E38
Tom Rarich TW/A08 Larry Rasile ML12-

2/E71
Dick Reilly ML4-4/E99 Paul Rey ML8-
4/E86
Glenn Reyer MK/2D3 Mike Riggle ML4-
1/B32
Oscar Rodriguez ML12-2/E71 Dave Rodgers
TW/C04
John Rose ML12-3/A62 Wayne Rosing
TW/C03
Steve Rothman TW/D06 Bob Rottmayer ML1-
3/E58
Ken Russ ML11-2/E83 John Sackman ML4-
4/E99
Brian Samuels MR1-1/M74 Frank Sanjana ML12-
2/E71
John Sartory ML4-4/E99 Grant Saviers ML1-
3/E58
Henk Schalke TW/C17 Dick Schneider ML11-
4/E53
Bill Segal ML3-5/E82 Herb Shanzer ML21-
1/E81
Tom Sherman TW/C02 Don Shuda MK1-
1/M37
Ed Siegmann ML1-3/E63 Ken Sills ML1-
3/E58
Joe Smith ML11-4/E53 Kevin Smith ML1-
3/E58
LeRoy Smith ML4-2/E27 Dick Snyder MR1-
2/E37
John Sofio TW/D02 Keshava Srivastava
ML1-3/E58
Joe St. Amour ML1-5/E29 Gil Steil ML5-
5/E76
Chuck Stein ML5-5/E97 Tom Stockebrand AQ
Ollie Stone ML21-3/E87 Pete Straka ML21-
4/E10
Richard Strauss ML5-5/E76 Phil Tays ML11-
4/E53
Walter Tetschner ML5-3/E12 Mike Titelbaum ML1-
2/E65
Mike Tomasic ML12-2/E71 Rollins Turner ML3-
2/E41
Pete van Roekens ML12-2/E71 Armen Varteressian
ML5-5/E39
Jim Wade RE John Wanamaker

TW/D17

Jane Ward	ML12-3/A62	Ted Webber	MK2D3
Mike Weinstein	ML5-5/E97	Pat White	ML12-3/E51
Art Williams	ML5-3/E12	George Wood	AC/E44
Ed Wright	ML12-B/B75	Mike Wurster	ML5-3/E12
John Xenakis	MR1-1/M74	Chuck Youse	ML1-3/E63

****
* d i g i t a l *
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TO: LARRY PORTNER

DATE: FRI 27 JUN 1980 2:56 PM EDT

FROM: GORDON BELL
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: ENGINEERING ORGANIZATION

Let's set aside significant time to go over the engineering organization, what each group's charter is, what it's doing and who everyone interacts with before the August Woods and possibly the joint M/E Woods.

It feels like everyone is responsible for everything and the reporting of products seems too low.

The areas of concern:

Semis: 3 diverse technologies and needs all mixed together. NIH. May not be able to compute as we all diverge. We are dedicated though.

Terminals: Line printers including for Mid and hi-end, old products
and enhancements, low volumes via Gigi, and VT/LA 200 together with
color and high resolution, lack of coupling to get A/D work done.

Mass Storage: Delegated product responsibility, too many get us too
little, too late. Poor semiconductor capability, poor ability to use
emerging semis for low end.

Small Systems: Range includes cabinets. We're getting killed in
smaller configurations.

Mid-range: Very concerned as to lack of output, to lack of technology
focus, to control systems, and departure of Rothman, Armstrong, and
Cane on COMET, given its status. We have a pending disaster? Their
schedules are so unreasonably long as to get us nothing. The spending
there is the largest (considering Hydra) and probably in worst shape.

LSG: Too many products for the budget will get too little, too late!
(Also, unrest and uncertainly on 20.) Note, the O/C concern about
morale and our fire-walling and stability of 20 budget. Andy is
waffling on what I thought was a basic selling posture.

Thompson/Holman: Generally decoupled from both plants and engineering
developers.

Tech. Director: More architectural focus needed plus use as

a
sounding board, and test vehicle for our direction.

Research: Really quite spotty and generally decoupled.

A/D: Not installed adequately in groups. But hope.

GB:swh
GB1.S5.9

Thoughts on Engineering Changes 2/14/82

Our Productivity Review is the catalyst to undertand and make the organizational changes. Every organization is moving faster. I see no fires, but a number of changes are necessary.

Fine: BJ, Grant,
OK: Gutman, Lacroute, Fuller, Fagerquist
Overloaded: Avery, Demmer
Unclear: Teicher
Change: Holman, Thompson

Autonomy requires managers that can walk and chew gum at the same time. Ulf failed, among other reasons, because he had lots of folks who were irrelevant to designing products: Venus, Jupiter, Technology Developers, Computing, an A/D project, two individual helpers, personnel, operations, finance, CSSE and Mfg. co-team members, all of which had a vote on something. Cause or effect?

Our managers spend far too much time on personnel, finance, space getting computing facilities, and operational issues. Have I encouraged them to be more general at the expense of products?

CHANGES
1. Still too much centralization, too little direction and unclear output in TOPS and PTD. We need a technology manager.

2. Too much on the Demmer plate: (Bill knows and is on

products)
.32 bit program (he's letting this one go with less direction)
.Microvax (Croxon and Moffa are driving this)
.Scorpio Systems
.Nautilus
.730, 750, 780, 782 and CI
.Workstations

3. Too much on Avery plate: (The May announcement drives em.)
.VT old and new
.CT
.LA
.LP
.278
.Robin and Cat
.Monitors

4. Semiconductors - We need more from the 100M/year we spend. I think Hudson's fat and we need change. We aren't getting enough designs or designers! Jeff and Steve acknowledge this.

5. We want to consolidate some mechanical and packaging groups.

6. CAD has to be much more effective. The Productivity Review and susequent detailed CAD Reviews are needed first.

ENGINEERING REQUESTS TO MANUFACTURING PAST AND FUTURE

1. Processes (technology) requested and not committed, -2 years
-Process-process for determining essential processes

2. Processes requested for +3 years
-Process-process and responsible soul (other than Jack Smith)

3. Requests -2 years from FAT for field integration
-Processes st Field Integration is possible
-Experiments with the existing dock merge components (eg.

LA,VT)
and Packaged Systems (eg. Minc, 11/70,11/780, 2020...)

4. Requests +3 years from FAT for field integration
-see 3. Aggressive trial for key Packaged Systems.
-Information system for controlling flow merge of products
-Forecast and control by system versus piece parts

5. Is field integration likely until an exogenous force (e.g. expensive transportation or high interest on the extra 3 months of finished goods) occurs even though a significant number of the components are dock merged and a large fraction of business is in a small number of packaged systems?
-Probably not, could occur after a good order processing system

6. Do I believe the FAT organization is mostly redundant, misdirected, and mismanaged, as I might have implied in my meeting with Jack, Jack and Win last Tuesday?
-No, Never! I have privately apologized to each of them and hereby apologize publicly!

(I have also declined a Playboy interview regarding my heart's feelings)

WHY IS FIELD INTEGRATION UNLIKELY

There is no "buy-in" that field integration is a goal, possible, desirable, etc.

Even with a goal, it takes bright, hardworking people to put processes in place. "Jack is the brightest person in the company", says Ken Olsen and the only progress he made was to install part of the APT and CSI lines after constant encourgagement by me. I don't want to supply this encourgement to Jack's successor.

All budgeting is a linear extrapolation of the past. There has been no change or commitement to FAT cost reduction independent of the dock merge program or Packaged Systems.

All organizations grow in a self-perpetuating fashion

The FAT coupling with P/L's builds even greater size and inertia

"Hell must freeze over first" - anon

1. GB PROCESS IMPROVEMENT REQUESTS -2? YEARS

Process-process to determine the essential processes from the desirable, possible, requested, and cute

Planning process for physical interconnect organized about systems
Process to "know" where we are (i.e. metrics) wrt competition

Sort out the morass among Acton and the plants, particularly wrt Modules and test technology

Cost analysis and prediction with an error bound, versus situation on COMET chips and TS04

Significantly improved ECO turn-around time by having sufficient wip knowledge and ability to transfer data among computers controlling the process (i.e. insertion, and test, but ultimately including kitting and flow control)

Significantly improved turn-around for low volume and product start-up using the multi-wire process (Recently rejected)

Elimination of clandestined paper tapes on all process computers to be replaced by APT connection (see previous)

Process to filter out the open loop processes by review of every product build plan. For example, all sets of modules that form a disk control built in a hv site remote from disk plant would be checked to dock merge quality.

Machine readable module or sub-assembly type, lot and serial # for:

Production flow control without manual transduction of data

In line process control of insertion and test

ECO control

Labor saving and error reduction where test information is essential (eg. MR memory test)

Future automated handling

Control when consumer business tracking is required

2. GB PROCESS IMPROVEMENTS +3 YEARS

Develope a really great process architect

SEE 1. Get Will Thompson to get a plan together. Change organization to get quality and output not hassle, old boys, and a fat organization. Spend more if necessary. Couple these folks to the plants somehow.

Couple Capacity Plan and CAD Plan to Process-Process Plan

Process control on all assembly lines that matter

Semiconductor Plant Process Control that is no more than 3 years behind others in the semiconductor industry

Automatic parts handling for kitting

A first breadboard of automatic flow of wip modules

A first breadboard of Marvelous Module Making Machine using available technology

A first use of an industrial robot for mechanical parts fab (eg. Combined keyboard assembly and keyboard testor)

Fine line for small modules in low end (form factor)

Large Modules with fine line, 4 layer, controlled impedance for EC with local build (Maynard?)

3. GB- FAT CHANGES FOR FIELD INTEGRATION -2 YEARS

Clear segmentation of system class types by size such that everyone knows the process that can be used to achieve FI on all systems. Some systems may not be FIable and will continue with std FAT.

Finish the APT work along the orginal plan both as a vechicle for significant cost reduction and a method to check and improve qualtity during pre FI phases

- absolute control and data gathering for all options
- round the clock test with 8 hour repair
- BOM control
- software production

Do essential experiments st complete FI is possible using MINC, 780, 2020 and WP78

Do essential experiments using main line Packaged Systems as in the case of the 11/03 and 11/70 which constitute about 50% of our systems either by unit or by $'s.

Use exercisors versus hard disks to get cost reduction and better tests and not use the disks or terminals being shipped because of capital equipment constraints.

4. GB- FAT CHANGES FOR FIELD INTEGRATION +3 YEARS

Move to get system level, not component forecasts to solve memory, terminal and disk imbalance (the so called mix problem) idiocies

Establish BOMS for all systems and processes for FI

Make Field Integrateability the goal instead of Dock Merge and have this automatic on all future products, except low volume (11/74 mP)

Do 3, especially using concept of FDS (Final Disassembly and Ship) to get to FI by taking out the necessary options of a processor that comes from HV prior to ship. This can be implemented as per the original plan to get the 780 numbers up and out

Install the various communications and control mechanisms such that FI is possible using hv cpu plants to directly supply the cpu part complete with memory and comm options. Use the FDS method to get the appropriate parts shipped. Drop ship disks, tape and terminals

Remove the needless gates and the gate generator in the Comet Dock Merge Plan

1. ENGINEERING REQUESTS FOR -2 YEARS

High quality modules and backplanes for high performance systems st the systems come up and work without burn-in

Larger Modules and Backplanes

Standardization on Modules, Backplanes and Grids

Thicker Power Planes for large systems

Testing of all processes st a process remains calibrated and problems get fixed at earliest possible place

Process control st there is minimum person to person variation (Process sheets for all products that matter)

Tape manufacturing processes and ability to generate them

Memory and analog testor strategy and ability to develope testors

Process data collection in all plants (see also GB)

Ability to ramp up faster based on a faster release cycle

Piece part tooling and component engineering at plant

More uniform process development, probably checked by a good review process

Overall process to strengthen ME and QC

Engineering and Manufacturing must get together st outside resources can be used to layout and produce modules

Ability to build outside designed modules st we can make license deals if they make sense

Significant jump in ability to do in circuit test and diagnosis of LSI devices

Elimination of the use of models and use more modern methods of process control and QC

Method to determine screening st right module build strategy is used particulaly wrt ssi and discretes

Clear producibility criteria with streamlined review

Power supply test method development with technical backup

Useful failure data collection, analysis and feedback

Process data st decisions such as burn in can be reached without hassle

SINGLE CORPORATE AUTOMATED PARTS LIST

NPSU procedure review and development st the process is clean and easy

New product inventory tracking so that ECO exposure is known in this critical phase

Process to decide when process support should be carried out at plant verus engineering--Plants have yet to pick up mature product in MSD area

More stability in process design by stability in plant and personnel areas

Plastic mold making and molding capabilities

Ceramic substrate process design is in sync with use and needs

Semiconductor developement process developement is sync with CAD and the appropriate circuits effort (eg. clear plan for 4 micron, before we get the technology)

Keycap assembly automation as a vehicle to move us to learn about high volume assembly

Better tooling of print head process with universal machines versus special processes

Process for determining second sourceness of chips with appropriate review (eg LA chip second source is lacking)

Process to measure gloss, texture and spectrum for the specification and control of matching products in a system

IDENTIFICATION OF WIP WITH REVISION USING THE NEW CODES

Modern approach to analog testing, especially the Power Supplies

Kitted control of cabinets, versus loose piece (cost reduction)

Configuration control st orders are electrically and mechanically repeatable

Wave soldering of fully assembled power supply boards

Plastic trimming with lasers especially for molds

Process knowledge and ability to get to zero burn in on hi volume products (eg terminals)

Standard IC grid resolution

2. ENGINEERING REQUESTS FOR THE NEXT +3 YEARS

Do some of the items in 1...especially the critical ones

Pilot process for cost-effective disk media production

HDA assembly as per Winchester technology

Clean room operation

Materials process control necessary for precision head manufacturing

Better response in plants st we can get into mfg quicker and be more competitive given the rapid changes in both semiconductor and disk processes. Both of these technologies seem to be evolving at a more rapid rate.

Process for resolving hassles between corporate and plant sites st work is done, not hassling

Heat pin planar packaging for high end

Surface mounting of components using solder reflow process

Automatic assembly of LSI

Do the MCA

Methods to do cost reduction on a rational basis. There will be much pressure for vertical integration and we have to test this.

Trade-off of early test versus FAT through in process control

PROM burn and test at plants

Investigation of manufacturing items like screw machine parts, motors and general purpose molding

Understand competitive issues like TI's automatec assembly and have ability to apply as they make sense in the increasing labor cost market

Fiber optics parts assembly

Ability to adapt to new packaging materials

Conductive coating

Product safety testing and configuration control

Automated assemblies and test techniques enabling drastic reduction in labor content and skill levels

More aggressive CAM for turn-around, cost and flexibility

Insistance of built-in test and diagnosis and ways of adding on when not built in

Better standard parts control with fewer parts

Computer product ECO and documentation control using DECnet linking all sites and having the automatic transmission of production information

Really fast semiconductor turn-around for design!

Two micron MOS

Good recipes so that we can run the myriad of processes easily and reliably. Also this will be necessary as extra plants are put on line.   Tend toward the HP philosphy in semiconductors although we have to stay away from process proliferation!

Automated hybrid assembly that can be distributed to plants

3. ENGINEERING REQUEST TO FAT FOR FIELD INTEGRATION -2 YEARS

Process to supply appropriate data so that corrective actions can be taken either in engineering or test

System parameter testing

Plan from FAT to do something

Reduction in paper flow st it is possible

Process to get competitive lead times of add-ons by the shipping/forecasting/slotting process that seems non-existent

Feedback if there is any dock merging

4. ENGINEERING REQUEST TO FAT FOR FIELD INTEGRATION +3 YEARS

Direct ship to customers from volume plants in the same way all our competitive suppliers such as Memorex do now!

Less than 30 day ARO on add-ons

Clear segmentation as to what is done in FAT and what is volume

IQL visibility and measures

Better response time on getting to dock merge or FI. Fix the process so that it is not roadblock generating and self-stopping the way it is now. When a product gets off of DM, it has to get back on quickly.

High integrity data base on customer configurations--ultimately needed for liability issues. Clearly needed for add-on.

Earlier involvement for FI plan, if we ever do a DM product

Designing the appropriate test process to support the flow from volume plants

Documentation and data base st options of varying revision can be combined to form a system, rather than trying it and seeing if it works (This only adds cost and it can not be tested, it can only be broken or worn out.)

CUMMULATIVE SHIPS (by $) OF DOCK MERGEABLE COMPONENTS

Standalone Disks

RP06/06	6.9
RK06/07	3.2
RM	2.2
RP04	1.6
	13.9

Rack-Mounted Disks

RK05	4.4
RX's	2.6
RLO1	1.0
	8.0

Standalone Terminals

VT's	5
LA's + LP's	11.6
	16.6

Direct Shippable CPU Systems

70's (no memory)		4.1
70 memory	4.	
03 (no memory)	0.9	
	9.0	

All Memory 12.4

(Note: 72% of hardware sales accounted for by Product Accounting)

Organizational Change Ideas 2/14/82

The current engineering organization is:

PEG(8): Ulf, Bill, Mike, Bill, Bernie, BJ, Grant, Walt

Technology(3): John, Will, Steve

GB Staff(1): Sam

LP Staff(6): Joe, Rick, John M, Pete, Bruce, John R

This gives a total staff of 20 of which two are VPs. The principle product developers are only 7+2, but both Demmer and Avery are overloaded. There are too many direct reports.

HELP TO RUN ENGINEERING
No matter what kind of organization, I need an associate head to help with the administration.

Some of the candidates not in engineering: Long, Yen, Metzger, Crawford, Hamstein, ... Bloch, Heart,

Some of the candidates in engineering: Demmer, Teicher, Daley, Heffner, Rose, Croxon, Reilly, Will

CHANGES
1. Will and John organization can be run by Metzger. Maybe it should go back to being part of manufacturing. When we do this, the mechanical design centers can be set up and consolidated.

2. Too much on Demmer's plate.

3. Too much on Avery's plate. Walt is an alternative.

4. Personnel can be fully decentralized and distributed to line.

5. Semiconductors must be more effective.

6. CAD must be more effective.

CHANGES TOWARD MANUFACTURING/ENGINEERING PRODUCT GROUPS
Jack an I believe there is another path which we should explore which combines engineering and manufacturing into a products group. If we did this, then these product groups could report into the company in a different fashion. Rather than proposing many changes, we should try several changes:

1. 16-bit Systems group consisting of hardware and software engineering, manufacturing and possibly the micros engineering.

2. Printing terminals group- all the LA type printers

3. Printers group with all the LP type printers, associating this with the LP buyout activity that CSS engages in.

4. A low end VT/CT group. Andy is the main customer now.

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+---------------------------+
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| d | i | g | i | t | a | l |   i n t e r o f f i c e   m e m o r a n d u m
|   |   |   |   |   |   |   |
+---------------------------+
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SUBJ: ENGINEERING STRATEGY PRESENTATION

Date: 2/5/79
From: Gordon Bell
TO: Attendees
Dept: Office of Development
MS: ML12-1/A51 Ext: 223-2236

Date: February 8 - Thursday

Place: Sheraton Boxboro - Colonial Room
(**badge required**)

Time: 4:00 PM Product Strategy Presentation - Gordon Bell
Implications for Software - Larry Portner

Question/Answer Session - OOD

7:00 Dinner

*Attached is the Strategy/Rationale for Engineering Product Development. Please read prior to the meeting.

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TO: Operations Committee
Board of Directors

Date: 9/3/80 Wed
From: Gordon Bell
Dept: OOD

CC: Office of Development (OOD)

MS: ML12-1/A51
Ext: 223-2236
EMS: @CORE

Subject: Engineering and Gordon Bell's Annual Review and Fiscal 81 Goals

Attached please find:

1. OOD Goals (and Objectives) FY80 [and how we did against them]

2. OOD Goals (and Objectives) FY81

3. My Role in the Six Most Important Things the Company Has to Do!

4. Glossary of Abbreviations and Terms Used in the Attached Documents

To be discussed at the September 17, 1980, Woods, and for the Board of Director's information.

GB:swh
GB1.S6.34

00 BURT DECGRAM ACCEPTED S 29070 O 58 30-MAR-81 09:09:02

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* d i g i t a l *
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TO: GROUP VP COMMITTEE: DATE: MON 30 MAR 1981

9:02 EST

FROM: GORDON BELL
cc: KEN OLSEN
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: ENGINEERING/MANUFACTURING SEGMENTATION

REISSUE OF MY 7/13/80 EMS
REFERENCE: 3/29/81 EMS, COMMENTS ON WHAT AN ORGANIZATIONAL CHANGE MIGHT LOOK LIKE, GB

00 BURT DECGRAM ACCEPTED S 1757 O 01 14-JUL-80 00:27:18

****
* d i g i t a l *
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TO: JACK SMITH
DATE: SUN 13 JUL 1980 11:24 PM EDT

FROM: GORDON BELL
cc: OOD:
OPERATIONS COMMITTEE:
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: A BETTER? SEGMENTATION OF MFG/ENG/MKT(IN SOME INSTANCES)

It feels like we could have a cleaner coupling between manufacturing and engineering. Also, we need a better segmentation of product flow among the plants. There is an assumption that each major product grouping is quite vertically integrated, at least back to include modules and special packaging. Since we are stressing point of manufacture and field integration, the organization is set up to focus on this.

Although this structure is focused mainly on the

Manufacturing
Engineering coupling. In several cases it could conveniently extend to couple to the product lines, such that it would be possible to have a segmented business unit of manufacturing, engineering, and one or more product lines. In nearly all cases, products sold on the open market would also be sold internally as part of larger systems (eg. terminals). Note these groupings:

Group name	Customers	Suppliers
Semiconductors	MS, T, S, M, L	Ext. too
Phys. interconnect	"	
Microprocessors	Ext., S, M	Semis, Phys. I/C
Mass store (MS)	Ext.?,T, S, M, L	Semis, PIC
Communications and networks	Ext.?,PLs	Semis, PIC
Terminals and T-based systems	Ext, PLs	Semis, Phys. I/D, MS
Small	PLs	Micros, MS,
Medium	"	Semis, PIC, MS
Large	"	"

Semiconductors (M/E)
Behavior is like a semiconductor supplier! Supplies chips and occasionally a set of chips carrying out a well defined function and mounted in a single or multi-chip carrier.
.The big issue is how to segment this to get the necessary charter protection among MOS, Bipolar TTL, and Bipolar ECL?
.Also, how do we tradeoff between manufacturing and engineering resources (product ships versus new products)?

Physical Interconnect and Packaging (M/E)
This group would develop and sell this components (chip carriers, boards, modules, and back planes) to both develop groups and to

plants. It would operate a manufacturing facility in which automation is tested and it would work on leading edge processes that are not done in a specific product group. This might include: very low cost PI or PIP, the high performance packaging needed in Venus/2080, and chip carriers. It would have: component development, cad development, process development, and test development. I would like to see us try to segment this effort and see whether such a group could exist. Some questions:

.What would it include?
.How does it couple to the plants?
.To the groups it serves?
.How is it funded? (The measures of this technology are quite clear!)
.How much of power?
.How much of packaging?
.How much is in the higher level-of-integration groups? ETC.

This is very important to look at, but very tough to do (assuming the people are not emotional about looking at it.)

Microprocessor board and box-level components (M/E/Mkt)
Fundamentally this group would develop module-level components for higher level systems sold through the PL. It would also sell its components so that a Small systems group could build conventional End user and OEM products complete with disks, comm., etc. Other systems groups would buy modules.
.Should we look at it, given the opportunity of it all coming together in Hudson?

Mass Storage (M/E)
Clearly a seperate entity.
.With the purchase of new board shop, is there a way to further clean up the interface so that modules are in their purview too,

i.e. how can we get them to a fully stand-alone vertically integrated division and out of the rest of the M/E planning, etc.?
.Should the low end be part of the Terminals activity? (probably
not, given the work needed to deal with better video, comm., intelligence and sw).
.I'm still convinced that it is desirable and maybe even necessary to sell disks on the open market to be truly good here,
.How can we get a look at this objectively?
.How can we get a better interface between disk and the systems
groups to avoid building expensive, segmented sub-systems (ala
floppy)?
.Getting right DM package ala the RL's?
.Dealing with what I describe as Type IV packages (where all the
stuff is in one cab. and we currently need FAT)?
.Why aren't these built into the disk instead of a CPU plant?
.Taking advantage of the HSC such that this is also the high end
11 system rather than returning it to NE for FATing?

Communications and Networks
With the new interconnect structure and the increased focus on
networking, it would be very good to have a strong emphasis again
on these products within all parts of the organization, including
the field. In some ways, the product strategy lessens the product focus need because all products must have built in connections. There will be more emphasis in terms of: communications concentrators ala Mercury (part of Hydra and other
products), Hydra itself is structured this way, Gateways to IBM,
x.25, and the phone companies, and voice switching. Electronic
mail systems per se might be sold through this channel. This

group would supply standards to other systems and products per
se.
.What is the best way to provide this focus?
.What is its product charter?
.How are M and E coupled?
.Is there a need for a better PL focus?

Terminal and Terminal Based Systems (M/E/MKT)
This one is clear I hope. I'm deadly afraid of seperating dumb
and smart and intelligent, cause they are just a few Kilobytes of
RAM away from one another and differ by whether there is
secondary memory or not. In the not too distant future, I see
the convergence of all our current dumbs to have local
intelligence and sufficient secondary memory, versus being all
dumb. This follows the Xerox and Datapoint models to a certain
extent.   At any rate, the customers are: all systems, Terminals
PL, most of WPS, and Retail.
.How can these best be coupled to form a business unit?
.How to segment into various price and function ranges? .
.How to integrate the base software?
.The applications software?
.Is there a need to have the mass store as part of the group?

System groups (M/E)
Currently this is a disaster by every conceivable measure:
inventory, cost, time to get something to market, forecasting,
order processing. Jack's edict that we are not going to have any
more FAT, but instead are going to ship from point of manufacture
beginning in year ?, is the beginning of what should bring about
this change. We still must deal with the turning of the corner

of what we produce as components and what some customers and
PL's, believe is an ala carte approach to building systems.
The
interconnect fully supports this approach! Some of the
questions:
.How many, and what is the segmentation? (by type, $-amount,
architecture, technology?)
.How is the corner turned so that PL's "feel" their
inventory?
.What are the rules to deal with "specials" ... which I think
are
minimum?
.How to plan the transition associated with the products and
back
up if there are any slips?

Diagrammatically, the product flow, through the various M/E
and
possible M/E/Mkt groups to PLs would be as follows:

```
Semis    PIP (lead technology only, not dominate supplier)
!        !
--------------------
!        !         !
MS+PL?-x Micro+PL-x!
!        !         !
----------------------------------------
!        !         !         !         !
T+PL?-x  C/N+PL?-x S         M         L
!        !         !         !         !
----------------------------------------
         !
         OEM and End user PL
         !
         x
```

x = customer

This is hardly meant to be final, but is rather something we
might
discuss from. I think it would acccomplish better interfaces
and

more autonomy among the groups.

What you folks think?

Hopefully it might help in the Woods discussion on Wed./Thur., although it only deals with trying to segment a small part of our world. Again, please don't take it as final. (There is another memo that deals with the various dimensions I use to work on segmentation.)

GB1.S5.53

GB2.S5.34 (4/15/81)

ID#422

d i g i t a l **interoffice memorandum**

Subject: **Modifying the ESG Buyout Terminal and Getting Graphics Expertise**

To: Si Lyle, MR1-1/M42

CC: Dick Clayton, ML12-2/E71
Ulf Fagerquist, MR1-2/E78
John Holman, PK3-1/P84
Bill McBride, MR2-3/E70
Jerry Witmore, PK3-1/M40

Date: 1/17/79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

follow up 2/7/79

I understand that ESG is planning to bring in a high performance graphics terminal for the market, and I clearly support that need and direction. There is no other way to get there so fast.

If we can get the graphics strategy together (and possibly even if we can't), I would like to urge you to consider giving us (CRT and terminals) the contract for this work. At this time, we could have a single, consolidated thrust in graphics where we try to bring this all together and get all these products, with a single architecture to the marketplace at one time. We have a rare opportunity in time, and if our experience in programming is true here, it's necessary to be under a single manager. Even if we can't have the common architecture that we should be able to get, we are doing enough graphics work such that the added understanding from a critical mass will make future terminals better.

What you think?

Bill, can you get the critical people together here to discuss?

D I G I T A L INTEROFFICE MEMORANDUM

DIST: Dick Clayton ML12-2/E71 Ulf Fagerquist MR1-2/E78
John Holman PK3-1/P84 Si Lyle MR1-1/M42
Bill McBride MR2-3/E70 Jerry Witmore PK3-1/M40

March 23, 1981

Arthur W. Burks
University of Michigan
Department of Computer and Communication Sciences
105 South State
2076 Frieze Building
Ann Arbor, MI 48109

Dear Art:

Thanks so much for your slides. Do hope you are planning to dub the ENIAC film with a sound track for the Museum -- at our expense. If this is impossible for you, perhaps you could do a script that we could then prepare. Whoever speaks, we won't have a professional media-type.

Could we set a firm date for your Museum lecture next winter?

Thanks again.

Sincerely yours,

Gordon Bell

Vice President,
Engineering

GB:swh
GB2.S4.7
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<spouse>Karen
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<name>Smith, Jack
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<name>Strecker, Dr. Bill
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<date>12/2/76y, 10/2/77y, 3/4/78y
<phone>772-0267
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<name>Sherwood, Will
<friend>Cheri Fletcher
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<name>Sutherland, Ivan
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<name>Teicher, Steve
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<name>Titelbaum, Mike
<spouse>Barbara

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<name>Vrablik, Ed
<spouse>Carol
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| D | I | G | I | T | A | L |
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GB3.S1.41

I N T E R O F F I C E
M E M O R A N D U M

TO: CHARLIE ROSE

CC: RICK MERRILL
BOB GUARENTE

Date: NOVEMBER 18, 1981
From: GORDON BELL
Dept: ENGINEERING
MS: ML12-1/A51
Ext: 2236
EMS: @CORE

SUBJ: SPECIAL PROJECT EQUIPMENT NEEDED

Please make available to Bob Guarente all equipment needed for the special project he is working on. He needs: a GiGi, a DECWriter IV printer, a Barco monitor (#GD33), Software: Data Plotting Package, Dec-Write Text Editor, Gigi Slide Projection System, Graphics Editor, The Regis Application Library, The Character Set Editor, and a T/S account to be charged to CC 383.

Thank you for your help.

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* d i g i t a l *
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TO: KEN OLSEN
6:32 EST

DATE: WED 25 MAR 1981

FROM: GORDON BELL

DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: CONTINUING TTHE DIGITAL ERGONOMETRIC COMPUTER... 278 TYPE

I'm delighted that we have some outside review of Product Line Projects. For years, I have apparently terrorized the incompetents, calling out, a priori, losers. Mostly they just go back in their caves and knaw away at making poor products. In this regard, a recent memo pointed out 30 of these, virtually all of which I flagged both before and then after (when it was obvious). The memo of the dirty 30 also gives the why it happens. Si is working with Stan to take over the hardware development of these products since they are all concentrated in RPG, Micros, Terminals and possibly CSS. There are enough bucks here to do the right terminals and CT, provided we get it organized and stop the marginal stuff.

I think you'll find that my record of actual stopping anything is pretty poor. The DECset product was delayed a year, but for the dirty thirty, I had no affect. On the other hand, I'm marveling how rapidly you are able to get things done on the 278, simply by doing it independent of the decision vacuum, budget, and possiblity to sell it. At some point, we'd better worry if we are working with a sow's ear. Since you never stop anything, and are probably the greatest protector of the underdog, we have a problem in terms of how to make all the stuff fit into either a factory, or into the product line forecasts. Therefore, I worry more about you than me.

If the meeting is unsuccessful at getting a decent product strategy in the low end, based on organization and products I can be proud of (you have the 35 simple heuristics that feel appropriate), I intend to propose that we make the necessary changes that will at least get us good products.

Assuming that I'm able to sell whoever you want me to sell (the OC, GVPC, BOD), then it would seem appropriate that we begin to get some plan as to how they might be distributed.
This one worries me greatly, cause I don't have the detailed heuristics, only instinct that we have been in abyss, are in one, and there is no leader to get us out of this.

All of us have really been working hard here, and intend to win, but it would seem that it should just be a lot easier to get things done.

Ken,
I frankly believe that the reason the dirty thirty were built was because we have operated so long against the magic engineering percentage, and that these have always fallen outside, when voted on by all the product lines, and hence have not gotten done right (low cost, operational hardware, appropriate performance and functions, and software).

I certainly do not intend to let this situation continue.
We have to build products that I think will sell in our current
organization considering the fact that there's no marketing channel (or virtually none) for them ... cause the marketing folks in this area are all desigining their favorite hobby computer, instead of marketing. Alternatively, you might let engineering set up a product line to market, where we would not hire any salesmen or any marketing people or open any
stores. Then we could develop products and save all these variable costs that hit the bottom line and get us no market share.

Si omits the other project, the electronic disk for the

278.

PS
I started this last nite, woke up early, depressed and sat down 30 minutes ago to get this off my chest and onto yours.

ATTACHED: MEMO;138

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* d i g i t a l *
****

TO: GORDON BELL DATE: TUE 24 MAR 1981
16:11 EST

FROM: SI LYLE
DEPT: CSD
EXT: 223-7311
LOC/MAIL STOP: ML12-2/E71

SUBJECT: 278 DEVELOPMENT

Gordon, sorry I forgot to include you in the CC distribution that went out earlier.

Peg

****
* d i g i t a l *
****

TO: STAN OLSEN DATE: TUE 24 MAR 1981
15:44
EST

FROM: SI LYLE
cc: see "CC" DISTRIBUTION DEPT: CSD
EXT: 223-7311
LOC/MAIL STOP: ML12-
2/E71

SUBJECT: 278 DEVELOPMENT

SL1/S3/2

At the present time, we have a hardware development team in place that
is finishing off the RX02 and RL02 versions of the 278.

Once this work is completed, it will be necessary to decide whether we
want to keep the team together for follow-on 278 work or to assign them to other development tasks. This decision has to be made shortly since some members of the team have moved to other projects as their part of the 278 was completed.

The specific decisions required are:

1) Final configuration package for 278/RX02.

This decision is required this week so that we can use the new package for FCS and the NCC demo units.

2) Final configuration package for the 278/RL02.

This packaging problem is tougher than #1 since acoustic treatment is required to make the RL02's acceptable in an office environment. Because of this, we cannot make changes as close to FCS as we have done in #1. We should close on a packaging arrangement as soon as possible.

3) Implementation of the T&E floppy on the 278.

This project will take 30% of a 10 man team. Since these are key individuals, I do not want to leave them wondering what their next task is so I need a go ahead by April 10, 1981.

4) Implementation of the graphics hardware option.

The project as you have seen is at the breadboard demo level. The decision required is whether this should be completed as a product.

5) Implementation of an acoustic coupler option.

Ken asked that this option be included so that technical evaluation of the implementation alternatives will be completed for review and decision. The decision will not be on whether we go ahead but on the implementation.

6) Re-engineering for cost reductions.

Cost reduction is possible within the current 278 but depending upon the nature and extent of the work it could involve resources currently working on CT related or 11/23B projects. Because of this, I believe we should set some criteria on how much payback we expect and what magnitude of investment would be considered and then use a one shot task force to come up with possible solutions.

Since you fund all of the 278 hardware activity, I suggest the following steps to close on these decisions.

A) You indicate which of the above 6 items you want to consider and/or list other possible projects.

B) I will respond with cost and delivery.

C) You make final selection.

D) I will commit to the completion of the selected projects.

I would like to complete this cycle as quickly as possible so let's
discuss it when we meet on Wednesday, March 25th.

These decisions will also play a role in the 278 hardware and software
product strategy vis-a-vis the CT. I have asked the CT Program Office
to prepaare a 278/CT product strategy so that we can understand the
role the 278 can play in seeding customer and distribution
opportunities for the CT.

Although it is your market and your money, I would like to interject my bias. The 278 can be used as a seed for the CT just as we saw at our Chicago visit, so, I believe we should do retail type packaging for items #1 and #2, and do #3. I am on the fence on #4, but would do it if we could get an outside group to do some graphics software or could capitalize on some of the internal software. I would not do item #6 unless we could show a return greater than what we would get out of new competitive products.

See you on Wednesday.

Si

"CC" DISTRIBUTION:

DAVE KNOLL	AVRAM MILLER	KEN OLSEN
PAUL GARDNER @MLXX	HERB SHANZER	JACK SMITH

GB2.S5.25

+---------------+
! d i g i t a l ! i n t e r o f f i c e m e m o r a n d u m
+---------------+

Subject: **Some Thoughts on ESG Marketplace**

To: Jack Gilmore, Bob Joseph,
Bernie Lacroute, John Leng,
Si Lyle, Larry Wade

Date: 28 APRIL 78
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

CC: Marketing Committee, OOD

The possible engineering marketplace (based on ESG customers, competitors, sales and marketing people) is really exciting to me, as an engineer, but alas I think we aren't really going to capitalize on it.

<u>Summary</u>

1. We need a <u>single</u> catalog of ESG hardware and software products versus the plethora of garbage we barrage our sales and customers with.

2. We need a way to offer and sell the complete WP system which includes FORTRAN and/or BASIC and/or possibly the Bus languages.

3. We need a VAX Promotion and Sales Plan for the RT/C market...including ESG!

4. We need an effective Marketing/Product/Sales for the ESG market versus a totally random, opportunity outlook to the market.

5. We need to manage the availability of internal and external software for this market. We need some interface between our internal development and ESG!

At a talk to 50 ESG customers and 10-20 sales-marketing people, I observed:

1. Our salesmen mainly talk to other salesmen even though there are plenty of customers around. Our affinity to focus inward is everywhere!

2. We still do not offer a WP-BASIC-FORTRAN calculator personal computer for this market. WP is a unique P/L and there's no way to package and sell it with other software as a product. (I trust we may move when HP puts a good WP system on the HP45.) We have a unique -- and <u>great</u> product here if we could have

a. a brochure and/or manual;
b. a way to sell low cost products.

3. We have an unclear method of having graphics terminals -- and many customers want it.

4. We're writing DDP papers for the ESG marketplace, and it's unclear what our products are.

5. The silver applications brochure helps...but is meager. It doesn't include our standard products or ESG products.

6. The collection of literature to the ESG user is at best a repository of garbage. There are 20 rinky dink brochures on products (10, 20, 11, VAX, WP), software (Cogo, Silver Brochure, etc.), company (annual report), and users (how x uses our y). We need a single coherent product catalog that makes it clear to our sales and customers what we have!

7. There was interest in buying Engineering's design tools (on the 10). We aren't co-ordinating our internal and external development with this market to provide software.

In discussing the graphics market (if there is such a thing) with Tektronix, it seems clear that ESG applications are a part of their plans. They understand the need for a clear, user interface integrated with a language (e.g., FORTRAN or BASIC) and graphics -- but their view is limited. They still underestimate the need for large memories and applications. Our view is even more limited. We don't have a model of standalone vs central computing. I discussed the possibility of a small VAX (e.g., 1 or 2 hex), at a slow speed. They understand and want it -- we haven't had any requests for such a system.

The head of the Manhattan, New York Regional Office, who is from the commercial marketplace, believes we aren't in the ESG marketplace. We don't have the tools, etc. His view is that the 1130 is the right machine. No, his salesmen probably aren't calling on the plethora of large engineering houses, who are mostly in FORTRAN and could change, given a large cost/performance incentive! Note, a virtual 1130 (on VAX or 11/60) could run the IBM O/S and applications SW directly.

We could identify key accounts for each Engineering area (e.g., Philadelphia Power or American Electric Power), sell them and use them for future reference sells. We fundamentally appear to have no coherent Engineering (by area) plan!

There appears to be no coherent sales plan to identify and target customers in any priority by size and application and especially for VAX! We should be able to cream scim for customers to replace old machines (e.g., 1108 and 6600's) and the off load large 360/370s.

For a small product line, like ESG, there needs to be a VAX sales training, and promotion plan that's attached to a large P/L.

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST: Jack Gilmore MK Bob Joseph MR1-
1/M42
Bernie Lacroute TW John Leng MR1-
1/A65
Si Lyle MR1-1/M42 Larry Wade PK3-
1/M56

Jim Bell ML3-2/E41 Dick Clayton ML12-
2/E71
Jim Cudmore ML1-4/E30 Bill Demmer TW/D19
Ulf Fagerquist MR1-2/E78 Win Hindle ML5-
2/A53
Ted Johnson PK3-2/A55 John Kevill ML1-
3/E58
Andy Knowles MR2-2/A52 Julius Marcus MK2/C37
John Meyer ML12-1/A11 Stan Olsen MK
Larry Portner ML12-3/A62 Bob Puffer ML12-
2/E38
Bill Thompson ML12-1/F41

****
* d i g i t a l *
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TO: PETE HURLEY DATE: TUE 22 JUL 1980
8:32 AM EDT

FROM: GORDON BELL
cc: see "CC" DISTRIBUTION DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: ESG'S PERSONAL WORKSTATION 11/M AND/OR VMS

F/U

8/1/80
We (Bell, Chapin, Flitterman, Ross, Smith) met and discussed ESG's need for an interim personal workstation based on the 23.
I came out against this because: it's interim; it detracts from
the 32-bit effort; it will split revenue and detract from getting
maximum learning curves in products and in support; an 11/23 and
Nebula would both be about the same cost; it is a tough software
problem for a 16-bit address space machine - hence it's going to
be expensive; and it DOESN'T SEEM GOOD ENOUGH when compared with
the new microprocessor-based systems which don't have the PDP-11
address space limits.

In the next few months Barbara is going to visit customers to formulate the requirements for this. She will include the SUVAX
A/D Team in some of these visits.

In order to make this decision it feels ike we need to answer various questions like:

1. How small can VMS get such that there would still be room
for user programs and data in a small configuration?

2. What is the configuration (primary and secondary memory)
required for VMS?

3. What would the schedule be for the two approaches? (The 23
would be targetted for 1 year from now.) We assume that
software packages will come out and evolve.

Let's do a real comparison of the two approaches. Could you please work with Barbara to define SUVAX and see if we can use it
instead of the 23?

GB1.S5.27

"CC" DISTRIBUTION:

BARBARA CHAPIN JOE CARCHIDI MARION DANCY
BILL DEMMER DICK HUSTVEDT SAM FULLER
BILL HEFFNER BILL JOHNSON BILL KEATING
ANDY KNOWLES BERNIE LACROUTE LOU PHILIPPON
LARRY PORTNER WAYNE ROSING PETER SMITH
DICK SNYDER

ID#: 0149

| d i g i t a l | **I N T E R O F F I C E M E M O**

SUBJ: Engineering/Word Processing Brochure

Date: 5 JULY 78
From: Gordon Bell
TO: Si Lyle, Ron Cohen
Dept: Office of Development
MS: ML12/A51 Ext: 2236

I'm honored to be the feature of the brochure. Somehow, I'd like to add something to it that is substantially meatier. Like so many brochures, it lacks one important item:
There are no product specifications...it's just a story.

The parts that I think are important are marked on the brochure, but it's essential to include:

1. The fact that it can stand alone and that an engineer can run BASIC or FORTRAN on it. No need to buy the specialized terminals that just do BASIC. Also, for the small consulting firm, there is DIBOL and Business BASIC, both of which give more productivity for report writing than languages we know. IT IS THE PROGRAMMING CAPABILITY THAT SETS US APART FROM NEARLY ALL OTHER WORD PROCESSING SYSTEMS AND THIS DIDN'T COME OUT IN THE BROCHURE.

2. The word processing system is really a media for communication. Communication can take place using 5 methods: 1. the paper--direct output of using the system; 2. the floppy -- can be carried, easily distributed, basis for field (remote) changes; 3. machine to machine -- more rapid than FAX; 4. via central system with everyone's documents; 5. floppy/people -- several people can work on a project at a time (e.g. I type memos or articles and others can read on/work on them).

3. Recommend that there be areas where engineers have direct access to them. This was aimed too much at the secretary and not the engineer or engineering manager. All engineers should know how to type and write.

4. Too much emphasis as a terminal, and not as a computer in its own right.

5. Maybe a section on how it is used, (as distinct from benefits) would get over my concerns.

6. We use it in every department. Personnel has various letters on it and their files for college recruiting. Engineering standards are on it. Purchasing letters and specs are on it. We keep a list of all our projects that get updated monthly. With this we can publish various reports from just one data base.

7. Maybe some vignettes ala 6 where there is a paragraph on each use. My own personal use would go like this:

Mary Jane insisted that I get my own word processing system at home so that she wouldn't have to retype memos from either typed/hand-editted or hand-written documents. Now, I type a document at home, bring it in to her system which has a mailing list corresponding to the names on my memo, and the memo and its mailing list address is run off. In a recent book, we did the entire book on the word processing system and then fed it directly into a typesetting machine. There are various letters on the system that can be recalled and printed easily. The system also prints an index to my microfilmed files.

8. The interface to the typesetting system is also necessary for those organizations that do a lot of printing, and/or want high quality typeset documents.

9. Although there is a self-teaching manual that tells all and takes about 3 hours to run through, the machine can be used quickly by an engineer. I have yet to read the manual and I can get nearly all the things done I want just by using it and experimenting with the keys.

10. There are various sized type fonts so that overhead slides can be made that people can read. It has sub and superscripts.

11. There is a problem which is quite fundamental...it lacks an organization.

A possibility might be:

Intro (what's there)
Overview of what a WP is and how it is used (roughly what's there)
The Four Styles of Use (see below)
What a Total System Might Look Like and What Are the Benefits
(This is what you have there now)
The Nuts and Bolts of a System...here clean up the

product definition act

- The software- the facilities a user sees
- The stand-alone terminal, storage and printers
- The communications with a central (DEC computer)
- Optional software to use the terminal as a gp computer
  - BASIC
  - Business BASIC
  - Fortran
  - Dibol

Any useful (to the engineering community) applications software

Some of the current uses within DEC (engineering):

- my own
- personnel
- purchasing
- engineering standards
- product management
- software document writing
- Peter Christy, John McNamara writing books

The Four Styles of Use

There are many ways a WP is used within an organization depending on the organizational size, style and function. At DEC, we are used to a fair amount of personal autonomy, hence there is no attempt to control or have any sort of centralization. Each potential user can obtain a system based on need. We have a range of uses from the one person office to the pooling of text entry for some of our manuals. The system we have provided makes four distinct kinds of use possible.

1. Stand-alone, supplement/change existing document production/storage.

   a. Indirect-The WP system replaces the typewriter.

   b. User direct-The engineer, engineering manager, writer, clerk, etc. creates the text directly. Subsequent changes etc. may be under someone else's control.

2. Communication among independent autonomous systems. Any WPS can communicate with any other one. It permits various sites or offices to communicate with one another. In essence it is a form of FAX...but unlike FAX the information can be then changed at the receiver.

3. As a computer. Unlike a WPS-only system, ours can be a gp computer with a language suited to this distributed computing. There is no need to get a specialized BASIC-only calculator.

a. BASIC-faster than x, has features y and z.

b. Business BASIC-for doing the control programs

c. Dibol-best interactive business language

d. Fortran-the scientific language

e. Various applications langages...list the ones you'll sell.

4. As a total system with DEC central computer for files and or computation.

a. Economical central storage system (don't push this yet because they haven't even bought yet). You should say what cost/terminal is.

b. Computation at the central site, just get the software and you too can word process if you have a DEC computer now.

c. Computation and central storage of a single site. Communication and control of documents.

The reply card must have a price list and way of ordering the system without a salesman. The brochure should make it clear enough what it is. Put various manuals in the price list so the potential buyer can buy a manual (refundable) and see for himself. Do the same for the BASIC, Fortran, Dibol components.

Somehow this needs something, and I hope this'll help.

GB:ljp

To understand computer structures, one must have a fairly clear idea of the process that produces and consumes machines; from research and development through applied technology, into architecture (the emphasis of these essays) and implementations, operating systems, and languages; and then on through applications, through marketing and sales and finally to the user community (consumer). The process (highly simplified) is shown in Fig. 1, in terms of both the physical and information (specifications and requests to specify) flows. Other entities (functions) in the proocess that affect the product are: government and voluntary standards groups, professional societies to provide intercommunications among all parts and, of course, the ensemble of all producers (the competition) that provide alternative designs. This flow is a pipeline process, and quite like other producer-consumer processes. Each stage has a transfer delay (from input to output) duration of anywhere from one to ten years (with an average of 2); so the time scale from basic idea to implementation can range from five to ten years...and up to twenty years. The emphasis is on mini(mal) (e.g., microcomputers and calculators) and other small computers (e.g., minicomputers).

ORGANIZATION OF ESSAYS

The process and resultant products are the subject of these essays. The first four essays (part 1) describe the environment for producing/consuming computers: this first one on the basic, underlying product and overview; applications (use) and the segmentation of the marketplace; technology (which I believe is the dominant factor in determining machines); and the organizations (people) and their interaction.

This first essay describes minicomputers and other small computers, then separates them from neighboring larger computers. A taxonomy is presented in terms of a hierarchy of the physical parts--called levels-of-integration, as a mechanism to let us focus and understand the computer on a piece by piece basis. The notion of a 24+ dimensional computer space that contains all computer structures is also described. Thus, a computer is a point or surface in that space.

The final set of essays (part 2) describes the machine and the software used to operate it. The first essay of part two describes the physical parts and the resulting computer structures in terms of the PMS (i.e., a computer's) components and notation*. An attempt will be made to show how design at this level, by the user, takes place in terms of the components in a fashion akin to circuit design. The second essay will describe various behavioral aspects of the Instruction-Set Processor (ISP) design and uses the ISPS notation*. The third essay shows how the various technology described in the first part implements the various PMS components in the cost/performance space. The final essay will discuss the software that utilizes the hardware and provides various language environments for final (higher) use programs.

Although the process, as measured quantitatively, is similar the results have been significantly different from nearly all other processes. Stored program, digital computers have evolved more rapidly, and over a much wider range than any other man-made object in the history of civilization...(except semiconductors)* and after only 30 years, we still regard computers as being in their infancy in terms of numbers and use.

A simple explanation for the rapid evolution is not possible, however one could speculate that they evolve based on market need which drives the design (and technology) which drives the production (at a lower cost) which drives the market (appearing to be completely elastic) which drives the...as shown in Fig. 2.

Perhaps the greatest factor is the pervasive nature of the user throughout the process and the dual role of each entity in the process as both a supplier and a user of computers. This dual role focusses each (entity) supplier on the goals of providing either lower cost computation or increased computational (functional) capability for wider application. That is, research, advanced development, architecture, implementation, government, manufacturing are all significant users with deep understanding.

The operating cost being about the same order of magnitude as the capital equipment (purchase or rental) cost permits a relatively high turnover of equipment and encourages use due to ease of decision making for capital expenditures. (This is in contrast to industries where little changes occur due to very high capital/plant equipment costs and there are relatively few suppliers or buyers.)

MINI(MAL)-COMPUTERS

Although trying to understand and define the mini(mal) computers versus micro, midi,...super computers may appear tedious, we believe it's worthwhile as this segmentation (and in some cases extreme lack of segmentation) has focussed the very rapid development and use.

Let's go through some definitions of minicomputers and understand the frustrating problem of formulating a definition, and eventually reach a point of diminishing returns. The need, although trivial sounding, is simply that the process including salesperson and buyer must have a common language and way of identifying one another.

Computing Europe, as late as November 6, 1975 was very frustrated: "When is a minicomputer not a minicomputer? Surely it is time the industry faced the problem of evolving a standard definition." I believe providing a simple definition is difficult, unless a flowchart is permitted. But this is probably not the kind of definition that most readers would like. As a good reporter, he collected inputs from all those who had time and energy to output, hopefully reproducing their definition without adding too much noise. One observation was "announcements from minicomputer companies aren't, by definition, minis". For example, although DEC is regarded as a minicomputer company, I must say that many machines it makes aren't what I would call minicomputers.

Some of the definitions used price as the discriminating attribute and it was suggested that a minimal configuration should cost less than 20,000 pounds (or $50,000). The maximum price definition is reasonable, very often, although one has to beware of currency variations. Also, one has to be careful of a price discriminator as some low priced computers tend to be short lived due to their high cost of manufacture...and ultimate demise of the manufacturer.

Iann Baron (Computing Europe, December 1975) made the simplest, most useful definition; that is, "Minicomputers are a state of mind [design/applications]. It is not useful to define them in terms of price or capability because of the rapid changes in technology." This corresponds to perhaps the earliest definition (Bell, 1971).

"Minicomputers (for minimal computers) are a state of mind (or the design minds); the current logic technology, and the characteristics found in larger computers, are combined into a package which has the smallest cost," (i.e., the lowest cost, operational computer). Note, this definition includes processor-on-a-chip (i.e., microprocessor) based computers or microcomputers as minicomputers. Thus, the sole goal is cost;

hardware/software tradeoffs are made to transfer any hardware costly operations to the software.

Although herein we define a minicomputer (hopefully happily enough to live with), it is important to understand why a minicomputer is difficult to define. Thus, a minicomputer is a computer that is hard to define.

A price-based definition can be exacerbated by people who collect and base analysis on time varying data; so one is comparing different machines at different times in their lifetimes.

The wide variation in configurations causes the greatest complications in comparison and definition. That is, each instance (application) of a specific machine model varies greatly. I recall being asked by a telephone company engineer whether he should install a dozen 100 megabyte discs (each cost about $25,000) on a PDP-11/70 (approximately $125,000) to do a job that he used to do with a 370/168 (approximately $3,500,000). It was a data base problem and he wondered whether he really ought to be doing that with an 11/70. My only doubt was not that it should be an 11/70, but whether he could use a lower model number like an 11/40 (approximately $60,000), and thus get the attendant less parts and higher reliability. The notion of balancing a computer to handle any task in a general sense just does not usually apply to minicomputer applications;

that is, trying to process average job mixes with maximum job flow through a batch processing center (where any job can be run) just is not what minis are all about. This is like designing a factory to make automobiles, and only being allowed one machine type to handle the foundry, metal stamping, conveying, welding, assembly, etc. for steel, aluminum, plastic and glass parts! Minis are generally applied to specific tasks, using specific configurations, and operated with specific software rather than being configured to handle any situation. The configurations vary so that, in the case of the large data base problem, one could have a $5,000 or $10,000 processor and several hundred thousand dollars' worth of disc. That is, in principle; users more often succumb to their other instincts and get the biggest machine they can to drive the data base, (to be safe) even though it does lower the system reliability. Many engineers applying computers don't understand the need for processing power to access a data base, unless it is to execute the overly general operating system that has to do everything else...but won't in this environment.

One comment in Computing Europe, (December 1975) summed this up; "The difference is similar to tungsten or fluorescent lamps...lower efficiency...or higher overheads. Fluorescents are undoubtedly more efficient for business lighting, but have a minimal share of the Christmas tree lights market".

MINICOMPUTER ANCESTRY

Now, each application area (or company) claims to be the father, mother, midwife, or purveyor of the minicomputer. How did it come about? Did it come from control, switching, computation or data processing? When I started to think about this, I had to admit that, in a sense, everybody was right. This means that a minicomputer, is a philosophy (or style) of design. Cambridge University's EDSAC was, what one might think of as the first minicomputer that had significant use. The Manchester University Mark I prototype to test the Williams Storage Tube was probably the first operational computer and it was clearly a minicomputer! Both of these computers operated two years before the larger, U.S. computers as they were designed to be minimal such that they could "test" the technology. The small computer still continues to be a "test bed" for technology.

It should be noted that by working early, at a slower speed permitted more instructions/year versus the theoretically higher, but non-operational instructions/second. Thus, all minicomputers combined tend to execute more instructions than their larger relatives.

I would classify IBM's first minicomputer as the 1401. It was a data processing computer and distinctly a change in design philosophy at that particular time. It was the lowest price of any of IBM's computers...as opposed to a design oriented to the greatest performance/price ratio, or the greatest performance. In fact, the 1401 as initially conceived was merely a stored program replacement for the former, hardwired controllers used to interconnect card readers, magnetic tape units and line printers in an off line batch support system. The 1401 was not designed as a computer in response to a market, nor was it part of a market plan until a long time after it was operating. The designers, merely applied the best technology...the stored program computer, to the problem at hand.

Minicomputers also originated from a computation base. The most famous (U.S.) computers were the Librascope/General Precision LGP-30 and Bendix G-15 of the early 60's. These were used for computation in engineering and scientific applications and eventually control.

Control applications are also clearly a part of the ancestry, and the part

I identify with because they emphasized the direct coupling of the external process to the computer. The CDC 160, introduced in 1960 at a price of about $60,000, was I believe, the first high performance, low cost, real time computer. Like the 1401 it was designed as a support computer to a larger machine and as a computer to test peripherals...not to be sold as a programmable computer. It subsequently was applied for control, scientific computation, and NCR bought and used them for commercial computation.

Various aerospace control computers can argue that they are the true minicomputer antecedants because of their small size and short word lengths. Although interesting, I would argue against their inclusion because of price, and because they were usually military based, hence relatively unknown within the main computing community.

At that time DEC introduced the PDP-1 in 1960, an 18-bit computer, a direct descendant of MIT's Lincoln Laboratory TX-0, and its predecessor Whirlwind (the first 16-bit minicomputer). Again, the TX-0 was not designed for computation in its own right, but to test transistor circuits for the large TX-2. The TX-0 did operate as a general purpose, laboratory experiment control and computer at MIT from 1957 to 1974. The early chain is shown in Fig. 3. The variations in word length reflected the change in character encoding from 6-bits (hence, 12-, 18-, and 24-bit) to 8-bits (hence 16-bit). With the exception of the IBM 1401, all early computers had very good interconnection to the human user with typewriters, although Whirlwind had interactive CRT's.

Another factor that complicates finding a definition is that one often designs a machine to be implemented as a range of computers. A machine that performs and costs a certain amount is a minicomputer, yet other implementations of the same basic architecture, may not be...such as we have done with the PDP-11 series. This, again introduces much noise to the definition price-based.

Finally, the notion of a computer being a hierarchy of physical parts in various levels-of-integration, completely rules out a price-based definition. Levels-of-integration, is the nested application of hardware and software in a hierarchial fashion such that the resulting structure solves a particular application problem. Note, from the definition, one can stop at any level. The current levels for hardware are: semiconductor chips; printed circuit boards; frames (or boxes) holding printed circuit boards; and interconnected boxes. The software levels begin with hardware and include: the operating system; language; and application programs. Each level, of course, may be repeatedly nested as a structure.

The question is how much of the computer or how the parts are tied together (i.e., integrated) do you get for a particular amount of money? Now, for $10 you can get a computer consisting of some small amount of memory, a processor, occupying about 200 x 200 mils of silicon, and being packaged as a dual-inline-package...no power, no way to mount or use it. If one doesn't mind doing testing, making printed circuit boards, or need an interface to the outside world, e.g., lights, switches, or other transducers, software, or want it to be otherwise powered, used or applied, then one has a computer. Clearly it is less than $50,000 and it also fits the style of design for minicomputers as it is the minimal computer that one can get from technology.

-I-

COMPUTERS AS POINTS AND SURFACES IN COMPUTER-SPACE

I believe the best way to consider a computer and (set or family of computers) is a point (and surface) in an n-dimensional computer-space. Each dimension of the space represents a functional, structural, or performance attribute of the computer with the provision that several dimensions are nearly perfectly correlated with one another. Calendar time and price, although possible dimensions should be considered as dependent variable, as a given structure will dictate a particular price at a given time.

Although the notion of an n-dimensional space may feel uncomfortable, it is in reality, what's being used when we make tables to describe objects. A definition (Bell, et al, 1971) of a various computer based on this approach,...and still quite valid if we ignore price:

NAME	Mp.SIZE	BASIC PRICE	C.P. 1971	WORD LENGTH (BITS)	Pc.STATE (WORDS)	DATA-TYPES
MICRO	8K	5K	8-12	2	(1-2)	WORD,BYTE,

INTEGER,BOOLEANS

MINI 32K (5-10)K 12-16 2-4 (3) +
ADDRESSES,
VECTORS
(INDEX)

MIDI 65-128K (10-20)K 15-24 4-16 + DOUBLE
INTEGERS +
. FLOATING-
POINT
.
.
MAXI

ALL ARE: 5-10 MHZ CLOCK; TTL MSI LOGIC; T. CYCLE 0.7-2 USEC; FIXED TO A SPECIFIC, SINGLE TASK.

Figure 4 shows/applies the notion of a computer space using the 5 dimensions of the previous table which are relatively orthogonal to one another and observe just two of the dimensions (in K$) and how new machines traverse the space with time. The price is on the vertical axis, and is the dependent variable; at that time, in 1963. The minimal machine, a PDP-5 with 4K, 12-bit words and teletype for program loading and i/o, price was about $27,000. In moving through time from 1963, one can either keep price constant, providing increased functionality with the technology, or one could continue to design the minimal configurations. The simplest indicator of performance is memory size, so as we traverse time, the amount of memory increases (giving higher performance). If you look at some of the other dimensions and where we are now, the current definition of the "average" minicomputer is a word-length of about 16-bits with somewhere between 2 and 3 data-types. This is not a "minimal" computer, since the true "minis" are called microprocessors and have an implementation of 8-bit width with smaller memory, run slower, and cost less.

For example, the first DEC minicomputer, the PDP-5, was introduced in 1964 primarily for real time data collection and control. In fact, the machine was built in direct response to the Atomic Energy of Canada's need to have a data recording display and alarm monitoring system independent of a controlling computer (PDP-4). Clearly, as computer designers the only possible solution to such a complex device was a stored program computer. The cost was constrained to be as low as possible to be competitive with the fixed hardware. The PDP-5 had a hardware processor state of one 12-bit accumulator, 1-bit link for overflow and multiple precision arithmetic, and 1-bit interrupt enable bit. The program counter was held in primary memory. Also, an analog-to-digital converter was built into the accumulator and was controlled by a program instead of using a separate converter. Now, processor states of 8-16 words is common!

The PDP-8 was the successor to PDP-5, and was based on the PDP-5 ISP (Architecture). It was delivered in 1966, ($18,000 for 4Kw, with teletype). The significant contribution of the PDP-8 was to use a wire wrap technology developed by IBM and Gardner-Denver, enabling significant higher volume production. (It's interesting to note that the technology was introduced to DEC to enable large machines to be fabricated more easily (with relatively error-free connections.)

<u>USING TECHNOLOGY FOR DESIGNING PRICE AND PERFORMANCE COMPUTERS</u>

The advances in basic technology can be translated into either of two fundamentally different designs based on: constant performance and minimal price, or constant price and increased performance. The following table shows the effects of the two design alternatives.

<u>Table</u>: Comparison of New Technology Constant Cost, Constant Performance Designs

Introduction time	t	t+1	t+1	t+1
Design style	base case	constant cost	constant performance (Mini)	constant performance (Mini)
Application	base	base	base	new base
Computer price	1	1	0.5	0.5
Operating costs (range)	2-4	2-4	2-4	1-2
Total cost	3-5	3-5	2.5-4.5	1.5-3
Improvement (in cost)	1	1	.83-.9	.5-.6
Performance (and improvement)	1	2	1	1
Performance/price (and improvement)	1	2	2	2
Performance/ Total-cost	.33-.2	.66-.4	.4-.22	.66-.4
Improvement (perf./cost)	1	2	1.21-1.1	2

The first column gives the base case, with a price, performance and performance/price ratio of 1. As the computer is applied to a particular environment at cost of 2 to 4 times the original price of the computer, the total cost of the computer becomes 3 to 5, and the performance/total-cost ratio is reduced to .333 to .2 (depending on the total cost. Now assume the same environment, with the same fixed (overhead) costs to operate, at some time, t+1 later after technology has "improved" by a factor 2. Both the constant cost and minimal cost designs give the same basic performance/cost improvement-when we only look at the cost of the computer. However, when one considers the high, fixed overhead costs, there is a relatively small improvement in cost performance/cost, although there is a savings of 17 to 10 per cent with the minimal design in the cost assuming no inflation for the operating costs. The greatest gains come in applying the computer with greater performance and getting the attendant factor of 2 gain in performance and in performance/price.

The final column shows how a new market is approached with the minimal machine. Namely, all the indicators are the same as with the constant performance case, but it is clear that the computer must be applied to smaller scale application processes.

Which approach should a producer pursue? Throughout the history of computing, one can, to a first approximation, assume the market is infinite, hence it doesn't matter as long as one can meet the competition of the chosen market. For an established company with a user base, a way of designing, manufacturing, selling, and applying computers, there is really little question. A supplier is forced by the whole system to provide machines at the same price levels by the whole process given in Fig. 1, because:

1. The user (market) has fixed overhead, and requires improvements in productivity since the internal balances of his organization have already allocated funds. The operating costs are likely increasing due to inflation, and although a lesser priced machine could hold performance/cost constant, no productivity gain would come. Requiring less or equal funds, will ultimately translate to loss of own power (based on people, capital expenses, ability to provide increased service, etc.) In fact, the pressure among him and his peers in other organization is to "work-up" to larger, more powerful machines. The most significant cause of inertia is the tremendous investment in software that prevents change and requires compatability at time t+1. A user at time, t, is virtually locked in at time, t+1, assuming there is a need (e.g., growth) to have a different computer.

2. Sales as information transmitters, respond mainly to loss of sales because of poor performance, and functionality performance is more straightforward to sell. Price is secondary and considered when performance is equal. More fundamentally, the salesperson's habits are based on the amount of work he has to do...where work is measured in sales yields, and then directly to the number of systems sold. If a salesperson is selling a given system with a given performance, and the price is reduced by a factor of two, then he must sell twice the number of systems...which means working significantly harder (although there is

elasticity in the price). Within DEC, for example, a salesperson may sell one large system/year...and at the low end sell, 1500. The differences are based on the particular distribution/reseller/applications chain where a customer buys many systems.

3.Marketing reinforces the inputs from the salesperson (with its own biases) and presents the conflicting definitions of what the next new product should be...reflecting lost sales and last sales request. There is virtually no transmission of sales that were lost due to substantially lower priced or newer market potential products. The new product must have the performance of the current most competitive machines, the price of the most marginal competitor (who is possibly losing money to buy the market); the software of all the competitors (since each differentiates itself by unique software functionality and languages); and with all the service of the largest (highest price competitor). To make matters worse, highly technical people are in the market function, and provide not only all the conflicting demands but many product solutions (i.e., constraints)...rather than the price and functional goals and constraints. Marketing virtually guarantees building constant price, increased performance more than any other function (e.g., the DECsystem 10 group).

4.Development. Much of the input is from marketing to improve performance, and the technology push is to use the various new components that have more performance (since the suppliers of technology behave in a fashion that's nearly identical to the computer supplier). Although there are various styles of designs (and designers), the most common tendency of the designer is to use new technology and to provide higher performance, and solve all the problems inherent in subsequent designs rather than working to reduce costs again.

5.Manufacturing is subject to the same constraints and planning as sales. A given plant is measured in units, quality level, and price per unit giving a net cost productivity. By radically changing the costs and thereby the volume to get the same net cash flow, requires totally different approaches to planning, materials movement, testing, etc. Since the basic time focus is so short term within manufacturing, radical changes required for a higher volume (flow) business (i.e., long term planning) is a total paradox.

USING PRICE AND PERFORMANCE TO DEFINE COMPUTER CLASSES

The previous section predicated technology which allowed complete trade-off between price and performance, giving two equally valid approaches to new products. The essay on technology will examine the validity, but we will proceed on the basis that such a trade-off is possible. The simplifying assumption that it is entirely trivial to determine performance as a single metric...as opposed to the n-dimensional space as previously discussed, will be made. Figure 5 plots price and performance planes for three times, t, t+1, and t+2. Names are introduced to identify each computer by particular price ranges. The names are: sub-micro (to come in the next 2+ years), micro, mini, midi, maxi, and super. Very simply, a given named computer occupies a particular price range even though mini has been used poorly over a much greater range. At each new technology time, the performance increases by one category (e.g., midi performance is available on a mini); and a new type of computer; the mini(mal) computer is introduced at a significantly lower price level.

In this model, there are discrete times t, t+1, t+2 which are discrete. Hence technology advances in revolutionary steps. In reality we tend to see evolution take place in a number of technologies (e.g., semiconductor and magnetic storage density). However, on a post facto basis, it is possible to go back and mark certain events as significant in the computer's evolution. These are shown in the following table, and are denoted as generations (we're now in the fourth).

Table: Four Generations of Minicomputers

	MIT WHIRLWIND	DEC PDP-1	DEC PDP-8/1	DEC LSI-11
GENERATION	first (1950)	second (1960)	third (1968)	fourth (1975)
PRICE	?	$120,000	$10,000	$650
PACKAGE (processor and memory)	Building	4 Cabinets	Box	Board
SIZE	50'x50'x20'	8'x2.5'x6'	2'x2'x2'	8.5"x10"x5"
POWER (Watts)	150,000	2,500	250	50
SPEED (Memory accesses/ second)	80,000	200,000	600,000	833,000
TECHNOLOGY	Vacuum Tubes	Single Transistors per package	Integrated Circuit(IC) (many transistors per pkg. forming logic ckt.)	Large Scale IC (1 processor-on-a-chip)

In Fig. 6, a simpler 2-dimensional plot is given showing price versus time for the "named" machine types together with lines of constant performance. The three styles of designs are noted: Minimal cost; Performance/Price optimized designs, subject to the constraint that the machine cost less than a given amount; and finally, the largest machines, that can be built with a given technology at that time (the super). While the mini(mal) type design pervaded for nearly 10 years, and carried the minicomputer name, the semiconductor based, processor-on-a-chip (called a microprocessor) computer (called microcomputers) name identifies a significantly lower priced computer-based products...to displace the lethargy growing around the now constant price minicomputer of the mid-1970's. In this way, more radical thinking permits different customers (i.e., users) to be identified and the price to decrease. The sub-microcomputer is predicated as a complete computer (with both processor and program memory) on a single chip, although it is hardly as radical as the microprocessor which moved users to apply computers based on interconnecting chips (on boards) and interconnecting a small number of boards (as opposed to designing boards to be placed in minicomputer boxed computer configurations). As a given computer becomes more and more powerful, clearly established (via a name), and taking on the characteristics of an earlier successor (e.g., at time, t+2, the mini is as powerful as the maxi at time, t), significant pressure is applied by the various alternative organizations to apply a mini, versus, the higher performance of the current maxi. The cost, performance/cost, and performance improvements of the mini capture the well defined applications which are "discovered" when using the "general" maxi...but are too expensive to apply.

Figure 10 shows how inertia in the various producer-consumer pairings (of Fig. 1) can cause a market to move away from a set of suppliers and users. Here, we assume only two machine types 1 and 2 (each covering a range of prices). With new technology, there are no subsequent truly higher performance implementations, only lesser priced ones. In reality PC pair I goes on to build and apply higher performance machine types 3 and 4 at times t+1 and, t+2, with the attendant danger of not being able to build or utilize the attendant higher performance. Similarly, consumer set II, who may have secondary users of PC pair I, now can become fully independent at time t+1 with their own machines. This phenomenon of migration is clearly visible as users of large, central computation centers, (e.g., a small part of an organization) gets its own minicomputer at time, t+1. Then at time t+2 the individuals of the small organization get their own computers.

Figure 7, another representation of Fig. 5, plots the price versus performance for various times, and for the computer types. Here, another measure (or test) is introduced--namely the notion of economy of scale--so the performance and costs among the species can be compared.

Herb Grosch (1953) suggested that the performance/price relationship between various computers (at a given time):

$$\text{Performance} = \text{constant} \times \text{Price}^2$$

A great deal has been written as to whether this is true for a given set of machines, or whether the relationship is used in pricing, etc. It is clearly desirable that the performance increase more rapidly than the price. This relationship has been tested for various computers, and computer families.

Pricing can be based on the desirability to have performance increase more rapidly on more expensive models. According to the IBM Telex papers, the goal of 360/370 models is to provide a factor of 3 (not 4) in performance each time the price is doubled. The PDP-11 models will be analyzed in these terms in a subsequent section, and on the underlying technologies that would affect the price, performance relationship.

It can be argued, on a fundamental basis, that performance increases as the price squared:

1. Processor cost is negligible (optimistically); memory size and speed can be traded-off equally to give a certain performance (their product). Note, thhis is akin to saying the performance of an automative vehicle is the product of its speed times the number of passengers it carries (or its payload). Such a performance measure is probably quite reasonable, (i.e., passenger-miles-per-hour). Therefore:

$$\text{Performance} = \text{memory-data-rate} \times \text{memory-size}$$

2. In 1977, 4K bits of memory sell for about $25, hence:

$$\text{memory-size (in bits)} = 4K/25 \times \text{price (in \$)}.$$

3. Each 4K memory chip can be accessed at a rate of 2mhz, hence:

$$\text{memory-data-rate} = 2M/25 \times \text{price}.$$

4. Therefore, assuming an arbitrary number of chips can be accessed in parallel with no loss of access time. Therefore:

$$\text{Performance} = (8 \times 10^9/625) \times \text{Price}^2$$

5. Alternatively for various fixed width processors, the performance only increases with memory size since there is not simultaneous access beyond the base level, processor limiting access-rates.

The following table shows various computer implementations. It assumes an architecture that accesses 32 bits of instructions and data for each instruction executed.

Processor Implementation	Memory Data Rates (Mb/s)	Insts/sec(Mips) = "Balanced" Memory-size (Mbytes)	Performance (Mips x Mbytes)
8-bit	16	0.5	0.25
16-bit	32	1	1
16-bit with overlap of 2	64	2	4
32-bit	64	2	4
32-bit with overlap of 2	128	4	16
64-bit	128	4	16
64-bit with overlap of 2	256	8	64
64-bit with overlap of 4	512	16	256

Hence, for a given processor, performance increases only linearly with price as memory is added since the data-rate is fixed. The performance (using Mips x Mbytes) for the set of processors does increase as the square of price provided we assume that a "balanced" computer requires one byte of memory for each instruction/sec executed* since the price is just proportional to the amount of memory.

The design styles of mini(mality) at low end, optimality (in middle) and greatest performance at extreme further greatly suppress and extend the basic access-rate performance beyond the above predication) for the processors.

The following table segments the named computer types into different attributes. Note, with this segmentation, one should be able to "tell the players".

Figures 9 and 10 give DEC computer prices and logic (price) with time. Notice that a constant performance, minimum 4K work PDP-8 has followed a line of diminishing cost, although the average price has remained relatively constant, and occupies a price band at the low end as a function of configuration. The PDP-1, 4, 7, 9 and 15 have tended to follow a constant price curve, which turned out to be of the order of $100,000, although the minimum configuration price of $120K in 1960 declined to $25K in 1970. It is properly a minicomputer, although the average configuration was priced over $50,000 for a long period of time. Figure 4 also shows how the PDP-11 was introduced as a family and then was implemented as micro-, mini- and midi-computer at various times to span a price range of a factor of 500 ($600 to $300,000). The PDP-10 has followed the traditional constant cost curves (at about $0.5 million and increasing) with increasing performance. The recently announced DECsystem 20 is an attempt to reverse this trend and provide lower cost (and performance) computation.

LEVELS OF INTEGRATION

Figure 11 illustrates the levels-of-integration as applied to computer prices. The price depends partly on implementation (and architecture) word-length; so, as the word-length is made shorter, there is some economy particularly at the minimal machine. Note there is not a 4-bit computer shown at the board level, but only as chips. In fact, most hand held calculators are implemented using 4-bit, stored program computers with fixed programs. We see a movement in price versus time that is parallel; for various different scaled machines--which means that all constituent components have the same fractional use. An astute marketing-oriented person might ask, "How, with all the technology can we do something unique to get off the curve?" One answer: "Let's reduce prices by not providing a power supply and mounting hardware. Let the user provide it and mount the computer as needed...in this way, the total cost is reduced. We'll sell at the board level." So we start stripping away items and make a "skeleton machine". Computer Automation introduced this idea in 1972 to get at the problem of the lack of progress in packaging and power technology, and trademarked the name, "Naked Mini".

Figures 9, 10, and 11 show the effects of levels-of-integration on the DEC PDP-11 series. In 1970 DEC introduced the PDP-11/20. The average prices of the various model PDP-11's is given in Fig. 10 with lines of constant performance. A Model

05 was subsequently introduced at .7 x performance and .5 price. Model 40 overlapped the Model 45 in performance, but at about the same price as the Model 20. Hence, one can see that a board and 4,096 words of memory, for the LSI-11 can be obtained for about $600. The boxed version costs?, reflecting negligible improvement in packaging. The price-performance successor to the 11/45 extends to $300,000 maximum, (the 11/70). Thus, various implementations of the architecture span a price range in the order of 500 to 1.

Note that the lowest level of technology, semiconductor chips has the greatest price decline. Boards have a lesser price decline because they are a mix of: chips, printed circuit boards, labor (and capital equipment) to insert the components), and testing labor (and capital equipment). At the board level there have been negligible gains in fabrication and printed circuit board technology, and increased labor costs yield an over-all cost increase.

At the box level-of-integration, power supplies and metal or plastic boxes increase due to labor intensive nature. The only gains are by-products of using less power and less space. Finally as boxes are integrated (by people), and applied (by custom, people intensive programmers) the prices begin to be constant (hopefully not increasing).

In about 1971, Intel, North American Rockwell and other semiconductor companies had gone through the marketing exercise of trying to decide what to do with the higher semiconductor densities. They had been in the semiconductor business, and had assimilated logic design. They were frustrated because they could say to their customers, "We've got a silicon chip, and can put on the order 1,000 gates on a chip to give you some function. What do you want that chip to do?" Their customers could only reply "We don't know what you can do with 1,000 gates on a chip (besides memory), since adders don't take that amount of space." Their logic designers had integrated adders and adders are kind of trivial anyway, although academicians still write text books about adders and the technical community generally devotes too much time and journal space to them. But the semiconductor companies did not know about all the exotic adders (as most of the engineers (including me) don't read that much); even though they could have been building 1,000 gate adders, to add faster. Various users asked "Why not make something truly universal. Would this be a finite state machine or a sequential machine?" They then discovered what almost everybody has discovered about sequential machines. First, people cannot do any interesting or useful design based on this approach. One can minimize things in the order of 10 states but since most useful designs are much larger, it's useless. Sequential machine design was designed by the academic community to write papers and texts and to teach. Second, even though there's a theory it's generally neglected (due to inapplicability), but there are many errors that people make due to the combinatorial nature of the problem. They then discovered that the best finite state machine that one can make is just a simple computer because it provides the finite state machine plus the useful functions that are not covered by the theory. Finally, as it is used, many of the pitfalls of finite state machine design are avoided because one is forced to think of the states sequentially! Thus, the power of parallelism is double-edged, since it can't be applied correctly.

So the most interesting finite state machine, as far as I am concerned, is a general purpose, stored program computer. The semiconductor industry discovered this and said, "We'll put a processor on a chip. Never mind your logic designers, we'll make processors, at low cost to be applied universally." Furthermore programming is understood, can easily be re-invented as it was for large, and minicomputers; people enjoy doing it and nearly all of us can learn to do it better. And the semiconductor industry has provided the computer at a very low cost. Processors-on-a-chip have followed a very steep price decline of up to 50% price reduction/year. You can currently get a processor for anywhere between $5-10. So, if you need a processor, the price is generally not a barrier. It is just a small matter of programming to do something useful and we all know that this only costs $1-$100 per instruction.

Bob Noyce, head of Intel, presented Fig. 12 in October 1975. It illustrates what is happening in the semiconductor industry; and I have added to it slightly showing the technology that DEC has assimilated with time. It shows the breadth semiconductor manufacturers have in technology, starting from semiconductor device level, through the various levels-of-integration continuing into end user applications.

It will be interesting to speculate how rapidly and how well the semiconductor industry assimilates computers. As suppliers they have been superb, providing much impetus to the computer's growth. However, other industries they have tried to absorb have reacted agressively to prevent their entry (e.g., watches, cash registers, special terminals, super computers, calculators). Greed may not be a very good motive--more idealistically, one would expect to base an industry on constant return and contributions in that discipline; on the other hand, something so universal and fundamental as the computer is not a monopoly...nor can the existing industry expand rapidly enough to design, manufacture and apply completely.

Let's return to Fig. 11. There have obviously been machines at the top of the graph, earlier in time and they were following the downward trend too, and crossed the magic 50K boundary. Does something happen when you cross that $50,000 boundary? Is it like the sound barrier? Machines that were above that line as late as 1960 must now have fallen way below it. So where do you get the software ideas for current machines below the line? Obviously, they come from the earlier machines, above the line. So if one wants to know what is going to be in minicomputers in the future, there is really no secret; one can find out by looking at the larger earlier midi's. Similarly the microcomputer characteristics are derived from those of today's minicomputers. For example, the cache scheme originated in the early 1960's was applied in the 360 Model 85 maxi ($2.5M) in 1968, and subsequently appeared in the PDP-11/70 ($100K) in 1974.

Figure 13 assigns ordinal numbers to the levels-of-integration. The assignment to a number to what might appear to be quite fuzzy, is my attempt to be convinced that we can structure this knowledge in precisely this fashion. Note that this numerical assignment is quite possibly time dependent. The numbers correspond to the structure of mini (and larger) computers. Figure 13 also shows how a group of the levels are compressed, since the complete system, such as a hand-held calculator, only consists of one chip, board, keyboard and lights, power (perhaps a battery), package, operating system, and machine language application program.

The notion of the levels-of-integration is that elements at one level, are combined into the next highest level in a lattice or network fashion. Each level can, of course, be nested itself. A level also denotes that there is a single discipline or set of interacting disciplines which determine the function, structure (and cost), and performance of the constituent of the level.

Figure 13 associates the physical levels-of-integration with: the corresponding levels of the abstract machine (and its language); and with the various design disciplines at each level. One can start from the topmost level and go down below the chips and on to the atomic level. One could argue whether the world is analog or digital at the atomic level, which is roughly level 0. That is why I started at the top; and stopped at 2. A physicist could go down half a dozen levels beneath that. From our point of view, we start with finite state machine components; that is, data operators, AND gates, OR gates, even some adders; and flip flops to hold the state. These are implemented as interconnections on an area of silicon. The behavior is expressed as an electrical i/o transfer function, and the discipline is both that of the electrical circuit engineer, and semiconductor device engineer.

From these we build finite state machines and express their behavior as state diagrams and flow charts. The discipline is that of the logic design engineer.

From this viewpoint a stored program computer, a microprogrammed machine, language is formed. The design discipline is essentially that of programming with the emphasis on writing interpreters, and on managing the small amount of parallelism inherent (and necessary) in these designs. The resultant microprogrammed with its interpreter program is the machine language that we all generally know and love, as expressed in the reference manual of the machine.

Whereas the lower levels implement the machine and are "implementations", the ISP for Instruction-Set Processor, was originally synonomous with the notion of architecture. While architecture has been extended, it was originally the machine as seen by a program (or programmer) and distinct from any physical implementations.

Using the hardware (architecture) as a base, we typically extend it with an operating system. There are now several levels of the operating system machine. A kernel machine, which deals with the management and diagnosis of hardware components (e.g., disks, terminals), providing synchronizing capabilities so that multiple processes can operate quasi-concurrently. Then one starts building policy elements in the operating system, such as file systems, resource management facilities accounting, and basic utilities. At this point, looking through the operating system, one sees a much different machine than that provided by the basic hardware. In fact, it is hardly recognizable as the machine of the symbolic assembler level. It is, but with much more capable i/o and the ability to be shared by many programs.

We say that people need all these facilities so that they can implement a standard language: e.g., BASIC, FORTRAN, ALGOL or

COBOL or any of the other hundred standard languages and their dialects (all language dialects are about the same, but just different enough to prevent the transportation of programs between them). At this level, a user observes a common language machine.

Often an additional special language is used because an application can't use the standard language per se and it's necessary to get into the domain of the problem. Finally, using a special language, various application subprograms are written to enable a particular application to be written. One then may build an application and finally, if all is well, an applications use will drop out, provided there has been the right set of primitives.

In 1976 Jim Bell (no relation) and I were invited to edit a book from an IFIPS conference (Bell and Bell, 1976) on minicomputer software. As the papers arrived, we wondered whether the conference should be held because many described techniques had already been applied to larger machines...although usefulness is generally not a prerequisite for most conferences. Surprisingly, the conference was useful or rather we were able to rationalize that it was. The outcome showed that the difference with minicomputers was that the machines were in significantly more dedicated, particularly in the operating system area, in that one did not provide the full generality possible and did not have the overhead associated with that generality. Hence, minis were leaner, more responsive, and specialized to use. When people designed minicomputers, they sometimes got carried away too much in terms of cost per bit; the emphasis in general with the mini was in fact on performance and on size (perhaps to the extreme). The mini had also contributed significantly in education and understanding about operating systems, simply because people could afford to experiment.

The issues of the conference tended to be programming languages, productivity, portability and also user microprogrammability for extending architecture. The ideas overall were:

1. A minicomputer is not just a scaled down large computer.

2. The limited size of minicomputers can be an asset, because of the discipline.

3. One of the key barriers to minicomputer use is psychological; one must face it without the massive support organization generic to large machines.

4. Standardized (compatible) languages are more important than better languages.

5. Portability of programmers is as vital as portability of programs.

6. Minicomputers are for those applications not feasible with maxicomputers where cost, response time (performance), human or machine interface, ultra-reliability, are important.

7. To minicomputer users, old technical papers are more valuable than newer ones.

8. Minicomptuer software is shaped primarily by applications, yet forces most programmers to be systems programmers.

9. Differences: a. Dedicatedness (e.g., operating system to a task)

b. Memory size is a constraint (although cost/bit is cheaper and memory size is increasing).

10. General issues of importance: a. Programming languages (structured-type),

b. Productivity,

c. Portability,

d. User microprogrammability

PRODUCER/CONSUMER PAIRS BETWEEN THE LEVELS

Since each level is a separate type of physical structure with it's own set of design disciplines, a significant problem is the interconnection of the levels in terms of quasi-independent design activities. The levels arise in large part from the need to have well defined interfaces so that users can build (and rebuild) from common materials. That is, consider these common levels:

1. Applications interface

2. Cobol - transportability among machines and people

3. OS/360 - transportability of programs for different machine implementations

4. PDP-11 ISP - transportability of operating systems across machine implementations and time

5. PDP-11 Unibus - interface common peripherals across all models

6. Logic signal level - common voltage levels and logic design convention

The levels appear to operate as interconnected producer/consumer pairs. A lower level provides an interface or langauge which is consumed (used) at the next highest levels and the producer level is the consumer for its next lowest level machine. So one design determines another and there are a set of boundary conditions that must be met at each level.

In marketing parlance the producer-consumer pairing is also biassed either on the basis of a technology-push or marketing-pull, depending on whether the next lower level producer (technology-push-input) or the next higher level consumer (market-pull-output) dominate mostly to influence the product. It should be clear that each level is different, although the hardware appears to be dominated by technology and the software (function) by the market...with the understanding that various language (market) requirements rapidly feed down to affect the hardware (given that technology will support the need).

Whether the consumer decides the design of the producer or vice versa depends on the way one works and thinks. In the programming discipline, "top-down" design is "in". Therefore, from a "top down" viewpoint and wondering why a machine was designed a certain way, we would say, "Obviously, we knew that we were going to write a certain type, payroll package and that's what determined the AND gate circuits for the machine." This is, of course, utter nonsense because there are very many different levels, different pairs, and it is almost impossible for people to talk to one another even across a pair of levels. However, if we were following this purely top-down structure, one would start at the payroll package, or the scientific package, and work down to finally determine the circuits.

Fortunately, there is also bottom-up programming. Hardware designers are always accused of starting with the circuits and pushing up so that eventually, with luck, somebody may be able to write a payroll package on the final machine. Then there is the "start in the middle and work out" model.

I do not believe we have a good enough model of the whole notion of design to say that any of these approaches is what we actually use. Where do you start in this process? I tend to think of the overall design problem as being a "boundary-value-like" problem. We start everywhere at once and negotiate like hell at each boundary until there is convergence. All of the design activities operate concurrently. The more interesting (better?) designs stem from having the best coupling between the levels, and then having the best performance at each level. A single individual with tremendous breadth is then preferred to do the complete design, or at least define the interfaces among the levels. The innovations in computer structures appear to be the movement of an implementation level across a boundary, or the interesting interaction of many design disciplines (e.g., logic, cabling, and an electromechanical subassembly) within a boundary.

Some interesting examples of trade-offs across levels are:

CRAY-1: Vector operations - (transfer software->hardware)

PDP-11: Stacks - (transfer software->hardware)

PDP-8: Minicomputer (transfer all hardware to software to minimize hardware cost)

PDP-11: Interrupt (transfer operating system software to hardware for scheduling)

CDC 6600: Cooling (transfer heat to save time and increase performance)

Intel 8008: (early processor-on-a-chip trades off programming for logic for user)

Similarly poor design often comes from lack of precise definitions between the interfaces such that lower level implementations can be changed subsequently without affecting the next highest level. Parnas has described this design principle as Information Hiding.

Rather than point out specific poor designs, the following interfaces have been classically ignored, hence there has been an inability to build on subsequent work:

1. Bus - method of interconnecting computer component.

2. Basic ISP - provides a single (not multiple) interface so that multiple models can be implemented over time and a performance range.

3. Operating System - User/Language Interface - provides the ability to modify an operating system independent of the user program.

4. Language run time interface - provides common base for multiple languages to be used to express a single program.

5. Subprogram interfaces - each subprogram can be changed, independent of one another.

DEC'S PRODUCTS VERSUS LEVELS-OF-INTEGRATION - THE NETWORK

Figure 14 shows various constituent components that form DEC's products. Here, it's interesting to note that while we presented the model purely as a hierarchy (and implicit tree structure), it is actually a network. A component at a given level is formed from constituent parts from lower levels. Each lower level part is often used in many higher level components. And similarly each formed component is used by the several systems (components) at the next highest level. Parts may be marketed at each level, or they can just be made for internal use.

Note that there is an attempt to structure the components on the basis of price.

ONION-SKIN VS. LEVELS-OF-INTEGRATION MODEL

A computer system can be described as a structured hierarchy consisting of layers, in a fashion resembling an onion...hence the "onion-skin" model. The layers correspond to the way various users may view the system's behavior (see Fig. 15). The layers correspond to the levels-of-integration previously discussed.

The inner-most layer (at the core), is a set of hardware modules which are combined together to form the hardware base (layer). With most smaller computers, a user can take the hardware modules, and build a hardware base using a set of interconnection rules.

The hardware base is then combined with two system software layers: the operating system, and a language (usually scientific- or commercially-oriented) to form a system of interest to a Direct Language User. Anyone who solves problems in terms of programming languages (eg. APL, BASIC, COBOL, DIBOL, Fortran, RPG, etc.) may use this system as a base to program a particular application. There is no need to understand the operating system or the languages not being used (i.e. the system documentation is oriented around the principle of hiding information unless there is a need to know).

In order to assist in the solution of problems of interest to the final Applications User a set of applications modules (libraries) are available for many commercial- and scientific-oriented disciplines. These modules permit the Applications Designer to interconnect them (sometimes with the help of programming languages) in a fashion to finally solve applications-oriented problems.

At the outer most layer, we finally see the Applications User, who, we assume, has no interest in information processing other than to get a particular problem solved. There are various applications systems, eg.

Word Processing for the Application Users.

The model is also useful in helping a particular user structure the information on the basis of his "needing to know". As one descends into (or across) a level of the hierarchy to gain performance or, to add functionality, increasing amounts of detailed knowledge about the system are accumulated. One should also note that using fundamentally different outer layers for a common inner set of layers creates quite different machines, hence a set of onions.
(edit/print date 11/22/77)

TECHNOLOGY PROGRESS, LEARNING CURVES AND ELASTIC DEMAND

The discussion of technology progress has been in terms of exponentially decreasing prices and/or exponentially increasing performance. Thus, a metrics of technology, t(t) at some time, t, is classically just:

$$T(t) = Ke^{ct}$$

This can be converted to a yearly improvement rate, r, by changing the base of the exponential to:

$$T(t) = T \;\; x \; r^{t-t}$$

where T = the base technology at t
r = yearly increase (or decrease) in the technology metric

This is the same form we have used for declining (or increasing) cost from base c

$C = c \;\; x \; r^{t-t}$

The questions that should arise as we observe all the previous graphs is:

1. Under what conditions does cost decrease exponentially?

2. Under what conditions does technology imprive exponentially?

Clearly there are manufactured goods that neither improve nor decrease in price exponentially, although they presumably should. The notion of price decline is completely tied to learning curves.

Learning curves don't appear to be understood beyond intention, and are (empirical) observations that the amount of human energy, En, required to produce the n^{th} item is:

$$En = K.n^d$$

where K and d are "learning constants". Thus, by producing more items, the repetitive nature of a task causes learning and hence the time and perhaps cost to produce an item decreases with the number produced and not with the calendar time an object is produced. Fusfeld furthermore conjectures that the technology of the $:^{th}$ unit produced also improves exponentially with the number produced just as in the case of the learning curves. Thus, using the technology measure:

$$Ti = ai^b$$

he found the following technology progress constants:

Item	Total Measure, Ti change	Quantity produced(i)	Technology progress(b)	Change observed in study
light bulbs	lumens/bulb 80	10^{10}	.04;.19	33
automobiles	vehicle h.p. 6;13	$3x10^{7}$;10^{8}	.11;.74	10
titanium	p.s.i./$/16 350	3 x 10^{8}	.3;1;1.04	10
aircraft	max.speed 56	2 x 10^{5}	.33-1.2	6
turbojet engines	fuel consumed, weight 2.9 x 10^{4}	1.6 x 10^{4}	1.06	2
computers	mem.size x 3.5 x 10^{12} rate	10^{5}	2.51	10^{9}

Here we note that computer technology has evolved substantially more than any other technology. This in part because there are so many materials to store, transmit and process information nearly all of which are electronic based. In the above technologies, most are mecahnically oriented with the physical associated limits. In essence we are comparing systems constrained by Newton's Laws with those determined by Maxwell's Equations.

Fusfeld also showed that provided the number of items produced increases exponentially (with time):

$$i = e^{c/b \times t}$$

Then calendar time and units produced can be used interchangeably.

Therefore, in our study of computer systems since we have exponential growth, calendar time can be used instead of units. Furthermore, calendar time is then simply an easier and more accurate method to measure learning curves.

The question of why the cost declines exponentially can be answered by using Fusfeld's observation that it is because of learning curves and the exponential increase in quantity produced. Furthermore, this exponential increase raises a third question;

3. Why is the demand exponential?

Very simply, the demand or quantity, q, sold per unit time completely elastic, or exponential, according to the expression:

$$q = k/price$$

This creates a positive feedback market system whereby decreasing prices increase demand exponentially causing decreased costs (through learning) which support the decreasing prices.

There has been no attempt to answer question 2 of why technology improves exponentially nor is the answer for why cost declines exponentially at all satisfactory. Simple production learning does not account for the rapid technology changes in integrated circuit for example where totally different production processes have been evolved to support the greater technology. It appears best to simply observe that the three situations <u>have</u> <u>been</u> true, and can be extrapolated to hold over the next few years.

Technology historians and futurists have made a number of studies and observations about technology progress:

1. Quantity produced is simply a good dummy variable to measure improvement. (With exponential increasing sales, we can use time as the dummy variable.)

2. Technical problem solving is correlated with business activity. Inventors tend to be stimulated by sales and slacken efforts when sales are low. (This is a counter-initiative observation.

3. Major innovations come from use (sales). Indeed with computing, most of the system development is done by the user to solve individual problems. This is opposed to innovation arising from a technical possibility for which use is subsequently discovered. For example, in the case of semiconductor technology, the computer designer (user) is responsible for many of the design innovation.

4. Production alone does not stimulate innovation. A lesser number of inventions are stimulated by production needs. Of these, the same user-supplier relationship is the best framework. The users of equipment (the producer for the end

product) stimulate the production equipment suppliers.

The gains in packaging (i.e., integrated circuits, printed circuit boards, backplanes, and cables) have been driven by production, versus product functional needs. Testing technology of all types has been motivated solely for production needs.

The cost of computing is the sum of costs which correspond to the various levels of integration we described in the first section. (see Fig.) plus the operational costs (see Fig.). In actual practice, each layer, or additional level-of-integration is often looked at as overhead. Using standard accounting practice, the basic hardware cost, at the inner layer, is then multiplied by an overhead factor at each outer level. While this may in principle work operationally, for a stable set of technologies it is hard to condone and we will describe the constituent technologies and resulting structures at the next level together with operational cost models. An overhead-based model will not adequately allow for rapidly evolving technologies or the elimination of levels, for example. By examining each part, we can then make observations about the use and substitution of technology. More importantly, we can draw conclusions about how structures are likely to evolve.

Table Costs gives the various technologies and other cost components at each level-of-integration. Only the major components will be discussed as marked. Sub-component technologies such as cables will be included in systems at the next highest level. Figure Memtax shows a taxonomy of the various technologies used for memory on logic technology.

Semiconductor technology is singled out as the main determinant of a computer's cost, performance, reliability and memory size. This technology is clearly at the lowest level of the structure. Magnetic storage technology of secondary importance will be briefly discussed and contrast with semiconductors, together with disks and tapes, will be discussed at the box (computer system component) level. We would also expect these to be of more interest to most readers.

<u>Technology Substitution</u>

Each constituent technology evolves at its own rate, hence the cost and performance of a system is roughly the additive and multiplication functions, respectively, of the parts. Usually when one component begins to dominate (e.g., packaging), then pressure occurs to more rapidly change and improve the technology to avoid the cost or performance bottleneck. Sometimes a slowly evolving technology is just eliminated as a substitute is found.

These substitutions have been ovserved for semiconductors:

1. Semiconductor memories are used in place of core memories. Since the latter has evolved more slowly in terms of price decline, semiconductors are now used to the exclusion of cores. (This has not occurred where information must be retained in the memory during periods of time without power.)

2. Read-only semiconductor memories are substituted for semiconductor logic elements. Using the technique of microprogramming, table (logic function) look up, and sequented (vs parallel) processing, this substitution is quite natural. In fact, it has been estimated that a single logic function of 1-3 variables is equivalent to 5-7 bits of a random access memory.

At a given time the slowly improving (or increasing) costs, like the packaging and power, may become a significant fraction of the total cost. Costs are additive and hance exponential improvements have disproportionate effects causing pressure for structural change.

For instance, although the PDP-8 is normally considered to be the first minicomputer, it post dates the CDC 160 (1960) and DEC's PDP-5 (1963). However, the PDP-8 was unique in its use of technology to reduce cost by:

1. Use of a separated small box for the processor, memory and many options. It eliminated the full frame cabinets used by other systems.

2. Using automatic wire wrap technology to reduce printed circuit board interconnection cost.

3. Machine insertion of components for lower cost printed circuit boards.

4. Use of the Teletype ASR33 (also used on PDP-5) to have a combined printer, keyboard, and paper tape i/o device (for program loading). It eliminated the paper tape reader and

punch.

Cost, Performance and Size

Too often we simplify the understanding of technology to have only cost and the dependent performance parameter. This simplification omits the most significant parameter, calendar time, particularly for a rapidly evolving technology. In a similar way, we have only briefly considered whether there is any associated economy of scale when considering the performance (utility) of a given set of devices. That is, do larger units perform significantly better than a set of small units when taken either independently or as a collection? Therefore, a more correct assessment of an economy of scale law for performance, assuming it holds, would be:

$$\text{performance} = k \times \text{cost}^e \times r^t$$

where
k = base case performance
e = economy of scale coefficient
r = rate of improvement of technology
t = calendar time

For many of the technologies in which we're interested, a second dependent utility parameter, size, is important because it is a useful alternative measure of performance. Occasionally size can be used as a performance tradeoff, but often the two must be taken as independent resources. For example, a certain memory size would permit a certain number of accesses. For some applications, we would ask whether the size were adequate and for other applications we ask whether there is adequate time to access the data. Thus the systems performance in such an example is bottlenecked by or the minimum of one of two resources. That is:

$$\text{system performance} = k \times \min(\text{memory-size}, \text{memory performance})$$

Figure Perfsize shows the various options of the amount of economy of scale:

1. Economy of scale holds. A particular object can be implemented at any price, and the performance varies exponentially with price.

$$\text{performance} = k \times \text{price}^e \quad e>1$$

2. Linear price performance relationship.
performance = k x price

3. Constant performance, no matter how much is spent.
performance = k

4. & 5. Only a particular device has been implemented. The performance (or size) is a linear sum of such devices.
performance = n x (k x price)

A memory system might permit an encoding to be used such that memory accesses could be traded for memory size. This condition is shown in Fig. Tradeoff for 3 points. Here, the effective memory size can be increased or reduced by either using memory system accesses for computation or for storing precomputed values. This tradeoff permits the operating region for the system to be greatly extended to either include the memory (by giving up 1/2 of the processor or 2.5 times the amount of processing/by giving up 1/2 the memory).

<u>Semiconductors</u>

Semiconductors will be described in terms of: the attributes that are relevant for computers; a model of how these attributes have evolved and are likely to evolve; and their application. Besides the logic for implementing computer componenets, semiconductors are also used as ordinary, random access memory. They replace and substitute for other memory technologies (including alternative semiconductor memories).

A single transistor circuit performing a primitive logic function within an integrated circuit (IC) is perhaps the smallest man-made object. Alone, such a circuit is intrinsically trivial; but the fabrication process for a set of structures to form a complete integrated circuit is complex. To the IC user there are only a few interesting parameters:

1. The function an individual circuit performs together with the aggregate function of the set of circuits.

2. The number of circuits per IC as a measure of the process capability.

3. Cost.

4. The performance of each circuit (as measured by the time it takes to perform its function) - semiconductor circuit technology - power consumption.

5. The number of pins (interconnections) to communicate outside the IC.

6. The reliability which is a function of technology, density, and number of pins and the operating temperature.

Figure ICtree shows a relationship of the various digital IC's that have been implemented. The main discrimination is by the regularity of structure and the amount of memory on the chip. With large scale integrated circuits there is a necessity to implement only regular structures. There are only a few useful, regular functions that don't have memory (e.g., arithmetic units, fast multipliers, multiplexors). The 2-level AND-OR or OR-AND structure, the PLA, is especially useful and is often applied in place of read-only memories which also can implement logic functions of several variables. Circuits with only memory will also be described in a subsequent section. The remainder of the circuits (at the lower part of the figure indicating increased number of circuits) are mostly computer related. At the extreme right hand, a complete processor occupies a single LSI circuit. Peripherals which are often as complex as the processor are also implemented on a single chip. Here, the tendency is to have both the processor and memory--a full computer-on-a-chip.

Although we consider the circuit function to be an attribute that's separated from others, it is clearly dependent on the number of circuits which can be placed on a chip. Thus, the single most important parameter is the number of circuits/chip. From this measure, we can predict the functions likely to be implemented just follow the tree. It should be noted that the nodes on the tree are stable, and increases in density simply improve a node. As density increases sufficiently, a new node can be reached. For example, the processor-on-a-chip started out as a 4-bit processor (or rather as 2 chips for a single processor) and then progressed to be 8-bit and 16-bit size. Similar effects are observed with the arithmetic logic unit, memories, etc.

The number of circuits per IC is the measure of density as seen by a user. This metric is the product of the circuit area and the number of circuits per unit area. Both these measures improve with time, reflecting process control. Semiconductor device (individual circuit) performance is just correlated with the implementation technology. The performance of circuit is also proportional to the power applied to operate at it. The speed-power product metric for a technology time is more appropriately a more refined measure.

The number of pins that communicate outside the circuit indicate the packaging technology level. Low and medium scale IC's often need more pins than LSI since the latter is capable of carrying out a complete function independently.
00 BURT DECGRAM ACCEPTED S 1155 O 05 14-FEB-80 08:23:00

****
* d i g i t a l *
****

TO: DON FROST @TKYD DATE: THU 14 FEB 1980
8:21 AM EST

FROM: GORDON BELL
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1
A51

SUBJECT: EUROPEAN ENGINEERING LOCATION IN JAPAN

I AM DELIGHTED THAT WE ARE GOING TO HAVE A STRONG PRESENCE IN JAPAN THROUGH HENRY'S PERSON IN PURCHASING. FURTHERMORE, THE SAVIERS STORAGE CONTINGENT TO JAPAN SEEMS LONG OVERDUE.

I AM TO ASK BOTH GRANT AND HENRY TO GET TOGETHER AND FIGURE OUT A REALLY GOOD LINK SO THAT WE CAN TIE INTO THE MANAGEMENT IN THE OFFICE THERE. I TALKED WITH DON FROST ABOUT THIS AND HE'S AGREED FOR THE NEED TO CO-ORDINATE.

I WOULD LIKE TO HAVE MR. WATANABE, WHO HEADS CSS THERE, TO BE THE PERSON TO WHOM OUR PURCHASING/ENGINEERING PERSON REPORTS TO. AND IF WE DECIDE TO DO SOME MORE WORK THERE IN TERMS OF BUYING OR ENGINEERING, HE WOULD BE THE LINE. IS THIS WHAT WE'VE BEEN THINKING ABOUT?

WOULD IT BE TOO COMPLEX FOR WATANABE TO LINK TO US, TO GIA IN JAPAN, AND TO CSS HERE?

WE HAVE TO TIE TOGETHER, AND WE ALL THINK IT IS MORE SENSIBLE TO INVESTIGATE THE ENGINEERING POSSIBILITIES IN JAPAN.

CAN YOU START BY WORKING TO SET UP THIS LINK AND DECIDE WHAT IT IS GOING TO BE FOR SURE?

THIS MESSAGE ALSO WENT EMS TO: DICK CLAYTON, GERRY BUTLER, GRANT
SAVIERS, AND HENRY CROUSE

GB1.S2.28
00 BURT DECGRAM ACCEPTED S 25741 O 41 28-MAR-81 21:14:42

****
* d i g i t a l *
****

TO: BERNIE LACROUTE
DENNIS O'CONNOR
LARRY PORTNER
BOB SAVELL

DATE: SAT 28 MAR 1981 21:10 EST
FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: EUROPEAN ENGINEERING IN AYR

Dennis tells me that there are 3 engineers in the ayr plant that are both good with hardware and software. I want to get started with engineering there, by getting them or someone off working on some of our comm. designs.

This is the approach that we used in colorado for disks, namely a small group (1 person initially, Fred Hertrich) was in place and designing the rl01. The plant was located and product was moved so that the plant startup was isolated to making an existing set of products. As the design progressed, the startup engineers were added by moving people from here to help and to do more designs.

In this case, we can give them some work, say a
modem or a board or even a system task of some sort, say
the testers. The design would be done there and integrated
into the factory.

The issue about where the budget would come from is clear.

Let's cap the engineering groups here, and add the additional
folks there.

No way should we get out of an area here until we
have some work going there aand some designers
who have proven themselves.   Similarly, Dennis O'Connor
is sponsoring some work at U of Edinburg to help in ai.

What is the problem of starting to get this going?

GB2.S5.30
00 BURT DECGRAM ACCEPTED S 3952 O 366 19-FEB-81 10:45:29

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION   DATE: WED 18 FEB 1981
21:17 EST
FROM: GORDON BELL
cc: ENG STAFF: DEPT: ENG STAFF
    LARRY PORTNER   EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: SCOTLAND, FRANCE AND GERMANY FOR ENGINEERING?

Today we discussed the European Mfg. plan at OC as part of
the
Mfg. plan. Paul Newman presented the mfg./European
priorities:
France, Germany, and UK (Scotland).

France
This is the first time that I got any feeling that manufacturing
would reconsider France.

Remember, I unilaterally squelched an engineering group in Annency because of proximity to a mfg. plant. Annency is about
as far from mfg. as you can get.

Mfg. is saying they would now locate in France, NOT Annency though.
Frankly, I think it would make sense to have a core group of engineers in a french plant that is making terminals. We should
give them enough resources to plan a worldwide product. My reason for France: They are spending much on their Telemechanique
Program and they don't have the facilities to fully utilize the
ideas... we can really build off their architecture; they are working on low cost terminals; they have some technology in the low cost area which we need; and we can build off their modem
and communications understanding (if it comes). The main function of the plant would be terminals and small systems for europe. If they are able to propose a really hot product,
then we get them to build it for the world. There would be product support engineers in the plant.

Edinburg
Looks good to me. Let's go ahead and put some communications hardware there to complement the English software group. Also,
Edinburgh has a very strong AI group, they are one of the best in CAD and they use our equipment. Also, there is comm. expertise there (HP has a good group building worldwide comm test equipment).

Germany
Up to Bob and Grant. If we go ahead with the expensive

Munich
area, we could probably get good people. Siemens is there and they would probably like to work if we got them a good product area. Can we afford it though? I don't see that much technology except at a components or possibly basic communications link and switch level. Right now, I don't see engineering there.

Frankly, I'm ambivalent. Japan clearly has the best technology in all these areas, but our market is in Europe and we have to have engineers there to maintain the plants and do the customization.

What you think?
John, I trust you and Jim and Paul will be catalysts here?

"TO" DISTRIBUTION:

BILL DEMMER	DICK ESTEN	SI LYLE
PAUL NEUMAN	STAN PEARSON	BILL PICOTT
BOB PUFFER	JOHN ROSE	GRANT
SAVIERS		
JIM WADE		

ATTACHED: MEMO;27

****
* d i g i t a l *
****

TO: GORDON BELL   DATE: TUE 17 FEB 1981
11:31 EST
    BILL DEMMER   FROM: EDWARD A. SCHWARTZ
cc: DAVID LAWRENCE @AYRB   DEPT: LAW
    PAUL NEUMAN   EXT: 223-5500
    JIM WADE   LOC/MAIL STOP: MS/F17

SUBJECT: SCOTTISH FACILITY

I have heard that Larry is considering putting a small R&D group near Edinburgh. I think that is great, but I believe

that
we must coordinate such an action.

We are seen as one company is Scotland and are expected to act
that way. You may know that European manufacturing has been exploring the possiblity of a second plant in Scotland in the next few years. Ground work has already been laid for this possiblity.

If you are serious about this possible venture that you or someone
on your staff speak to me before they start looking for land or
talking to people in the Scottish Government.

GB2.S4.29

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+---------------------------+                            GB0003/29
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Subject: **Thoughts on European Engineering**

To: Jim Bell, ML3-2/E41
Bill Demmer, TW/D19
Justin Kelleher, ML12-3/A62
Andy Knowles, ML10-2/A52
John Meyer, ML12-1/A11
Jean-Claude Peterschmidt, GE
Larry Portner, ML12-1/T32
Geoff Shingles, GE
Jim Wade, RA
M/C

Date: May 29, 1979
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

Follow-Up: 6/15/79

I've just had an interesting time in Germany talking with the several senior sales support salespeople and they made the following points:

1. Junior salesmen sell standard products; senior salesmen sell the company and more complex, occasionally custom systems; sales support and senior management sell ideas. They would like much closer coupling to the engineer's doing the products so as to give input and occasionally for help and to be able to discuss our general direction. Now they have no communication.

2. These sales support persons in Europe have been successful salespersons and they are interested in the technical details of computer systems. They are attached to a geography for a long time and they have knowledge that lasts over several computer generations. They can be utilized, but are frustrated due to lack of coupling to where we are going and they need in depth information.

3. P/L's technical support is really poor because these are half-way jobs between marketing and sales and the people only stay in them for a few months.

4. How can these people at the District Sales Support level couple into European Engineering?

As a separate issue, getting software and other (maybe advanced development-type) engineers from ICL would seem worthwhile - particularly with the recent changes in management there.

GB:swh

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Jim Bell ML3-2/E41 Bill Demmer TW/D19
Win Hindle ML10-2/A53 Ted Johnson PK3-
2/A55
Justin Kelleher ML12-3/A62 Dave Knoll ML1-
4/P69
Andy Knowles ML10-2/A52 John Leng MR1-
1/A65
Bill Long ML10-2/A57 Julius Marcus MK1-
2/C37
John Meyer ML12-1/A11 Ken Olsen ML10-
2/A50
Stan Olsen MK1-2/C36 Jean-Claude
Peterschmidt GE
Larry Portner ML12-1/T32 Jack Shields PK3-
2/A58
Geoff Shingles GE Bill Thompson PK3-
2/C12
Jim Wade RA

June 8, 1979

Frank Berger
Central European Region Marketing Manager
Digital Equipment GmbH
Frankenallee 13
D-1000 Berlin 19
WEST GERMANY

Dear Frank:

Total airline fare for my trip to Berlin was $348.00 (one way).

The talk at PSI was the reason the trip took place, but the balance of the time was business and pleasure.

Therefore, the only expense to be billed would be the above airline fare to Berlin.

Sincerely,

Gordon Bell
Vice President, Engineering

GB:swh
GB0003/49

ENCORE COMPUTER - EMPLOYEE WEEKLY EXPENSE REPORT

For Week Ending: JULY 30, 1983

EMPLOYEE NAME:	Gordon Bell
Temporary Advance:	0
ADDRESS:	Page Farm Road
Amount this Report:	929.50
CITY, STATE, ZIP:	Lincoln, MA 01773
Balance due Encore	0
Balance due Employee	929.50

DATES		Sun	Mon
		Tue	Wed
		Thu	Fri
		Sat	TOTAL
	Month/Day		
		7/26	7/27
		7/28	

Travel From
Lincoln San Jose
LA
To
San Jose LA
Lincoln

Auto Miles Traveled 0 0
25 0 25
0 0 50
Auto Mileage Allowance @ $ /mile $ 0 $ 0
$ 5.00$ 0 $
5.00 $ 0 $ 0
$ 10.00

Car Rentals 0 0
0 0 0
0 0 0.00

Parking/Tolls 0 0
0 0 0
0 0 0.00

Air/Rail/Bus/Fare 0 0
737.00 0 0
0 0 737.00

Hotel 0 0
88.00 0 0
0 0 88.00

Tips 0 0
0 0 0
0 0 0.00

Meals & Tips Breakfast 0 0

0	0	0
0	0	0.00
Lunch	0	0
0	0	0
0	0	0.00
Dinner	0	0
0	0	0
0	0	0.00
Taxi, etc.	0	0
0	0	0
0	0	0.00
Telephone	0	0
.50	0	0
0	0	0.50
Bus, Conferences & Entertainment	0	0
0	0	94.00
0	0	94.00
*See second sheet		
Miscellaneous	0	0
0	0	0
0	0	0.00
**See second sheet		

DAILY TOTALS		0	0
	830.5	0	99
	0	0	929.5

Business Travel Purpose (Explain briefly the purpose of travel): visit several companies as possible investment.

EXPENSE DISTRIBUTION

Submitted by:___________/____/1983

Dept. No. ______________|Exp.Acc.No.______:Amount___________

Approved by:____________/____/1983

___________________:___________________:___________________

Approved by:____________/____/1983

Accounting only - Audited By:_______

Expense Voucher - Page 2
*Explanation of Business Conferences and Entertainment
(Receipts required for all expenditures over $25.00)

DATE	:	NAME, TITLE, COMPANY AFFILIATION
	:	PURPOSE
	:	AMOUNT
7/28/83		MR. KATISHIBA, FUJITSU Discuss Encore 94.00 GORDON & GWEN BELL

**EXPLAIN MISCELLANEOUS EXPENSE IF OVER $25.00

DATE	:	
EXPLANATION	:	AMOUNT

>

ENCORE COMPUTER - EMPLOYEE WEEKLY EXPENSE REPORT

For Week Ending: July 23, 1983

EMPLOYEE NAME:	Gordon Bell
Temporary Advance:	0
ADDRESS:	Page Farm Road
Amount this Report:	332.63
CITY, STATE, ZIP:	Lincoln, MA 1773
Balance due Encore	0
Balance due Employee	332.63

DATES

		Sun / Tue / Thu / Sat	Mon / Wed / Fri / TOTAL
	Month/Day		
			7/20/83
		7/21/83	

Travel	From	Lincoln	& return
	To	NY	

Auto Miles Traveled	0	0
	0	50
	0	0
	0	50
Auto Mileage Allowance @ $. 20 /mile	$ 0	$ 0
	$ 0	$ 10.00
	$ 0	$ 0
	$ 0	$ 10.00
Car Rentals	0	0

		0	0
		0	0
		0	0.00
Parking/Tolls		0	0
		0	9.00
		4.50	0
		0	13.50
Air/Rail/Bus/Fare		0	0
		0	57.00
		57.00	0
		0	114.00
Hotel		0	0
		0	0
		190.63	0
		0	190.63
Tips		0	0
		0	0
		0	0
		0	0.00
Meals & Tips	Breakfast	0	0
		0	0
		0	0
		0	0.00
	Lunch	0	0
		0	0
		0	0
		0	0.00
	Dinner	0	0
		0	0
		0	0
		0	0.00
Taxi, etc.		0	0
		0	4.50
		0	0
		0	4.50

Telephone	0	0
	0	0
	0	0
	0	0.00
Bus, Conferences & Entertainment	0	0
	0	0
	0	0
	0	0.00
*See second sheet		
Miscellaneous	0	0
	0	0
	0	0
	0	0.00
**See second sheet		
DAILY TOTALS	0	0
	0	80.5
	252.13	0
	0	332.63

Business Travel Purpose: (Explain briefly the purpose of travel)

To New York for Encore Press Conference

EXPENSE DISTRIBUTION

Submitted by:____________/_____/1983

Dept. No.____________ :Exp.Acc.No.______ :Amount____________

Approved by:____________/_____/1983

____________________ : ____________________ : ____________________

Approved by:____________/_____/1983

____________________ : ____________________ : ____________________

Accounting only - Audited By:_______

ID#381

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Subject: **Extended PDP-11 Instructions**

To: Dick Clayton, ML12-2/E71
Roy Moffa, ML5-2/E93
Mike Titelbaum, ML1-2/E65

Date: 8 DEC 78
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

CC: OOD, Recipients, Authors,
Ed Fauvre, MK1-2/E06
Bill Heffner, TW/E10
Wayne Rosing, TW/C03

Wayne's pencilled comments are good advice.

There is an 11 ISP for > 18-bit physical address that our software supports (see Sam Fuller to further clarify).

Do these. We do not want enhancements to 11's that are incompatible or require <u>any</u> new software.

Proceed ASAP to spend energy on:

1. Fonz physical address extensions and;

2. LSI-VAX.

GB:ljp

Attachment

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Dick Clayton	ML12-2/E71	Jim Cudmore	ML1-5/E30
Bill Demmer	TW/D19	Ulf Fagerquist	MR1-2/E78
Bill Johnson	ML21-3/E87	John Kevill	ML3-6/E94
John Meyer	ML12-1/A11	Larry Portner	ML12-3/A62
Bob Puffer	ML12-2/E38		

John Ankcorn	ML5-5/B35	Dileep Bhandarkar	TW/A08
Rich Billig	MR2-2/M65	Anton Chernoff	ML5-5/E76
Duane Dickhut	ML1-2/E65	Lloyd Dickman	ML3-2/E41
Ed Fauvre	MK1-2/E06	Sam Fuller	TW/A08
Don Gaubatz	ML3-2/E41	Burt Hashizume	ML1-2/E65
Bill Heffner	TW/E10	Bill Keating	ML12-3/A62
Howard Lev	TW/C10	Art Lim	TW/B02
Jeff Mitchell	Tw/D02	Roy Moffa	ML1-2/H26
Bill Noyce	MK1-2/L02	Wayne Rosing	TW/C03
John Sofio	TW/D02	Gil Steil	ML5-5/E76
Bob Supnik	ML1-2/E65	Mike Titelbaum	ML1-2/E65

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ID#359

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Subject: **Extending VAX Architecture For Cobol**

To: Bill Demmer, TW/D19
Ed Fauvre, MK1-2/E06
Sam Fuller, TW/A08
Bill Johnson, ML12-3/E87
Bill Keating, ML12-3/A62
Bill Strecker, TW/A08

Date: 20 NOV 78
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

follow up 12/3/78

How good are we now architecturally with VAX and Cobol?

How does this compare with the 10/20 CIS?

What could we do to get much better?

How much better?

I understand we'll look at this after COBOL 79 generates code.

Who'll do it?

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST: Bill Demmer TW/D19 Ed Fauvre MK1-2/E06
Sam Fuller TW/A08 Bill Johnson ML21-3/E87
Bill Keating ML12-3/A62 Bill Strecker TW/A08

ID#0263

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Subject: **External Manufacturing Go-Away**

To: Jack Smith -- staff

CC: George Chamberlain, Jack Harrigan, Larry Ricci

Date: 8 SEP 78
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

I'm distressed that we have to give this up due to taxes. Can we/should we get AVCO to do some engineering, too on a captive basis?

The Japanese subcontract 1/2 their work outside knowing full well that large organizations are inefficient.

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST: George Chamberlain MS/B80 Henry Crouse ML1-5/B98
Jim Cudmore ML1-5/E30 Bill Hanson ML1-4/P11
Jack Harrigan AC/P96 Dan Infante Ml1-4/P14
Dave Knoll ML1-4/P14 Larry Ricci MS/F24
John Sims ML1-5/B15 Jack Smith ML1-4/A54

Digital **Interoffice Memo**

Subject: **Extra Code as Way of Achieving Compatibility with Less Processor Hardware**

To: Distribution

Date: 4 OCT 76

From: Gordon Bell

Dept: OOD
Loc.: ML12-1
Ext.: 2236

F/U 10/11

In doing smaller computers, can we build a kernel 11 with not all instructions, and put the other instructions in macro code? It's also desirable to handle CIS too.

This would ensure that we could build a 1-chip, fully program compatible 11 and it might permit a 3-chip, versus 4-chip

11/03 now.

Atlas extra code, PDP-10 UUO, and the TRAP are all ways of doing this...but we need more.

Architecturally, it may be essential to invent this now.

Can we?

Ideas?

GB:ljp

<u>Distribution</u>

Bob Armstrong	Bill Demmer
Duane Dickhut	Lloyd Dickman
Len Hughes	Richy Lary
John Mackeen	Roy Moffa
Ralph Platz	Steve Rothman
Bill Strecker	Steve Teicher
Mike Titelbaum	Rob VanNaarden

Digital **Interoffice Memo**

Subject: **<u>F-11 Review for Computer-Moduleness, and Performance</u>**

To: Distribution

Date: 25 OCT 76
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

It would probably be worthwhile to get Dan to do the above review to see how easy it is to build Computer Modules in terms of mapping and interconnection. A single cluster (up to 14) is operating now.

Also, Dan could review them as to their applicability for building reliable structures.

Perhaps the most useful review will be in terms of his knowledge of all the 11 implementations (as a student has developed an understanding and model which can predict performance based on the technology and structure).

GB:ljp

<u>Distribution</u>

Bob Armstrong	Jega Arulpragasam
Dick Clayton	Duane Dickhut
Lloyd Dickman	Dick Eckhouse
John Holz	Ted Johnson
Richy Lary	Steve Teicher
Mike Titelbaum	

00 BURT DECGRAM ACCEPTED S 17343 O 45 21-FEB-81 13:35:25

****
* d i g i t a l *
****

TO: DICK ECKHOUSE   DATE: SAT 21 FEB 1981
13:31 EST
FROM: GORDON BELL
cc: see "CC" DISTRIBUTION   DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: RE: RE: WEST COAST R& D FACILITY?

Maybe Zenith decided it should concentrate on TV or that it might lose it's shirt in the computer business (this personal
computer and high end PC segment, in particular).

Let's keep discussing Suvax with ARPA, directly cause they have the bucks. Hopefully the only contender is Xerox (who I doubt really wants to do this cause they've got their hands full with low end Japanese copier competitors) and Apollo, who should have trouble growing really very fast to

be a
threat before we get our machine. Then there's Apple who seems
to be having trouble getting chips from National, and finally Al
Michael's company that has good technical people, a potentially
winning strategy (from what I can see from the outside); but is
probably in trouble cause of Al. Ed Fredkin is incredibly
bright, hard working, and ends up on top... hence, Three Rivers
will probably be the biggest competitor for awhile.

MIT has still reneged on a contract we had with them to
do LISP. Dertouzous has probably got 50 deals in his
pocket, together with a $ pipeline from IBM, Exxon, Ewing Oil,
and others. I'd sure like to help them, but I don't think we
have anyone sharp enough to contract with them.

For now, the best move is probably to hang on to any and
all valuables, and to listeen to them. What youse think?

"CC" DISTRIBUTION:

ULF FAGERQUIST   MARY JANE FORBES   FU 2/27 VIA FORBES
SAM FULLER   BOB GLORIOSO   ALAIN HANOVER
ANDY KNOWLES   KEN OLSEN   PEG:
LARRY PORTNER   JOEL SCHWARTZ   STEVE TEICHER
HARVEY WEISS

GB2.S4.30
NEEDS FOR GREATER PROCESSING AND PRIMARY MEMORY

PC's- USERS ARE EXPECTING BETTER RESPONSE AND MORE INFORMATION

HIGHER RESOLUTION TERMINALS- >2X MORE CHARACTERS TO INTERPRET

UNIX- REQUIRES 2X THE PROCESSING POWER,

ALSO MORE RUNNABLE PROCESSES PERMITS PARALLELISM

WINDOWS AND MULTIPLE PROCESSES- PERMITS GREATER PARALLELISM PER USER

EASE OF USE TOOLS- REQUIRE INTERPRETATION

GREATER PRODUCTIVITY- IS PROPORTIONAL TO SPEED AND PROGRAM SIZE

HIGHER LEVEL OPERATIONS- GRAPHICS, SPREADSHEETS, DATABASES

AI LANGUAGES- E. G. LISP (X10-X20) AND PROLOG (X1000)

REDUNDANCY AND VOTING FOR GREATER AVAILABILITY

MANY MORE USERS FOR LOWER COST FACILITIES-
E.G . ELECTRONIC MAIL AT LOWER COST/USER INCREAES DEMAND

LARGE, APPLIED MULTIPROCESSORS FOR INCREASED PARALLEL COMPUTING

NETWORKS

WIDE AREA NETWORK - SPATIAL PARALLELISM

LOCAL AREA NETWORK - MORE TIGHTLY COUPLED, SPATIAL PARALLELISM

LOCAL AREA NETWORK CLUSTER - ALL PROCESSORS OPERATE AS A SINGLE SYSTEM

CLOSE AREA CLUSTER - HIGH RELIABLITY / HIGH PERFORMANCE - SINGLE SYSTEM

SINGLE COMPUTER SHARING A COMMON MEMORY

FUNCTIONAL MULTIPROCESSOR COMPUTER - ONE PROCESSOR PER FUNCTIO (E. G. I/O)

TIMESHARING - ONE PROCESSOR PER USER

PARTIONED OR TRANSACTION PROCESSING - ONE PROCESSOR PER PROCESS OR STEP

FAULT-TOLERANT

- DIFFERENT PROCESSORS ASSIGNED PER STEP WITH REDUNDANT PROCESSING

PARALLEL PROCESSING (MULTIPLE PROCESSORS PER JOB)

CONCURRENT-TASK - MULTIPLE PROCESSORS OPERATE ON PARTIONED, INDEPENDENT DATA

PIPELINED-TASK - PARALLEL PROCESSING OF A SINGLE TASK IN PIPELINE FASHION

GENERAL PURPOSE PARALLEL PROCESSING - DYNAMIC ASSIGNMENT OF PROCESSORS

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.___.___.___.___.___.___.___.
!   !   !   !   !   !   !   !
! d ! i ! g ! i ! t ! a ! l !         I n t e r o f f i c e
M e m o
!___!___!___!___!___!___!___!
```

TO: GERALD V BUTLER   DATE: THU 20 JAN 1983
3:29 PM EST

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION   DEPT: ENG STAFF

EXT: 223-2236

LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5188487148

SUBJECT: YOUR PROPOSAL FOR FACTORY AND LABORATORY HARDWARE

GB4.S1.22

I sure liked the notion that your group would supply this for the whole corporation.

Rather than even worry about who's to do it, I'd love a three-part proposal by price band:

1. Real time factory computers -- this would have special i/o and cover a wide product range from the IEEE bus to marry point analog/digital. In addition, there would be special languages for analog and digital control (eg. Boolean equations, ladder diagrams, process control).

2. Factory terminals -- this would include everything from rugged
crt's to bar code readers.

3. Laboratory front ends -- this might be a natural coupling given the
analog commonality. The positioning would show price (probably
starting with the 488 or HP calculator bus) versus data-rate (with
the number of channels or a third parameter).

It's important to also include high speed digital channels using CI
to connect to Cray and lab instruments.

Also, we badly need a real time server that sits on Ethernet,
collects data as fast as possible and sends to a VAX.

"CC" DISTRIBUTION:

WIN HINDLE KEN OLSEN JACK SHIELDS
JACK SMITH

June 30, 1980

C. Lester Hogan
Fairchild Camera and Instrument Corporation
464 Ellis Street
Mountain View, CA 94042

Dear Les:

I heard from Carver Mead that you have compiled a book on the origins of semiconductors. Could I please have a copy?

Attached is a copy of a brochure on the Digital Computer Museum which we have established in our Marlboro building to preserve artifacts. It's contents are less than 50% Digital related. Is there any chance you or someone at Fairchild would put together an exhibit on the origin and evolution of semiconductors for it?

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:swh
GB1.S5.15

Enclosure - Digital Computer Museum Brochure
July 24, 1980

Andy Grove, President
Intel
3065 Bowers Avenue
Santa Clara, CA 95051

Dear Andy:

I'm delighted that you could visit us on Tuesday.

Dick Clayton will be responsible for establishing and maintaining a process which co-ordinates and monitors the Digital (buyer) - Intel (seller) technical interface. As such, he is the contact for learning about and obtaining new escalating problems in this channel of buying parts, process interchange and joint development. The Engineering Marketing Group under Andy Knowles and Pete Smith is a separate channel to you as a buyer; however, we will co-ordinate internally as necessary.

Dick will set up what may be a two-day meeting so that we can learn about your future direction of products and processes in order to be a better customer.

On the second day, we would like to discuss a set of issues that impede our being a better customer. The agenda would hopefully be constructed via phone in advance. Some of the topics that I'd like to see:

- History of the relationship (what went wrong on the process transfer? Why did we reject your presentation earlier this year? Who said don't bother to come and sell us?)

- How are we going to interface in the future?

- Information about parts early in the design process that we may influence.

- Development of advanced parts by Intel, such as the Ethernet interface.

- Joint developments in what might be MITI-like:

  specific parts; 2 micron, double metal; computer aided design--here, we have a significant effort;

  computer control of processes with significant data base capability; development of operating systems and languages for Intel processors - in particular, P2 and P5.

- Buying significant, dedicated manufacturing capacity for DEC-proprietary parts.

Also, several of us would like to visit your Oregon group and learn more details about the 432.

Again, thanks for visiting us. I hope we significantly improve our relationship. Sorry I didn't have time to give a demonstration of our Electronic Mail System.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:swh
GB1.S5.61

CC: Dick Clayton, DEC
Dan Hamel, DEC
Andy Knowles, DEC

July 24, 1980

C. Lester Hogan
Fairchild Camera and Instrument Corporation
464 Ellis Street
Mountain View, CA 94042

Dear Les,

So nice to get your short history of semiconductors and beautiful book, A SOLID STATE OF PROGRESS. We learned a lot from each of them.

We would like to use them as a basis for an exhibit at the Digital Computer Museum. Could you help us collect the photographs and artifacts that would cover the history of semiconductors, somewhat along the lines of your microphotograph book? However, we would like each panel (corresponding to a year in your book) to include: a microphotograph, a schematic, the specification, prices(t), a part (with magnifier) and the process steps by which the part was made. In some cases, there should be exhibits or photographs of the critical manufacturing equipment. As you stated it would be worthwhile to try to cover some of the contributions of other organizations such as Bell Labs.

I would like to encourage you to carry out this project and in addition, prepare a well-documented and illustrated book or small, highly pictorical monograph. I'd, of course, like to encourage you to publish it in our history series of Digital Press. (In case you've not seen some of these publications, I'm sending some brochures, together with a copy of the book, <u>Computer Engineering</u> on DEC's computers under separate cover.

It seems if you took the approach of collecting the above information, coupled with your article, a short monograph might be easy to write.

Please let me know what you think of my sketchy idea for an exhibit and book. What can I do to help?

Sincerely yours,

Gordon Bell
Vice President, Engineering
Keeper, Digital Computer Museum

GB:swh
GB1.S5.60

CC: Heidi Baldus
Gwen Bell

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+---------------------------+
|   |   |   |   |   |   |   |
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a n d u m
|   |   |   |   |   |   |   |
+---------------------------+
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Subject: **Fall DECUS**

To: Development Managers

CC: Marketing Committee, OOD,
Ed Kramer, Bill Picott

Date: 11 DEC 78
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

Having attended Fall DECUS let me congratulate you and your co-workers on their performance. It was one of the most intensely technical user-developer conferences I've seen and it was impressive to see the respect our customers have for our products and developers. (It was also much larger than the first FJCC I attended in 1960.) We want to keep up this communications channel.

The exhibits and talks were extremely professional and very stimulating. The VAX sessions, were crowded and the customers very happy.

I was truly proud to be an engineer at DEC.

GB:ljp

D I G I T A L   INTEROFFICE MEMORANDUM

DIST:
Norma Abel MR1-2/E37 Kami Ajgaonkar ML5-
5/E97
Bob Beck MK1-2/D3 Mike Brading RG
Mary Breslin ML5-5/E39 Norm Brimhall ML5-
5/E39
Joe Carchidi TW/D08 Peter Christy ML12-
3/A62
Dick Clayton ML12-2/E71 Dan Clont ML5-
5/E97
Ron Criss MR1-2/E37 Don Crowther ML5-
5/E72
Jim Cudmore ML1-5/E30 Bob Daley MK
Dick Davies RG Bill Demmer
TW/D19
Ulf Fagerquist MR1-2/E78 Ed Fauvre MK-
2/E6
Richard Glantz MR1-2/E37 Brad Glass
TW/C10
Steve Gutz ML3-5/E82 Ron Ham MK1-
2/J5
Jim Harnedy MK-2/E6 Frank Hassett
TW/C10
Bill Heffner TW/C10 Win Hindle ML10-
2/A53
Bill Howerton ML12-3/A62 Bill Johnson ML21-
3/E87
Ted Johnson PK3-2/A55 Justin Kelleher ML12-
3/A62
John Kevill ML3-6/E94 Andy Knowles ML10-
2/A52
Oleh Kostetsky ML5-5/E39 Ed Kramer MR2-
2/A67
Dom Lacaud ML12-3/A62 John Meyer ML12-
1/A11
Jim Mills MR1-2/E37 John Morgan MK1-

2/H3
Bill Munson ML5-5/E76 Stan Olsen MK1-2/A57
Bill Picott MR2-3/E55 George Plowman ML5-5/E97
Larry Portner ML12-3/A62 Bob Puffer ML12-2/E38
Terry Retford RG John Rose ML12-3/A62
Andrew Skinner RG Dick Snyder MR1-2/E37
Gil Steil ML5-5/E76 Bill Thompson ML12-1/F41
Armen Varteressian TW/E45 Jim Wade RB
Jane Ward ML12-3/A62

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+---------------------------+                                  ID#0260
|   |   |   |   |   |   |   |   |
| d | i | g | i | t | a | l |   i n t e r o f f i c e   m e m o r a n d u m
|   |   |   |   |   |   |   |   |
+---------------------------+
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Subject: **Manufacturing in the Far East**

To: Jack Smith

CC: OOD/Manufacturing Staff,
Operations Committee,
Bill Thompson

Date: 8 SEP 78
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

Given status:

1. We need/rely on the tax havens.

2. HK/TW are capable of making <u>anything</u> (especially complex, process-based stuff like cores) we can in the U.S. and probably better.

3. Future intrusion of Japanese into markets we now serve (e.g., terminals -- when they have systems that need them).

4. Lower cost to manufacture in the Far East in hours, quality, and direct labor/total labor.

5. Overcapacity (especially boards) in the U.S.

Why not:

0. Stop the attrition in the Far East.

1. Move quick to get products there -- plus some manufacturing engineering capability (e.g., the VT100 monitor).

2. According to Andy a 15% lower cost gets a 2X volume. Then lets do:

   a. VT100

   b. LA34 (old LA00) to get this market. It would also pave the way when/if we went into the typewriter/terminal business for mail, TWX, etc. with a higher quality device. That is, I think we want and need to build IBM quality typewriters.

   c. RL01 - to get a double whammy on the high costs of being in Colorado -- we could probably get this at 30% less -- or 4 x the volume. This might also get us in the iron business!!

d. TU58 drive and cassettes (especially labor intensive). This would then let us manufacture nearly all the PDTs except the hi end. (Don't bother with floppies to limit the scope.)

3. Close down some very small plants. This would get us reasonable cost again when running at low capacity.

4. Consider putting Augusta (F/S repair) in HK.

5. Use the U.S. plants as pilots for 1/2 the capacity (the system's and U.S. business).

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Al Bertocchi	PK3-2/A56	Dick Clayton	ML12-2/E71
Jim Cudmore	ML1-5/E30	Henry Crouse	ML1-5/B98
Sheldon Davis	PK3-1/C16	Bill Demmer	TW/D19
Ulf Fagerquist	MR1-2/E78	Bill Hanson	ML1-4/P11
Win Hindle	ML5-2/A53	Dan Infante	ML1-4/P14
Bill Johnson	ML21-3/E87	Ted Johnson	PK3-2/A55
John Kevill	ML1-3/E58	Dave Knoll	ML1-4/P14
Andy Knowles	ML5-2/A53	John Leng	MR1-1/F35
Bill Long	ML5-2/A53	Julius Marcus	MK2/C37
John Meyer	ML12-1/A11	Ken Olsen	ML12-1/A50
Stan Olsen	MK1-2/A57	Larry Portner	ML12-3/A62
Bob Puffer	ML12-2/E38	John Sims	ML1-5/B15
Jack Smith	ML1-4/A54		

****
* d i g i t a l *
****

TO: JOHN F SMITH @CLEM

DATE: WED 20 FEB 1980 3:58 PM EST

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION

DEPT: OOD

EXT: 223-2236

LOC/MAIL STOP: ML12-1
A51

SUBJECT: FAT/VOLUME CHARTERS (>2)

Restructuring the FAT/Volume charters for a different systems manufacturing process.

This memo describes the advantages of what we might gain by changing
the nature of the system manufacturing process by eliminating much of
FAT as we currently know it.

We agreed to hold a meeting with Demmer and Fagerquist and see if we
can continue to make progress and get the necessary commitments to
Systems. Also, Jack and I are going to examine the utility of a high
level reportee who will work on this problem and get at the numerous
issues in both manufacturing and engineering.

Here's why I do not believe in the current volume/FAT systems manufacturing process:

Production

1. Production learning curves are minimized by having systems of a
   given type built in a maximum number of plants (volume CPU + on FAT
   areas). In assemblying complex units, of numerous model types (we
   now have over a dozen basic processor types - and this is NOT going
   to decrease in the next ten years!) no real learning takes place at
   the FAT centers. By having an organization arranged by size and
   types and connected with the processor, memory, and

control options learning takes place and is contained at one site. If FAT centers have to exist, they have to be by system size and type so that learning on 8/10/20/11 (the 3 or 4 different operating systems types) and VAX-11 can be segmented. Each system has its own idiosyncrasies, and goes together in a unique way, requires support with APT and has little in common with its neighbor. In other words I don't think FAT should do anything but P/L specials (hardware, software, and burn-in) and to send shipping labels and building instructions to the volume plants.

FAT thwarts organizing to build systems by size, in such a way as to take advantage of the learning that already exists in the Processor factories. We must build to order PMK's in the various processor volume plants in the same way autos are built so as to get expertise on a system type basis (8/10/20/11-by size and operating system). It is not adequate to use the FAT plants as is to build for order as we now do. This will get us the cost by letting the volume plants really get good at the PMK kernels, and they will ship to the customer or to an intermediate staging area.

2. Multiple FAT sites introduces a second, redundant stage, at finished goods when we can least afford it using finished disk,

terminals, and the Processor/Memory/Controller Base Component (PMK).*

Thus, given that we can somehow build the right PMK Base Component for a particular customer, a system should be able to be customer site, or field warehouse merged. By having FAT, the tendency is to use it to build the PMK and to have to test the PMK (again!) by unpacking the disks and terminals in order to verify that the ports emanating from the PMK are working correctly.

3. The second stage amounts to at least 4 weeks when stockroom and transport delays are considered. These costs do not show up in the cost because inventory interest is not charged, except in the circuitous ROI calculations in the P/L. This saving probably swamps all others.

4. There is a larger inventory with multiple FAT centers, each of which has to have its own disk, and terminal. If two sites build the same system type, then P, M, and K components are also replicated. This inventory is in addition to the WIP additional delay in the process given in 3.

5. FAT is a costly QC function that should be doen some other way. Apparently the quality of the volume plants is low enough that FAT is necessary to check quality. At best, this is a noisy issue. My own belief is that the breakage and quality of a product

is a
function of handling. FAT simply breaks things, and does nothing
else, other than uses the dock mergeable options for testing PMK's.
Furthermore, a FAT plant is not equipped to make the fix, due to
the large number of option types. It mainly runs up labor costs
and in some cases bootstraps the product into a poor state.

6. FAT is the key inhibitor of attaining systems focus because it
operates on average costing. It is associated with the marketing
groups, rather than being a virtual unit that processes orders and
tells the volume PMK, terminal, and disk plants where to send the
units. We will continue to be able to define any option such as
the new ESG graphics terminal, or the LDP A/D converter to be parts
of legitimate systems because there is no incentive to define any
collection of components as a system, to not segment and get the
cost. The bright assemblers in FAT can make anything work, and the
tax is high, is averaged cost, hence will always exist and be
available to cover any specials or ad hoc systems that a customer,
salesperson or marketing person can dream up. Therefore, as long
as we have FAT, I hold little hope for having any systems focus or
discipline, because the cost doesn't matter. Any ad hoc system can
be built for the same cost of one that is restricted, because the

big costs of inventory, order processing and assembly are averaged.

7. Engineering can support PMK plants, and they will become the focus of systems, because there is only one per system! Now the systems groups can only support the volume processor plants, and any plant can order components and put system together. We need this in order to move from the era where the customer, P/L's, and FAT are the systems engineers.

8. Every glitch (e.g. having to build 300 more 11/40s) gets transmitted to all plants. There is no volume anywhere! Moving to segmented PMK's can be clear and used to segment (contain) the glitches on the basis of size, product age, system type, to maximize learning.

9. The lower costs, and implied capacity gains are enormous! Certainly there are many issues involved here. I want to help model, then because I think the gains in time, manufacturing and engineering, learning, distribution, inventory, support and getting to a systems focus are immerse! We should be able to model all the factors, and I think come to the obvious conclusion I have: we must drastically restructure our work between FAT and volume (especially processor) plants along the above fashion.

At our next meeting could we discuss each of these points and determine just how much each contribute to cost...and whether I've assessed them correctly or left out risks or benefits of the correct system? Let's get more aggressive this year in moving to a better process at a time when the increased capacity released, can go into the incredible 40% increase manufacturing is committing in 81.

I submit given this year's growth we must do something drastic in manufacturing plus support you in systemness!

*(Here, I want to introduce the part we ambiguously have been calling CPU's by segmenting the processor (P), main Memory (M), and Controllers-K, which are: internal processor options like floating point, communications line and printer controllers, and disk controllers. Hence, let's use the term, PMK, to reflect everything but the disks (which are sometimes internal as in the case of the RL01) and the external terminals and printers. Another document will give iron clad definitions so that we can talk about any part and have the same meaning.

GB:swh
GB1.S2.6

"CC" DISTRIBUTION:

LARRY PORTNER	DICK CLAYTON	ULF FAGERQUIST
GRANT SAVIERS	JOHN HOLMAN	BILL DEMMER
SAM FULLER	DAVE KNOLL @CLEM	DAVE THORPE @CLEM
DENNIS O'CONNOR @CLEM	WILL THOMPSON @CLEM	

GB:swh
GB1.S2.6
00 BURT DECGRAM ACCEPTED S 15605 O 33 03-MAY-81 21:07:36

****
* d i g i t a l *
****

TO: JOHN KIRK   DATE: SUN 3 MAY 1981
21:02 EST
    BRUCE STEWART   FROM: GORDON BELL
                                                 DEPT: ENG STAFF
                                                 EXT: 223-2236
                                                 LOC/MAIL STOP: ML12-
1/A51

SUBJECT: I TRIED TO DO A TRANSFER OF A DOCUMENT TO EMS

I tried the following message, and it was correct using a
65 character ruler. It got garbled in transmission. What's
the story?
Let me express my written thanks for the effort in gettng the
bubble into operation, reiterating what was said at the
ribbon cutting on Friday:
. to quote Ken: "it's amazing what a $28,000 balloon will
buy"
 it was done on a very tight schedule in 100 days ... one of
the
few engineering projects to be done this way. Normally
engineering projects are managed to yearly budgets.
 it had much teamwork and hardwork ... very much like VAX,
the
irst system to be tested there
t was a really significant piece of engineering as we hadn't
e like it before with the very tight schedule and
set of risks which got covered by extra $'s. Let's feel good
about getting it, not bad about overrun.
it had our combined support to be done.
. it is great to work on projects that are really necessary
and
 to be done in a timely fashion

Now, let's get on with the testing. We need it badly.
Congratulations and good work,
Gordon

PS
I hope various members of the Operations Committee and ring will see this very impressive structure, provided of course, that it doesn't interfere with testing.

GB2.S6.35
00 BURT DECGRAM ACCEPTED S 27572 O 65 25-MAY-81 22:56:13

****
* d i g i t a l *
****

TO: PETER SMITH   DATE: MON 25 MAY 1981 22:54 EST

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: RE: FCC/11C03

No. I basically think you ought to use the 23 and make it pass, rather than going for a two step set of products. This will be very expensive for DEC.

We have to start doing it right the first time, versus introducing obsolete, interim junk that someone will get stuck
having to fix in 2 years.
No, am opposed!

GB2.S6.49

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION DATE: FRI 8 MAY 1981 14:14 EST

FROM: GORDON BELL
cc: see "CC" DISTRIBUTION DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: CONGRATULATIONS ON GETTING THE BUBBLE INTO OPERATION

Let me express my written thanks for the effort in getting the bubble into operation, reiterating what we said at the ribbon cutting on Friday:

.to quote Ken: "It's amazing what a $28,000 balloon will buy".
.It was done on a very tight schedule in 100 days...one of the few engineering projects to be done this way. Normally engineering projects are managed to yearly budgets.
.It had much teamwork and hardwork...very much like VAX, the first system to be tested there.
.It is a significant engineering accomplishment as we hadn't done anything like it before with the very tight schedule and set of risks which got covered by extra $'s. Let's feel good about getting it, not bad about overrun.
.It is great to work on projects that are really necessary and have to be done in a timely fashion.

Now, let's get on with the testing. We need it badly. Congratulations and good work.

P.S. I hope various members of the Operations Committee and

Engineering will see this very impressive structure, provided of
course, that it doesn't interfere with testing.

GB:swh
GB2.S5.47

"TO" DISTRIBUTION:

DAVE BROWN JOHN PRATT VIA BROWN PETER BOERS @MLXX
TOM CAMPBELL @CFXX

"CC" DISTRIBUTION:

ENG STAFF: JOHN HOLMAN OPERATIONS COMMITTEE:
JOE SMITH

****
* d i g i t a l *
****

TO: ROD TUTTLE DATE: WED 7 JAN 1981 3:33 PM EST
FROM: GORDON BELL
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: MEMO FOR JEFF BURNETT -- FCC

Please see that Jeff Burnett gets this message. Thank you.
00 BURT DECGRAM ACCEPTED S 6791 O 548 12-DEC-80 22:09:45

****
* d i g i t a l *
****

TO: DAVID W BROWN DATE: FRI 12 DEC 1980

10:08
PM EST
OOD: FROM: GORDON BELL
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: IF PRODUCTS DO NOT CONFORM TO FCC RULES THEN NO ANNOUNCEMENT

I intend to push this very hard and I'm delighted to have Andy's support. At this time, please consider it a unilateral, within engineering decision that can be overridden by going around me to the Marketing Committee. The policy is effective immediately (12/12/80):

No new products will be announced that do not meet FCC requirements.

Please stop any product announcements that have not been tested to conform to meet the FCC requirements.
Gordon

ATTACHED: MEMO;15
****
* d i g i t a l *
****

TO: GORDON BELL DATE: FRI 12 DEC 1980
2:20 PM EST

FROM: ANDY KNOWLES
cc: MARKETING COMM: DEPT: TECHNICAL GROUP
ADMIN

EXT: 231-6312
LOC/MAIL STOP: MR1-1/A65

SUBJECT: FCC ADHERENCE FOR NEW PRODUCTS

Ref: Your EMS 12 December. I totally agree with you.

GB:swh
GB1.S13.57

GB2.S4.16
****
* d i g i t a l *
****

TO: KEN OLSEN   DATE: FRI 9 JAN 1981
9:55 PM EST

FROM: GORDON BELL
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: I'M GOING AHEAD WITH BOYLSTON FOR AWHILE

I think we want to continue the review and improvement of Boylston. We need a permanent site even though an air bag might work.

We are going flat out to get a Marlboro Air bag and I'm pushing
to get one started in Tewskbury too. In doing this, I think we can get the experience to decide (in a month) whether to stop the Boylston site.

I think this is the right way to go. I want you to look at the revised design... assuming we don't go to the air bag.

If you say no, then I'll call off the troops.

ATTACHED: MEMO;39

****
* d i g i t a l *
****

TO: GORDON BELL   DATE: THU 8 JAN 1981

5:58 PM EST

FROM: DON METZGER
DEPT: EXTERNAL RESOURCES
EXT: 223-9740
LOC/MAIL STOP: ML1-5/B98

cc: DAVE BROWN
HENRY CROUSE

SUBJECT: BOYLSTON FCC TEST SITE

I met with Dayton T. Brown, test consultants today. They looked at the Boylston concept drawings and made several comments about the execution details. They reported that the two-level wooden structure was the best in their opinion. They further reported that Bell Labs/Western Electric have had some problems with their air bag. I discussed their concerns with Dave Brown and Peter Boers and learned that modifications have been made to the site design (such as a larger floor area and roof height) which answer their concerns. The FCC is testing with a three- meter site at present and would use it to verify any Class B that we might want to qualify. Apparently, the FCC test set-up is similar to the Boylston proposal. They (D.T. Brown) had a proposal to act as consultants to DEC during the construction and I believe some scaled-down part of the proposal would be in order in the outside chance that we might have over-looked something.

Their facility (sans toilets and fancies) they felt could be duplicated for approx. $110,000.

Bottom line is that we probably should go ahead with Boylston but look to see if some things might be pared from the cost. If the air bag works very well, we would replicate that instead of Boylston in the future. I do think we should have Dayton T. Brown look at our final drawings and critique them.

GB2.S1.36
00 BURT DECGRAM ACCEPTED S 4433 O 161 16-APR-81 12:18:52

****
* d i g i t a l *
****

TO: DAVE BROWN   DATE: WED 15 APR 1981 20:27 EST
FROM: GORDON BELL
cc: see "CC" DISTRIBUTION   DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: RE: MINC, 11CO3, ETC., ETC., AND FCC

Dave is saying it right. Much better than I did. Let's go his way.

I really am not going to support the introduction of one more crappy, obsolete, average product.   We get average products by default when we miss on the good ones.   We must never start with the average in mind.

This product appears to be in a direct violation of Win's goal for Productivity and Quality for the 80's.

"CC" DISTRIBUTION:

JERRY CREASER   JOE DZEKEVICH   FCCDIS:
JOHN HOLMAN   KEN OLSEN   LARRY PORTNER
JOE SMITH

GB2.S6.2
00 BURT DECGRAM ACCEPTED S 4411 O 154 16-APR-81 12:12:20

****
* d i g i t a l *
****

TO: JERRY CREASER   DATE: WED 15 APR 1981
20:06 EST

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION

DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: RE: MORE FCC AND 11C03

I would be strongly against announcing this product.

The product will have a much longer life than we think, hence going over to the 23 would make sense, it would seem.

Why not do it right? Interim things always seem to lose.

If you think so strongly that we should put it on the market, then it would seem that it should go the appeals route. In this case, I think the OC or Group VP Committee should do the waivering.

"CC" DISTRIBUTION:

KENT BLACKETT
DAVE BROWN
WILLIAM KOTEFF
PETER SMITH

GB2.S5.69

<subj>NATIONAL RESEARCH COUNCIL
<from>BLACKBURN, JACK F.
<to>BELL, GORDON
<date>80/2/26
<date rec>2/29/80
<log#>2-45
<dispo/date>
<message>
<answer>
<f/u>

<filed>
<ret-gb>
<roll>
<>

<subj>OCDE
<from>LEVASSEUR, PAUL M
<to>BELL, GORDON
<date>80/2/19
<date rec>2/29/80
<log#>2-44
<dispo/date>DICK ECKHOUSE - 3/10/80
<message>YOURS. SHOULD SOMEONE FROM EUROPEAN ENGINEERING GO? WASTE OF TIME?
<answer>
<f/u>3/14/80
<filed>
<ret-gb>
<roll>
<>

<subj>LOS ALAMOS SCIENTIFIC LABORATORY
<from>METROPOLIS, N.
<to>BELL, GORDON
<date>80/2/22
<date rec>2/29/80
<log#>2-43
<dispo/date>MARCY KENAH - 3/10/80
<message>MARCY, COLLIER FEELS WORSE TO ME.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>UNIVERSITY OF NEWCASTLE UPON TYNE
<from>RANDELL, BRIAN
<to>BALDUS, HEIDI

<date>80/2/19
<date rec>2/28/80
<log#>2-43
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>TWX (TERRA, SELO SOC, ELETTRONICA LOMBARDA)
<from>TERRA, L.
<to>BELL, GORDON
<date>80/2/25
<date rec>2/25/80
<log#>2-42
<dispo/date>SEE LOG #2-38 - 2/28/80
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>UNIVERSITY OF ROCHESTER
<from>FELDMAN, JERRY
<to>AD HOC COMMITTEE MEMBERS
<date>80/2/25
<date rec>2/27/80
<log#>2-41
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<f/u>
<filed>
<ret-gb>
<roll>

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<subj>CARNEGIE-MELLON UNIVERSITY (NOTES AND QUERIES TO AUTHOR)
<from>SIEWIOREK, DAN
<to>BELL, GORDON
<date>80/2/15
<date rec>2/27/80
<log#>2-40
<dispo/date>
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<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>CARNEGIE-MELLON UNIVERSITY (THE DESIGN/IMPLEMENTATION OF A PMS LEVEL HARDWARE INTERCONNECTION LANGUAGE)
<from>HOSLER, BRAD W.
<to>BELL, GORDON
<date>79/10/24
<date rec>2/27/80
<log#>2-39
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>TWX (SELO COMPANY)
<from>TERRA, L. (GENERAL MANAGER, SELO)
<to>BELL, GORDON
<date>80/2/27
<date rec>2/27/80

<log#>2-38
<dispo/date>TWX SENT BACK TO TERRA (CC:JOEL SCHWARTZ) - 2/28/80
<message>TERRA SHOULD CONTACT JOEL SCHWARTZ.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>NATIONAL SCIENCE FOUNDATION
<from>PASTA, JOHN
<to>BELL, GORDON
<date>80/2/21
<date rec>2/26/80
<log#>2-37
<dispo/date>
<message>
<answer>
<f/u>
<filed>
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<subj>HODGE COMPUTER RESEARCH CORPORATION
<from>HODGE, WINSTON, W.
<to>BELL, GORDON
<date>80/2/20
<date rec>2/26/80
<log#>2-36
<dispo/date>
<message>
<answer>
<f/u>
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<subj>TECHNOLOGY RECOGNITION CORPORATION
<from>JONES, DONALD H.
<to>BELL, GORDON
<date>80/2/21
<date rec>2/26/80
<log#>2-35
<dispo/date>
<message>
<answer>
<f/u>
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<subj>SOFTWARE ENGINEERING MONTHLY REPORT FOR JANUARY (BOOK 1)
<from>SHELDON, LIZ
<to>BELL, GORDON
<date>80/1/?
<date rec>2/26/80
<log#>2-34
<dispo/date>FILE #13 - 3/10/80
<message>
<answer>
<f/u>
<filed>
<ret-gb>
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<subj>WARREN, GORHAM & LAMONT INC.
<from>BEAN, WILLIAM H.
<to>BELL, GORDON
<date>80/2/20
<date rec>2/25/80
<log#>2-33
<dispo/date>NO INTEREST - 2/27/80

<message>
<answer>
<f/u>
<filed>NO - 2/27/80
<ret-gb>
<roll>
<>

<subj>CESARI AND MCKENNA
<from>HERBSTER, GEORGE A.
<to>BELL, GORDON
<date>80/2/20
<date rec>2/20/80
<log#>2-32
<dispo/date>GEORGE HERBSTER (CC:SIEKMAN, SCHWARTZ) - 2/22/80
<message>THANKS.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>UNIVERSITY OF CAMBRIDGE
<from>HARTLEY, DAVID
<to>BELL, GORDON
<date>80/2/11
<date rec>2/20/80
<log#>2-31
<dispo/date>
<message>
<answer>
<f/u>
<filed>
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<subj>CREATIVE COMPUTING

<from>AHL, DAVID, H.
<to>BELL, GORDON
<date>80/2/15
<date rec>2/20/80
<log#>2-30
<dispo/date>
<message>
<answer>
<f/u>
<filed>
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<subj>DUN & BRADSTREET LTD.
<from>STUART, NATALIE
<to>BELL, GORDON
<date>80/2/1
<date rec>2/20/80
<log#>2-29
<dispo/date>AL BERTOCCHI - 2/22/80
<message>
<answer>
<f/u>
<filed>
<ret-gb>
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<>

<subj>MICROCOMPUTER APPLICATIONS
<from>ZARRELLA, JOHN
<to>PUFFER, ROBERT W.
<date>80/2/?
<date rec>2/20/80
<log#>2-28
<dispo/date>TO LETTERBOOK (GB1.S2.16) - 2/26/80
<message>
<answer>
<f/u>
<filed>

<ret-gb>
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<subj>NATIONAL ACADEMY OF ENGINEERING
<from>LIEBOWITZ, HAROLD
<to>BELL, GORDON
<date>80/2/11
<date rec>2/18/80
<log#>2-27
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
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<>

<subj>BOSTON UNIVERSITY
<from>O'DETTE, DEBORAH
<to>BELL, GORDON
<date>80/2/13
<date rec>2/18/80
<log#>2-26
<dispo/date>JANE GORING 2/18/80
<message>HELP! YOURS?
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>ASTM
<from>CAVANAUGH, W.T.
<to>OLSEN, KENNETH H.
<date>80/2/7
<date rec>2/15/80
<log#>2-25
<dispo/date>ORIGINAL TO F/U - (CC: HOLMAN, SAVIERS) - 2/19/80

<message>WHAT DO YOU SAY.
<answer>
<f/u>2/29/80
<filed>
<ret-gb>
<roll>
<>

<subj>MIT
<from>MOSES, JOEL
<to>BELL, GORDON
<date>80/2/13
<date rec>2/15/80
<log#>2-24
<dispo/date>ORIGINAL TO F/U - (CC:SAM, KUSIK, MUDGE, ZEH, JIM BELL, TEICHER, MEYER, ULF, ROSING) - 2/21/80
<message>WILL SOMEONE TAKE CHARGE OF A RECRUITING CAMPAIGN FOR TOM?
<answer>
<f/u>2/29/80
<filed>
<ret-gb>
<roll>
<>

<subj>WELLING & WOODARD, INC.
<from>LANE, CHRISTOPHER T.
<to>BELL, GORDON
<date>80/2/12
<date rec>2/15/80
<log#>2-23
<dispo/date>ED FINN - 2/15/80
<message>YOURS.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>ACECOM AMERICA INC.

<from>KOH, HOON
<to>BELL, GORDON
<date>80/2/7
<date rec>2/13/80
<log#>2-22
<dispo/date>BILL PICOTT - 2/15/80
<message>YOURS.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>RESUME' - JOHN MICHAEL SELANDER
<from>NICHOLS, TOM (IN-HOUSE)
<to>BELL, GORDON
<date>80/2/7
<date rec>2/13/80
<log#>2-21
<dispo/date>ARMAND LA VALLE - (CC: GLORIOSO, SAM, MEYER) - 2/15/80
<message>LOOKS LIKE YOUR KIND OF PERSON. SAM, HOW ABOUT ARCHITECTURE? LET'S INTERVIEW HIM.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>COMMONWEALTH OF MASSACHUSETTS (U MASS BOSTON)
<from>MORRIS, ROBERT
<to>BELL, GORDON
<date>80/2/12
<date rec>2/13/80
<log#>2-20
<dispo/date>ORIGINAL TO F/U (CC:DICK ECKHOUSE, JIM BELL, JOHN MEYER, ANDY, PETE SMITH, SAM, SEGAL) - 2/15/80
<message>CAN YOU GET SOMEONE WHO COULD INTERACT WITH THEM?

<dispo/date>TO LETTERBOOK (GB1.S2.47) - 3/12/80
<answer>
<f/u>2/29/80
<filed>
<ret-gb>
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<subj>BAXTER ASSOCIATES INC.
<from>GREATHOUSE, CARROLL A.
<to>CUDMORE, JAMES C.
<date>80/2/4
<date rec>2/13/80
<log#>2-19
<dispo/date>TO LETTERBOOK - (GB1.S1.73) - 2/15/80
<message>
<answer>
<f/u>
<filed>
<ret-gb>
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<subj>RESUME' - BETSY GERSHUN
<from>GERSHUN, BETSY
<to>BELL, GORDON
<date>80/2/8
<date rec>2/11/80
<log#>2-18
<dispo/date>ARMAND LA VALLE - 2/11/80
<message>PLEASE HANDLE.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>INTERSIL INSIGHT

<from>PHELPS, MEL
<to>BELL, GORDON
<date>80/1/?
<date rec>2/11/80
<log#>2-17
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
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<>

<subj>MINNA POST PEYSER AND ASSOCIATES
<from>PEYSER, MINNA POST
<to>BELL, GORDON
<date>80/2/7
<date rec>2/11/80
<log#>2-16
<dispo/date>TO LETTERBOOK (GB1.S2.11) - 2/22/80
<message>
<answer>
<f/u>
<filed>
<ret-gb>
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<subj>APPLICON
<from>RICHARDSON, FONTAINE K. (DR.)
<to>BELL, GORDON
<date>80/2/8
<date rec>2/11/80
<log#>2-15
<dispo/date>
<message>
<answer>
<f/u>
<filed>

<ret-gb>
<roll>
<>

<subj>OREGON MINICOMPUTER SOFTWARE INC.
<from>WHITNEY, RUSTY
<to>BELL, GORDON
<date>80/2/5
<date rec>2/11/80
<log#>2-14
<dispo/date>ORIGINAL RETURNED - (CC: THISSELL, PORTNER, BJ, HEFFNER, KEATING, SYNDER, DALEY, CLAYTON, STEIL - 2/15/80
<message>CONGRATULATIONS. IT'S REALLY GREAT TO SEE THIS EFFORT - I HOPE WE CAN DO MORE WHEN IT'S COST-EFFECTIVE. WE CAN'T BUILD ALL THE SOFTWARE WE NEED. NOW LET'S MAKE IT A GREAT DEC PRODUCT.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>TOYOMENKA (AMERICA) INC.
<from>MORRISSEY, GEORGE
<to>OLSEN, KENNETH
<date>80/1/31
<date rec>2/6/80
<log#>2-13
<dispo/date>ORIGINAL TO F/U - (CC: JACK GILMORE, DICK CLAYTON, BILL PICOTT, BOB GLORIOSO) - 2/12/80
<message>SHOULD WE TALK TO THEM? COULD YOU HAVE SOMEONE TAKE THIS CALL? - WHO?? - IT'S IN LINE WITH OTHER WORK.
<dispo/date>ORIGINAL TO ANN JENKINS - 2/25/80
<message>PLEASE ROUTE CALL TO JACK GILMORE
<answer>
<f/u>2/22/80
<filed>
<ret-gb>
<roll>

<>

<subj>UNIVERSITY OF NEWCASTLE UPON TYNE
<from>RANDELL, BRIAN
<to>BELL, GORDON
<date>80/1/29
<date rec>2/5/80
<log#>2-12
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>TACTICAL EQUIPMENT CORP.
<from>KAUFMAN, PHILLIP A.
<to>BELL, GORDON
<date>80/1/28
<date rec>2/5/80
<log#>2-11
<dispo/date>ED FINN - 2/5/80
<message>YOURS.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>CORPORATE SALES LONG RANGE PLAN (6 - TO GB, 6A - TO WAR ROOM)
<from>?
<to>BELL, GORDON
<date>80/2/?
<date rec>2/4/80
<log#>2-10

<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
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<>

<subj>UNIVERSITY OF VERMONT
<from>HILL, DAVIS B.
<to>BELL, GORDON
<date>80/1/30
<date rec>2/4/80
<log#>2-9
<dispo/date>JIM BELL (CC: ARMAND LA VALLE) - 2/5/80
<message>LET'S INVITE HIM IN? I'LL SEE HIM TOO.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>DARTMOUTH MEDICAL SCHOOL
<from>STIBITZ, GEORGE R.
<to>BELL, GORDON
<date>80/1/31
<date rec>2/4/80
<log#>2-8
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>UNIVERSITY OF MICHIGAN
<from>BURKS, ARTHUR W.
<to>BELL, GORDON
<date>80/1/23
<date rec>2/4/80
<log#>2-7
<dispo/date>MARCY KENAH - 2/4/80
<message>YOURS.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>W. SCOTT ANDRUS, PH.D.
<from>ANDRUS, W. SCOTT
<to>BELL, GORDON
<date>80/2/1
<date rec>2/4/80
<log#>2-6
<dispo/date>ARMAND LA VALLE (CC: GRANT, JIM CUDMORE) - 2/5/80
<message>ARMAND, PLEASE HANDLE. GRANT, JIM CUDMORE, ANY INTEREST?
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>UNIVERSITY OF NEW HAMPSHIRE
<from>HASKELL, JOHN R.
<to>BELL, GORDON
<date>80/1/28
<date rec>2/4/80
<log#>2-5
<dispo/date>JOHN MEYER - 2/5/80
<message>YOURS.
<answer>

<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>MAGNEX - EXXON INFORMATION SYSTEMS
<from>LEVINE, JOEL H.
<to>BELL, GORDON
<date>80/1/28
<date rec>2/1/80
<log#>2-4
<dispo/date>GRANT SAVIERS - 2/4/80
<message>YOURS.
<answer>
<f/u>
<filed>
<ret-gb>
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<>

<subj>SCIENCE
<from>ABELSON, PHILIP H.
<to>BELL, GORDON
<date>80/1/29
<date rec>2/1/80
<log#>2-3
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>SOCIETY OF MANUFACTURING ENGINEERS
<from>TAYLOR, R. WILLIAM
<to>BELL, GORDON

<date>80/1/28
<date rec>2/1/80
<log#>2-2
<dispo/date>WILL THOMPSON - 2/4/80
<message>YOURS.
<answer>
<f/u>
<filed>
<ret-gb>
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<subj>SOFTWARE ENGINEERING MONTHLY/QUARTERLY REPORT FOR 12/79 (BOOK 1)
<from>SHELDON, LIZ
<to>BELL, GORDON
<date>79/12/?
<date rec>2/1/80
<log#>2-1
<dispo/date>BURN BOX - 2/4/80
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

FROM: GORDON BELL DATE: WED 17 OCT 1979 8:34 AM EST
DEPT: OOD
EXT: 223-2236
TO: SHEL DAVIS
cc: JACK SHIELDS
CARL JANZEN @CLEM
TED JOHNSON @CLEM

SUBJECT: THE FIELD MATRIX

Paul Lawrence wrote an excellent (small) book on this subject. Bruce Ryan (GIA Manager for SA, Mexico, Caribbean, and Japan) and I had an hour of interesting discussion on this subject. We even watched a SWS employee resign because of it. "The Matrix" clearly has problems for subsidiaries and even no doubt for regular offices.

Maybe you could help clear the air by helping with responsibility charting and clean things up.

GB:swh
May 12, 1982

Takuma Yamamoto, President
Fujitsu, Ltd.
Furukawa Sogo Building
2-6-1 Marunouchi
Chiyoda-ku, Tokyo
Japan

Dear Mr. Yamamoto:

We have been interested students of the public literature on the Fifth Generation Computer Program, and were most fortunate to have Professor Moto-Oka visit with us in January of this year.

We have expressed our interest in the Fifth Generation program or a possible participant. Hence, we were puzzled by the recent quote in the New York Times, attributed to yourself, that no U.S. company had "applied" for participation in the program.

Please consider this letter as a sincere expression of Digital's interest in understanding how we might participate in the program.

I would be pleased to visit with you or have our Japan Engineering Center, Manager, Dr. Tom Kobayashi, who is a resident in our Tokyo office meet with the appropriate program officials.

I look forward to hearing from you at your earliest convenience.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:mal
GB3.S4.21

ALPHA EXTERNAL FILES

ADVENT
AEC - AMERICAN ELECTRIC POWER
AMDAHL
ANSI
APPLICON
ARIZONA
ARPA
ATANASOFF, DR. JOHN
AUSTRALIA

BAUMANN
BELL LABS
BELL TELEPHONE
BERGLES, ARTHUR
BERKELEY, EDMUND
BLOCH
BOLT, BERANEK & NEWMAN, INC.
BOSTON SYMPHONY ORCHESTRA
BOSTON UNIVERSITY
BRAZIL
BROWN UNIVERSITY

BURNESS, JACK
BURROUGHS

CALIFORNIA DATA PROCESSORS
CALTECH (CALIFORNIA INSTITUTE OF TECHNOLOGY)
CAPITAL CHILDREN'S MUSEUM
CARLETON UNIVERSITY (OTTAWA)
CASASENT, DR. DAVID
CASE WESTERN RESERVE
CBEMA
CCA - COMPUTER CORPORATION OF AMERICA
CDC
CONTROL DATA RESEARCH
CHICAGO UNIVERSITY - ICR (ASHENHURST)
CHINA
CMU - BELL
CMU - CMMP
CMU - COMPUTER MODULES
COMPUTER SCIENCE & TECHNOLOGY (BOARD MTG)
CMU - GENERAL - 1979
CMU - MICROPROGRAMMING RESEARCH
CODENOLL TECHNOLOGY CORPORATION
COLLINS
COMPOSITION TECHNOLOGY, INC.

RLO.S9.5

DARTMOUTH
DATA GENERAL
DATAPRO
DATAQUEST RESEARCH NEWSLETTER
DAVIS, GERALD
DEFENSE ADVANCED RESEARCH PROJECTS AGENCY
DEPEYROT, M.
DESIGN AUTOMATION
DIRKS, DR. GERHARD
DPD
DUPONT

ECKHOUSE
EDUCOM
ENGLAND
EXXON

FAIRCHILD
FLOATING POINT SYSTEM
FRANCE
FUJITSU LMTD.
FULLER, SAM

GENERAL ELECTRIC
GEORGIA TECH
GILLESPIE, BOB
GRASON, JOHN

HARRIS
HARVARD
HARVARD UNIVERSITY
HERTRICH DEVELOPMENT INC.
HELITRON
HEWLETT PACKARD
HITACHI
HOBBS ASSOCIATES
HONEYWELL
HOPPER, CAPT. GRACE

HUDSON INSTITUTE
HUGHES AIRCRAFT
HUMMRO CORPORATION

RLO.S9.5

IBM
ICL
IRS PACKAGE
INDIA
INDUSTRIAL NUCLEONICS
INFONET
INFOTECH
INTEL
INTERACTIVE SYSTEMS CORP.
INTERDATA
IRIA
ITALY

JAPAN

KAENEL, REG
KODAK

LASL
LIPOVSKI, JACK
LLL (LAWRENCE LIVERMORE LAB)
LSI LOGIC

MASS HIGH TECHNOLOGY CENTER
MCC - ALPHA O PACKAGING
MCF - MILITARY C. FAMILY
MCCREDIE
MEMOREX
MINSKY, MARVIN
MIT + LIFETIME EDUCATION PROGRAM DEVELOPMENT
MIT - PROJECT MAC
MODCOMP
MOSTEK
MUDGE, CRAIG

RLO.S9.5

NASA
NBS - NATIONAL BUREAU OF STANDARDS
NEC SYSTEMS LABORATORY
NETWORK SYSTEMS CORP.
NEWELL, ALLEN
NICOUD, JEAN-DANIEL
NIXDORF
NORTH CAROLINA STATE UNIVERSITY
NORTHEASTERN UNIVERSITY
NORTHERN TELECOM INC.
NRC - NATIONAL RESEARCH COUNCIL
NRL - NAVAL RESEARCH LAB
NYIT

OLIVETTI
OMSI
OREGON SOFTWARE

PARIS
PARNAS, DAVID L.
PHILLIPS
PHISTER, MONTGOMERY
PRECISION INSTRUMENT
PRINCETON UNIVERSITY
PURDUE

ROBOTICS
ROCKWELL INTERNATIONAL
ROSE, BETH (WPS CONSULTANT)
RPI
RUSSIA

SANDIA
SAYRE, EDWARD
SCHAFFNER, MARIO
SCHUGART
SCHWARTZ, JULES
SCOTT, DR.

SEYBOLD, PATTY
SIEMENS
SIEWIOREK, DR. DAN
SIGNETICS
SPOCK, MIKE
SRC PROPOSAL
SRI - STANFORD RESEARCH INSTITUTE
STANFORD

RLO.S9.5

TEAG
TEKNOWLEDGE
TEKTRONIX
TELENET
TELETYPE
TELEX
TEXAS INSTRUMENTS - TI
THOMPSON, MURRAY
TREES - GB
TUROFF, MURRAY

UNIVERSITY OF CALIFORNIA
UNIVERSITY OF CHICAGO
UNIVERSITY OF COLORADO AT COLORADO SPRINGS
UNIVERSITY OF ILLINOIS
UNIVERSITY OF MANCHESTER
UNIVERSITY OF MASSACHUSETTS
UNIVERSITY OF NEWCASTLE UPON TYNE
UNIVERSITY OF NEW SOUTH WALES
UNIVERSITY OF PITTSBURGH
UNIVERSITY OF ROCHESTER
UNIVERSITY OF SOUTHERN CALIFORNIA
UNIVERSITY OF TEXAS
UNIVERSITY OF TORONTO
UNIVERSITY OF WASHINGTON
UNIVERSITY OF WATERLOO
UNIVERSITY OF WISCONSIN
UNIVERSITY OF WISCONSIN - MADISON
UNIVERSITIES

VENDORS, GENERAL
VIRGINIA POLYTECHNIC INSTITUTE & STATE UNIVERSITY

WANG
WASHINGTON UNIVERSITY
WEINER, PETER
WESTERN DIGITAL
WILKES, MAURICE
WPI

WULF, W.A.

XEROX

RLO.S9.5

DEC GENERAL FILES

NOTEBOOK IN BACK/PRES. FOR OC REV. ON 32 BIT/APR.81
NOTEBOOK IN BACK/ENG. STRAT. OVERVIEW PRELIM MAR.82
NOTEBOOK IN FRONT OF DRAWER/FY 82-86-LRP

- DEPARTMENTS
  - DEC-GENERAL 72/73
  - DEC-GENERAL UNIVERSITY RELATIONSHIPS
  - DEC-GENERAL VISITORS
  - DEC-GENERAL ORDER/ADMIN
- KO MEMOS
- FORECASTS
  - FORECASTS
  - SYSTEM, SIZE, COST, ETC.
  - FINANCE INDICATORS
  - LRP
- PL - ESG
- PRICE LISTS
- DEC-SYS. DIAL UPS
- DECUS
- DEC PRESS
  - VAX/VMS RELEASE 1.0
  - COMP. ENG. - 9/78
  - GENERAL - DIGITAL PRESS
  - BGN - PROMOTION
  - GB MAILING

BGN - COSTS
DIGITAL PRESS - BOOK REQUESTS
DIGITAL PRESS - LEGAL & AGREEMENTS
PRODUCTION
ENGINEERING
GENERAL
BUDGETS
EUROPEAN ENGINEERING
ENGINEERING REVIEW BOARD
ENGINEERING BULLETIN BOARD
ENGINEERING '74 REVIEW
CENTRALIZED ENGINEERING
ENGINEERING - FCC
PACKAGING
NOTEBOOK - CHARTERS/GOALS/OBJECTIVES
OFIS
BASIC STRATEGY
BASIC PROD. STRAT. 2/81
BASIC PROD. STRAT. SUMMER 79
STRAT. PRES. 2/79
ORIGINALS
LANGUAGES - DAWN
PERSONAL COMPUTER PAPERS
P.C. PAPERS 2/10/81
P.C. PAPERS 11/10/80
FINANCE

RLO.S9.2

POLICY STRATEGY
 GENERAL
 NEW PROD. IDEAS
GB STRATEGY SLIDES FOLLOWING OC WOODS 4/15/81
 GB STRAT. SLIDES FOLLOWING OC WDS 4/15/81
 WOODS PRES. 1980
PERSONNEL
 GENERAL
 MUDGE
EUROPE
 DEC GENERAL
FACILITIES
 CONSERVATION/RECYCLE
 SPACE BOARD OUTSIDE CONTACTS/VENDORS
 TI - TERMINAL
 SPACE - GENERAL
 SPACE
FIELD SERVICE
LEGAL
INVENTORS
 DAN CORWIN -LEGAL
 INVENTIONS
PATENTS
MANUFACTURING
MARKETING (VAX) ASK ANY USER
MARKETING CUSTOMERS
 COMPLAINTS
 GORDON BELL
 CUSTOMERS
 OLIVETTI
PLANTS - DOMESTIC
PLANTS - FOREIGN
 PUERTO RICO
PUBLIC RELATIONS
PURCHASING
PERSONNEL
 ENG. MGMT. GROUP
 PERSONNEL GENERAL
 RESUMES
CONSULTANTS

PER BINCH HANSTEN
CONSULTANTS
VENDOR, HODGE, WINSTON
BBN
CONSULTANT, SCHEIN, ED
CONSULTANT, FUSFELD
CONSULTANT, BILL ROBERTS
CONSULTANT, METCALFE, BOB
IEEE PRESENTATION BROCHURES

RLO.S9.2

GB PERSONAL FILES

CHRISTMAS CARD, MASTER LIST
OLD MONTH AT A GLANCE APPOINTMENT BOOKS (3)
TABLE OF CONTENTS
COMPUTER CARDS
TECHNICAL PAPERS

GB OLD MEMOS 66/71
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 COMP. ARCHITECTURE ARTICLE
BELL - BOOK
 B&N 2ND EDITION
 B&N UPDATE
 BOOK - GEN
BOOK HELP
 11 PROG. BOOK
 BOOK AUTHORSHIPS
CORRES. REF. LETTERS
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 REF. SHEETS

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BELL - PRIVATE COLLECTION
HARRIET WYNTER LTD.
DELEHAR
GEN. BILL COLLECTION
HIST. TECH.

LAWSUIT
MAGAZINE ARTICLES
 ELECTRONICS
 DATAMATION
 MAG./NEWSPAPER ART. ON BELL, GB

MUSEUM
ACM
BRDC (BOSTON RESEARCH DIRECTORS CLUB)
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 CACM
 CACM - SPEC. EDITION
CAMAC
COMP. IN SCIENCE ADVISORY BOARD-FRIEDLAND, SMITH
FULBRIGHT COMMITTEE - EXCH. PROG.
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IEEE COMMITTEES
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NATIONAL SCIENCE FOUNDATION
 ADVISORY COMM. ON INFO SCIENCE & TECH.
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 NAT. SCIENCE FOUNDATION
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GB AT STRATTON V. PBS ALTERNATE STRUCTURE
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 MUSEUM SLIDE TALK MAIN ST. LOBBY 9/75
 NATIONAL RESEARCH COUNCIL MTG. WASH. D.C. 12/8/75
 AMERICAN CAN TALK 11/12/75
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TALKS 1972
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C. ARTIFICIAL INTELLIGENCE
C. CAD (COMPUTER AUTOMATED DESIGN)
- AD - SIMULATION
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C. CARTOONS
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C. DEC 10
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C. DEC 2080
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C. DESK CALCULATORS
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C. ISP/PMS
C. IN-THE-HOME
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C.   LOW END
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C.   MICROPROCESSORS
C.   MICROPROGRAMMING
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T. ALPHANUMERIC
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* d i g i t a l *
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TO: DICK CLINTON DATE: SUN 12 APR 1981
18:46 EST
DICK HOUGH FROM: GORDON BELL
cc: see "CC" DISTRIBUTION DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: ACTUAL PRODUCT DATA VERSUS BURP PLANS: WHEN???

I thought we were going to have some actual versus Burp
business plans for the engineering overview and the April
Woods. When are we going to get something done?

The projections we do for Burp fine. I'd like to use revenue
accounting to verify how we do against the plan. Your
response
in requesting this is unacceptable, and is why I have a basic
problem in understanding financial folks... because
it is basically the difference between accuracy and precision
(a
concept that apparently isn't taught in accounting school).

You do not make these comparisons because our data is not
precise
enough in terms of field service, sales, manufacturing costs,
etc. True. This is not where we blow it, nor do we give a
damn
about these costs cause they are being managed already from a
different viewpoint.

The real issue is accuracy: namely we don't need to care
about these cause the difference that swings everything
is how many units we make, possibly the cost, and probably
the inventory. Since we aren't managing the inventory, I
suggest
the only thing we care about is how many go out the door
versus
how many we projected to. This gives to a first
approximation
the real measure.

If you can not get a set of numbers within some reasonable
time frame that allows us to have a measure of these Burps, I
want all work on revenue accounting ad burping
stopped. We are spending incredible sums in these areas and
I have yet to see ONE number. This is the greatest
fiasco within engineering, and makes all our project screw-
ups
pale by comparison. (I doubt if you can even tell us how
much we spend in making business plans, maintaining, Burp,

doing all the revenue accounting, including the books. The real tragedy is that real people have to spend time filling out these very precise, low accuracy forms and reading the data.

In our new drive for productivity, this is the first set of forms and numbers that should go.

In order to test the system, I would like us to look at the true reveue picture against the Burps in the low end on some of our problem children in order that we don't go blindly on. The products include: tu58, la34, la180, pdt150, vt78, the current pdp-8's, the 11/23's overall. Unless we get some of these metrics fedback, we will continue to make head in the sand forecasts, not measure, and continue to promote and mix around the same crowd.

When could I see some data? (The hope was that this would have been in our overview book ... we really do have an obligation to help run this place on something other than a personality basis.) Also, I am really getting fed up of building some good high volume products and then finding that our P/L colleagues go blow the money taken in on crappy,new, money losing products. Our financial organization isn't helping at all here, and seems to only be reducing productivity elsewhere by requiring forms and pushing numbers that aren't reviewed.

"CC" DISTRIBUTION:

A. M. BERTOCCHI   WIN HINDLE   LARRY PORTNER
BILL THOMPSON

GB2.S5.65

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Subject: **Review of Product Financial Statements**

To: Bob Puffer

CC: OOD

Date: 19 SEP 78
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

follow up 10/03/78

Please send these to each member of the Operations Committee.

Follow-up, scheduling presentations by the group level managers on the performance (S/T, M, L), Memories and Software.

GB:ljp

FROM: GORDON BELL DATE: SUN 10 FEB 1980
6:28 PM EST
DEPT: OOD
EXT: 223-2236
TO: BILL DEMMER
cc: JIM BELL
SAM FULLER

SUBJECT: FINISHING THE 74 PROPERLY

Could you please get someone to take on the task of writing a journal quality paper On the 74 experience? It would tell just how well it performed and include the details (if wise to do so) of the cache invalidation for multiprocessors. It would give the details of M+ and begin to hype it, as it relates to more reliability. I'd be happy to interact with the crew to get an outline (Russ Moore, Kim Kinear, Frank Hassett?, Verell boae, and surely others should be candidates to co-author). There should be experience on the 4 processor case.

Get us together here. I want to learn and document this... and
I think it would be benefical for the designers, DEC and the computer community.

PS
I want to make one of these on the BI using Jaws.

C O M P A N Y   C O N F I D E N T I A L

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Subject: **Some First Impressions of Japan**

To: OOD, OC, Dave Ballantine, Jim Bell, Max Burnet, Don Frost, Bill Green, Carl Janzen, Ron Smart, Dick Yen

Date: 24 AUG 78
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

Here are a few brief first impressions of Japan (having visited Sony, NEC, Fujitsu, five Universities and a Government Lab). As you see below, I'm impressed with their intense drive, technical ability and will to win. Also, I position my understanding of factors which support what I believe is a basic goal to dominate the computer market...just like they do other (especially consumer electronic) markets.

This is a one-sided view as to their ability to win in our market...I didn't see things to get in their way.

I was prepared to dislike the Japanese because they had been so closed and absorbing of our technology and work. I could not help but like them; they were generally open. Now, I fear them more than I was prepared to. Here's why:

1. As a group, they're (industry-government) the most competitive. It's really built into their culture and reinforced by training. The only reason they aren't competing in minis is they're still enamoured with competing with IBM and building mainframes e.g., Fujitsu's new M200 technically dominates the new IBM3033 and Amdahl V7 machines. (We must worry because of what they've done in quality cameras/optics, textiles, small cars, radio, TV, tape recorders, watches, calculators, their position in semiconductors and semiconductor-making equipment, typewriters, sewing machines, etc.) This also drives them to fast response and hard work.

2. They're excellent engineers and tend to be less NIH-oriented than us. This is derived from having less egos, although there is a strong group ego! Japan has acculturated customs, technology, etc. from everywhere for centuries. In the 16th century they apparently set up manufacturing of guns/gunpowder in 18 months once the Portuguese brought them in. Any good idea is fair game (subject only to strict patent technicalities). Having adopted an idea they want to understand it and improve it. (This can be seen looking at progress in all the above plus the research they do.)

3. The current computer manufacturers have a complete line of peripherals, and set of test and manufacturing equipment, taken from copying and improving counter-part U.S. products. [Just as we all learn something from touring another facility, so do they. Should we avoid having them visit our plants? We have to be careful about our discussion of technology!] Here, I'm somewhat ambivalent, because I think we should trade - buy/sell - with them. We (DEC - especially the 11, DG, HP) clearly influenced their minis.

4. All of the manufacturers have acquired their technology over a 10+ year history of dealing with U.S. manufacturers either as a joint venture or under license: Fujitsu (Amdahl/Siemens); Hitachi (RCA); NEC (Honeywell, GE, Varian); Toshiba (Honeywell, GE, Interdata); Mitsubishi (Xerox), Oki (Univac - actually joint venture); Yokogawa (HP); Nippon Minicon (DG). In all cases, the technology has been improved in terms of quality and manufacturability. For example, in the case of the Amdahl technology (that was at least started at IBM), I suspect Fujitsu is one of the few companies capable of manufacturing the miniature/hi-density PC Boards, backplanes and small cables.

5. They seem to be less oriented to technology for its own sake versus what it can do for them in the long run. For example, they moved more rapidly into gate arrays for their computers earlier. (Maybe Amdahl's influence). They clearly think both product and process together in what is a longer term view. (Here, let me reiterate: We must clean up our processes or they'll win by default. We can't make one shot products on a rigged up, ad hoc process). Again, here they're competitive and they orient the processes to 1. Quality first, 2. Volume second (for growth) and 3. Flexibility and turn-around in order to support the volume. This gets into:

6. The Japanese orientation is a strongly engineering versus strongly science-based culture! (We - the U.S. - do their research, wo why should they bother?) This comes about because of the competition through manufacturing novel products and their total dependence on export/manufacturing. For example, much of our federal training, funding, comes through the NSF, ARPA, and armed

services for research. Their funding comes through MITI (Ministry of International Trade and Industry). There's rotation among design and manufacturing engineers. They do have good central research staff and their flow appears to exist to the development groups. They both think they're on the same team. -- In contrast, research in many of the large U.S. corporations is a vast waste, e.g., GE, Westinghouse, RCA and Univac; the work is usually behind the average development and totally decoupled. It's clear how TV, Radio and recording was lost, but the engineers had help because:

7. We (U.S.) have a higher regard to business training versus engineering training. They're in good shape because they don't yet have all the business schools. Therefore, instead of getting MBA's, their students get engineering masters. This not only makes them better engineers, but doesn't reinforce the notion that engineering is the route through to the management ladder, or that an MBA is automatically needed if one is to supervise people. The MBA, oriented at every dual-career person being president, and epitomized by the content-free case study methodology, focusses on the quick buck. This is in contrast to the Japanese concern for the long term (an overall theme).

8. They've read the Boston Consulting Group monograph and are volume (and growth) oriented, subject to the quality-first constraint. Knowledge of the learning curves is everywhere, even the government research labs and universities. Their needs and goals are manufacturing/trade/industry oriented. This also means, like TI that they're will to dump and lose money for the short term in order to gain the market. Although they put on a good act that their products won't be competitive when the yen is so strong, having gone from 300/$1 to 100/$1, it's a big ruse because:

9. Roughly speaking, they have systematically transformed American business from inventor-manufacturer-distributor to simply distributorships. This is in complete keeping with the goals of American business and the modern business school, Horatio Alger, such as RCA, GE, Chrysler, etc. No investment, no planning, no risk, these simply distribute products for the Japanese and roi, profits look fine. All a person has to do to be successful is buy the right product for resale. RCA/GE don't have to worry where the money comes from to pay the Japanese (or Arabs). On the other hand a group who can only run a distributor is probably fairly top heavy and can easily be replaced say, be a hard-working Japanese group. [A solution here is to make someone at the Commerce Department responsible for each area. This should include the joint planning with industry and the prohibition of current manufacturers from being importer/distributors. I.E., RCA would not be allowed to remain in the business and import. The responsibility for an industry has to be delegated!!]

10. There's no way we can re-enter

various lost businesses now that we're just a distributor. The spirit, understanding to develop and manufacture are gone. It's too easy just to distribute. There are now no decent American TV, radio, Hi-Fi, or video recorder products/manufacturers for what are basically indigenous U.S. products and which the first invention or key patents apply! Somehow, these industries and companies have been grossly mismanaged. (I also blame the Department of Commerce - a faceless, leaderless nobody!) How? Why? It can easily happen to us!

11. They're more long versus short term oriented. Their history encourages this. They're capable of waiting us out in an area because we're so big bang (product) oriented and because they want long term business domination. NEC, Fujitsu and Hitachi, unlike Xerox, GE, Westinghouse, RCA, have all persisted with computers and now appear to be winning! This timeliness certainly affects their thinking on quality, and lastingness both in markets and products.

12. They believe computers are fundamental for the long term and they're prepared to wait. Machines are used in all products they build for export and they save labor - and labor is precious expensive in Japan as there are only 110 M people and 2% unemployment. They're considering raising retirement from 60 to 65 to get the extra productivity. They need computers to raise productivity! This is vital to their domination of manufacturing. (This is the opposite of the Australian attitude where there is high unemployment and a need/belief that computers must be eliminated. Australia is now almost totally dominated by Japanese products).

13. They are willing to give up profit for growth. For example, RCA is on a rug maker (or distributor), car rentor, book publication, TV Distributor etc., instead of an electronics company that really pioneered the T.V. Whereas there is extreme pressure on business for profit and return on investment, these factors are less in the Japanese companies. Sony is quite profitable, Fujitsu does relatively poor financially and I'd bet NEC or Hitachi computer divisions might even lose money. For now, they may still be buying in - clearly more acceptable than GE, Xerox and RCA. (This makes them doubly hard to beat...since they can lose money on every one and make it up in volume. They'll buy this business - DUMPING! and why not?)

14. Products are quality/detail oriented versus being the ultra-high volume, low-quality throw-away types. These are characterized by say, Sieko (versus Timex) and anyone of their cameras say, Minolta (versus Kodak or Polaroid which assume an idiot user with no concern for quality picture, but must have it now...again the time attitude). For example, while they make no instant cameras, perhaps due to patents, when they do they'll be quality.

There are zero defect signs everywhere! In the Sony VTR plant there was no burn-in of the recorder. All subassemblies had been inspected and tested. When it was put together it worked.

15. They are compulsively clean. In an indirect way, this really helps the manufacturing of small, precise goods (e.g., cameras, LSI, high-speed computers, some disks).

16. Even though they have a concern for long term, <u>they work the short term very hard</u>. This may follow from the competitiveness/growth. They engineer for quick turn around, they have good processes and the engineers at these large companies work very hard. The official work week is 40 hours, but a more accepted pattern is 50-60 hours...particularly to maintain schedule or to win against IBM, Amdahl or Hitachi (if you're at Fujitsu).

17. As the head of our Osaka sales office put it: the Japanese live to work versus the American need to work to live. He claims this is instilled at birth and trained. Work is a central theme, and the companies go through extensive screening to hire for life - e.g., some companies only get graduates from certain universities. Housing is provided for the workers and they have what amounts to a lifetime contract. This is bad if a person's incompetent, it also means that it's hard to breathe different life into an organization. On the other hand, turn-over is low to non-existent and a team spirit clearly develops as the various members learn to work with one another.

Their physical condition certainly reflects this work ethic too! On one hand there is a great deal of smoking, although a campaign is in progress to reduce it. However, nearly all Japanese are trim versus being basically overweight. Their diet (including excellent raw fish and vegetables) is conducive to trimness and better health, I'd guess. Although alcoholism is supposedly on the rise, the consumption in business I saw was certainly less than in the U.S.

18. The long term, quality products makes them build products that are hard to beat on a life-cycle basis. While it isn't clear they really consider all life-cycle costs, their cars now get good ratings - even though they may be designed to decay rapidly after say x years/y miles. In the case of computers, they always build multiprocessors because their customers invariably buy and want upgrades. Since IBM rents, the multiprocessor approach hasn't been developed. The multiprocessors they sell are also built for better Reliability, Availability and Maintainability. They seem to do a better job considering life-cycle costs than we do!

19. At a government/society level they appear to have their act together much more than we do. In both newspaper stories and in their products they seem to have clear, crisp ranking of goals and priorities. For starters, they know them, whereas nearly all our issues that start out simple become entangled as everyone (a new set of referees) enters the fray (e.g., human rights vs equal rights; full employment vs inflation, balance of payments; environment vs region vs country; capital vs labor; consumer protection vs business protection), but worse than a muddy set of design

criteria is a muddy set of decision makers and an unclear decision process.

Because of the need to export, there's very good support for engineering and many go into it. There are comparatively few lawyers, (factor of 2 per person), so the emphasis is on physical output rather than paper, and intergroup contracts, and bickering among semantic accountants.

20. INVESTMENT

As a simple explanation, more money is available for investment because of lower taxes. This clearly affects their ability to invest in industry. They're supposed to be willing to pollute for profit...I didn't observe this. (Maybe they only kill whales outside of Japan and pollute other environments). Their environment is fine - though high density. On the other hand, taxes can be low because:

21. <u>Their Government spending for military is far less</u>. (Nearly non-existent). Although there is some fall out of our military spending for computers and related research, it's small compared to what it could be if there were more directed goals such as the Japanese export goals. It's not clear what these goals should be.

22. The <u>Japanese don't have the waste, federal research expenditures, such as NASA and the Energy Department</u>. (Here again, they can rely on us if there's any output.) These are big expenses and contribute little. The Energy Research seems to still be the old Atomic Energy Commission, but dressed in new clothes. The labs do about the same work, with essentially no output. (At least at the AEC, their goals were clearer, and we had a consistent flow of big computer bangs...plus a constant market that's motivated to provide computers.) Here, the Japanese do some nice work in regard to funding and managing research flow. Their labs buy versus develop in a vacuum with no way to get the flow.

23. <u>MITI</u> and other labs <u>fund other laboratories and corporations</u> to carry out research that's oriented to getting experience that will assist products. This not only provides a system of checks and balances, but provides an incentive. This minimizes what I call the "dusty-lab syndrome". Many of our government and federally funded labs were initially set up for a mission, and once the mission has been completed, the lab continues to exist. Since there's no real need, or mission, or review, negligible new work is output. (Recall visiting labs in which the dust is blown off the equipment for visitors and the same demo is run year after year. The same equations are on the board, with the same usually vague, unattainable, immeasurable goal for the research.) A buyer-seller relationship can help check this to some extent. Also this brings the groups together and technology transfer is more likely to take place.

For example, NBS is setting up a lab to do standards research and industry is free to contribute interns to them - this is ridiculous! A more fruitful way to bring about the standards is to subcontract several approaches and have industry develop and report on them with NBS. In this way the staff is minimized at NBS (which will be obsolete and impossible to acquire) but they will get more quality through their buyer role. Foremost, there's a reason to interact.

There's a good understanding about the research flow mechanism. They use all sorts of techniques -- organization, people-rotation, having many visitors to the U.S. Labs, buyer-seller, space, etc. -- but they do have the concern because of the limited number of people. We seem to have too many doing too little with no concern for output.

24. Overall, MITI appears to be very strong and competent! The goal of MITI/industry is a strong industry! This is in contrast to our Department of Commerce which appears to have the standard 9-5 bureaucrats, who are in it for either security or power - but with no real way to make anything happen. Nor is there any measure. I don't know what's missing that they have (just quality people - as Reischauer suggests, the right longevity, power, process, maybe they segment responsibility and measure results with reward based on performance (e.g., winning in a trade area)). In a few samples, I believe it's simple people quality, and the right process enabling them to accomplish something. Being responsible may be the key variable. Here, this suggests we could probably eliminate the Department of Commerce and have no real change except more output.

25. While there doesn't appear to be Japan Inc., there is clear collusion (planning etc.) among the government, and companies. They actually plan to win! This includes basic strategy setting among the players to segment and go after various markets (e.g., Fujitsu/Hitachi are 370 plug compatible). The companies can talk to one another and do, but certainly compete intensively with one another.

Japan is quite a closed society and market. As the most powerful, homogeneous culture there is a long history of this. A quick trip, a pass through Reischauer's book, The Japanese, and an explanation of just a part of the tea ceremony make this vivid! Two years is a frequently quoted number to begin to understand this.

26. The language is a code to further segment. It's not clear how difficult it is to learn, but it's probably relatively useless without the societal understanding. We don't teach Japanese widely. On the other hand the technically trained Japanese have maybe six years of English in order to read the literature. (This is probably a good reason why we should use OEM's to enter the end-user commercial market versus translating the many manuals.) On the other hand, the lab, industrial, educational and engineering market may be open without extensive mail translation.

27. The tariffs support the establishment of any industries they target. Now the computer import duty has been reduced, but I doubt if this matters much

since their industry is strong enough to withstand imports!

28. By the society and the emphasis on personal relationships (not clear they're any more than French) it's hard for foreigners to break into or sell, especially on a one shot basis. (It remains to be seen whether an American manager say, could set up and effectively manage a Japanese office.) "Doing business" together appears to be done over a long time period and is almost ritualistic.

29. There is an amalgamation of the Japanese within an industry which creates something that's often referred to as Japan Inc. (I think the Japan Club is a better name, because there's at least a show of competitiveness at the market level.) Not only is MITI supportive, they also appear to dictate. What's worse is they interact with industry in what appears to be a helping way as described above. For example, DEC products were in the Computer Engineering/Science Departments when the 11 first came out, but with a Japanese mini industry we really don't sell there. I'm sure it's because of their recognition of this market (also they discount heavily in the universities and consider it a prestige sale)...there may even be some special tax incentive. There is incredible pressure to buy Japanese products!

The high cost of labor, limited population and full employment coupled with few natural resources, creates some interesting by-products.

30. The pressure to work is fed back, creating more work and output, since everyone is working.

31. Inventions are to labor-saving devices. I saw countless gadgets of this form. All the printers at computation centers had paper cutters on them with conveyors to bring output back to a single station. There are NO computer operators, tape mounters, etc. running around!

32. There's real concern for saving of physical resources too. At the computation centre, printout isn't automatic; it's queued and must be requested by badge reader, (also, lights - always fluorescent due to efficiency - are off in the computer room - the console is external with only one or two operators!) Of course small cars, taxis, a good train/subway are other indicators. The cars have bells that ring when the car is going over 100kmh!

33. There's measurement of and pressure for efficiency (i.e., work out/work in is high). In a taxi, there's an automatic back door opener so that the driver can load/unload faster. Of course, the factories graph everything. It feels like the notion of efficiency is taught to all.

34. Everything runs on time and at

full capacity (trains, planes, a supply of taxis, buses and especially meetings, tours, etc.). This is in contrast to the habits we've gotten into on scheduling and performing at meetings! Also, Yu Hata did an excellent job of scheduling customers, manufacturers and sightseeing. I accomplished roughly twice as much per day as in another western country.

35. There's orderly queueing at each server. The Japanese appear to be the world's best self-queuers. There's probably some protocol for resolving races when two persons arrive to the queue at the same time.

36. There is a range of basically human/personal concern. While the subways and trains jostle people pretty badly (at high density), and there's no segmented smoker areas (and many smoke), there's great concern for the feeling/privacy/treatment of individuals. Perhaps I had special treatment, but on arrival/departure at every organization, we were given hot cloths for refreshing (it was hot and humid - but taxis and all buildings had A/C), and either tea (occasionally coffee - to be really considerate of a westerner) or cold juice. The hotels though incredibly expensive were the best I'd ever stayed at in terms of quietness, service and general treatment. This included a large, but very well run chain hotel in Tokyo. In Kyoto I stayed at a tiny (fifteen room) old style, old Inn, and only once did I ever see any other guests (at the front door). The goal is to make certain that guests are totally alone, with incredible attention to simplicity, design and detail (e.g., there was a cloth over the telephone because it didn't fit the room decor).

Of course, the food is the ultimate in personal concern. Food served in seven, nine, or eleven courses varied from raw fish to pickled vegetables (e.g. potatoes) and flowers (lotus blossoms) with lots of seaweed and fish and fish eggs. There is western-oriented food like tempura (deep fried), hibachi grilled meat and fish and teryaki. At the first of the week we had western/continental/universal-style food because our hosts were concerned, and then we asked to have only Japanese food. We ate nearly everything (there's one kind of seaweed I found unpalatable). Of the sandwiches we had, the bread crusts were removed. There was much concern that the colors of the food matched - the physical looks were important.

There are Japanese baths, and these are great too!

37. Products are designed for people with attention to detail. The styling happens to be also attractive to others, but their technical, gadget-orientation really biasses them to designing technical looking, knob-intensive products (hi-fi, complex watches, cameras, etc.). It's probably impossible to have them design a product like the polaroid one-step camera. (Emotionally, I doubt if the designers can do it based on the picture quality.) Color monitors were used to control the larger machines.

38. Contrary to expectations they are working the environment issue. There were U.S. environmental people there at a conference, and the Japanese were politely ignoring them...and taking their conference registration fees. Nearly all cabs are LP gas! Although they're physical comfort oriented, they do work the resources too.

39. They seem to do "bottom-up" product design versus "top-down" market planning as typified by the expensive heavy, multi-volume market surveys. These usually report history and extrapolate it in a self-perpetuating fashion. Using this approach, we continue to build heavy, gas-consuming cars because the market has historically bought them (given few alternatives). They look at the needs, and take existing ideas (designs) and improve them.

<u>EPILOGUE</u>

On arriving at Sydney, I was struck with contrast to dense, intense, humid and hurried Tokyo. I was ecstatic to get back (after twenty years) to a life style, people and place I really like:

Sydney's beaches are the world's finest; the weather's great; people spend lots of time out of doors with sports, strolling and simple gardening (versus the subtle and very complex Japanese gardens); work starts late, runs slower and ends promptly; and the food (universal/continental/western), beer and wine are drastically improved having moved away from the early English influence. I look forward to a last weekend stroll. I'll enquire about the best reef for SCUBA diving (on another trip).

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Al Bertocchi	PK3-2/A56	Dick Clayton	ML12-2/E71
Jim Cudmore	ML1-5/E30	Sheldon Davis	PK3-1/C16
Bill Demmer	TW/D19	Ulf Fagerquist	MR1-2/E78
Win Hindle	ML5-2/A53	Bill Johnson	ML21-3/E87
Ted Johnson	PK3-2/A55	John Kevill	ML1-3/E58
Andy Knowles	ML5-2/A53	John Leng	MR1-1/F35
Bill Long	ML5-2/A53	Julius Marcus	MK2/C37
John Meyer	ML12-1/A11	Ken Olsen	ML12-1/A50
Stan Olsen	MK1-2/A57	Larry Portner	ML12-3/A62
Bob Puffer	ML12-2/E38	Jack Smith	ML1-4/F31
Dave Ballantine	ME	Jim Bell	ML3-2/E41
Max Burnet	SN	Don Frost	PK3-2/S50
Bill Green	ML1-4/B34	Carl Janzen	AK
Ron Smart	AK	Dick Yen	TA

Digital **Interoffice Memo**

Subject: **Fixed (Non-Programmable) Applications Product Line (as a Dist. Channel)**

To: Marketing Committee   Date: 29 SEP 76
OOD   From: Gordon Bell
Jim Bell   Dept: OOD
Ed Fauvre   Loc.: ML12-1
Ext.: 2236
Bob Glorioso
Len Halio   F/U 10/6
John Holman
Jack Mileski
Steve Teicher
Jim Willis

I'm proposing that an engineering group work with several PL's to identify, design, and build specific, fixed application-direct hardware/software products which will be sold across many PL's (either on basis of their SIC-code orientation or their different channels of distribution).

For example, Word Processing can be looked at several ways:

1. Basic (evolutionary) editor, product available on a specific configuration to be sold through one or a small set of product lines (i.e., Commercial).

2. It can be confined to its own line.

3. Sold like any other software product across all product lines.

Is it worthwhile to think of an existing or new channel which is the "fixed program applications" PL?

With more intelligence at lower levels in terminals, etc. we're going to have infinite opportunities to bind applications to particular products, and it seems we have a basic choice:

0. Ignore the opportunities. Let's not.

1. Let our OEMs (1 or 2 forms) do the particular ones. Unfortunately there is only 1 program to write and no way for them to add anything except sell them.

2. Develop OEMs who distribute the fixed program things. For example, a single program to index microfilm will convert the DS31 into a microfilm indexing and retrieval unit.

3. Set up separately or as separately but adjunct to each PL, a part that markets particular applications systems.

What do you think?

GB:ljp

ID#0273

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Subject: **National Floating Point Standard**

To: Sam Fuller

Date: 15 SEP 78
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

follow up 9/29/78

Somehow continuing on the National Floating Point Standard is essential. Can you take Mary's place at meetings? or who should? Stone?

GB:ljp

It is possible to make a drive that looks like a floppy to a system, but is much faster and not very expensive. Consider making a drive with say 256Kbytes using 36 chips at a cost of about $5 per chip would give a drive of about $250. The pseudo drive would have a battery and would get rid of all the access times. Maybe it doesn't work well enough, but on the other hand, it is clear that all of our Personal Computers (278, CT, 18X, etc.) would probably use it if it were transparent to the software. Also, there is probably an outside market.

What do you think?

July 27, 1978

Ivan Flores
Flores Associates
Computer Consultants
108 Eighth Avenue
Brooklyn, N. Y. 11215

Dear Mr. Flores:

Mr. Bell received your letter of June 21. He is away on an extended business trip and asked me to let you know that he doesn't believe we are interested.

If, however, you find yourself visiting out our way, please give him a call.

Sincerely,

Mary Jane Forbes
secretary to Gordon Bell

MJF:ljp
ID#0177

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SUBJ: FOLLOW UP NOTICE

TO: Bob Grimes, ML1-5/B90

Date: 25 JAN 79
From: Gordon Bell
Dept: OOD
MS: ML12-1/A51   Ext:
223-2237

Follow Up 2/7/79

I'd still appreciate an answer to the attached.

mj

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SUBJ: FOLLOW UP NOTICE

Date: 11 JAN 79
From: Gordon Bell
Dept: OOD
MS: ML12-1/A51 Ext: 223-2237

TO: Bill Johnson, ML21-3/E87
Bill Keating, ML12-3/A62
Dave Schroeder, MK1-2/H32

Follow Up 1/19/79

I'd still appreciate an answer to the attached.

mj

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SUBJ: FOLLOW UP NOTICE   Date: 11 JAN 79
From: Gordon Bell

TO: Carl Janzen, AK   Dept: OOD
MS: ML12-1/A51   Ext:
223-2237

Follow Up 1/19/79

I'd still appreciate an answer to the attached.

mj

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Subject: FOLLOW UP NOTICE

To: Bob Grimes, ML1-5/B90   Date: 2 FEB 79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-
2236

follow up 2/9/79

I'd still appreciate an answer to the attached.

mj

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Subject: FOLLOW UP NOTICE

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To: Dick Clayton, ML12-2/E71          Date:  17 JAN 79
    Bob Glorioso, ML3-2/E41           From:  Gordon Bell
    Len Halio, ML1-2/H26              Dept:  OOD
    Roy Moffa, ML5-2/E93              Loc:  ML12-1/A51  Ext: 223-
2236
    Charlie Rupp, ML3-2/E41
                                      follow up 1/24/79
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I'd still appreciate an answer to the attached.

mj

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Subject: FOLLOW UP NOTICE

To: Jim Cudmore, ML1-5/E30

Date: 17 JAN 79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

follow up 1/24/79

I'd still appreciate an answer to the attached.

mj

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Subject: FOLLOW UP NOTICE

To: Bob Puffer, ML12-2/E38

Date: 17 JAN 79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

follow up 1/24/79

I'd still appreciate an answer to the attached.

mj

ID#405

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Subject: **Using Fonz and Tiny with Industry Standard Chips**

To: Roy Moffa, ML1-2/H26

Date: 1/8/79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

Don Gaubatz's work on multiprogramming at the microprogram level on LSI-11, Fonz and Tiny appears to enable systems to be built using these computers which also use industry standard peripheral chips. At least we have an 11 ISP that can use the standard peripheral chips in a software transparent fashion.

It seems there are several implications for you as chip suppliers:

1. Don should write it up, educate chips developers, educate users and try to apply it on several internal applications.

2. The new computers (eg Tiny and Fonz) must be able to support the method using one of the several methods.

3. We have to make sure the new product opportunities are identified, so we get as much bang as possible as quickly as possible. These include: very low cost systems; peripherals for existing systems which would use Fonz or Tiny as the controller to a Unibus, or possibly even a Q bus; peripheral systems such as the communications and HSC subsystems for HYDRA; and peripherals in general (e.g., LA34).

CC: OOD
Sam Fuller, TW/A08
Bob Glorioso, ML3-2/E41
John Holman, PK3-1/P84
Jack MacKeen, MR2-2/M65
Jim O'Loughlin, TW/E07
Wayne Rosing, TW/A03
Joe Zeh, WZ2
Bruce Delagi, MR2-1/M64
Don Gaubatz, ML3-2/E41
Len Halio, ML1-2/H26
Andy Knowles, ML10-2/A52
Bill McBride, MR2-3/E70
Bob Savell, ML5-2/E50
Mike Titelbaum, ML1-2/E65

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Roy Moffa	ML1-2/H26		
Dick Clayton	ML12-2/E71	Jim Cudmore	ML1-5/E30
Bill Demmer	TW/D19	Ulf Fagerquist	MR1-2/E78
Bill Johnson	ML21-3/E87	John Kevill	ML3-6/E94
John Meyer	ML12-1/A11	Larry Portner	ML12-3/A62
Bob Puffer	ML12-2/E38		
Bruce Delagi	MR2-1/M64	Sam Fuller	TW/A08
Don Gaubatz	ML3-2/E41	Bob Glorioso	ML3-2/E41
Len Halio	ML1-2/H26	John Holman	PK3-1/P84
Andy Knowles	ML10-2/A52	Jack MacKeen	MR2-2/M65
Bill McBride	MR2-3/E70	Jim O'Loughlin	TW/E07
Wayne Rosing	TW/A03	Bob Savell	ML5-2/E50
Mike Titelbaum	ML1-2/E65	Joe Zeh	WZ2

Hydra Evolution. Hydra is designed using a standard commercially available microprocessor family, the National 32032 (and compatible 32016) microprocessors which we rate at 0.75 Million instructions per second when instructions are run from the common, 32Kbyte cache memory and 95% of the references are in the cache.

The National 32000 family was selected based on these critical factors: ability to access large virtual and physical memories, having a wide range of data including IEEE Floating Point format numbers, and closeness to the highly successful VAX-11 architecture which enabling effective utilization of UNIX and other software. Texas Instruments is also designing and manufacturing 32000 compatible products. National has announced future microprocessors which operate at 2 and 4 Million instructions per second for availability in 1986 and 1988. Encore expects Hydra to evolve to 40 processors and over 100 Million instructions per second, and 256 Megabytes of memory within three years.

Encore software is written in transportable C language, in order to utilize microprocessors which meet data-type, compatibility performance (including floating point) and memory access ability for both virtual and physical memory. When faster processors are available, new cards can be intermixed with existing DPC100 cards for continuous and compatible upgrade, preserving customer investment.

<u>MULTIMAXX</u> <u>Performance</u>. Performance is highly application, basic software language, program location and computer configuration dependent. The ideal multiprocessor application utilizes the processor's registers, makes a high percentage of references to cache memory, and utilizes all memory cards equally.

Since multiple processors share common hardware facilities, performance degradation occurs when a single hardware resource is in contention. Also, the cache memory operates on the statistical principle that most references are to the cache which has an access time of 100 nanoseconds; when a memory word is not in the cache, then primary memory which has an access time (including bus access and transit time of ? nanoseconds) must be referenced. Two sources of hardware contention can occur:

- . Dual Processor Card - two processors access the common 100 nanosecond memory. We have measured a range of applications and have observed processor degradation due to contention among the two processors on the same card to vary over the range: 4% to 14%, and anticpate an average of 7%.
- . Shared Memory Card / Nanobus - When a memory reference is required, the bus must first be accessed, followed by the memory access. Since the bus is requested and access to memory occurs. Since memory contention is highly dependent on the location of a program and specific cache success results, it is difficult to predict the performance loss on an average basis. A simulator has been used to study a range of programs. Two cases can be observed:
  - . the worst case - all processors simultaneously access a common area of memory within two memory cards (this

condition can occur when all processors are interpreting Multos);
.the best case - all processors access memory distributed equally in all memory. (This is roughly equivalent of four of 16 processors accessing each pair of memory cards.

A simulation of /////

A similar phenomenon of software contention occurs when multiple processors must access common program or data. Contention of this type is systematically reduced by reducing common programs and data where waiting must occur. Experimental systems at CMU and other commercial systems have been able to accomplish the reduction so that negligible loss occurs.

Hydra Longevity and Its Application. The Nanobus provides the key to product longevity by being able to accept new, higher speed processors that will be evolve with CMOS VLSI. Real time data can be processed at up to full bus bandwidth (100 Mbytes per second) using all known methods of interfacing including: interrupts (? events per second), direct program control (? events per second) and direct memory access (DMA).

Hydra will be used for traditional timesharing, batch processing, transaction processing and real time where powerful multiprogramming is required.

In order to get started on the longer term process improvement program I'm calling Force '83 which you nominated me to look at, we need to progress rapidly on the interim process Engineering Process Improvement Program, EPIP (alias Operation Tourniquet). On Thursday, each of you are naming persons for EPIP to address processes and Pete will chair the overall program.

I would like to propose the following review for our education:

Engineering Staff would do a one day review of all the Force Lines (note below) for building hardware systems. We would ask the responsible operational process managers to present the various engineering processes which they run at the sites, together with the performance of the line segments. Alternatively, we might ask various Project Engineering Managers for a product or set of products to describe the Force Lines in use for their product or product set. Let's settle the approach on Thursday, or make it at the discretion of the site manager. In either case, I would like to have both Force Line and Product Force Line Managers there for cross checking purposes.

In particular we would review the Product Force Lines x Force Fields for:
.ML- Terminals and Workstations; and 11 Systems; Mass storage
.TW- Distributed Systems; Gemini/Nautilus/Scorpio
.MR- 2080; Venus
.MK- Distributed Systems; Commercial Hardware
.CX- Disks
.HU- VLSI; Various gate array Force Lines
.Reading- Distributed Systems

These folks would present:
.Graphs of the Force Lines broken into Force Line Segments for various Product types

.Organizational structure for the managers responsible for the complete line (if any) and each of the line segments. Also, comments on how information is controlled across the Line Segments.

.Performance in terms of time (versus pertinent parameters) of the Force Line Segments together the organizational interfaces and the queues. Bernie gave a review of UNA here that could be used as a template. Also, the metrics folks publish results across nearly all line segments for the module layout line segment.

THE DEFINITIONS:
.Force Field- collection of Force lines forming a single site

.Force Line- collection of Force line segments that operate mostly in a single thread, feed-forward fashion with virtually no merger with other force lines

.Force Line Segment- defineable and schedulable process step which corresponds to a work station operated by a single organizational individual or group on an assembly line (eg. design, module layout, module fabrication, assembly, product introduction). A segment is created anytime there is transfer of work outside an organization (2 levels usually).

.Product Force Lines- the set of lines used for a particular product. This can be as small as a Force Line when it is defined as capable of building a module AND the module forms a single product. Examples of a complex set of Force Lines include the Venus Force Lines that form the tree: MCA's (a line), Modules (another line), a collection of Modules forming a Box (possibly another line), the backplane (a seperate line), and the whole system formed from the boxes together with the mechanics to house the system. The PFL's correspond only roughly to the PERT chart of the project because a given line segment can operate on different parts of the project at different times!

|n looking at these various processes x products, I think it would let us really kick off EPIP appropriately. It seems to me we could schedule it very soon as I assume the whole set of proceses are very clear.

What you say?

Please comment so we can sanction this by Thursday and get into details!

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Subject: **Forms Languages**

To: Pat White, ML12-3/E51

CC: Dick Clayton, ML12-2/E71
Ulf Fagerquist, MR1-2/E78
Ed Fauvre, MK1-2/E06
Bill Johnson, ML21-3/E87
Bill Keating, ML12-3/A62
Larry Portner, ML12-3/A62
Dick Snyder, MR1-2/E37

Date: 8 DEC 78
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

follow up 12/22/78

We have many. Could you get the forms languages enumerated and characterized?

Should we have a standard(s)?

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST:				
	Dick Clayton	ML12-2/E71	Ulf Fagerquist	MR1-2/E78
	Ed Fauvre	MK1-2/E06	Bill Johnson	ML21-3/E87
	Bill Keating	ML12-3/A62	Larry Portner	ML12-3/A62
	Dick Snyder	MR1-2/E37	Pat White	ML12-3/E51

DISTRIBUTED SITE PARALLELISM

INDEPENDENT

NETWORK, WITH EXPLICIT TRANSFER OF INFORMATION AMONG NODES

SINGLE (BUT DISTRIBUTED) DATA BASE

DYNAMIC ASSIGNMENT OF PROCESSING AND INFORMATION STORAGE

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! d i g i t a l ! i n t e r o f f i c e m e m o r a n d u m
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Subject: **Fortran (not BASIC) Policy**

To: Ulf Fagerquist, Bill Heffner, Bill McBride, Larry Portner, Pat White
Date: 20 JUNE 78
From: Gordon Bell/John Leng
Dept: OOD
Loc.: ML12-1 Ext.: 2236
CC: RT/C POT, Andy Knowles

follow up 7/5/78

I believe our action with respect to Fortran has been irresponsible. We're spending much of our resources to fooling around with Basics after getting many poor ones to a fewer number; now we're adding more again (Basic-11, Basic-10, Basic + 2 (10, 20, 11, VAX), Basic LDP, RSTS and probably many more I don't know).

The fact is, RT11/Fortran is selling more than BASIC and our scientific users are Fortran. This may be because it is a standard versus the situation in BASIC (another name for Anarchy).

We would like to ask:

1. Where are we on all our many BASICs? How much did we spend, how long did they take to get, how big are they? What are they written in? What's our strategy on the language and evolving it? (Let's review history and let it help us guide the future.)

2. Do the same with Fortrans. Plus how are we coming on the necessary ANSII improvements?

3. With all our competitors (e.g., with HP's, Tektronix's, Radio Shack) building BASICS, how will we be unique? Maybe our buyers are saying something -- for serious computing (where it's

necessary to have subroutines, libraries, a programming discipline, and a community of shared users) they prefer Fortran.

As of now Basic will never be anything except a way to solve small problems quickly. (The first 1% of large problems can be solved quickly too.)

4. Review our strategy.

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST:	Ulf Fagerquist	MR1-2/E78	Andy Knowles	MR2-2/A52
	John Leng	MR1-1/A65	Bill McBride	MR2-3/E70
	Larry Portner	ML12-3/A62	Pat White	ML12-3/E51
	John Adams	MR1-1/M42	John Buckley	MK
	Bill Heffner	ML5-5/E76	Bernie Lacroute	ML3-5/E35
	Steve Mikulski	ML5-2/M11	Jack Mileski	ML12-3/E13
	John Mucci	MR2-4/M38	George Plowman	ML5-5/E97
	Mike O'Connell	MK	Grant Saviers	ML1-3/E58
	Charlie Spector	ML5-2/M17	Mike Tomasic	ML3-3/E71
	Larry Wade	PK3-1/F51		

The first article of three on Digital, describes the situtation as the company was poised to enter the Fifth Computer Generation. The second part describes the various critical alternatives facing the company. The concluding part describes the chosen path and the market reaction.

Early in 1981, Olsen realized they were in trouble with respect to being a leader in the diverse range of products and markets. They were poised to only get a small part of the many explosive markets, while at the same time, lose market share for their traditional timesharing products. Specifically, DEC was:

. facing an explosive word processing and office automation market with a solid set of products. While each of the products were not best, the combined set gave the broadest product range, covering word processing, electronic mail, combined word and data processing, and typesetting. Unfortunately, marketing expertise in word processing was confined to a single, small group and management spent most of its time defining charters for its groups rather than on the tactics of winning the market by requiring all its market groups to sell the products!

. evolving its traditional 1970's, third and fourth generation "rack and stack" business to meet its mainly OEM customer requirements. Past customers had locked DEC into its historical product set; many of the same technical customers were however, busily designing with the emerging Fifth Generation non-Digital Semicomputer company Standards set by Intel, Zilog and Motorola. The OEM group was arguing to perpetuate the Unibus, the defacto standard interconnect of the '70s that came out with the original 11/20 in 1970. At the same time, they were introducing a new set of systems based on their later interconnection scheme used for their early fourth generation (circa 1975). Unfortunately, both historical packaging schemes were inadequate to permit competitive systems to be designed, since the Semicomputer companies had set substantially higher performance and lower cost standards through the defacto and the international standards bodies.

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Don Knuth's Tau Epsilon Chi (T_EX) is potentially the most significant invention in typesetting this century. It introduces a standard language for computer typography and could rank near the Guttenburg Press in terms of importance. The T_EX system:

. understands typography from individual characters to page design;

. permits any typewriter, word processing system, computer-based editor, or T_EX system editor to be used as an input device with a standard language;

. can typeset various formats and languages;

. is structured to be user extendable to virtually all applications.

These characteristics represent a benchmark improvement in both typesetting and text creation. To date, computer-based typesetting systems have simply facilitated typesetting. The proliferation of word processing systems makes it possible for widespread direct transmission of text to typesetting without the intervening typesetting process--provided we use the standard language that TEX offers.

A direct link between text input and typesetting will permit a drastic restructuring of the arcane journal and book publishing industry, allowing it to be oriented substantially more toward the author. Even with word processing equipment, authors have not been able to participate in the representation of their message. Prior to the Guttenburg Press, manuscripts were conceived and designed simultaneously, and the author's hand shaped the entire final product. The results were beautiful and varied in contrast to the manufacture of most modern books, which vary only in cover design. With TEX, moreover, not only does the author again control his own format and representation, but he can also produce more accurate material that can be rapidly mass-produced, shortening the time between idea and dissemination.

TEX is significant as a standard language because of the way it understands typography using a framework of boxes and glue in a hierarchical fashion so that any font, page layout, or other typesetting parameter can be set. This is in striking contrast to most typesetting systems, which are built with no generality. Finally, the input form is user-defined by means of a macroprocessor so that virtually any text can be input and control the typography part of the program. It is this generality and segmentation of function that will make TEX significant.

The book is about much more than just the TEX system. The Gibbs lecture presents the twin themes of how typography can help mathematics and how mathematics can help typography. Although the lecture of Metafont is intriguing and useful and describes the use of mathematics in type design, it is the discussion of TEX itself that interests us in the short term.

While the emphasis of $\TeX$ is on mathematics, the systems is equally applicable to and will no doubt be used in many other domains. Don Knuth, in fact, shows us precisely how the system can humanize basic communications.

At DIGITAL, we hope to use $\TeX$ immediately. I urge others to adopt and use it so that the language standard can be established.

June 1, 1978

Mr. Guy L. Fougere
Vice President
Arthur D. Little, Inc.
Acorn Park
Cambridge, MA 02140

Dear Mr. Fougere:

Ed Vrablik is in charge of co-ordinating external acquisitions and he has tried to get our internal users interested in Space Graph.

Unless there is an external buyer who would put up the funds to further develop and buy the product on a low volume basis, it feels right to me that we not invest in it. I'd like to encourage you to work with our Computer Special Systems Group to get such a buyer.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:ljp

CC: John Holman, Head of CSS
    Ed Vrablik

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SUBJ: FOUR WHEELS OF REINCARNATION

TO: DISTRIBUTION

Date: TUES 13 SEPT 82
From: Gordon Bell
Dept: Eng. Staff
MS: ML12-1/A51
Ext: 223-2236
EMS: @CORE

BACKGROUND

The new version of Computer Structures has a six dimension Kiviat graph to represent the rough performance and implied structure of all kinds of information processors, eg. teletype, PDP-8, Cray-1, database machine. The six basic dimensions are the PMS structure components: Pc, Mpmemory, Msmemory, T.human, L.communication and L.external (C, T, L).

Today there are predominately four higher-level types of information processing system types, labelled by their function:

1. General purpose processing or computing C := Pc + Mp, The function is to take some imput information and generate new . numbers, test, symbols.)

2. Database centered storage and retrieval, ie. backends or

   C.database := C + Ms. The function is to accept, hold and retrieve information in a suitable and reliable fashion.

3. Communications processing (the front end), or L.communications- -links to other information processing. The function is incestuous--simply communicating with another information processing system.

4. Visual display processing or T.human(visual)--a transducer that transforms information in a computer to picture information, usually on a CRT with an embedded computer.

OBSERVATIONS

1. Each functional type of system is based on special knowledge:

Pc(numerical, symbolic,...)

C.database(numerical, large, text,...)

L.communication(protocols for various links,...)

T.human(graphics, forms,...)

2. Within each function there's a hierarchy of levels of protocols and corresponding machines to implement them. These levels are quite similar conceptually and level by level:

Pc(microprogram, macroprogram, operating system,
higher level language)

C.database(physical block, logical block, record,
file,...database)

L.communications(physical link...7 ISO, OSI levels)

T.crt(bit map image, character/line/etc., forms)

3. With low cost ROMS, RAMS and Pc's, each function operates at an increasingly high level of intelligence, requiring less information to direct it at the higher levels.

4. Thre are now more (4) chances to have wheels of reincarnation --see Computer Engineering, p.201-202, 390-391--for a recall. Furthermore, we seem to be succumbing to this.

The problems with the continued addition of non-transparent, programmable processors as we traverse the wheel are:

1. Cost and complexity of many coupled, ad hoc machines, i.e. it's awfully easy to form a kludge.

2. In many cases, all that happens is many wasted cycles and increased entropy.

3. We start to support the programming of them and they're simply another ISP. The result is a new set of supported software.

4. A new set of special, evolving protocols between the two coupled systems is required! (The VS100 is an example of a potential problem.)

5. The last turn of the wheel is likely to be a net

loss. The addition of the final processor to off load actual loads all processors by requiring them to only communicate with one another.

6. There is a new software system to boot. Now, the main processor is totally off loaded, but has to do more processing to communicate with the off loader.

We should have stopped just as the specialized function is added. This is where the big gain is--not the off loading.

1. The classic display processor

The cycle is: direct point plotting (or bit memory mani-
pulation by the Pc as in the Apple). Adding character look-up and plot instructions, still under Pc control provides even more performance. As the Pc is loaded, DMA is provided. Next, a display list (actually a set of instructions) are interpreted and executed forming a P. display. Some examples:

VT200: DMA chip for picture maintenance, Bit Manipulation chip to interprint the picture, and we have and idle Pc!

At most, a DMA and pixel controller are required (bit blt operations).

In the VS100 case, the bit blt processor isn't even essential because the 68,000 is fast enough for many operations. By adding the bit blt, the 68,000 is completely idle (not really an important criteria).

2. Conventional Processing

Many array and vector processors are attached to both minis and mainframes. Ultimally they become simply general purpose processors with array data types! The FPS-164 is an good example of how one extends a special, microprogrammed, signal processor. It started as a device for signal processing, using separate memories for instructions, data, temporary address and temporary data. As it ran into the data transfer bottleneck, it was extended to do really all the processing for scientific tasks. With VAX, the remainder consists of file, (backend), communications processing, (front end), computing and debugging.

Is there anything to be gained by our building such a specific, attached processor, given the evolution?

3. Communication Front Ends

Here it's difficult to really off load very much as the two systems vie for control. It's easy to have a complete, system-wide loss of computing power as the added protocols between front end and host kill us. This is potentially solvable IF we decide that a LAW is a single system with reliable communication and start using "light-weight" protocols rather than the evolution of the multi-level protocols that have become so ROCCOCO.

Pluto appears to be the ultimate in ROCCOCO architectures with: four processing elements-Pc(11/24, 0.2 mips); two communications queue C(2901, 5 mips) Pc(console-8080, 0.1 mips); and two K(DMA's) for the Ethernet (the UNA) and the Signetics UARTS which had DMA capability, but were disabled.

A Pluto can only handle 32 lines requiring 32 kchar/sec. There is 10 million instructions/sec available to process each output character, or 300 instructions available, just to take a character from a memory queue, doing nothing to it!

4. C (Database)

This project appears to be potentially worse than Pluto. We're off a C(16032) so as to make a computer for databases. This merely means we throw VAX/VMS AND all the database software away and somehow get the o/s, languages and database reimplemented on a 16032. In three to five years, we'll have the breadboard of a database system which was to be the off loadee. While at the same time, we should be shipping a product running on VMS!

Why can't we merely:

a. Model and instrument the VAX/VMS database system we have today and are building so that we understand where we need additional, clearly specialized processing?

b. Take either a 750 or 780 and build a special processing unit which either operates directly on Mp (as in the case of the VS100) or operate in series with a UDA on the fly. Conceivably a UDA could be remicrocoded or appended because it has the ability to execute many mips. Make this work. If this is done on CMI (which is a clean, simple bus), then it might even be a product!

c. With Scorpio and BI, we hae a very good system:

```
                 Pc(Scorpio)-Mp....Mp
K(disk)   x  (special)
                 |                 |        |
|
                ------------------------------
-------------------
```

That is, whatever needs to be done, we build X as in b) where X is a K/controller that executes an instruction under Scorpio's control or a computer with its own very fast, specialized processor, eg. 2901. Note: it can NOT be a 16032-because if we needed one of these, it would be just another Pc(Scorpio)!

HSC should have taught us something because with a unique set of software and acting only as a disk server, we're unable to move the file service or higher level functions into HSC. Similarly, the HSC parts aren't bus compatible with those that connect to a unibus, CMI, BI, etc. Clearly, there's no way to have databases there, except by a whole new database system.

BOTTOM LINE

We should be very uncomfortable indeed with the basic PMS structure and resulting software that's coming out of the emerging functionally specialized systems. The positions taken in the wheel are either too far or not far enough.

DISTRIBUTION

PEG:

BILL AVERY	ML02-2/U15
LARRY BORNSTEIN	PKO3-1/C21
BILL DEMMER	TWO/D19
ULF FAGERQUIST	MRO1-2/E78
SAM FULLER	HL02-3/N11
MIKE GUTMAN	ML012-2/E71
BILL JOHNSON	MLO12-3/A62
JEFF KALB	HL02-2/M11
BERNIE LACROUTE	TWO/A08
DON METZGER	ML01-5/B98
JOE REILLY	MLO12-2/A16
GRANT SAVIERS	MLO3-6/E94
JACK SMITH	MLO1-4/A54
STEVE TEICHER	HLO2-2/N07
WILL THOMPSON	ML012-3/A62

RAD:

PETER CHRISTY	HLO2-2/N07
RUSS DOANE	ML01-5/T55
FRED ENGEL	MRO1-2/L10
DON GAUBATZ	MLO1-2/E60
ROB HANNEMANN	ML08-3/T13
DICK HUSTVEDT	ZKO1-1/D42
TONY LAUCK	TWO/C11
MARGARET LEDGER	HLO2-2/N07
JESSE LIPCON	MLO12-2/E71
CAROL PETERS	HLO2-2/K13
ROB ROTTMAYER	MLO4-1/B32
JOHN SHEBELL	OGO1-2/R07
BOB E. STEWART	TWO/D25
BILL STRECKER	TWO/B05
MAURICE WILKES	HLO2-3/M08

TMC:

JOE CHENAIL	Q10/B17

BOB GLORIOSO	MRO1-2/E47
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NANCY NEALE	HLO2-3/N04
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BOB SUPNIK	HLO1-1/S08
WALT TETSCHNER	MLO5-3/E12
SULTAN ZIA	MLO1-2/E47
BILL NOYCE	MKO1-2/J12
BOB DALEY	MKO1-2/E06
TOM BURNIECE	CXO/Q21
MIKE RIGGLE	CXO/Q29
DAVID ROGERS	TWO/A08

15 November 1982

Mr. Lloyd D. Turner, President
Floating Point Systems, Inc.
P.O. Box 23489 Portland Oregon, 97223
3601 S.W. Murray Blvd.
Beaverton, Oregon

Dear Lloyd:

It was good to meet you last Friday and discuss how our companies might co-operate more effectively. This kind of relationship, really parallel processing, seems unique within the industry. The discussion with Norm Winningstad, Bob Schuhmann, Emmons Miles, Peter Smith and you was quite stimulating. The 564 looks quite promising and we hope to have a complementary VAX to support it, together with a file system and system interconnect to make it more effective and accessible.

I understand that we have discussed the possiblity of doing office automation work on VAX with you. Many regard Digital in the top 2 or 3 in office automation, and personally I'm quite excited about this use of computers, especially for Electronic Mail to give much better, and cheaper communication. Within Digital, we have one of the largest Electronic Mail Systems with about 20 dedicated computers and 7555 subscribers. Al Crawford, who heads our Corporate Distributed Information Systems group, has written a prize winning paper on our office automation system, and it is also enclosed. While we can demonstrate these system here or at FPS, I'd like to extend an offer to install and let you try various components of this system.

Peter Smith and I would like to extend and invitation to your staff to visit our various facilities and discuss the details of how our future products will work together better. At that time, you could look at how we are using our computers for office automation and computer design. You also might want to visit our Colorado facilities where our disks are made. We are starting to discuss the sale of disks on an OEM basis, and this would make the coupling much better for both our customers. Peter will be communicating with Carmon Cunningham and Lynn Berg who work to set up a convenient date for the visit.

Again, thanks for the hospitality and stimulating interaction.

Sincerely,

Gordon Bell
Vice President of Engineering

CC:
Lynn Berg
Peter Smith
Norman Winningstad

Encl.
GB3.S8.45

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SUBJ: FOLLOW UP NOTICE   Date: 12 DEC 78
                                           From: Mary Jane Forbes
  TO: Bill Demmer, TW/D19   Dept: OOD
      Bernie Lacroute, TW/A08   MS: ML12-1/A51   Ext: 223-2237

John Leng, MR1-1/A65
Dave Rodgers, TW/C04
Jack Shields, PK3-2/A58
Bill Strecker, TW/A08

follow up 12/19/78

Gordon would appreciate an answer to the attached memo.

mj

June 4, 1979

Nobuaki Kawato
Fujitsu Laboratories Ltd.
Computer Science Laboratory
1015 Kamikodanaka
Nakaharaku, Kawasaki
JAPAN

Dear Nobuaki:

I just received your request to visit DEC. Unfortunately, I'm not working in this area. Since there will be DEC people at the 16th DA conference, I suggest you talk with them there about RTL design. Also, I will not be available on the 21st.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:swh
GB0003/39

April 12, 1979

Dr. F. Kurosaki, Director
Fujitsu Limited
1015, Kamikodanaka, Nakaharda-ku
Kawasaki, Japan

Dear Dr. Kurosaki:

The literature and parts arrived here in fine shape last week. I am in the process of collecting parts suitable for your museum and I will write you when they are sent.

However, at this time I am sending the following literature:

a.Computer Structures - a book by Allen Newell and myself discussing computer history in general.

b.Computer Engineering - a book by three of us at Digital. This book describes the first 20 years of the Company.

We are going to catalogue many of our DEC parts this summer and will send you some pieces in the Fall.

Thank you very much for the Fujitsu parts. They are a valuable addition to our museum.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:ljp

GB0002/4

+---------------+ ID#1079

! d i g i t a l !   i n t e r o f f i c e   m e m o r a n d u m

+---------------+

Subject: **Fujitsu's M-200 (Compatible with 370)**

To: OOD, Sam Fuller, Alan Kotok, Dave Rodgers, Bill Strecker, Pete vanRoekens

Date: July 28, 1978
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

I've just seen what I think is a decent 370. It's supposed to be the highest performance one (1.3-1.5) x 3033 as a single processor. The beautiful part is how they do 2-4 processors. Two memory controllers arbitrate requests on two separate buses for the 16 Mbytes in the memory modules. The memory controllers multiplex requests from 4 processors and 4 multiplexors from the I/O channel groups as follows:

```
                Mp          Mp          Mp         Mp


T.-K(system)---K(Mp)                            K(Mp)-----K(system)--T.console



         Pc1    ...  Pc4                  S1               S4

                                           Pio...            Pio...
```

A failure anywhere can be tolerated. The K(Mp)'s have separate power. T.console communicates to all modules. Pc has a cache (write through) and each K(Mp) broadcasts writes to all Pc's on a physical memory basis. They're after reliability and incremented upgrade (since their customers buy and want more capability). They're also going after the performance title! The O/S modification was <u>very</u> hard, due to the structure of IBM's system.

GB:ljp

D I G I T A L   INTEROFFICE MEMORANDUM

DIST:

Dick Clayton	ML12-2/E71	Jim Cudmore	ML1-5/E30
Bill Demmer	TW/D19	Ulf Fagerquist	MR1-2/E78
Bill Johnson	ML21-3/E87	John Kevill	ML1-3/E58
John Meyer	ML12-1/A11	Larry Portner	ML12-3/A62
Bob Puffer	ML12-2/E38		
Sam Fuller	TW/A08	Alan Kotok	MR1-2/E47
Dave Rodgers	TW/C04	Bill Strecker	TW/A08
Pete vanRoekens	TW/B10		

GB0003/52

| d | i | g | i | t | a | l | i n t e r o f f i c e   m e m o r a n d u m

Subject: **Future Terminals Architecture**

To: Dick Clayton, ML12-2/E71
Bruce Delagi, MR2-1/M64
Sam Fuller, TW/A08
Bob Glorioso, ML3-2/E41
Len Halio, ML1-2/H26
Stan Pearson, ML12-2/E71
Art Williams, ML1-3/E62

Date: 6/12/79 Tue
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

Follow Up: 6/29/79

Let me suggest an idealized goal of future terminals:

> We should have a mix and match approach to terminal design such that a combination of line interface, modem, protocol, fixed or programmable intelligence, mass storage, graphics, and basic terminal can be combined over 2 terminal generations. Thus, a user can add capability in the field to an existing terminal as it becomes available and not throw away his old one. Our approach would sell modularity, range through upgrade and preserving one's investment.

Obviously this ideal is not fully attainable, but it is much more possible than the approach we are now taking.

Could we sit down and brainstorm the goal? Art please set up.

GB:swh

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Dick Clayton	ML12-2/E71	Bruce Delagi	MR2-1/M64
Sam Fuller	TW/A08	Bob Glorioso	ML3-2/E41
Len Halio	ML1-2/H26	Stan Pearson	ML12-2/E71
Art Williams	ML1-3/E62		

Digital **Interoffice Memo**

Subject: **FY77 Engineering Budget Overrun Request**

To: OOD
Operations Committee

CC: Bob Lander

Date: 13 DEC 76
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

We are currently headed for a $1.0M budget overrun for the year. If you authorize it, we can keep current projects on schedule.

Without this increase we must cut back to our original commitments at a cost to one or more projects. However, we must have guidance from the Marketing Committee or Operations Committee as to what's cut back.

The alternatives we see now to cut:

1. **High End/New Mid-range VAX** - the culprit of much overrun. However, this group is the only one on schedule. Also, I believe we need the products (STAR & COMET) most. The group is the most competent and motivated; hence, money spent here is the most effective.

2. **Medium - PDQ or 11/34 Enhancements** - By shutting off PDQ we incur a high loss in manufacturing and profitability since we'll ship 11/34's at lower profit level. The 11/34 enhancements (cache and CIS) would be delayed.

3. **Low - Krypton/DK/LSI-11** - Since this area is in it's formulative stages, and we're probably in the most competitively poor position, we probably need more effort in LSI, not less. There's not enough money here to make a difference.

An across the board 6% cut for Q3 and Q4 would be too disruptive to all groups and ought not to be considered because we're likely to pay a 10-20% penalty for a 6% cut applied to all projects.

The budget (situation) is attached.

GB:ljp

Attachment

D I G I T A L INTEROFFICE MEMORANDUM

DIST:	Jim Bell	ML3-4/E41	Al Bertocchi
	PK3-2/A56		
	Dick Clayton	ML3-3/E71	Ulf Fagerquist
	MR1-2/E78		
	Arnie Goldfein	ML12-2/A16	Win Hindle
	ML5-2/A53		
	Ted Johnson	PK3-2/A55	Pete Kaufmann
	ML1-4/A54		
	Andy Knowles	MR2-2/A52	Henry Lemaire
	ML1-4/A97		
	Julius Marcus	PK3-1/M29	John Meyer
	ML12-1/A11		
	Ken Olsen	ML12-1/A50	Stan Olsen
	PK3-1/A57		
	Stan Pearson	ML12/E13	Larry Portner
	ML12-3/A62		
	Bob Puffer	ML1-3/E38	Bill Thompson
	ML12-1		
CC:	Bob Lander	PK3-2/F33	

Digital **Interoffice Memo**

Subject: **Operations Committee (and others) Concerns about OOD; Our FY77 Budget Overrun Presentation January 3 and 4.**

To: OOD
Bill Thompson

Date: 20 DEC 76
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

F/U 1/3

We obtained the $5M contingency for FY78. This means that the results of the Spring Red Book Budget are to be $61.4!

The 5M is to be unallocated during this pass!

Larry, will you please co-ordinate our approach for the January 3 and 4 meeting presentation? We are to interact with PL's for 1.5 hours and to help get resolution of our budget problem. On Tuesday, the Marketing Committee will either grant the $1.0M overrun, or give us guidance on cutting back.

Some suggestions:

0. Find out where we really are budgeting and what we really need! (I have negligible confidence in #'s now. Arny is soon to be full time...and none too soon.) I don't want to go back in March or be over for the year.

1. Get any $ direct on tincup (PL/by/PL) basis now before the request.

2. Get the presentation ready. There are all sorts of possibilities:

   a. Would they like to understand details of the overrun?
   b. What the %'s are in area?
   c. How do we manage?
   d. Does the grant mean we'll be OK on all projects now?
   e. What are some reasonable cutback alternatives (list 10)...and effect to strategy?
   f. Did we pay anything to change a support plan?

Other concerns raised in the meeting:

0. We have to revamp planning and communication now!

1. Ken Olsen - All PM's need a single boss (not clear if we can show hierarchy and levels-of-integration).

2. Ted Johnson - PM's need a charter (or since each level-

of-integration has different problems, a set of charters).

3. Stan Olsen - Because Julius is having schedule/budget problems, only proves CE is bad, no matter where it reports.

4. Jake - wants regular interaction with Larry on where things are.

5. We have to educate/prompt Ed Roberts. This is one chance we have to communicate with our peers about the development process! Bob, can you get several sessions with me to review the course with Roberts?

6. We have to continue peer-level interaction all the time to avoid this problem of continued uprisings. I for one am not spending what probably will have to be 20% of my time listening to MC/PLM's instead of looking on products.

7. Henry's mix #'s of cpu, memory, and disks are cuckoo. Dick, your hardware system's management is supposed to focus on this and provide sanity checks/configuration plans.

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST: Jim Bell ML3-4/E41 Dick Clayton
ML3-3/E71
Ulf Fagerquist MR1-2/E78 Arnie Goldfein
ML12-2/A16
Henry Lemaire ML1-4/A97 Julius Marcus
PK3-1/M29
John Meyer ML12-1/A11 Stan Pearson
ML12/E13
Larry Portner ML12-3/A62 Bob Puffer
ML1-3/E38
Bill Thompson ML12-1/F41

Digital **Interoffice Memo**

Subject: **FY78 Recommended 8% Engineering Budget Increase**

To: OOD
Operations Committee

Date: 13 DEC 76
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

CC: Bob Lander

As a budget strategy, we would like the corporation to set aside $5M as a "line-of-credit".

Expectations of what engineering can deliver are getting too high. The Red Book will address specifics. We want to cut back to what we can deliver for $61.4M, but this is going to make noise. Even with cut backs our $61.4M plan is too tight.

We want to propose to the Marketing Committee (after June 77) specific uses for the $5M on the following basis:

a. Technically innovative projects at the early project phase.

b. Market driven significant program or spec changes.

c. Schedule enhancement opportunities.

d. Return some to corporate profit.

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST: Jim Bell ML3-4/E41 Al Bertocchi
PK3-2/A56
Dick Clayton ML3-3/E71 Ulf Fagerquist
MR1-2/E78
Arnie Goldfein ML12-2/A16 Win Hindle
ML5-2/A53
Ted Johnson PK3-2/A55 Pete Kaufmann
ML1-4/A54
Andy Knowles MR2-2/A52 Henry Lemaire
ML1-4/A97
Julius Marcus PK3-1/M29 John Meyer
ML12-1/A11
Ken Olsen ML12-1/A50 Stan Olsen
PK3-1/A57
Stan Pearson ML12/E13 Larry Portner
ML12-3/A62
Bob Puffer ML1-3/E38 Bill Thompson
ML12-1

CC: Bob Lander PK3-2/F33
DIB Code numbering:

__________ **LIST OF BIOGRAPHICAL REFERENCE BOOKS IN WHICH YOUR BIOGRAPHICAL NOTE AND/OR SPECIAL MENTION OF YOUR ACTIVITIES HAVE ALREADY APPEARED.**

Who's Who in Technology Today
Men of Achievement
Who's Who

__________ **MEMBERSHIPS OF SOCIETIES, CLUBS, ETC. IN ORDER OF IMPORTANCE:**

National Academy of Science; IEEE Fellow; AAAS Fellow

Member Computer Sciences + Technology Board, NAS

Eta Kappa Nu, Member Assoc. for Computing Machinery, Am. Assoc. for Advancement of Sciences

---

CREATIVE WORKS (PUBLICATIONS, COMPOSITIONS, PAINTINGS, ETC.):

Books: Computer Structures, 1982, co-authored with Siewiorek and Newell;
Computer Engineering, 1981, co-authored: Bell, McNamara, Mudge;
Computer Structures, 1971, co-authored Allen Newell;
Designing Computer & Digital Systems, 1972, with John Grason and Allen Newell;
6 patents; 50 papers

HONOURS, PRIZES, AWARDS (WITH DATES):

6th Mellon Institute Award, ACM-IEEE Eckert Mauchly Award 1982

1975 McDowell Award

American Men of Science, Eta Kappa Nu, IEEE SIGARCH Board of Directors

---

HOBBIES:

Deep Sea Photography

ADDRESS TO BE INCLUDED IN YOUR BIOGRAPHY:

Digital Equipment Corporation
146 Main St.

Maynard, MA 01754

GB5.9
August 16, 1985

Bernard Galler
Computing Center
University of Michigan
1075 Beal Avenue
Ann Arbor, MI 48109

Dear Bernie,

Since, I have had nothing of substance to do with the Annals, my role is that of a critic. I have three problems with the July issue that I consider to be quite serious. They are taken up in order of seriousness.

1. Criteria of articles to be published. Neither the Williams, Milligan, or Weiss articles should have been published. Williams sets a very bad precedent for vanity publishing about a course. Editorially no comments were made by you in "About this issue" that points to the fact that other courses have been taught and are being taught. Would you like me to encourage everybody else to send in their outlines? Or, would my associates who teach courses have their articles refused? I think you are trapped.

The Milligan article again is vanity publishing -- her story of an insignificant journal. It is quite different to have an inventor tell about the experiences designing a machine or language. This article would be ok in a magazine devoted to publishing. Not one on the history of information processing.

The Weiss review is not a review of the The Computer Museum, it is a description of the exhibitions and peoples reaction to them. This is appropriate for <u>Abacus,</u> that does not claim to be a journal of record, but not for the <u>Annals.</u> A review looks critically at an institution and its policies. The role of the Museum in collecting, publishing, and programming are not touched. You could have required this as an editor. As the head of the institution, all that I could do is correct is mistakes. I don't believe in vanity writing. A person in the Museum business that I showed this to, thought it was a joke.

In News and Notices, I don't think anything should be used from a press release. The Science Center is not history so it should not have been included. The Proposed Brtish Computer Archive notice does not fit the information that I know about. Was this from a news release or did someone check it out?

2. Editiorial standards. These problems were all compounded by the lack of editorial work to make the material focus and be understandable.

In the Tomayko article the circuit diagram illustrations are insufficiently captioned. I couldn't make head nor tail of them and didn't know why their had to be so many. The Scientific American has captions that explain what is going on to the reader. I believe this should be the policy of the Annals.

The Williams' article was poorly edited.
  para 2 -- run-on sentence (try to parse it?)
  an editing policy to change all reference's to time, "now", "today" etc. to exact dates is important in a journal of record.
  last sentence, p. 241 - Does this matter in a history journal?
  para 2, p. 243, starting "Obviously," ditto.

In the Milligan article, the inclusion of the part on "The Look" and then the two contrasting pages seems to be ludicrous. The Annals is not a design journal -- its like a computer architect article on the placement of the corporate logo and how it changed. That is appropriate for industrial design and the people who know how to judge it. Not the Annals. The article might have worked had it been edited down and put in some greater context.

3. Design, layout and waste of space. The paper just does not lend itself to photographs. The layouts are very wasteful of space and not terribly interesting. Many other publications get one-third more information on a page and are better designed and produced. Page 223 is a wonderful example of how pictures aren't worth words -- one was enough and they are hard to see and just waste space.

If the Annals feel that readers subscribe because there are 100 pages, I think they are wrong. Lets make the quality better and have some standards.

Sincerely,

Gwen Bell
President

cc: Arthur Norberg

Jeff's observation on the use of gate arrays is something that we should act on because it speaks to our competitiveness. Products coming from Japan (eg. Sony, Sieko, Sharp, Brother) all use custom parts as a matter of standard practice. On the other hand, our products are neither based on the commodity micros (excepting Rainbow and Robin) nor are they aggressive enough in cost, or form factor. CT has twice the parts of the IBM PC. Somehow we're content to settle for a hex full of logic when the design should fit on a quad. This requires much extra packaging, power, cost and servicing. Can this be the cause of our lack of product competitiveness?

An addenda to Jeff's message shows that gate arrays not only get lower product and powering costs, but the servicing cost is drastically less. Comet experience verifies the tremendous advantage of using VLSI.

EVERY engineering group should be orienting several designs using gate arrays in order to be competitive in the 80's and to orient our engineers to VLSI design. This means a major change in skills toward correct designs, with top down design and verification and simulation.

This may mean fewer, better designs. Within a few years, because of the orientation to quality and verification, we should see a tremendous increase in productivity.

What's the plan for your products?

00 CORE DECGRAM ACCEPTED S 003676 O 367 09-AUG-82 19:02:22

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION DATE: MON 9 AUG 1982 3:40 PM EDT

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION

DEPT: ENG STAFF

EXT: 223-2236

LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5172024932

SUBJECT: FEWER, BETTER PRODUCTS THROUGH GATE ARRAYS

Jeff's observation on the use of gate arrays is something that we should act on because it speaks to our competitiveness. Products coming from Japan (eg. Sony, Sieko, Sharp, Brother) all use custom parts as a matter of standard practice. On the other hand, our products are neither based on the commodity micros (excepting Rainbow and Robin) nor are they aggressive enough in cost, or form factor. CT has twice the parts of the IBM PC. Somehow we're content to settle for a hex full of logic when

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verification and simulation.

This may mean fewer, better designs. Within a few years, because
of the orientation to quality and verification, we should see a
tremendous increase in productivity.

What's the plan for your products?

"TO" DISTRIBUTION:

BARRY JAMES FOLSOM   JOHN KIRK   AVRAM MILLER
PEG:

"CC" DISTRIBUTION:

JIM KING   ROY MOFFA   KEN OLSEN
JOE REILLY   JACK SMITH

ATTACHED: MEMO;178

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*****************
* d i g i t a l *
*****************
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TO: EMC: DATE: THU 29 JUL 1982 11:33
AM EDT

FROM: JEFF KALB
DEPT: LSI
EXT: 225-4025
LOC/MAIL STOP: HL2-2/M11

MESSAGE ID: 5170911043

SUBJECT: EARLY FEEDBACK FROM THE GATE ARRAY CENTER

As I've indicated to all of you, we have set up a small Gate Array activity within the Acquisition and Test Group which has been functioning now for about 3 months. The primary focus of this activity is not towards the high option rate users such as CPU's, but the large volume of SSI and MSI which is used by eveyone else in the Company. The Group is focusing its efforts on trying to get the gate arrays designed in and supporting existing systems as opposed to trying to develop something new and wonderful. So far things are going extremely well, with about 23 options to be processed in FY83 in other than direct CPU application. At least one of these is a cost reduction program which we hope to turn around in about 4 months from start to finish. We've got everyone signed up from gate array, through module, through requalification at this time.

However, the purpose of this memo is not to talk about the progress of the gate arrays, but rather to indicate what we've learned about design style and how people are making their choices of components. This is only an early reading, and clearly does not apply to all groups. However it seems to be typical and while I ordered them in what seemed to be the priority of decision making, different groups may use a slightly different priority. By understanding the motivations, perhaps we can turn the tables and get people to change their design habits and increase the level of integration.

The following seem to be the primary decision making criteria.

1) Form Factor

The primary forcing function seems to be size and form factor. We understand what size module needs to be built, and use essentially the lowest level of integration (simplest to understand) which will fit on the module. Once this basic boundary condition has been satisfied, the motivation for an increased level of integration wanes dramatically. In one specific application that we looked at, it would have been possible to replace an entire hex module of TTL MSI and other components with a couple of LSI packages and four gate arrays. This is one of the projects that was rejected. In doing so, a fairly senior person commented that if he ever designed a hex module with that few components on it, he'd be ridiculed for overkill. While the comment may have been made light heartedly, the fact that it was made at all is somewhat indicative of the overall evaluation process. What's missing from the thinking is that even though that particular product may have been very sparsely populated, at some point in the future someone could have put a lot more functionality on the board or designed a new board using the already developed gate arrays, such that the second product would be advanced because part of the job was already done. Since we don't seem to plan on re-using work, this kind of thinking apparently does not figure into the decision.

2) Debug Style

A very large number of our engineers are not familiar with using simulators or other debug means other than a scope probe. In order to use LSI components, particularly gate arrays in which the overall function is not easily quantified, it's necessary to develop a whole new set of debugging skills for the person actually using the component. Since you can't put a scope probe or wave-form analyzer on the internal node which may turn out to be a critical source of data, whole new methods of debug which involve a combination of logic simulation and traditional debug need to be developed. While the large CPU projects are now using these techniques, they are by no means common throughout the rest of the organization. In fact, quite often the equipment is not even there to attempt it. As a result, one of the tasks of the gate array group now involves helping some of these people to adopt new debug styles and to provide them assistance in getting solutions to some of their problems.

3) Component Costs

There seems to be a general tendency when making component decisions to go for the lowest component cost, independent of the assembly and other costs that might be attendant with the component chosen. Again, while this is not true with all groups there is much less consideration given to the ultimate maintenance costs, assembly costs, or for that matter even the opportunity of going with lower cost PC Boards than there is with the base level components themselves. In addition, there are a couple of financial barriers to people using gate arrays and other such technologies. First of all, if you are an engineer and want to bring in a unique component, you have to pay for its qualification costs. Often that weighs against bringing in an LSI device if there is any way of solving the problem with SSI or MSI. Additionally, when people add together component costs they're influenced by a quirk built into the system. Presently, we have set up different acquisition rates for SSI and MSI than for LSI components. Some of that is due to the fact that LSI components have a much higher component of test costs in them than do simple devices. Within the Semiconductor Industry tests costs have blossomed enormously in terms of their percent impact on final selling price. Beyond that, there's the fact that the equipment base and program development costs have all been written off on these older TTL devices. In total, this means that TTL MSI and SSI have an acquisition cost of 10 to 12%, and LSI has a present acquisition cost of 26%. While this latter number is totally unacceptable (down from 32% on custom devices last year) and will be brought down in the next year to a number which is much more competitive with the TTL MSI etc., it will never be as low as the simple devices. So when an engineer tries to make a decision about component costs, he actually see LSI carrying these added burdens. It drives people in the wrong direction.

4) Trade Off Risks

People are still concerned about the risks associated with implementing things in custom or semi-custom LSI. Fundamentally, I think it goes down to the idea that people only trust what they can control themselves. Since designing in LSI requires a lot of implementation issues which are outside the normal scope of experience and control, these are seen as large project risks. Rather than trying to go out and work that risk and invest energy into it, it's just much safer to continue doing things the way you've been doing them and are familiar with, especially if you can meet the other boundary conditions.

5) Power

In some situations, people run into power dissipation limits which make it impossible for them to implement the system in question. At that time, they will often go to LSI to get rid of the unwarranted dissipation associated with SSI and MSI. Again, however, this is generally only true down to the point where the solution fits the problem space, and then it no longer becomes a significant issue.

6) Reliability

There have been a couple of cases identified now where reliability is a concern. By eliminating some of the SSI and MSI components, people can see means of improving the overall calculated reliability of the system. Again, this is one of the situations where you need to get the solution within the limits of the problem and that's generally the end of it.

As I indicated upfront, these are early indications about the way people are making decisions on components in a large segment of the Company. By and large, these are probably the people who design in the most SSI and MSI today. Perhaps as we get deeper understanding of the motivational aspects, we can change some of the boundary conditions to force people to innovate and find it to be in their own best self interest to use the kinds of LSI components that are becoming available.

JCK:met
6.46

WPS USERS - Leave HP mode and type <CR>

00 CORE DECGRAM ACCEPTED S 002463 O 267 07-JUN-82
15:02:00

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION   DATE: MON 7 JUN 1982
2:52 PM EDT

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

MESSAGE ID:
5165631637

SUBJECT: CMOS GATE ARRAYS: WHO, HOW AND NEED ON ROAD TO VLSI?

Camille reported that CDC used CMOS gate arrays to build a 10 mips 7600 using 8K-12K gate chips. Six chips are packaged on each side of a 4 x 4 inch ceramic substrate. The cycle time is
25ns with 10ns interchip time. The machine uses 19 chips (with 9
unique) and the Cio is on a board. A chip is < .5w, 3 micron features, 160 pins, and 2ns gate delay. Motorola and National make the chips and Kyocera makes the substrate. FCS '82.
The Japanese are shipping products with large CMOS gate arrays.

We need a concerted effort to use these larger gate arrays:
0. We're in trouble if the CDC is real and marketed to kill.
1. Our low end products need fast turn around glue chips since we don't use fully industry standard VLSI. Even if we did, having gate arrays would also be advantageous.
2. We are continuing to perpetuate conventional msi ttl designs.

A histogram showing gate count for chips points out the problem: .4ssi, .2msi, .05 lsi (processors), .35 vlsi memory.

For example, ct has 2 times the chips as the IBM PC

3. In the foreseeable future, many of our systems will be one chip. We must train and evolve the designers to do these designs. The CMOS gate array seems like an entry.
4. The tools for these gate arrays look to be substantially like the ultimate VLSI in that they do NOT have video input or interaction. A design is specified like a program, and is compiled, routed and gets test vectors automatically.

Prakash is putting together a plan so that each group can do gate arrays. A group is investigating various design systems.
Jeff says that the users support this plan. I'd like to see this effort accelerated by having persons from each of the groups (16 bit, terminals, ct, comm, mid-range, and storage) contribute a benchmark design so as to evaluate the systems with real designs. Let's bring several of them in (eg. Lattice Logic) and try them on several designs by Q183.

Is the need absolutely clear? How can we get this effort going so as to make the system decision and then let people work?

"TO" DISTRIBUTION:

FOREST BASKETT PRAKASH BHALERAO TOM BURNIECE

BRIAN CROXON DON GAUBATZ BOB

GLORIOSO
ARNY GOLDFEIN JEFF KALB JESSE
LIPCON
DON MCINNIS DON METZGER AVRAM
MILLER
PEG: ROY REZAC CAMILLE
SAHELY
JACK SMITH BILL STRECKER BOB SUPNIK

WPS USERS - Leave HP mode and type <CR>

C O M P A N Y   C O N F I D E N T I A L

ID#418

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| d | i | g | i | t | a | l |   i n t e r o f f i c e   m e m o r a n d u m
|   |   |   |   |   |   |   |
+---------------------------+
```

Subject: **Graphics, A Rare Time To Get It Together. Let's do it.**

To: Len Halio, ML1-2/H26
Bill McBride, MR2-3/E70
Charlie Rupp, ML3-2/E41
Jerry Witmore, PK3-1/M40

Date: 1/16/79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

CC: Dick Clayton, ML12-2/E71
Bill Johnson, ML21-3/E87
John Leng, MR1-1/A65
Joel Schwartz, MR2-4/M51
Tom Stockebrand, AB
John Holman, PK3-1/P84
Andy Knowles, ML10-2/A52
Si Lyle, MR1-1/M42
Gil Steil, ML5-5/E76

follow up 2/7/79

The VT125 and the very low cost terminal in a keyboard, GIGI really look great! The architecture is a real, conceptual breakthrough since it is transparent to both operating systems and languages. Hence, it can be attached to any/all computers immediately. At last, it looks as if we can and must put together a set of four, compatible graphics products:

1. GIGI, the lowest cost simple graphics (including color) keyboard
2. VT125, the main, high volume base of the family
3. Bring in and see the, high cost, color Tektronix 4027 (modified to DEC architecture)
4. Making the ESG high cost, high resolution buyout terminal part of the family.

This would entail defining hardware and software architectures to encompass the above four terminals. Each member would have various levels of capabilities, just as we have in the 11 Family, but better controlled as to subsetting and evolution.

1. Take the Tektronix 4027 Graphics part as the base terminal architecture (ignoring their forms and editing architecture) and extend it to cover the wide range of terminals above. Put in TEK 4010 compatibility too. Use our VT52 and VT100 as the base of alphanumeric data types.
2. Define our own DECPLOT Interactive Graphic Interpreter (DIGI?) which would go well beyond PLOT10 in terms of capability as the software architectural base. (For example, although this is interactive, programs should be able to call it too.)

Thus, the terminals would be introduced to be a family, all of which could have the same capability at least when viewed through DIGI. We would come out with DIGI in a software package which would support all the terminals and have modest capabilities. Little, by little, we would add data-types and capabilities to DIGI, while also moving the software into the various terminals as they are introduced. (Fonz and TU58 in the terminal would allow an instant migration.)

Although this is a sketchy idea of my understanding of your direction, we can, if we really plan and drive it, get there quick. Let's not miss this opportunity.

When will the general direction be clear enough that it can be presented to us all?

D I G I T A L INTEROFFICE MEMORANDUM

DIST: Len Halio ML1-2/H26 Bill McBride MR2-
3/E70
Charlie Rupp ML3-2/E41 Jerry Witmore PK3-
1/M40

Dick Clayton ML12-2/E71 John Holman PK3-
1/P84
Bill Johnson ML21-3/E87 Andy Knowles ML10-
2/A52
John Leng MR1-1/A65 Si Lyle MR1-
1/M42
Joel Schwartz MR2-4/M51 Gil Steil ML5-
5/E76
Tom Stockebrand AB

15 BOVE--10/13 ARRANGEMENT/BOVE/GB2.S11
10/2/81 10/2/81 9:23 3
3 0:01 0:02

14 ENGINEERING NET TO GB THEN DELETE
10/1/81 10/1/81 9:43
26 2 0:02 0:02

13 EMS/ENGINET GATEWAY INSTRUCTIONS/GB2.S11
10/1/81 10/1/81 9:10 2
2 0:01 0:13

12 DSS - DECISION SUPPORT SYSTEMS--HERE WE GO/GB2.S11
9/29/81 9/29/81 15:22
5 9 0:00 0:55

11 DECWORD - NOT FOR US 200 USERS /GB2.S11
9/28/81 9/28/81 14:48
13 2 0:01 0:01

5 WT278 - DISKLESS WP - MY COMMENTS/ GUTMAN/GB2.S11
9/28/81 9/28/81 14:46

3 2 0:00 0:00

10 TALK - GETTING ORGANIZED WITH WPS /GB2.S11
9/28/81 9/28/81 12:50
8 1 0:00 0:00

9 FORCE 4K BASIC EDIT DEMO TRANSMITTAL LETTER/GB2.S11
9/28/81 9/28/81 9:55 5
3 0:00 0:11

8 FORCE 4K "OFFICE OF THE FUTURE" DEMO ORIGINAL/GB2.S11
9/28/81 9/28/81 9:14
10 1 0:02 0:02

7 FORCE 4K UDK DEFINITIONS FOR DEMO/GB2.S11
9/28/81 9/28/81 9:51 4
2 0:01 0:08

6 FORCE 4K DEMO STEP-BY-STEP INSTRUCTIONS/GB2.S11
9/28/81 9/28/81 9:56 6
5 0:00 0:04

4 RESULTS/GB2.S11
6/11/81 8/25/81 10:49
1 44 0:00 2:28

3 MESSAGE FORM - GB OFFICE/GB2:SECT11
6/10/81 9/24/81 12:27
1 8 0:01 0:11

2 MESSAGE SPEC - GB OFFICE/GB2.S11
6/10/81 8/25/81 10:49
2 43 0:00 0:13

1
6/10/81 10/2/81 9:20 2
26 0:01 0:03

17 DECEMBER '80 MAIL-LOG/GB1.S10
12/2/80 1/22/81 11:00
24 83 0:01 2:56

16 NOVEMBER '80 MAIL-LOG/GB1.S10
11/3/80 1/22/81 11:01
27 97 0:01 3:16

15 OCTOBER '80 MAIL-LOG/GB1.S10
9/30/80 12/5/80 13:31
40 95 0:02 4:33

14 SEPTEMBER '80 MAIL-LOG/GB1.S10
9/2/80 2/19/81 16:55 37 105
0:01 3:53

13 AUGUST '80 MAIL-LOG/GB1.S10
8/1/80 12/5/80 9:17 25 88
0:00 3:42

12 JULY '80 MAIL-LOG/GB1.S10
7/1/80 12/5/80 9:19 38 135
0:02 5:12

11 JUNE '80 MAIL-LOG/GB1.S10
6/2/80 11/4/80 11:21 36 100
0:01 5:15

10 MAY '80 MAIL-LOG/GB1.S10
5/2/80 11/4/80 11:24 38 115
0:03 4:46

9 APRIL '80 MAIL-LOG/GB1.S10
4/2/80 1/22/81 14:13 35 121
0:00 4:42

8 MARCH '80 MAIL-LOG/GB1.S10
3/3/80 11/10/80 15:53 34
113 0:01 3:51

7 FEBRUARY '80 MAIL-LOG/GB1.S10
2/1/80 3/18/80 10:47 24 76
0:01 2:39

5 JANUARY '80 MAIL-LOG/GB1.S10
1/3/80 3/21/80 14:57 27 97
0:05 2:57

4 DECEMBER '79 MAIL-LOG/GB1.S10
12/3/79 9/10/80 15:51
26 78 0:01 4:14

```
  2         NOVEMBER '79 MAIL-LOG/GB1.S10
                              11/20/79 6/16/80 10:28    18
20          0:01              0:40

  3         INDEX FROM CI/GB1.S10
                              11/21/79 12/13/79 10:38   3
4           0:00              0:01

  1
                              11/20/79 9/28/81 9:30 2    46
            0:00              0:08

  7         GB2.S14 INDEX
                              10/2/81                NO/DA/TE     3
              1               0:00    0:00

  4         FORM FOR SORT
                              1/28/81                9/28/81 9:10 1
              5               0:00    0:00

  3         SPEC FOR SORT
                              1/28/81                1/28/81 17:48
             2                  72    0:00           0:04

  2         LIST TO BE SORTED/GB2.S14
                              1/28/81                6/23/81 16:09
             20                 12    0:00           0:22

  1
                              1/28/81                10/2/81 10:04
             1                  11    0:01           0:01

  5
                              1/28/81                1/28/81 17:48
             20                 21    0:02           0:03

  6
                              1/28/81                1/28/81 17:49
             1                  1     0:00           0:00

  7         GB2.S14 INDEX
                              10/2/81                10/2/81 10:04
             3                  1     0:00           0:00

  4         FORM FOR SORT
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                        1/28/81                 9/28/81 9:10  1
          5             0:00    0:00

  3     SPEC FOR SORT
                        1/28/81                 1/28/81 17:48
         2                72    0:00            0:04

  2     LIST TO BE SORTED/GB2.S14
                        1/28/81                 6/23/81 16:09
         20               12    0:00            0:22

  1
                        1/28/81                 10/2/81 10:04
         1                11    0:01            0:01

  5
                        1/28/81                 1/28/81 17:48
         20               21    0:02            0:03

  6
                        1/28/81                 1/28/81 17:49
         1                 1    0:00            0:00

  7     INDEX
                        7/23/81                 7/23/81 9:39
27        1             0:00    0:00

  6     TOTAL INDEX
                        7/23/81                 7/23/81 9:23
109       7             0:01    0:05

  5     CI S5
                        7/2/81  7/23/81 8:54  24   2
        0:01            0:01

  3     SECTION 4 INDEX
                        7/22/81                 7/23/81 8:53
11        6             0:00    0:01

  4     INDICES--GB'S LETTERBOOK - GB2 ARCHIVAL DISK/GB2.S15
                        2/4/81  10/1/81 15:26 124   75
        0:18            8:18

  2     INDICES--GB'S LETTERBOOK - GB1 ARCHIVAL DISK/GB1.S15
                        10/31/80 7/23/81 8:50 158   37
```

0:00 4:25

1

12/31/79 10/1/81 11:26 1

90 0:00 0:10

The big problem is the unavailability of a decent simulator that you folks can run. Tewksbury engineers don't trust the 10 there because you have such a decrepit engineering process and facility.

You might be able to use the MR facility for simulation off shift.

We're scheduled to start the total board debug on the simulator on 2/15... so that will give us all more confidence that this is the way to design. Why don't you at least look at the effort required if you simulated? (It might give you an earlier product and reduce a pass or two at TI.

The deal I made with George Michael is that we would supply 50% off on a 784. Would you please review his proposal to us so that he can take it to various funding agencies for approval. He plans to go ahead with it.

I think the question we want to ask is whether we also inlude PPA in the proposal because that would make it a much more attractive rationale for them to get the 784. I view this is an ideal way to kick off the parallel processing effort especially since we are working together with them on the dataflow work.

Let's do it!

Tom, it is up to you to coordinate comments on his proposal and to get him a configuration that would do our job experimentally.
The Office Manager reports to the Director, the secretary to the DEC Operations Committee and a DEC Supervisor. Reporting to the Office Manager are the Secretary, Business Manager and

Store Manager. (This area needs clarification from Gwen.)

A. Management of office
   1. Supervise secretary
   2. Supervise Business Manager
   3. To ensure smoothly-running operations, act as interface to Digital service organizations such as Facilities, Field Service, Payroll, Personnel

B. Assist Director with Fundraising

1. Goal - coordinate 100 solicitation letters per month (over $100)
   a. Director provides lists of persons/groups to whom letters will go
   b. edit Director's letters for format, accuracy, style
   c. input list into list processing
   d. mail letters
   e. copy to correspondence file
   f. copy to Office Manager's Monthly Solicitation file (green folder in O.M.'s desk by month)
2. Month-end Membership Report
   a. for Executive Committee
   b. shows how many new members in each category
   c. includes list of all current solicitations
   d. who responded
   e. what results
   f. filed in Executive Committee Book (white book in Business Manager's Office)

C. Manage Annual Cost Center Budget
1. WHAT -- $60,000 from DEC
   a. includes O.M.'s salary
   b. aviation expenses
   c. supplies from Stationery
   d. miscellaneous shipping
   e. other
2. HOW --
   a. make up budget

    b. track it monthly
    c. keep Director aware of status
3. Budget overrun -
    new process to be worked out with Director to voluntarily reduce contribution from DEC to compensate

Other activities of the Office Manager

A. Proposed installation and management of 11/45 computer connected to all museum users
    1. in location off lobby
    2. work with Field Service of DEC to install
    3. obtain correct programming for each function
        a. accounting
        b. correspondence
        c. members lists
        d. mailings
        e. librarian-archivist procedures
        f. program dates
        g. others

B. General Assistance
    1. mailings
    2. travel arrangement
    3. museum events and functions
    4. others

C. Supervision of Store Manager (?)

Floppies used:

A. GERI - correspondence and other
    1. filed in O.M.'s office (2 drawer file, under Floppies)

B. BUDGET - Director's floppy
    1. updated monthly
    2. filed in Executive Committee Book (white) in Business

Manager's office

3. contains Monthly Membership Report

C. SOLCI

1. filed in O.M.'s desk in "solicitation" folder
2. contains Update Form
    a. updted monthly solicitation lists
    b. positive or negative responses recorded
    c. paper file - left desk drawer under "Project - Solicitations over $100

"GETS"

	Budget FY79				FY79-81 Rev. ($M)		
Project	Q2	Q3	Q4	Total 3Q	79	80	81
TINY 11	206 Chipset Only	225	286	717	-	1.0	3.0
FONZ	546 System	621	504	1671	5.5	31.5	43.5
DOLPHIN(HW & SW)	725	960	1012	2697	-	-	4.5
68	171	219	242	632	-	0.7	20.3
44	387	327	289	1003	0.6	74.0	213.0
COMET	947	754	580	2281*	-	42.5	76.0
HYDRA	527	1025	1374	2926	-	-	25.0
SUPER STAR	26	44	44	114	-	-	2.0

*+500K just allocated not included

CANCEL

Budget FY79 **FY79-81 Rev. ($M)**

Project	Q2	Q3	Q4	Total 3Q	79	80	81
UNIFONZ	86	106	170	362	-	66.0	148.0
	Sys						
74	484	217	135	836	17.0	39.0	45.0
	cpu						
48	65	70	71	206	-	-	-
	FCS FY82						
S/T	635	393	376	1404			
MINNOW (P/L)	152	156	237	545	-	1.0	90.0
TOTAL	787	549	613	1949			
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00 BURT DECGRAM ACCEPTED S 4971 O 89 08-NOV-81 15:59:09

****
* d i g i t a l *
****

TO: BILL AVERY
PETER JANSEN
BILL JOHNSON
ANDY KNOWLES

DATE: SUN 8 NOV 1981 3:49 PM EST

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: RE GIGI SUPPORT

Andy,
I tried very hard when I had been excited about Gigi (before I knew about how we had botched it up relative to the VT125 and VT100) to get it into our systems. Pete Jansen doesn't have the foggiest idea of what this meant...
it is really very simple:
IN ORDER FOR A FEATURE OR TERMINAL TO BE INCLUDED IN A

SYSTEM, IT HAS TO BE WIDELY AVAILABLE TO THE DEVELOPERS!

Pete didn't do this, nor is the terminal very easy to get... as you have to somehow get the Barco monitor.

I don't have any strong opinion now, but I do believe the big issue (aside from the abysmal lack of architecture which is clearly engineering's screw-up) is that the product management did not include getting any support (I don't even know who it is or was except Pete.)

I do believe that EDU had better spend its money building PC support (which a university can probably give), s that we can get big systems business, versus flogging what may be a dead terminal.

GB3.S2.35
00 BURT DECGRAM ACCEPTED S 1791 O 45 12-FEB-81 13:16:46

****
* d i g i t a l *
****

TO: ANDY KNOWLES DATE: WED 11 FEB 1981 16:50 EST

FROM: GORDON BELL
cc: see "CC" DISTRIBUTION DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: USING GIGI TO MAKE MANY BIG AND GOOD, SMART TERMINALS

It seems to me that if Graphics takes off in any sense as a terminal, we have an interesting gadget in Gigi. Here, I would add some very simple rom, probably just a rom socket or preferrably a socket that can be plugged in from outside, to start with.

The purpose of the rom would be to use the 8K Microsoft Basic that GIGI has as a programmable device to convert the

terminal
into various simple "smart" versions. For example, why do we need the 134 when we could write an emulator? Or why not an emulator for the tecktronix? Or for the expensive IBM color terminal?

I do not believe we should be building the terminals that are being contemplated in TPG, but rather we should be honing our existing terminals and doing things that get volume by combinations of programming in the terminal and on our systems
(ala the ECS work). Here, I think the roi is potentially very high if we take this approach and we can follow it up with
even better versions of CT100 and CT25 (Gigi 1.5). The money is there and the talent is too, if we just direct it. This way gets us much more volume on existing terminals.   Let's make Graphics an essential part of terminals design. Gigi looks like a good way to do this.... also, it can be used in some very interesting way as a forms filling terminal, etc. in the transaction processing domain, using various character sizes, filled in areas, colors, etc.

I think the same statements can be made if we try to use Gigi in the MDC market for Mimic diagrams.

Summary:
Let's put rom in gigi asap and make it the base for fixed function "smart" terminals. The number of products we can build will be high, and they could all be money makers.
What youse think?

"CC" DISTRIBUTION:

ART CAMPBELL	BARRY JAMES FOLSOM	SI LYLE
STAN OLSEN	BILL PICOTT	

GB2.S4.25
00 BURT DECGRAM ACCEPTED S 4406 O 153 16-APR-81 12:11:26

****
* d i g i t a l *

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TO: PETER JANSEN DATE: WED 15 APR 1981 19:52 EST

FROM: GORDON BELL
cc: see "CC" DISTRIBUTION
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: RE: VK100 (GIGI) INCOMPATIBILITIES WITH VMS

There are clearly about 3 items:
1. Get an architectural group for terminals. This is a crazy situation. The 125/gigi incompatibilities are dumb too.
2. Fix Gigi. Make it right! We can't support all these variants.
3. Start by working the issue... clearly past due.

"CC" DISTRIBUTION:

JOE CARCHIDI	BILL DEMMER	GARY FINERTY
BILL HEFFNER	BERNIE LACROUTE	SI LYLE
BILL PICOTT	CHARLES A ROSE	

GB2.S5.68

Glossary

A/D- Advanced Development- a group within each development group whose goal is to show feasibility by building working breadboards

Beige Book- all project plans and resources for each group for next 3 years

CAD- Computer Aided Design. Covers use of computers to engineer computers and includes every aspect from simulation to analysis and design

Computer Engineering- book by Bell, McNamara and Mudge for detailed definintion

Computer System Component- the part, we call an option, from which a Computer System is built. The components types are: CPU's (which is actually the processor, primary memory, and controllers for other options), secondary memories (currently disks), tertiary memories (currently tapes), printing and CRT-based terminals, and special hardware options. Other components include the software, cables, and all documentation.

EBOD- Engineering Board of Directors (subset of Marketing Committee responsible for reviewing and approving product development strategy

EMS- Electronic Mail System for creating, storing and sending messages to all persons who are subscribers to the system.

FAT- Final Assembly & Test- manufacturing site where various parts from high volume are collected, inventoried and assembled to fill customer orders

Field merge- computer system component or option that is part of a larger system that the customer buys. The option or product is capable of being built in a high volume manufacturing plant, shipped to the customer and connected to the systems by Field Service (and eventually by the customer) with the expectation that the combined system will work. This also denotes method of manufacturing.

GIGI- a product designed for Education marketplace which is a CRT controller packaged in a keyboard. The next version of the prouduct includes the processor and primary memory.

Individual Development Plan- a career plan made by individual with manager

Interconnect Task Force- group to assess position in Physical Interconnect (see below) and recommend how we improve it. Encompasses the technology, capabilities of CAD and of plants to manufacture the technology

Large Systems Development Group- responsible for systems selling for over $250K

M/E- manufacturing and engineering

Mass Storage Group- products used for secondary and tertiary memories. Includes disks, tapes, magnetic bubbles, video recorders

Mid and high end disks- disks for mid and large systems

Mid Range Systems Development Group- responsible for systems in range $16K-$250K

Network Interconnect- the means by which all our terminals and computer systems are connected together. This includes the network structure called Ethernet which we are jointly specifying with Intel and Xerox.

OFIS- a set of projects including word processing and electronic mail for use in offices

PDT- a small system that packages processor, primary memory, secondary memory, terminal and communications options together in a co-ordinated fashion

Performance Analysis Group- responsible for measuring and understanding why products perform the way they do

Personal VAX- a VAX computer oriented to a single user which has a 1000 line, high resolution CRT

Physical Interconnect- the scheme by which Integrated Circuits are coupled together. This area covers chip substrate carriers, printed circuit boards, backplanes, and cabling. See Computer Engineering book for details.

PMC- Product Manager's Committee- Si Lyle, Product Marketing Manager, staff

PMMMM- Si Lyle, Product Marketing Manager for all products

Point of Manufacture- a manufacturing organizational structure which Jack Smith is implementing that eliminates FAT plants such that various computer system components are built in high volume plants and field merged

Product Strategy- same as Red Book

Red Book- development strategy with past and future products for Product Lines

Research- group mostly concentrated in a single group. Oriented to several focussed projects, such as building a secure computer system, a personal computer system or a Database system that can be queried via forms. Projects are not oriented to making a particular product, but oriented to getting results or building an experimental breadboard by which a product can be made.

Small Systems and Terminals Engineering- all products up to $16K selling price

Stratton- an annual, three day meeting of 250+ representatives of all the engineering groups. Plans and direction are presented for many of the groups. Video teleconferencing was used to extend audience by 250.

System (or Computer System)- an assemblage or combination of parts (or computer system components which we call options) forming a unitary whole. Note this is the standard dictionary definition as applied to computers.

Technical Director- part of Office of Engineering. Responsible for Performance Analysis, Architecture, Standards and Advanced Development.

TRAX- a transaction processing system for commercial market. Very good specifications, but poor implementation. Delivered only 12 and withdrew it.

VAX- our 32-bit computer architecture, also used to mean the total system we have introduced as the VAX-11/Model 780 running the Virtual Memory System software (VMS)

Venus- follow on VAX Model 780 that will sell for about $250K

VT100- a CRT-based terminal that connects to a computer system

WPS- a Word Processing System

11/70mP- a multiprocessor computer system based on the 11/70 designed to provide both performance and higher reliability and availability. Described in Computer Engineering book. A superb product, but came in behind schedule. Sales on the VAX picked up and as a result we decided not to market it.

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Subject: OOD Goals (and Objectives) FY80 [and how we did against them]

To: Ken Olsen Date: 8/7/79 [edited 8/26/80]

From: Gordon Bell/Larry Portner

CC: OOD, OC Dept: OOD

Loc: ML12-1/A51 Ext: 223-2236/2471

Grade (Bell/Portner)
Goal - (8/7/79)
Performance (8/16/80)

0.
B- Build products as per Red Book (show 3 years and 5 years till end of life)
C and corporate strategy.
B- Manage according to budget and schedule.
D Poor schedule performance. Spent over budget, but understand why.
Operations organization installed and helping. There's good plans.
We have a fundamentally new and consistent phase planning process.
A- Stability, yet excitement.
Turnover is relatively low. Projects are stable, aggressive and exciting. We decommited TRAX (C-) and 11/70mP (A-).

1.
A- System orientation: make Small, Medium and Large Systems independent and
B+ the planning centers.
New system configurations reflect this.
B Have really clear charters and contracts by site, with only minimum

B+ central support and inter-dependence.
Power and packaging are coupled, -physical interconnect proceeding.

B The systems centers will work with Mass Storage, Semiconductors to the technologies they need for their viability.

A Mass storage product manager is resident and coupled.

C There is a process to couple users to producers of MOS and Bipolar.

2.

B- Significantly couple with the product line engineering groups where joint products and planning is essential for avoiding replication, insuring compatibility and leveraging base investment.
We sit on the group product line staffs!

3.

B+ Start to move to applications, versus base systems focus as per Product Strategy on the basis of measured funding by level of integration.
OFIS program for WPS and EMS is a major accomplishment.
Groups and components are going on the Personal Vax.

4.

A- Continue to improve EBOD, PMC, product marketing support through PMMMM.

A EBOD is working. Programs for product marketing in place.

B- Aggressively support marketing organization and improve coupling.

B+ Coupling through staffs. Doing product positioning vs market.

B- Use the contract process for product decisions and pricing.
This has been established.
Showed by example, through Venus, of a comprehensive plan which includes all aspects of the product's life!

F Review product profitability against the plans.
EBOD has been given this directive. We can examine VT100 and VAX.

5.

A- Build a first class architecture identification,

specification, and
A control function such that the Corporate Product Strategy can be implemented.
All groups exist, with connection to Technical Director.
A Make the Network Interconnect charter of Medium Systems a key interface and control organization.
Happened very well! We have the structures coming along to build
and interconnect computers for the next 10+ years.
B- Establish Small Systems and Terminals architecture.
Being exercised and tested now.

6.
B+ Keep our people and make DEC an exciting place to work and have high morale.
see 1
B- Get a human resources plan (HRP) so that we are able to have a resevoir of technical and managerial talent.
The Individual Development Planning part of the HRP is working.
C- Have available, almost trained replacement managers for two senior levels of engineering.
This review hasn't happened yet.

7.
B+ Get metrics for all products and processes permitting a better method of
C resource allocation based both on position and strategic need (market).
Several Redbooks (sets of plans) have been formed; including CAD and
Performance Analysis.
An Interconnect Task Force has started to work on this
critical area. Very high quality product positioning data and
benchmarks are available in nearly every area.

8.
B- Review for all our groups at least annually.
A- We had a 2 day major program review and set up a review cycle. We
have started to review every group based on the Beige Books.

9.
F Review our ability to produce reliable, quality software

in a timely, cost-effective fashion.
Did not do. Intend to use the review process above. However,
we do have a clear plan, together with some advanced development.

10.
B+ Review our R and D position by getting advanced development in
C development groups.
The RAD Committee reviews. Nearly every group has an A/D function!
The R and D group is now R and more research oriented.
B+ Get plans for 80's show possible 85 products.
C The systems in the mid and high end have been layed out till 90.
We need this for semis, disks, terminals and low end. Ok till 85.

11.
B+ Increase overall effectiveness by managing the Engineering and
C Manufacturing interdependency.
Had first joint meeting! Strong intent, less progress. Have common
issues list and people working on them. Have proposed a segmentation
and coupling which must me consistent with Manufacturing
reorganization.

GB1.S6.6

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i n t e r o f f i c e
m e m o r a n d u m

SUBJ: **OOD Goals (and Objectives) FY81**

TO: Ken Olsen, ML10-2/A50
Date: 9/3/80 Wed
From: Gordon Bell/Larry Portner
CC: Operations Committee
OOD
Dept: OOD
MS: ML12-1/A51/ML12-1/T32

Ext: 223-2236/2471
EMS: @CORE

OOD Goals (and Objectives) FY81

0.

Build products as per Beige Book (shows 3 years and project end of life). Update and clarify the corporate strategy in the Red Book and rate us. Manage according to budget and schedule.

1.

Continue to build a systems organization around products by size, and have clear alignment with various manufacturing sites, focusing on problems. Streamline Engineering (reinforce accountability and facilitate decision making) in terms of Product Development Engineering (PDE) and Office of Engineering (OE) such that more people are working in PDE with less matrixing. The OE will manage by formal review approval and inspection versus hassle. Build a single packaging/power/physical interconnect (PPPI) organization with a clear charter which is understood by product groups and plants.

2.

Increase the percentage of software spending for applications and increase the number and quality of groups in this area.

3.

Keep our people and make an exciting environment with high morale. Get a human resource plan that is well understood within organization. Have trained, replacement managers for two senior levels of enigneering.

4.

Review all groups annually as per their Beige Books. Review selected programs as appropriate. Especially review our ability to design and build software systems.

5. Review past product performance against plan so that we can better understand resource allocation, especially consider induced investment and ability to manufacture in a timely fashion. Review new products in terms of total resources (expenses, capital, computers, space and people).

6. Increase overall effectiveness by managing the Manufacturing and Engineering interdependency. Cooperate in the Manufacturing reorganization to assure the best coupling for planning and execution (product introduction).

7. Establish a long term strategic frame work to guide our investments in technologies, products, and related processes.

GB:swh
GB1.S6.35

GB0004/27

| d | i | g | i | t | a | l | i n t e r o f f i c e m e m o r a n d u m

Subject: **OOD Goals FY79 and Performance Against Them as of 7/28/79**

To: Operations Committee

CC: OOD, Barry Burns

Date: 6/13/78; Updated: 7/28/79

From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

ORIGINAL PERFORMANCE AGAINST GOAL

0. Build products as per Red Book.

Product Strategy and needs caused changes, else ok.
Manage according to budget and schedule.

Underspent by 2M (indirectly causing slips)
Hold organization together in face of lower growth (budget), and evolving market organizational changes.

Organization, new people, Larry and charters feel very
good now, despite changes. Turnover is still low.

1. Improve management process by clarifying organganization and organizational boundries.

Major improvement this year. Next year will be better.
Includes technical director function,

Solid and necessary to get Strategy going. Other parts

of organization are considering similar roles.
communication engineering,

Have it together finally under Demmer (Plowman).
commercial engineering,

Fauvre left, Daley is really good. Product position is

improving rapidly (eg. Cobol, TRAX).
CAD,

Are finally getting there...still needs work.
physical interconnections (PIC),

OK, but still can improve in direction and coupling to

systems groups and to manufacturing.
small systems,

Really great...have got it together.
architecture,

Very strong, and must be for our future.
diagnostics,

Being decentralized, also strong central technology.
microprogramming/microprocessor support.

Finally we have a good group (Bill Segal).

2.More development dollars (from base systems) into applications in line with group product line strategies.

Are holding base systems. Resisted many new base systems. Must move to more applications as per goal. Need measures to manage resources.

3. Work to make EBOD,

Feelings about EBOD were mixed. Si, Larry, and Andy are

committed to make it much better.
Marketing, and

VAX was moved to Tech. Prod. need to do this elsewhere.
Long Range Planning more effective.

Finally have two year planning horizon...next year we

must go to 5 years!

4.Get strategies and metrics for all products and processes with outside comparative data!

The RAD Committee has made this work quite well. Most
areas have measures of goodness.

5. Make the Product Managers more effective.

The PM Committee formed and solved several problems in planning, systems definition, product introduction, and

role definition. Si Lyle managing this should really
make for an effective organization...we're ready.

6. Focus processes and design factories for:
LO (NMOS and by-out microprocessors) I/C,

Pretty good, note Fonz and future direction
Mid (Bipolar and HMOS) I/C;

COMET, our first gate array work, had surprises.
Hi (ECL and follow-on) I/C,

We depend on Motorola, our CAD looks good.
Marvelous Module Making Machine - 4M (so as to reduce product cost turn around).

Didn't touch this one. Probably can't.
DECnet moves into distributed processing (production versus craftspersons), and

Shipped Phase II. We lead, but IBM's moving up fast.

Still want more technology here.
Software (implementation language, interface management, piece parts, portability, verification, and performance analysis/measurement).

Made progress in all parts, especially performance.

7. Establish some inter-group forum for team building across all of engineering (especially those in P/Ls). Communicate products and requirements so as to identify duplication and basis for future building.

We did not do this. It needs to be done and now I have

much more support in CE and PL's (eg. Stan and Bruce)

to improve next year.
Engineering management should understand products.

I feel better that they must and do.

8. Formalize management, especially planning and review process for non-product part of OOD budget.

Tools and RAD are working very well. Will be more

specific next year by area (eg. project management).

9. Make Research and Advanced Development more effective.

Excellent coupling to Small, some in Mid, little in Large and Software. Finally people are seeing how to

and why to build advanced development of their own.

10. Given that we can't excel in all products/technologies, make a statement as to just what we are good at and intend to dominate.

The Product Strategy came from this goal (and visits

last summer to customers). The result is more focus

in engineering.

Personal Goals...described after the fact

1. Make an everlasting organization which is composed of quite independent parts, several of which have to work together,
independent of much energy from me.

This is finally happening...or I don't see it isn't.

The main gain is seeing several next generation people (10-20 years younger) to raise quality.

2. Make a substantial technical contribution and delay technical obsolescence as long as possible. (Know where I am obsolete!) The temptation is always to define and assign.

The strategy took much energy. There are little

things, but I want to do more.

3. Build an interesting environment for understanding computing.

Have encouraged Digital Press, am trying to get a hi

quality museum with surrounding talks and papers so

that our people can interact with some great people.

4. Stimulate basic research in computing.

Served on NSF panel arguing experimental use of computers. Advise IRCAM (computers in music). Selective talks. NSF referee. On NAE nominating committee.

5. Understand a few business and engineering management issues.

Visited Japan. Wrote and presented a paper on it

internally, at Dartmouth conference on innovation,

and at Harvard Japan study group that included

Ambassador Reischauer (under Vern Alden's sponsorship).

GB:mjf

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|d|i|g|i|t|a|l| **i n t e r o f f i c e m e m o r a n d u m**
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+---------------------------+

Subject: **OOD Goals FY79**

To: Operations Committee

CC: OOD

Date: 6/13/78
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

0. Build products as per Red Book. Manage according to budget and schedule. Hold organization together in face of lower growth (budget), and evolving market organizational changes.

1. Improve management process by clarifying organization and organizational boundries. Includes technical director function, communication engineering, commercial engineering, CAD, Interconnections (I/C), small systems, architecture, diagnostics, microprogramming/microprocessor support.

2. More development dollars (from base systems) into applications in line with group product line strategies.

3. Work to make EBOD, Marketing, and Long Range Planning more effective.

4. Get strategies and metrics for all products and processes with outside comparative data!

5. Make the Product Managers more effective.

6. Focus processes and design factories for:

LO (NMOS and by-out microprocessors) I/C
Mid (Bipolar and HMOS) I/C
Hi (ECL and follow-on) I/C

Marvelous Module Making Machine - 4M (so as to reduce product cost turn around)

DECnet moves into distributed processing (production versus craftspersons).

Software (implementation language, interface management, piece parts, portability, verification, and performance analysis/measurement).

7.Establish some inter-group forum for team building across all of the engineering (especially those in P/Ls). Communicate products and requirements so as to identify duplication and basis for future building. Engineering management should understand products.

8. Formalize management, especially planning and review process for non-pots part of OOD budget.

9. Make Research and Advanced Development more effective.

10. Given that we can't excel in all products/technologies, make a statement as to just what we are good at and intend to dominate.

GB:mjf

GB0004/28

OOD GOALS FY 80 (GENERATED BY OOD) 8/2/79

Products and Plans

0. Build products as per Red Book and Corporate Product Strategy. Manage according to budget and schedule. Stability, yet excitement. (GB only)

1. Ownership/Leadership by OOD to a clear, written Product Strategy, showing 3 year plans and projected end of life to 5 years, with a committed implementation plan and supported by underlying technical (technolgy) plans.

2. Lead to get all Corporate

Product Development plans explicit and aligned with important strategy dimensions (eg. quality, ease of use, compatibility, networking).

3. Understand how we are competitively measured in terms of total cost (to buy, service and operate) effectiveness and establish a strategy for positioning (whether leadership or not).

Systems Emphasis

4. Clear, unambiguous systems responsibility and focus with organizational simplicity and clout to execute.

5. Explicitly understand, contribute to and support the base technologies of mass storage and semiconductors necessary for the effective systems.

Product Market and Quality

6. Be perceived as #1 by our customers in product quality and ease of use.

7. Be the most desireable alternative to IBM.

8. Be demonstratively and viably unique in the type of solutions we offer, recognizing that once we achieve leadership we will be imitatated.

9. Establish programs that contribute to ease of doing business with DEC.

10. Provide a strong Product Business focus. Use the contract process and review history of products.

Engineering Processes

11. Develop an understanding of the Design Processes for Technology, Tools, Processes and Competition.

12. Develop an R and D strategy for

DEC in the 80's.

13. Identify and eliminate the barriers and hassles within our processes to enhance productivity.

Interfaces among all engineering, service and manufacturing

14. Increase DEC effectiveness by managing the interdependency between Engineering and Manufacturing.

15. Develop an joint goal sets with Customer Service Organization to enhance DEC effectiveness.

16. Establish a collaborative and supportive environment across the engineering organization. Concentrate on modelling this behavior within OOD.

Personnel and People

17. Establish and maintain a positive, "people oriented" environment.

18. Make the company feel good about engineering by demonstrating capability, responsiveness and performance.

19. Sponsor an environment that allows and encourages entrepeneurial and creative behavior.

20. Understand our future staffing need 3-5 years out and develop specific programs that address those needs.

GB0003/68

| d | i | g | i | t | a | l | **interoffice memorandum**

Subject: **OOD Goals (and Objectives) FY80**

To: Operations Committee

Date: 8/7/79

From: Gordon Bell/Larry Portner

CC: OOD Dept: OOD
Loc: ML12-1/A51/ML12-1/T32 Ext:
2236/2471

0. Build products as per Red Book (show 3 years and 5 year till end of life) and Corporate Product Strategy. Manage according to budget and schedule. Stability, yet excitement.

1. System orientation: make Small, Medium, and Large Systems independent and the planning centers. Have really clear charters and contracts by site, with only minimum central support and inter-dependence. The systems centers will work with Mass Storage, Semiconductors to get the technologies they need for their viability.

2. Significantly couple with the product line engineering groups where joint products and planning is essential for avoiding replication, insuring compatibility and leveraging base investment.

3. Start to move to applications, versus base systems focus as per Product Strategy on the basis of measured funding by level of integration.

4. Continue to improve EBOD, PMC, Product Marketing Support through P^4M. Aggressively support marketing organization and improve coupling. Use the contract process for product decisions and pricing. Review product profitability against the plans.

5. Build a first class architecture identification, specification, and control function such that the Corporate Product Strategy can be implemented. Make the Interconnect charter of Medium Systems a key interface and control organization. Establish low end architecture.

6. Keep our people and make DEC an exciting place to work and have high morale. Get a human resources plan so that we are able to have a resevoir of technical and managerial talent. Have available, almost trained replacement managers for two senior levels of engineering.

7. Get metrics for all products and

processes permitting a better method of resource allocation based both on position and strategic need (market).

8. Review for all our groups at least annually.

9. Review our ability to produce reliable, quality software in a timely, cost-effective basis.

10. Review our R and D position by getting advanced development in development groups. Get plans for 80's show possible 85 products.

11. Increase overall effectiveness by managing the Engineering and Manufacturing interdependency.

GB:swh
Attachment

ID#0268

| d | i | g | i | t | a | l | **i n t e r o f f i c e m e m o r a n d u m**

Subject: **Goals for Operations Committee and New Strategy**

To: OOD

Date: 14 SEP 78
From: Gordon Bell
Dept: OOD
Loc.: ML12-1
Ext.: 2236

<u>Additional Goal #11</u>

Get a Larry Portner replacement by January 1, 1979!

First follow-up October 2.

Present a definition of PM's job, what they're responsible for and how they're measured.

Andy is to review their performance.

The strategy is to be presented at EBOD on September 20 (please schedule) for review and recommendation and to individual staffs (Stan, Julius, John, Ted) before this. The Marketing Committee will approve.

GB:ljp

December 11, 1978

Golden Bee Museum Collections
Dept. TF-9
P.O. Box 7000
Greenwich, Connecticut 06830

Dear Sir:

Please send me a catalog. I'm especially interested in replicas of computing devices.

If you do not have some of these, how large an order to you need to make and design such objects?

Sincerely,

Gordon Bell

Vice President, Engineering

GB:ljp

GORDON BELL AT STRATTON V: PBS ALTERNATE STRUCTURES

I made the mistake of not having GIGI-generated slides, and as a result they penalized me by only showing them at half-scale (laughter). Which I think is right: if you don't keep up with the times, you get the shaft. (laughter) But on my second talk on Friday, I will have GIGI-generated slides. They will be generated during the course of the next two - next three days. Somehow, Jan has said, "Oh, this is..." - STRATTON is a meeting that she says is mine. Well, I think it's not mine. I think it's clearly yours. I'm really impressed with the - with what's been achieved here in - I guess in many, many dimensions: the quality of the presentations, the demonstrations, just what we've gotten done, and in fact, it's so good that we're going to schedule a STRATTON in some of our plants so that we can get some of our products shipped that we have promised and scheduled (laughter), so there's going to be something called a Distributed STRATTON associated with each product now, in order to meet some of the deadlines that we've got. But seriously, I think that it sort of shows what deadlines will do, and also just what a lot of money will do in terms of going after some advanced development and having the right set of goals. It's exciting that we can now have some - we're seeing the signs of having better products, probably spaced longer in time, so it's really counter to what some of the arguments have been. I think we'll really make out a lot better that way than having a lot of products that are obsolete when they come out and I see some signs here of having some very good advanced products when they come out and I think that's a better approach.

Actually, this is three talks in one: one on Distributed Processing, which has to do with the - really, the root of Profession-Based Systems - because, like Dick's theme was balanced, I want to balance Dick's balancing by saying that to me the professional systems that I think are going to be exciting in the - probably in the near term and then even over the long term - really are predicated on a significant amount of distributed computing and we get two concepts mixed up here in professional - when we talk about the professional systems: one is low cost and personal - and the idea of having profession - and I don't think - I think we ought to keep those things separate. Not that we shouldn't strive for low-cost systems. But I think we should strive for cost-effective systems. I want to make sure we keep those ideas separate. The other thing is to - just to give some of my thoughts on Profession-Based Systems - and then the third talk is really on some of the human engineering details that I think are important about personal - or when dealing with people who have to use these systems which I - some slides I took last week of some of the systems that I use. Okay, the first slide.

So, really these are the - notice the - I hope you can - some of you can read them. They can be read in all of the remote sites

because I told them, "Cameras, zoom in on those." I can read them. I hope you can. Fundamentally, that it - that the profession-based system and - I'll say for large organizations, because I think that's totally different than the retail products store kind of problem where you're selling small systems to a small organization. That, fundamentally, there's a hierarchy of computers, including personal computers, that is, computers associated with an individual. That's sort of the first talk, and - which is really cleaning up a lot of last - the tail end of STRATTON last year, which is where we left off about a year ago.
It's - the second talk is really on the first - I'll call it the first level of profession-based systems. Let's not worry so much about the profession - each of the specific professions - say for the next year or two. Let's get what I call generic applications dealt with, namely, things that everybody has to do in a large organization; that is, handle text, handle graphics, handle filings, handle communications, and in fact, Charlé's system there, I think, is probably one of the best I'v seen as - that may be the right kind of terminal for the - for dealing with this set of problems.

And then the third talk is really on "Hey, let's worry about some of the attention in terms of human engineering and the cost of a capability." Now, I want to coin something which is - which - I don't know - I haven't got the right buzzwords yet. I'm not a marketing person. So we'll - we need some marketing people here to tune the new concept out. But it's beyond cost of ownership. I want to introduce a thing called Cost of a Capability or Cost of Providing the Service. Because I think we all only focus on the cost of ownership and what we really ignore is what is the total cost of use. So maybe it's cost - let me say it's Cost of Use - it includes the cost of ownership but in fact the real dominant cost is having somebody sit there and look at the thing. So here goes -

These first level of generic capabilities, goals I'd like to have for 1985 - I want to probably revise those upward, given the SUVAX, because it looks like we can get there, but I just needed something to feed my imagination a little bit. And certainly, at the word-processing level, full-page, voice-input graphics, profession-dependent archives at document parts and all documents - that is, the ability to retrieve parts of documents and put them all together in a sensible way, not by having to call it out by with a programming language or by commands but by some other means, something - probably using something like the knowledge-based systems to generate how you put those together. User typesetting: I want to be able to do my own typesetting, to generate my own slides and that should be part of the capability - I don't want to go through the middle man of having to have other people generate slides. Filing cabinet: yes - very good electronic filing cabinet, ultimately searching on the contents. So be content with searching for key words that you imbed in a document but then ultimately we really want to be able to go in and look through the document. The mail systems: certainly we want voice there, computer-conferencing to happen, and then I'll say personal videoconferencing in sight. A pretty good idea of how we want to do videoconferencing by 1985. Communications: certainly all the interconnections with the other computer companies which we - which I think our official party line is called INTERNET. PACKETNETs, which are the public network message - message networks - and then I'll say the old nets or the non-computer nets: phone and TWX and other institutions that have networks that we have to be able to interface to. We want the system to be able to deal with that. So, to me, that's the sort of first - that's the level that I think we want to be operating on. That's essentially the FORTRAN, the cost-enter(?) systems by the 1985 area.

Yeah.

Q: Gordon, are you proposing that we recognize voice and turn it
into English?

A: No. On that one, I believe we're limited by our ability to sell - to provide systems by whether or not we have voice input. I'm proposing that we have some combination of voice/text recognition so that you can correct on the fly as you dictate. We've got a Demo, I hope, that shows what I mean by that, made by an unbuildable machine right now, but I believe that the speech recognition - with proper feedback, I think the speech recognition capability we have now at an isolated word will let us do voice dictation, because I really see that as the limit of use now. There's a whole set of culture - of people who are not going to type. Either they can't type or they will never admit that they can type. Let me say, my peers, for starters.

Yeah.

Q: Recorded voice: do you see that as well?

A: Recorded voice?

Q: Recordings of the voice.

A: Oh, I think that's an interim stage that we will deal with - voice answerback so that the thing will sit there and behave as an expensive phone answering machine.

Q: I was referring to actually dictating and sending that coded voice to some of the personal office(?)..

A: I think voicegrams are an - that's an interesting interim way to go. I think we've - clearly we've got to do a bunch of experiments here to see whether that's better - or getting the whole message up at once. I really think it depends on what the thing is. The whole - this was the point I just made on whether - is it personal or shared? And I want to point out that everywhere, with the exception of disks, the - all the economy of scale is disappearing. The only time you get better cost-per-something is with large disks. In terms of keyboards, they're hard to share - to make a great timesharing keyboard that we all play on (light laughter) or even a primary memory or a processor. Processors don't cost anything. The primary memories are getting so that they don't cost anything. We're limited by a tube and a keyboard that that are already fixed in cost that we can't share. So the strategy is one that we've outlined that Dick has talked about, essentially moving through - we've been providing very general tools, namely with these kinds - I'll liken it to the fact that we've been in the lawnmower business by providing wheels, gasoline engines, wood, and it's simply up to the users to build their own lawnmowers. You can build lawnmowers and cars and everything else with what we provide. But I think we're going to move into a much more general - from a general to the specific generic, and then go into the much more personalizable things, which is probably beyond this. So the problems are clearly distributing and sharing programs - programming and data among this network, and then the other problem of simply how do you use the stuff, because I really - I come up against that every day in the systems that I use.

Here's where we were - I wanted to sort of report how we've come over the last year.

This is roughly the slide that I put up a year ago, which was - this is the environment that we're heading to, that we're building. I'm happy to say that the Interconnect program under Dave Rodgers and George and Bill Demmer and Gary(?) has really come a long way. This was a - I'll say a virtual network last year and now I see signs of it being a real network this year. We are - we've got a lot of the details fleshed out. We start with the top level, the central-sited computers, and in fact, in my - can I have a pointer? - introduction, I describe these - this is also in the handout. So, I believe that computing will continue along the lines that it has today of the central-site computers, these local group-level computers, that is, a computer assigned to perform the function of a group, which turn out to be mini-size computers, and then going down to the professional personal computers, and personally I've been interested in how do you take a program and move that around dynamically through that network, or even how do you take any kind of a program, even on a fixed basis, and have it work with any of the next levels. So I think that migration and cooperation among the various levels in getting the right kind of operating well. Jack Gilmore's slide of trying to follow those - essentially at those optimum points is the name of the game here, because these really represent the three curves that he had. But the impressive thing is that we've got CI coming, we've got the NI that's just about to be - an agreement with Xerox is going to be announced in the next week or two, in terms of providing coupling within an organization, and then down at this level we're working on the communications. And then, of course, you see SUVAX here as a beginning to see an inkling of what one would provide there, plus, of course, all the proliferation of everybody building a personal computer for something.

This is roughly the slide that corresponds to what I have in the handout in terms of what are all those levels going to do. The only one that I really forgot was in fact the fact that what I think the central computers are going to provide more than anything else are communications among computers, and the communication-oriented services, like a central mail facility. Strangely enough, I forgot that. I think that these machines, in a sense, are going to be out of business in many environments and just be in a holding pattern, if people try to get off of them. They have to be there because the data is enmeshed in the computation and these big COBOL programs and you probably can never move it from there, and so there's - this is job security for many centers and I don't know - you know - but I don't think it's going to grow. But clearly it's going - nothing here is really - these are all specializations rather than economy of scale. The only thing that I think is really special, that you really want for the central facilities to provide, is the archiving of a lot of the file stuff, because this is where it really costs to have individuals be their own filing clerks, becuase they lose the data and they don't worry about backup, and again the cost per byte there is in the right order. The group level machines: right now I believe these are the most cost-effective because they are the best matching of what does the group do for that - there's a group function, like a design group or a word-processing group, and you get cost-effectiveness by having only a single program or kind of a set of programs for that collection of people. And with processing power, what it is - this is kind - you get enough performance here, and then you're really doing a very good matching of needs to resource. Right now these clearly win in almost every dimension when you - if you can cluster a number of people around a single function system, they win, and in fact, this is why many computers have come in. Now what we see is, in fact, these guys coming in saying, "Gee, why do it in a cluster or why do it centrally? Just give it to me and let me do it at a personal level, having computed now or - having computed and still computing at all of these levels, this one has its set of problems, which I want to - which we'll get into on the last - my last talk, because we tend to thing of them as a panacea, and what happens is we all end up spending time doing all of the things that somebody else used to do for us, probably more professionally and more cost-effective. And the ultimate in this is: take all the computers away from everybody, give them all TI calculators, and have them programmmed in octal or decimal, which is what you program in in those hand-held calculators, and look at what the costs are for that. Very cheap to buy but the cost of ownership is the most. So I think these are the functions that we'll end up doing at the personal level facilities, and the SUVAX is kind of my ideal of - slightly modified, of course (light laughter) - it doesn't recognize that several people may want to use the same personal computer, for example, and that your personal computer isn't small enough to take home, and you need a port into it, but it's a good start. I like the - the resolution on the tube's(?) just right.

The - this is a slide Terry gave me which is really the status of the Interconnect at this time, which is - the other - the first slide on its - actually, upside-down - with a bit of information added. The low - the terminals are here, small systems here, mid-range systems and the large systems, and what this shows is the various ways of interconnecting these various systems. This thing - this symbol is a CI symbol, which says all of these computers are tied together through CI. There's some - all the other slides - all the other colors, which are a little bit hard to read. I won't go into - but, in essence, these various systems are connected together all through an NI type of structure. It really is - with the proper transformation, it can be shown that the two map(?) ones - I'll leave that to Terry in his talk. But I'm convinced that they are the same and that we are building this distributed computing system. And I think this is where it's at; this has really been our strength, and we are, particularly the software engineering network is, really a testament to the fact that this stuff works.

Now I want to go back into my system, and this is one of the central systems that I compute on. This is the input communication link that we - this is why NI(?) - come in through the telephone to PK1, in through some patch panels, and hope that I didn't get cut off, lots of scopes to map everything to everything else. If all else fails, there's a T-bar here which takes all the communications on one system and throws it to another system. Then it goes into all the modems of the thing, and then finally it gets to the computer. So we think - we happen to think that the computer is the most central part of this, but in fact, it's really kind of peripheral to all the other boxes of equipment that - actually this isn't the system - the EMS system - this is a thing called RCS, which is sort of an electronic torn-tape system (laughter), which allows anybody to talk to anybody else. This is the EMS in PK1. But you do need RCS, because RCS is the only way you can get from one EMS system to another EMS system. So it acts as a nice transmitting unit. But - so, here we're seeing one of the central services that we all need and have to compute on.

This other slide that should be about twice as big is the engineering network that in fact exists today of having all of the sites from Phoenix to the Mill, Hudson, Parker Street, Reading, Tewksbury - Reading isn't on yet, but Merrimack - and having them all tied together through a DECnet link, so that - in fact, here's another system that one computes on, that have access to - through - a group-level machine today, and can go in to several of these - I guess I have an account on the Corporate Research computer, and one somewhere else - can come in - the whole system isn't shown - and can compute in a true - at a group level or through this central thing. Here are the details, unfortunately, all of the links shown.

Now I want to get into - sort of, this is the second talk: What is the PBS system that I'd like to see - this sort of 1985 - by 1985, having it out there. The physical system is: a processor, a primary memory of a megabyte, 100 megabytes of fixed memory, no removable media - I don't want to mess with the file problem - I've got floppies that I can't find my stuff on now, and I don't want to have cartridge tapes that I can't find things on too. (laughter) So, I want to get them off to somebody else who will take care of my files and not lose them. I believe we need two to four CRTs per personal machine, because there are a bunch of persons that happen to use this personal system, which is really a database. Black-and-white or color monitor, high-resolution black-and-white a la the SUVAX - I think that's the right thing as long as we can make it so that it can either be this way or that way and display full 8 1/2 by 11.

Q: Gordon?

A: You got it? Yes?

Q: One of the things that's bothered me is (unintelligible) SUVAX structure.

A: Right.

Q: (unintelligible)

A:No, they're all going to be mapped out. (unintelligible) large organization they're all going to be networked.

Q: (unintelligible)

A: What?

Q: (unintelligible) small organizations, too.

A: Yeah, but they're not going to sell them. They want -

unless it costs two dollars they're not going to sell it. And let them beat their brains out trying - they can't cost-justify anything to their clientele. I want to build computers to people who really understand productivity and the minute that you get...

Q: (unintelligible) you don't have to work in that mode.

A: What mode?

Q: (unintelligible) you don't want to have to do it. You want to have to take the (unintelligible) When you're in a large network (unintelligible)

A: Right. Yeah, if somebody can figure out how to deal with the floppy problem why, great. I mean, that's...

Q: (unintelligible) work for Digital (unintelligible)

A: Oh, I'm not going to outlaw them. I mean, we did (laughter) - no, I mean I...

Q: (unintelligible)

A: Oh yeah, I just think it's a crock anyway (laughter). I hope we don't have any on our systems. No, I think people will get past that. I think the research so far in these kinds of machines has shown exactly that, and it certainly agrees with all the experience I've got in terms of the personal machines, of - get rid of that removable medium. The system has to know about that, and why turn us into (unintelligible)?

Q: (unintelligible) removable media...

A: Yeah?

Q: ...and they're so dead(?) that I don't want to have on the central system, because I know there's guys who can get at it. It's my data; I want to be able to keep it quiet.

A: Oh, for you people who really have got all those secrets (laughter), you'd better have personal media. Maybe you should never tell the computer, either.

But - and then, certainly, letter-quality printing, and being able to print what we see, so that means if we've got color we need a color printer(?) somehow.

A telephone dialer, a phone answerer, a voice output, and I somehow left off the voice input - something to really deal with the telephone. I really don't like the telephone. And I want this - the personal machine to really deal with the telephone. Certainly a link to the systems of the same type, and the ability to do things across systems. That may include actually both tele- and computer-conferencing, and videoconferencing. So the ability to share pictures across the network. And at the 10-megabit rate it seems to me that we get. We can transmit pictures on the thing, and particularly at the cost of current television cameras and the low-cost, low-resolution cameras that were coming, this is the kind of thing that we should have.

Yes?

> Q: (unintelligible) why do we have to bother with an LI. I mean, the telephones (unintelligible) communicate over the other networks.

A: Well, there's - I'll talk - I've got some slides about why you have to bother with the telephone company. There are a couple of reasons why they are important.

Q: (unintelligible)

(laughter)

A: There is this other world out there. But (unintelligible)

(laughter)

And then, I want a link to the central system for filing, printing, typesetting, slide-making, distribution of documents for people not on the system, and probably accepting documents for people not on the system, some ability to get stuff into the system. And then, certainly, electronic mail systems and other systems, so that they're providing the kind of capapbilities that (unintelligible). And then, video and voice I/O - that's kind of the physical system that I'd like to see us head toward. So, if we were sitting here in '83 - '84, say, then, having this same thing and having the next level of voice I/O and having communication among the various systems, really having the systems know what we're saying and the ability to share...

Q: (unintelligible) micro... (unintelligible)

A: Micro - microfiche? I think microfiche is an absolute crock. I - you know - I hate the stuff - I mean - I - until they invent a zoom lens for microfiche, it's totally useless. Every time I - talk about compatibility - if you - how many people use microfiche to any extent? Do you ever worry about compatibility? Do you have any problems with compatibility? Do you mind turning the little different knobs? (light laughter) I never have the right lens - I guess I (unintelligible) microfiche from outside.

What?

Q: Assuming that it's better...

A: Assuming that it works, that it's better? I don't know. I just see it as an out-in-left-field kind of thing, that external documents will come into for a while, but there's got to be a better way. If we could get the data in magnetically, then why do we want to muck around with the microfiche? I just find microfiche very, very painful. Accessing and compatibility, and another thing around that you have to tolerate. I think we can have - as an organization, we can use microfiche for specs and stuff like that. That I like it for - DEC standards - to collapse that many DEC standards into that much space. But to further clolapse it, put it on a disk, I think we'd be - we might be better off looking now on microfiche internally - having some of the stuff that we use microfiche for internally, having that on the database. Having direct recall from that, from the mail system or something else. I think it's - I hope it's an anomaly, because it just doesn't feel right in this (unintelligible). Because the system doesn't understand it, so it means every time we deal with it it's got to be translated, and that's going to a pretty high cost. These are sort of the functional levels that I was - at least, the way I think of the profession-based systems. We've come from an era of which - let me call it the profession-based system route - that is, hardware-operated systems, languages, networking and databases, are given. And I think we're just getting to that point. As soon as we have DBMS-32 and a good relational database we will essentially have the roots to build with. And there'll be extra languages, and we'll argue vehemently whether an ADA will surpass PASCAL, and whether everybody should turn off to APL, and how much (unintelligible), but I don't think it's - those are critical decisions to going beyond that. So there'll be the roots. And then, this next level of modules are the ones that we really have to concentrate on the next few years: generic modules for communication. As, dealing with text, for filing, electronic mail, these office procedures and forms filing: the tickler file, and (unintelligible) file, processing, and then these interfaces to these other systems. That's something that I think everybody needs. I think even LDP needs it. I mean, I think that those people communicate pretty much the way we do. I mean they use graphs, I think. The last time I was a scientist I remember doing that. But engineers also - actually, engineers and scientists use the same display forms and even the same natural language. So it's conceivable that we can make a text-processing system that a large number of users (unintelligible). I think even accountants use English to communicate, when they're not using numbers. But that level is something that we're into now. Now we move up a level, and we get into a whole bunch of - let me call them generic professional - general professional discipline modules. These are the ones - Engineering is one such discipline. So the best analogy:

this is a Dean, this is a Department, and this a Compartment. And namely, that Engineering, Electrical Engineering, and then RF Circuit Design, so that - there's a lot in common with that, but as you go more and more specific, then this commonality disappears. It all started from Calculus and then worked down to a specific set of laws governing different physical behavior. And the same holds, whether it's in the School of Business or School of Arts, or what have you. But this is what I think - this will come after we've dealt with this problem of communication. Essentially this is just another (unintelligible). I'm really using that for office automation. Definition - this came out of a report. In essence, it says "If the evolutionary use of word processing and electronic mail to improve office productivity through a bunch of different kinds of - really substitutions - we're substituting for typewriters, for torn-tape systems, for common carriers, for paper files, for keypunches, and so on. And then, the office of the future is a - I was amused - I (unintelligible) this out because I think it's in the definition. So it's a use of equipment which allows drastic restructuring of the office work among a different composite working force. And I paraphrase - I read a long report - it wasn't that long - three pages - they were trying to describe what Office of the Future was, because I'm always looking for a definition of something. And, in essence, paraphrasing it: if a secretary uses the equipment, it's office automation; and if we all use it, it's Office of the Future. And - oh - (laughter)

This is - now this - this is the third talk. (laughter) This is (laughter) - we finally - I was looking around for - in terms of - Charlé's got the person he wants to design for. I wanted to find me an average man (laughter) and so - yeah - and so - it turns out we finally got the blueprints (unintelligible) the way everything matches. My boss normally gives me a hard time, because when I say, "Hey, we want to put this capability," he says, "The trouble with you is, you can't - we can't base it on your thing, because you're not average. And so this is a proof that I am (laughter) (applause). Now we've got a bread(?) prototype, so when I say - when you say, "Hey, who are you designing for?" you say, "Well, the average person." Well, boy! am I going to come on strong, because I found him. (laughter) Okay. So, the average person last week - I went through the average person's computing last week. This is a typewriter that the average person has (light laughter) and it's bought because it was so pretty, actually. Every time I buy one of these things - it's an Olivetti, and I did it just because it's a classical thing - it'll - it's actually for the museum. It's mine, but it - but - the interesting thing about that, or I guess I'd talk to Dick last week about this, but the trouble with Olivetti typewriters, they have the - well, aside from Italian design (light laughter) they - you know, they really look nice - but then you sit down to play on them, and they really feel crappy. And fortunately, Olivetti is dominated by designers. There are no engineers there, and so we're safe. (light laughter) That's one extreme, and then you go to, essentially, TI, which is essentially - there are no designers there; there are only production engineers, and if it isn't cheap, it's not good. And I think we've got a wide open market. All we have to do is make a (unintelligible) look nice and have it work. That's the unique market. (laughter) And I think we can get that market. All we - just - only two things - but Olivetti right now has got the design market and TI's got the schlock market for cost. But I think the market we want.

This is what the average person's word processor looks like in an office environment. Note an IBM typewriter over there, that

still has to exist. There are two modems, because the 1200-bod modem and the 300-bod - 1200-bod is 1200-bod only and the 300-bod is 300-bod only, and never the two will be compatible with one another, and I happen to be on two systems, and it's simply a matter of - I'll show you how you change from one to the other. It's a very simple (laughter) operation. And then - no - and note all of - oh, and this is - people worry about storage of (laughter) - can they have the whole phase(?) Notice the two-drawer filing cabinet and the printer up there. (laughter) That's where the printer is stored. It occupies a predominant altar in my house, and - I will - believe me, when people say, "What do you want - what about hard copy?" I say, "Oh, God, I would like to do anything to get rid of hard copy," because it - I just can't stand it looming over me like that. (laughter) And besides, does anybody know - when you turn that printer on, it adds about 6dB at 125 cycles. And - oh, the other measure I - the average person - in my house - actually, the noise level is under the sound meter, so it was less than 25dB. Then, when I get everything tuned up and turn the radio up it runs up to about 40dB, then up to 43dB with the printer off, and then 48dB. But that's on the A scale, and if you flip over to - look at the cycle bands, there's 62dB at 125 cycles. So - we may get by with the right kind of - we'll get our lawyers to work in Germany to make sure that we can pass the test, but it just ain't very comforting and so probably what I would like to do is move the printer somewhere. And, sure enough, the cables are long enough to deal with it.
Documentation is really an important part of (laughter) of systems, and where do - and there's, of course, lots of room to store documents. This is my filing system for documents. There's a convenient shelf provided under the word-processing system (laughter), where I throw everything, and in the last resort, if I can't do it by trial-and-error, I will get the information out of the manual somewhere. There's only about - there are five manuals there, and about, oh, five hundred pages, and that usually only takes me ten minutes to find the stuff. So, documents aren't really cost-effective. Oh - here's how you change the modems: you simply get up behind (laughter) or pull the thing at your own risk - pull the thing out because you're afraid a few of these cables are a bit fragile, unscrew that EIA connector there, move it over to that, and then there's a little knob back here, conveniently located (laughter), that

you can deal with by a TV repairman. (laughter) A mirror, but I don't happen to have that option. But it would be nice to be able to change the speeds, particularly in that environment. So, Ken has his slide of Engineering or Marketing. This is mine. Note: here's Average Man sitting with knees crouched at the terminal. And all of these places of little tags on there: that's the ready reference manuals to deal with the three or four systems I use of tight dollar signs - well, we don't have any dollar signs and things, but log-in, remembering what the passwords are, and project numbers and so on, on the various systems. And then, also, all the various protocols of - there are only three different mail systems and they are all, of course, totally different, with how you speak to them. And then, this is getting enmeshed in the system here (laughter) - there are a couple of phones associated with these terminals, and normally the phone wires are entangled in this desk chair. This is me reflecting at the terminal (laughter). If you - I don't know - do you all often reflect at the terminal? (laughter)

VOICE: I glare at it.

You glare at it. (laughter) Well, it glares back. I wasn't glaring; I was reflecting that day. Actually, it was - oh, and things are better when you go to a shared system, because you don't have to take care of it any more, and that's the best thing about the shared system, except there's - the thing on the - the modem on the left is the GANDALF switch that can go to several systems. There are a couple of other - there's 300-1200 mod modems. Then you simply get up from your desk about 50 yards away, grab the terminal, go over and dial this thing in a very convenient cost-effective way, and - it got its cables too, of course. This is an advertisement for NI, in case people did - I hope it's better than this, but - this is a 248, full-house, 4 modems, 4 printers, and 8 terminals. So there's a hell of a lot of cables coming out of that (unintelligible). And then - now, here's a nice - now, this is why we need the telephone company. I wish you could see this a little better, but that black ribbon cable about that big is simply - now in the Mill you can get away with it, where we don't really control the esthetic qualities, namely, Field Service can come in with hammers and all kinds of units and put in this very black, wide black cable and run it up and down over the ceilings. I have - there's a lot of offices - ugh! - actually, I went to IBM, Armank, actually, a week ago, to look at some of their historical stuff, and - I just - they had this wonderfully - designer award-winning building there, and with people around that looked like IBM people running around. (laughter) And you didn't want to touch them - nice robots, and (laughter) they - you know, they wouldn't let us install a system like that, where with this big black cable which you simply tack up on the ceiling and run down the thing (laughter). So why we need the telephone company is to install all of this stuff, because we really don't know how to install cables like this. This was our - and this is a kind of a lesson in compatibility: here's the phone thing. At least it comes up under - at the floor. There's the big black ribbon cable that goes into the printer. This was our last aborted attempt to deal with terminals. That was still left on there. This is a four-wire phone jack with - but that's probably the one we would want to use if we'd had the phone company install it. It wasn't phone company installed. I mean, the phone company installed it where you can't see it. In our case, the guy installed it where it's the most convenient for him to put - he doesn't want to get too close to the ground, because if you're trying to put screws - wood screws - in, you don't want to do it down there. It's at user-level height. (laughter) And that didn't work, and we've now switched to another system. But frankly, I would like to go back to - this is the back of - Dick Schneider says that you're not supposed to do that - put coffee cups out - and then you also - there's a tilt mechanism here (laughter). It's two books - that way. And then we switched to a new jack back here. I want to switch again to another jack. I want to switch the phone company jack. Really want to get there. So that that way we let the phone company install all the cabling in the machines, and if you don't like that, you can go to Radio Shack and buy these little four-wire pinjacks and connect the stuff, if you've got to do it yourself. But certainly having 15 - having the EI connector, and having that go over to the central machine - that's just not the way to run the terminal. So let's go to phone-compatible interconnections.

Mary Jane reflecting at her terminal. (laughter) That's - and in fact we both - I want to indicate - there are several of us that use the same system and - I want to put that plug in. Here's a document that was edited. This is a printed document. Notice the big block letters, and then there's some symbols down here. And now, as you map that into a word-processing system, that's all you can see, so this is a pitch for a full-page graphics, and being able to type all the special characters and fully general stuff. This is a thing I've learned to which is - almost learned to do, using EMS and talking on a speaker phone at the same time. (light laughter) So I found out that I can - or listening on the speaker phone, I can get two channels of input but it's hard to do two channels of output. When you get two channels of output going, this is what happens: the guy on the other end has this dazed look on him. This is Dick, while I was talking to him, because there are these lapses of - when you get the two channels mixed up as you're(?) typing (laughter). But it does say that you can use two channels simultaneously. And then - I was away for a while and the trouble with EMS is that I came back and there were 24 unread memos staring me - that was (unintelligible) for a day or two, and then - but that didn't take away from leaving the office with two briefcases that night. So somehow we haven't learned to deal with the problem. Electronic mail doesn't solve - doesn't reduce all of the other communication. You still get paper mail.

I didn't go into some of the other things I've learned about the EMS system or the various systems in terms of just the speed that it operates, and the fact that if you're on electronic mail, that it's probably more cost-effective to print out the messages, not - if you're only running at 300-bod then have somebody else - have the - have all the mail printed out for you, then do it on paper and then have it rekeyed. That's better than sitting there looking at mail coming out at 300-bod. It just ain't cost-effective to sit at 300-bod, and certainly it's one of the things I've learned over the last few months. You really have to be running at 1200-bod for this to be cost-effective. There's a good - satisfactory - or satisfying effect of being able to press carriage return and having - knowing that you've deleted something and it's gone away. It's like throwing something in the mail - in the wastebasket. But, I too am concerned about being able to get to a cost-effective - whether this stuff is

really cost-effective - we've done a poor - even though we've got an incredible - incredibly large experiment internally, we don't have very good data on how cost-effective it is.
I want to close by one comment by Lord Kelvin, which I fortunately found in a magazine this morning: "When you can measure what you are speaking about and express it in numbers, you know something about it; but when you can not measure it, when you cannot express it in numbers, your knowledge is of a meager and unsatisfactory kind."

Right now we're building some things - I would like to know something about them in numbers - like how many dBs, and how long it takes to get through a page, and this kind of thing. So there's - in order to sell the stuff, we've got to prove that it's really cost-effective for the users. And there are times when I reflect back I'm not sure that it's so cost-effective. So - that's it.

(applause)

Any questions?

Q: Gordon, in the beginning of your talk, you indicated that you would have a strategic shift form what I interpret to be tool-building to applications-building. But later on it appeared that we were building those out of the same components. What is your message about - what do we engineer versus what do we market?

A: What do we engineer...?

Q: Today we engineer and market tools. (unintelligible) applications...

A: No. I think that - I believe that we're getting this next base of tools done. That is, the databases and the languages, and now - the next thing that I think we do is almost the next level of tools. To me the word processing in a sense is more of an in-use(?) rather than a tool. That is, you don't have to pry with it, but it solves a problem by itself. Rather, it doesn't require a program before one can start using it the way it was meant to be used. So I think the shift iis simply moving to a next level of integration, and it's one that where we really (unintelligible) that everybody must have.

GORDON BELL AT STRATTON V: WHERE DO WE GO FROM HERE?

The conference so far has generated a lot of - certainly stimulated me through a fair amount - I've prepared a two- or three-hour talk based on all of that (laughter) which I'll attempt to give in 50 minutes because my university training still makes it impossible for me to talk more than 50 minutes. This is actually - I guess, a few sort of final remarks before I go into this final talk, which is essentially - there's - do I have to answer that? - I want to run without interrupt. Sorry. Later (unintelligible) systems off. The video was really an experiment. We wanted to do that. We want to make this some way of getting much more participation here, and sometimes I think it would have been nice - we could have - maybe sometime we will have a distributed STRATTON in three or four sites with all of the things, including the workshops. I want the Colorado people to know in fact at 6 o'clock a lot of people were up here, too, from the night before, usually. (laughter) That's why the camera detected a lot of sleepy faces from time to time. I want to apologize to all the people who would like to have been able to be here but weren't. Notice - I would like to have had a lot more Product Line participation, Marketing participation, Programming, because programming is really what PBS is all about, and in particular, one crew of people that are really important to PBS are people who do technical documentation and already we're going to have a special conference that's being set up in Tewksbury with some people who complain about the way I talk about documentation. So it's going to be an n-on-one where (laughter) they'll give - they can - that we can interact about this because, hey, documentation is really important for these systems and finding a way in that people can use things, so I want to apologize that I don't think that we work that issue here at all. It's vital and we're going to go out now and work on that as something that has come up repeatedly as being important. Okay. Now, the three talks.

One, I just couldn't help, during this thing, of doing a little bit of sharing (unintelligible) and it may come across like an educational seminar, but it in fact comes across because I think I have a perspective - there are a few things that it is - that you do get by meeting regularly with people across functions, and I probably do that more than anybody else, just because of the meetings that I hold with the Marketing Committee and the Operations Committee and customers and things like that. So I've got to figure out how you can get into some of that, but certainly there's a bit of that I'd like to share - some reality and education here.

The second talk is really on realizing the passive - if in the past I've been able to set goals or help set goals because of some perspective I may have, why, that often ends up - I'm not trying to design all the systems, but by helping to set goals, hey, it provides a focus for people to work in, and I know that's not popular at DED for managers to have anything to do with establishing goals. It's supposed to bubble up and somehow the managers are to be able to have a process to let you decide which way - how to do your own thing. I would like to focus a little bit where you do your own thing at, which way - your own thing we go. So I'm going to interject where I want to go, and that's called goals. And then finally there's - got a tremendous frustration of the wide diversity of what - when we talk Profession-Based Systems - an incredible array over cost, size, depth, you know, many, many dimensions - physical architecture and want to start sharing some of that taxonomy. I've been playing with taxonomies throughout the last three or four days. I'll sort of share some of that with you too.

So, on the first part then, let's go on this, which is - I guess the - in fact, the reality - I find that we're really decoupled from the users because of what I hear, namely, that in fact - hey, folks, we're already building a Profession-Based Systems now. Now, the question is, "How are we building?" I heard four methods come up in this. Let me characterize them. Let's call it the Marketing Textbook approach. And we saw that in a flow-chart form. It's called the ask 'em/tell 'em approach, namely, you go out and you do some stuff, and then you provide a thing and then (unintelligible) a feedback that was described. And that you don't take them out of captivity, but you try to figure out what to feed them and maybe they'll die, maybe they'll eat the food. (laughter) Market survey is absolutely straight - straight conventional marketing text. I don't think it works worth a damn in - for complex things. I don't think that's been the secret of our success anywhere in and can't be except in conventional things where you ask them and it's COBOL 79 and it's clear because that standard is there and they know that that's what they should say, and you go back and do it. Now I heard the other one - let's call it the zoo approach, which is bring them in and let them tell us. We'll interrogate it and we'll build them and ask them. That's essentially just moving the animals in and try to find out a little closer what to feed them and see if they - but, in fact, when they come in they really aren't animals any longer. They take on a lot of our flavor and they can't run. They can't do any of the things that they used to do. And in short they're not professionals any longer. They absolutely have disappeared as professionals in that environment. They are - you know - that's how - in fact, well, I'll say, that's how we get a lot of marketing people when we're going to "go in the insurance business." Somebody might have sold insurance once for their father and so they came in and now we're, by God! we're in for an insurance business. So there's the zoo approach. Those animals are probably the most dangerous animals because they're in captivity and they can't do any of the things they wanted to do before, and they're asked to be translators. So - and then there's another form of that which is the zoo plus a genetic mutation form where we try to turn the animals also into an insurance-agent programmer, and so you essentially - you've got this new animal. But in fact you may get a great programmer out of him, but you probably have lost his view as what is means to have been an insurance broker. I don't think Tom McIntyre will say right now that he's a physiologist. I don't think he'll claim he's a physiologist any more. And we're glad to have him as a software engineer. And in the fourth - I think those may - that one may - conceivably might work in some limited thing. And then the fourth point is essentially: leave them alone in their environment. Do some genetic mutation of them. They've got to do it themselves. If you look at the MITech - MIT - result on where are complex instruments and tools built, God dammit, it's clear. The users have to build them. You give them as much help as possible with tools and I think one of the hidden tools we've got to supply is some programming languages that are non-sequential programming languages and Charle' - we saw one in Charle's slides - the Demo didn't quite make it, but if you know what that problem is all about, man! that's probably one of the most impressive pieces of work - being able to - he went up and changed the line on a 1040 and the whole goddamn thing changed and there wasn't a program sitting back behind there. He had expressed those in relationships. Man! that's impressive! And that's not programming like we used to know it. That's the way to do it, probably. Getting rid of sequencing: sequencing is only natural if you love computers, and I - the world, I don't think, thinks sequential. I mean, think of all the people who can't, who, given a watch - I mean, I got to meet a guy who used to be vice-president of an insurance - a retired guy - came over at Christmastime and said, "Hey, I got this watch and I can't set it. I wanted this electronic watch and I can't - and man, that was before it had four buttons. I think there were only a couple buttons. I mean, if you threw the Seiko manual at him, that guy never could - I mean, literally never could set a Seiko watch, and I must admit that I did have to refer to the manual a couple of times (laughter). But I had to put it in terms of a (state?) diagram (laughter) and I got it on one (laughter) page - I had to figure out how it worked and then it was obvious what the thing did. But in fact, trying to read it from the manual was a bitch. (continuing laughter) Now, who we're doing it for now is - here are some of the product line - here are the results we've got now and I'll just go over the approach. There's kind of the ask 'em/tell 'em approach, but in fact we have a number of them in captivity and we're trying - we're doing it - we're providing that. That both - and the column on the right-hand side is - this is at the levels. And level is an important thing; how do you provide it is an economy of scale. That's both for personal- and group-level kinds of things through the 78 and the 248 kinds of systems and on larger systems. Hey, we've got a group which is improbably using the approach number - it's the - actually, I think it's approach number one: it's the ask 'em/tell 'em approach, which is the professional typesetting. We're doing that now, and we believe we can do it because we use the ask 'em/tell 'em approach for newspapers, and we're in that business. That's a hard job; those guys have made money in their - in that - in the typesetting/graphic-arts thing, but boy! it's a real bear, and it's perseverance that has to carry - or has carried that effort. I don't think that they would advocate that's the way to do - if you had to do every profession that way, forget it. Then, you go down into the physical and natural scientist kind of things, there I think we really are pretty much sticking with a very low-level tool. We're really not addressing that, although we do sell it there. And who's doing it? It turns out the users are doing it, and library-sharing is the vehicle by which they're doing it. Now you go in to the engineeer, educator, and small-business persons - there's a methodology that we use there. Hey! all of that stuff - we got tools there and they're all done, pretty much without exception, buying out. Now: the question is, "How do you buy out things?" and then - here's a process that we are going through now which is user's development. It's probably the only way. And it's really through OEMs who are or have been users and in general we are not. And the process is really one of evolution. And it's an evolution (unintelligible). We look at success in our business, providing language capability, this is evolutionary. It isn't after the animals go headlong into something. So here's the process I'm advocating, namely, improve the languages, in this case DIBOL(?) and, by the way, let me say that in fact, if I were to program in some of these application languages, it would probably either be in MUMS (?) or DIBOL(?). Neither of these are popular, for some reason, by these groups. Simply because they're the best languages. They have the right data types already, and if you like low - if you like to look at (unintelligible) to program, you'd love PASCAL and FORTRAN and lower-level languages like this. These things know about the data types that you're working in, and I don't know why we don't use them for that rather than going down into these very low-level programming languages. Certainly it's got to be well beyond the implementation-language levels that we have today. But I think the most productivity is going to come out of that approach. But first off, I want - have advocated seeing an evolution of DIBOL to make it a little more robust in terms of allowing users to do things like set alternatives, set parameters, state alternatives to the parameters, and then eventually express limited algorithms, so that, in fact, you've got an algorithm for computation of income tax, and the neat thing about certain kinds of these programs we're talking about

- they go in and they flow through sequentially for all records and don't tell people about programming and loops. So I think we can - the world can - we can get these people into processes for starters not telling them about things called loops, which aren't natural things to most people. Okay, select a profession market-size. Go out and do the regular marketing kind of stuff that one does: how many people are there, and so on. Now here's where I, being chicken, and probably as a corporate officer, begin to say, "Hey, find a program out there!" I would simply go out and buy a program, and by God, there are a lot of them out there. We've got a lot of users who've done their own thing and - a lot of OEMs providing these services now - and go out and pick that program up. And then, what do we do? We probably want to do it. It probably isn't up to our standards. We don't think it's got the quality levels. We don't think it can be enhanced. But go and do it by testing in QC, enhance it, document it, and sell it. Let's - and then we've got some information to work on. And we aren't starting from a PASCAL or a file system or some very low-level thing. Now, I think we want to sense additional - sense what's happening somehow, not sure how you do it. Probably by getting a bunch of users to come to meetings like DECUS and say, "Gee, what do you want?" "Well, I couldn't - they changed the income tax kinds of things and you'd better figure out a way to give us a new option there somehow, so I think by having groups combine or by networking - lots of mechanisms to do sensing here. And then, what would I do? I would then do it like we do now, Goddammit, within - by evolution. Namely, I want to reimplement the thing using the requirements. I want to keep the documents constant, probably I have to - unfortunately, I have to keep the file system constant because these users have now got a lot of information on those old file systems. I then do a better job of reprogramming the thing, if the program by this time, as it keeps being refined, is going to get a little bit smellier, or creaky(?), and may burn out. So, I think this to me is probably the approach that I think is going to yield success in there. And I think, in general, "Gee, a lot of us may not find that challenging." Because we're not working from raw technology, we're not working through this other process, but boy!?r I think it - I kinda like it, because I think it'll just make scads of money. To increase the Engineering budget. (light laughter) And that's really what drives (chuckle).

(laughter)
Okay.

Now I want to go on - that's kind of a piece of overall perspectiv?re about how I think we're doing - how we've done it, a?rnd how I think we're going to do it in some of these insurance offices, the dental, the small-business kinds of markets. Now I want to go into, essentially, these goals. And if I look back on past STRATTONs, well, first off, I could't get to Lorrin to find out what STRATTON I was. But in fact, on II we had VLSI - was the focus, and I think we've made results since then. Mass Storage was III - hard to judge. I think we've made progress there. IV: Distributed Data Processing - I think we did a lot when we focused on Distributed Processing. I think the HYDRA stuff has come out there on the DECNET Version 3, 4, and the direction there, I think. The Interconnect is clearly what we were beginning to focus on last year. And then one of the side benefits is - we had a Workshop last year and really went at the RAMP issue. And I said, I remember I guess it was Steve Rothman and, I think, maybe, Dave Cane and Bob Stewart, all said, "Look. We know - give us a cookbook of techniques. Don't tell us how to design it." And I said, "Let's get a good cookbook." And in fact I've seen such a cookbook. Mickey Smith wrote it. It looks very good as far as I'm concerned, in terms of coverage and approach. But anyway, you're going to (unintelligible). Okay, fine, okay. But I hope you'll read this book in terms of - it must have been (unintelligible). But anyway, I think that there were lots of side benefits of interaction that I can identify with. In fact, this one - it seems to me we've gotten some ideas about the next ones. There are a lot of candidates for sensing I'd like to know - well, maybe next year - have we cleaned up our act? I'd like to have a follow-on. But I certainly intend to devote a substantial amount of time to cleaning up our act now. And then, clearly one that's come out of this is the Manufacturing/Engineering team aspect. That's really - really needs a lot of work. And, so whether that's the next one I don't know - there ought to be a lot of ideas for new ones. So, essentially, let me - in the goal sense - I think - what I want to do is go over some of the goals, which is, essentially, I want to clean up our act and, in essence, get back to basics. Not BASIC. (laughter) That doesn't call for everybody going out and building their own BASIC version (laughter) because we've only got two or three, three or four, how many? five? six? We'v gotten it down somewhat. I know we've gotten it down by one. So we're back. (unintelligible) But basics, as far as I'm concerned, are what's going to follow. This root level, either finish or finish starting, the Interconnect, SUVAX, VENUS, SCORPIO. There are projects here that I think we want to, above all, get those things - get - that's the goals I have, getting this root-system level - I'm sorry, DBMS-32, some of the database work. Let's get the whole operating system language hardware, these bases done, including the small systems stuff. I think we know what they are.

Now, the next area - here's what I mean by the basics, which are the generic level. I want to master this level within the next year-and-a-half products - products or product breadboard - or products that are reasonable through tasks. What does that have in it? We've dwelt on that a few times, which is essentially among other things, a virtual terminal capability to other systems. That's been left off a couple times. I want to get it back. To make sure it gets back on. So they will communicate to the rest of the hierarchy. And right now we've got to get the word-processing stuff straightened out. I want high-quality, compatible WPS in the 8 area and be able to evolve the 8. Right now the 8, as far as I'm concerned, the structure of that thing, the number of versions of it, isn't in a form that we can evolve and enhance on it. And, in short, we're going to get killed, continuing work based on that current base. So we've got to get to a point where we can pack the market, given that we've got a piece of hardware coming out there. We're going to get creamed. Stand-alone - 11. Hey! Right now I look at being able to track the thing - we're just not going to be able to track it in the long run, based on PDP8, the PDP architecture. Hey, and that's hard for me to say, because I invented that architecture about 1963. It's sort of - and so it's kind of like a first love or something. But for the kinds of complexity and systems we're building it just doesn't happen from a software standpoint, even though we can build cheap hardware it's not good enough. Then we've got to get on and get that capability on multi-terminal, probably on RSTS and VMS, right now. So I want those systems all up and running, compatible, high-quality. And then, getting that, we've got to get the EMS in there with the WPS compatibility, probably on RSTS and VMS again. So we've got to bring our EMS work in and have an EMS - a working EMS product - let me say it's got to be running, breadboard, internally, probably this time next year, for at least three months. So on the engineering network we've got to have this thing running. I guess that essentially what it amounts to is DECmail. And then, certainly a file cabinet for the documents and the forms and the thing that I'm thinking there - probably if we limit it to VMS, then I've got the candidate and I want to - I think you know what that is. Phone management: some - a few words got left off here - essentially a probably a breadboard for phone management. I don't - in its full glory, I don't think we'll have that running a year now. So I'd say a phone management, a breadboard, some office procedures, some of these things, some breadboards here, and then certainly a voice breadboard. So, of the last three, probably are breadboard kind of items, not running basics - running "as part of the generic base." Voice-out: some level of voice interaction that's appropriate to the technology that we have. I think there's a clear amount of technology there - let's do it. So essentially here's - I guess this one really should have been that other one - I think probably QBF is the way we ought to go there, in order to get these - to be able to deal with these filing-cabinet kinds of things, and have that integrated in there. Having it integrated in with the other syntax and use. Now there are a bunch of things that essentially are understanding issues. I think we need to understand what features should be versus time. Hey, we're not going to be able to get it - I want to go for completeness next year. There are a lot of things we can't get in by then. Then let's have a planned thing of, Gee, two years from now we ought to be here, and four years from now we are out there. So essentially a set of goals - that's going to help - that's going to determine exactly what we should be working on in the advanced development and the research domain. So I want a lot of the advanced development to come out of product direction that we should be going to. And then the other one is essentially some understanding which is one-bound(?). Count it back up one.

This last one is Understanding and - I'm adding this new word, which is Cost Of Use, not Cost of Ownership. Jim Bell came up with a nice metric, I think, which is set for the professionals that we're dealing with. If you save an hour a week, that probably is enough to justify the system. So all we have to do is find things that can save us about an hour a week to justify the systems that we're talking about. There are issues of understanding: what does it really mean to be personalized. Now, it's clear to me that we can't personalize these things. This is the dual(?) of why we're in such a mess in the networks domain because every company and every network group is personalizing their protocols. And by this personalization effect, as you build systems you get the cost product of every protocol that has to go in every system. And therefore nobody can ever talk to anything else, and nobody is ever complete, because you can evolve, and personalization is an issue that has to be treated very, very gingerly. You can't build a (TICO-based, TM-mass, QBF?), and so on, with that syntax, because when you go off on a particular path, then it all has to personalize within that domain and the connotorial effect on every one of those modules just can't happen. Certainly the PMS structure processor memory switch: how are the boxes, both the - let me use PMS much more loosely - the PMS - hardware PMS and software PMS - connected - how are the things packaged, that is, agglomerated in different things - and what's the structure - the PMS structure - for each size? What's appropriate for the kinds of things that we're doing there? We desperately need something - something in there - because there are so damned many options and, in fact, we saw Al Shugart give us a new option. God! the last thing I wanted was a new option. I'd like to point out, in fact, that with Shugart's correlation, we think - I've had a model until recently that in fact the world was pretty much driven from semiconductors, certainly, but in fact the sizes - systems sizes - semiconductors drive that, but in fact it's disks that drive the packaging structure. And hey, the net effect of that floppy or probably the mini-floppy was the creation of the whole word-processing industry. If you really want to get right down to it, Wang probably is based on Al Shugart. You know, they can say, "Boy, they were fantastic marketing - boy, wasn't that great? Software and man, neatsy RTs and all of that and great management." But yet it was a piece of hardware there that in that sense created that whole industry and they probably - at Wang - let's not tell them. They probably don't even know that's why it happened. But at least my simple model says that's probably the reason why Wang exists. Up until then they were making little desk calculators that you could do addition with, poorer that a program and all kinds of other local things. Now, I want to go and then, probably another thing - some other comments here - this is not in terms of the - summing up the goals - essentially I think using the generic level will get a bunch of users ready for the professions specifics. So let's do them as a - it's not a bait and switch - it's a get-'em-in or - let's - oh, it's the Trojan - I don't want to use the word "Trojan Horse," because that's a good - that's a security number. It's like the Trojan Horse. It's - it's - you know what I mean: it's not the Trojan Horse that's - which is a well-defined concept in security, but it's like that, where we sneak this thing in and people think they're getting a free ride to do all their communication and take word-processing report generation, all the kinds of nifty things that way, and when it's in there they're going to find out - "Gee, why isn't that thing doing this?" And they may try to do it, and that's one way to do it, or they may get us to say "Hey, just put up for a few forms for me and let me do some of the stuff." But that's probably - no , that's clearly the way it's probably going to happen in the profession. And I say, "Stay the hell away from this for a year." I don't want to hear any more nonsense about professionals. Besides, we're a bunch of amateurs and amateurs have more fun, anyway. And we can talk about professions in another year. So, essentially, here, in order to talk about this in another year, maybe we want to understand some profession structure and rude size and cost each could use a function of time, so that in fact what a professional does is really an economic question of "Is this thing going to help him or not?" and to do that you've got to look inside the profession structure, and it's all that mundane marketing crap - you get (unintelligible) and you can have a good linear programming program go (unintelligible) big data bases and professions will pop out at you. Gee, there are a lot of those guys in - you know, we can sell all the dentists in Detroit, or something like that, with one package. But let's get some understanding there. I'd say maybe we want to understand some design approaches and perhaps build a tool that will help them build some of their things, and then perhaps design and understand one profession in addition to the professional systems programmer that I claim we're probably designing our systems for now. If I had to take any profession - if I were programming, by God, you know, that's the one profession I'd really want to serve. It's a self-serving thing, but, in fact, it's probably the right thing for us to address, because it addresses productivity and ease of use, all the things that are important to our environment. And - hint! - don't go outside and look for animals to capture or to bring in, whether they're friendly or we want to keep them or whether - let's use - find some inside. There are enough interesting-looking animals inside to use. The zoo's big enough. (light laughter) And maybe here's one - I don't know - just for an example - design engineers at DEC, perhaps including packaging engineers - I look at all of the stuff coming out. First off, they do the generic capabilities - I have an ulterior motive about having (unintelligible) people who do packaging to use this equipment. I think that, in fact, a lot of these things were their - really - they felt a little stronger because they were using that - things like noise and cabling - by golly, they might get a little more attention. Because there's nothing like having to use your own stuff. Right now, we're really worried about schedules, so I put PERT in there. Everybody needs that. And then I - I'd like to hold all - right now, we're getting a much more complex environment. I'd like to hold all of the DEC standards. I can't think of any reason why that is on microfiche. I can not! It really is - this is a moral for us not to use computing for these particular kinds of things. I mean that whole process, that ability to use this. John Holman, I hope - Bill Tays, God dammit, get that stuff on there now. (laughter) Independent of whether you're professional or not, (laughter) use - I'd like to have query, answers (unintelligible) program (unintelligible) - that you can probably steal - don't do any programming either (laughter) - and can let a bunch of people go on and interrogate that and do some stuff like the HYDRA system. And then if we go beyond that essentially, I like to go to do printing of that and microfiche publishing directly of those kinds of things. But I guess I've got another fear here - I'd like to be able to check some designs against some of these database things - gee, I'd like to know, "Have I violated a given - DEC standard 30, for example. We ought to be able to do a little bit of that kind of thing - maybe - let me put - that one, I think, is a little bit hard. So, let me not - this isn't - besides, this wasn't a gauntlet, anyway. I'm - I think this is an idea that we might do, except one we really ought to do. That's just one that happened to come to mind when some people were talking. Now, (give me some time - twenty minutes - okay - it's going to go quick) I was - for example - looking at, say, the physical system with the -

This is the third talk. Sorry.

We need some measures and understanding about use in order to do what we're doing even at the generic level, and to provide systems everywhere. And I, frankly, am worried, because a physical system - I interviewed a few people, namely system designers, builders, system manager types, some product line engineers, some software engineers, some disk engineer designers and builders, some disk manager types, and my informal survey here reveals no knowledge of file size, RSTS versus features, number of users, and what set of programs are run, who wrote them, and how they relate to one another. And, you can say, "Boy, are we (unintelligible)" That just goes to show you how good our users are in taking what we provide and doing something with this. And I think probably that we've got too many - I don't know - I don't understand why this is. I think we get security in having so many people around and you figure out - it's the distributed database problem. It's me - if you can - somebody has probably got that knowledge. I think that knowledge is in the organization. And therefore, there's a certain security that comes with having knowledge in the organization that you don't - it is - you don't have to know anything because somebody knows it, and all you have to know is who to ask. And, with so many people - I don't know, I tried and I don't even know who to ask. I was really disturbed on that, particularly as I was trying to dream up a system there and I just couldn't get any sense at all, because of, really of lack of knowledge of how that - what that thing really was and how it was used. I think it's easy - not easy to get, it's going to be tricky - but we certainly have to know a lot of that. So that kind of prompted a thing which says, "We want to go for some definitions and measures." I think this is really another set of goals - or it's a tailing in of the goals, which is - certainly I'd like to publish a glossary with accompanied taxonomy. I want to really go back and relate to the price bands. I want to go into some of the - these are dimensions of the taxonomy - certainly the physical structure dimension, the PMS structure dimensions, software levels, and the program structures dimensions, which are really extended PMS structure kinds of things. So a way of talking about these things - I don't think we've got a very - we can't talk about these things with each other right now. I can't do design - I mean, I try to do design with Tom Orr and just for a minute throw out a thing out there and he says, "Oh, you can't do that because of that," and it turns out it's a piece - because it's all based on a piece of folklore that he happened to have gotten from a marketing survey that somebody - whether it's a natural constant or a - but we don't understand - you know, we don't understand some of this stuff. So we've got to have these dimensions so that we can talk about various alternatives here. And then, essentially, this is one like that - I said before, in terms of the - of a particular structure, and that is, we certainly - the kinds of things - one reason we've got a problem talking is, we're talking about systems - to me, my profession-based system costs thirty - sells for thirty thousand - I think we can - oh, I don't know whether we can get it out there for thirty thousand dollars or not, but it's a bargain if it produces the results I think it should produce. Thirty K is really quite cheap for one of these workstations, because if you look at some of the workstations that we have in a large KL-10, it's a forty-fifty-thousand-dollar workstation. When you put a KL-10 - central KL-10 - divide the number of actual users of that system in some of these design stuff, we're spending fifty thousand dollars a terminal. So thirty thousand - if we can come down to thirty thousand dollars for some of the things and get some benefit, that sound - to other people, they - Avram and Ken can talk about their professional-based system and they're only a factor - their dream is only a factor of ten apart. And in cost - and then to Tom - we heard a three-hundred-dollar - was his - he's got a system there that he's trying to build for three hundred bucks. And so we've got a factor - easily a factor of a hundred that we're talking about. So no wonder - and let's assume price - you can't always assume - that price has some relationship with capability, but say it did for the moment, then we're talking about a factor of ten or a hundred in terms of what the capabilities of these systems.

So I'd like to get some understanding of how we justify these systems, because I'm into that a lot on the case of, say, EMS. Why do we want more EMS terminals? Does it really make it more productive? And - for a select group of you, I'll let a secret out, that - I asked about, "Should we have touch-tones in the Mill?" And - I won't - please don't respond to me on EMS - oh, do it, do it anyway - but we wanted to find out a little bit about that, and see how do you go arbout - I wanted to know how you justify some of that. How do you go through the analysis of that? And, by George, I got a couple different points of view. Alan Kotok had a point of view. Mitch Kur had a point of view that Alan Kotok knew, of course, that he would have, and then Peter Christy has a different point of view, and then I like BJ's point of view. God dammit, I'm sorry (unintelligible) all this bitching - let's just do it. So, anyway, that was an exercise in how do you go about understanding this. What I've been trying to do is understand that. So if we look at - here's a set of - for those of you who don't - either haven't been exposed to - let me offer a notation - it's called PMS - as a way of describing things - I'm not going to talk about it here - this is just to refresh your memory as to what the words really - what the characters really mean. It has the advantage that you can type it on typewriters, and, forgive me for not putting boxes around all components, because everybody knows that components have to have boxes around them. The chemists didn't know that when they have their molecule diagrams, and I wish we could have EMS without boxes. But, forgive me for doing it here. But, look at some of the alternative structures that have evolved over time. In the beginning, people had their tertiary memory on cards, their file systems and - this double dotted line is a communication link - it was called "walking upstairs" - dumping it into a transducer, a card reader, putting it into the computer - and maybe having a secondary storage for programs and for mag tapes, and you walked off with - well, one of the things that you walked off with was paper - isn't - don't have it there. In DEC minis what we did was essentially - we put all that stuff in a room and you walked up to a terminal, which was connected to the computer and - these single dotted lines are - that's one integrated system, not going through a communication line, and that computer was connected with some kind of a memory that was both secondary and tertiary file, some - initially, it was tertiary, that is, a paper tape, and ultimately it evolved to mag tape and DEC tape, and in fact DEC tape was such an ideal tape. So LINC was an example of that kind of very, very simple structure. Well, then we got the bright idea of - it was called time-sharing, and that says, "Hey, keep - put the terminal with the user, go through some communication links, the three dot - the ellipsis means what you think it means - there are a bunch of those terminals. They're connected to a computer and there - that computer has both secondary and tertiary memories. So you keep your files there and you get rid of all that old problem." Them we built the 78 and we put the terminal and the computer together in a package, and then we have a link to the secondary/tertiary file store and the double link there is a communication link because it's got to communicate with other systems. And then the PDT says, "Hey, that's a dumb idea! You don't put the terminal with the computer. You put the terminal alone and you put the computer with the mass storage, so we went down that route. And tried - and we put them all - the terminal goes through a cable to the computer and the secondary/tertiary store and then the double dotted line for communication goes there. And now, Al Shugart, and Jesus Christ! what that allows you to do - that really frustrates me - you can - there will be - if we could get our competitors to really play fair, we could really do well. (laughter) And you know what's going to happen? Everybod's looking at that damned - that 5-megabyte thing - they're going to stuff the computer and the 5-megabyte in the terminal. That's unfair, because everybody knows either you go the PDT route or the 78 route. And what that does is get a lot of cost-reduction out of there. It gets a lot of the file storage. It gets rid of a lot of paper because - say I take a megabyte of that and run the last megabyte - I just simply allocate that - let's call it paper - and - which is four hundred pages of paper, and I simply scroll there. So I've got - I've now combined my paper input and my wastebasket in one unit. (laughter) No. I want to say - that wastebasket - because if I ever want to get at something again, I simply scroll back down that paper. So I've got the last four hundred pages of garbage that this thing has - well, of these words of wisdom that have come out of this system, or what have you. So, it really provides a very neat system. The trouble is, that's not - I've got a couple of other systems I'd better introduce here - and the other thing is - the small floppy that Chuck found - gee, that's got some interesting possiblities too, because then you can take the - do the same thing. And if these guys hadn't built these small units we couldn't stuff it all in one box and get that low attendant cost, we would continue selling what we have and we wouldn't have to do any work and we could think about profession-based systems rather than having to do something. And it's a lot more fun. We wouldn't have to interact with Manufacturing so much and gee, we could be philosophical. But we've really got to get back to work. (light laughter) And then this link here, I think, is - the possibilities there are to - oh, by the way, this one kind of should be up there, namely, that that's to - this is only a secondary storer, in our parlance, right now. It may end up to be a tertiary storer if it turns out to be so reliable and you can think that that's as reliable as the paper you have around, or it's not going to burn(?) - because things happen to paper, too - you spill coffee on it, and all kinds of other junk - and the alternatives that we do there is simply put that link into a tertiary storer to hard copy and other systems for shared use. We've totally changed the structure of the system. Not like the one we've ever had before. We've never seen an animal like that in our hardware zoo. And, I don't know, that may be an alternative, and if you looked at the di.. - if you looked at Xerox's stuff upstairs - that (?) - that's their model of the world. Those guys are doing it. And if they - let's not tell Xerox about Shugart - can you - Shugart probably won't ever talk to Xerox about that. There's probably no communication out there in Silicon Valley at all, and (light laughter) we can simply do all of our - continue all of our product planning based on the fact that those two guys will never get together. And the Xerox thing upstairs, which is a 5-megabyte hard disk, non-removable disk - they don't know what we know, that you must have removable media on the thing. We've got a history of removable media. There's no way that that system will work that they built a thousand of up there. All of those users can't be right (laughter), because after all it was a laboratory thing anyway, and when they really have to face the hard world instead of giving those to the White House and places like that, they will find out that it's no good. And so, what we've got to do in 1985 is go back to where we think the world is, which is - hey, let's go back and - it turns out - by God! lo and behold! it's exactly where we were twenty years ago. We've got a bunch of terminals connected to - through communications lines - to a computer and secondary storage and tertiary storage, with a couple of dotted lines that go out as communications options because these things have to talk to one another. So, in a sense, maybe there's nothing new under the sun. The thing that is new is, in fact, neat packages like Tom Orr has, which this is all really really quite small - it goes under a desk - and we have made a lot of progress, because in '65 we could barely get it in a room with air conditioning. Now we're sitting there and it easily fits under a desk with a hell of a lot more capability. So that's one way of looking - just wanted to throw that out as a way of talking about systems, namely - a little of the grammar - when you don't put lines between them, that means they're all in the same box. When you put a line between them, they're connected by a cable in different boxes. Anyway, it's a slight bastardization of PMS, but that's what happens when you take something from the academic world and try to apply it in a real-life application. And I think this allows this to go and brainstorm and look at a lot of things, maybe in a non-threatening way, and then look at what the alternatives are and what you can do with each of those. Now there's a taxonomy here that I've been pushing, not very successfully with Manufacturing, but it really has to start within our shop, which is really a packaging system type, and - I hate numbers but in this case - it's really based on scale and modular index, whether something is either, that is, the size, plus whether it's modular or integrated and that's an important thing because, again, when I talk with Manufacturing about "How do you build something?" somebody will talk about an 1134 as the epitome of the way to build something and somebody else is talking about MINC, and we have no way of focusing. Conversation about how to manufacture something is just a nightmare, because in some person's mind it's a terminal and in somebody's it's "How are we going to connect the cables on a big hydra structure?" And so, let me offer this one, which is Type One. Why say - why I want to bind it - when I bind something, it's putting a number on it, and that's about the worst thing you can do in my world, is actually assigning an index to it. And hand-held is Type One. It's an integrated system. Type Two is either a fixed or - I don't know - Two-A is a portable terminal like we saw with Field Service thing - those are integrated things. Type Three is really stackable. It's a modular and we saw Type Three, really a lovely thing, up there by Tom Orr. And if you like the lightweight version, you'll like the industrial design. The non-(?) version and the lightweight model, but if you've ever tried to compute on a bunch of styrofoam, it ain't that easy - you know - and the signals propagate somehow. There's no paper required, and - but, in essence it's a - Tom did an embodiment of the modular stuff that in fact - with the neat white box. The next version of our stuff certainly is going to get down in the white boxes, so we have to make the styrofoam versions first, but we've got the bigger versions now as things that are real, and they look - that looks like a neat thing. I think, whether you stack them vertically or horizontally matters. I think you can - probably there's - I don't know - maybe they have to be vertically stacked - and sort of Three-A is whether they're either a bench or a table or a desktop; B is whether it's on the floor - sort of a bottom-up design; and C is whether you put it in a cart as you did the MINC thing. And then Type Four are the rack things that you somehow bolt it in - and those are integrated systems, too. These, by the way, are the ones that, in a Manufacturing sense, are probably giving us the most trouble, because you're trying to pull a lot of different units that don't have as clean interfaces as one needs and make those all work as a system. And so, when we talk with Manufacturing, the world - somehow there's a view that everything is Type Four. My view is we're going to Type Twos and Type Threes and then - and we've got Type Fives, which is really collections of cabinets with big disks, and they are integratable. And then Type Six, which is the hydrastructures, collections of computers. So, this is another taxonomy. I'd like tro keep us saying, "Gee, are you talking about a Type Two system or a Type Three system?" So we are able to focus how our thinking went, rather than one person's three-hundred dollar terminal and somebody else's, well, three-million-dollar system. So it's a taxonomy I like to - let me skip past it - this one's a little messy - there are five - I think only five things matter, it turns out, but let me not get into that one. That's - how do I say stop? - okay. Now, let me turn the interrupts back on. Sorry.

Any questions?

I overloaded the channel or (laughter) or the tummies are underloaded. Probably it's tummy underload rather than information overload. (laughter)

VOICE: We have a scheduled one-minute break here.

GORDON BELL: Oh, there's a scheduled one-minute break.

VOICE: Go ahead, Mike.

(pause)

(END OF TAPE)

12 10/20 ITEMS FOR YOUR STAFF DECISION--EMS/LENG/GB0003
3/8/79 2/12/79 6:17 5 5
62 11/23,11/24 BI=UNIBUS - '90/DEMMER,CLAYTON/GB0002
5/14/79 5/14/79 1:19 8 6
40 11/24--EMS/CADY/GB0005
10/30/79 10/30/79 1:00 2 1
18 11/74 STOP, MOVE AHEAD 11/70 MULTIPROCESSOR--EMS/WD/GB0003
2/12/79 2/12/79 6:04 4 1
48 1990 CORE GROUP SPACE TASK FORCE/PORTNER--EMS/GB0003
6/7/79 6/7/79 4:57 2 1
48 1990 SPACE STRATEGY & PLAN/1990 COMMITTEE/GB0005
11/5/79 11/6/79 9:01 16 6
41 1990+ STRATEGY STATEMENT/FINN,CHAMBERLAIN/GB0005
10/30/79 11/2/79 0:02 8 9
17 2080 GOALS--EMS/FAGERQUIST,MCBRIDE.../GB0005
10/18/79 10/18/79 16:43 3 6

4 ABSTRACT--PROFESSION BASED SYSTEM,CONSIDERATIONS ON THE DESIGN/GB0005
10/15/79 10/17/79 17:03 3 10
26 ABSTRACT--REJUVINATING EXPERIMENTAL C.S./BROWN U/GB0004
7/30/79 7/31/79 0:44 4 5
18 ACS/AT&T/JONES/GB0001
2/25/79 2/25/79 5:57 3 4
49 ADVANCED DEVELOPMENT,DOING /MARSHALL,PARKE/GB0004
9/13/79 9/14/79 5:33 3 2
15 ALBUQUERQUE,LOS ALAMOS THANKS--EMS/HOLMBERG/GB0006
11/26/79 11/29/79 4:34 3 5

67 ALLOCATION "ENGINEERING" YOUR OFF-THE-WALL MEMO/OLSEN/GB0003
7/6/79 7/10/79 1:32 7 6
71 APPLIANCE MANUFACTURER--CANCELLATION OF SUBSCRIPTION/KNAPP/GB0003
7/9/79 7/9/79 0:21 2 2
17 ARCHITECTURE IN TERMINALS/SMALL SYS/CLAYTON/DELAGI/GB0002
4/11/79 4/17/79 0:37 8 5
58 ARCHITECTURE PROCESSES H/S--EMS/CLAYTON.../GB0006
12/17/79 12/17/79 7:48 2 4
46 ARGUS INTERNATIONAL--POSSIBLE VENDOR/SLEPPIN/GB0001
3/16/79 3/16/79 0:34 3 2
66 ARIES--EMS/PLOWMAN/GB0006
12/20/79 12/27/79 8:37 3 6
13 ASI INVITATION/INSINGER/GB0002
4/9/79 4/23/79 3:04 2 2
29 AT&T TO STANDARDIZE ON 11'S/VAX-11--EMS/COURTIN/GB0006
12/3/79 12/3/79 12:06 2 4
54 AZTEC DRIVES TO SYS.,HOW TO CONNECT--EMS/CLAYTON.../GB0006
12/17/79 12/17/79 7:53 2 7

71 BABBAGE, CHARLES INSTITUTE--EMS/OLSEN/GB0004
10/5/79 10/5/79 2:38 3 1
54 BACKPLANE INTERCONNECT TASK FORCE--EMS/ROSING,PLATZ.../GB0002
5/8/79 5/9/79 0:14 13 7
47 BACKPLANE INTERFACE - PAX PROBLEM/CLAYTON--EMS/GB0003
6/7/79 6/7/79 4:55 3 1
67 BASIC+2 ON VAX--EMS/SNYDER/GB0004
10/5/79 10/5/79 2:30 1 1
48 BASIC+2(IE.NEW VAX-11 BASIC)PUSHING AT DECUS/DALEY.../GB0004
9/13/79 9/14/79 6:30 4 7
2 BEIGE BOOKS--EIS,ENG. SERVICES--EMS/OOD/GB0004
7/12/79 7/24/79 5:10 14 7
54 BELL COLLECTION/MOSKOWITZ/GB0003
6/14/79 6/14/79 3:34 3 4
41 BELL LABORATORIES--ICCC-80 CONFERENCE/VERMA/GB0006
12/6/79 12/12/79 0:16 3 2
25 BELL LABORATORIES--NEW/MCGILL/GB0005
10/23/79 10/23/79 10:01 10 4
23 BELL LABORATORIES--OLD/MCGILL/GB0005
10/22/79 10/22/79 16:19 4 2
49 BI, MY UNDERSTANDING OF THE DIRECTION--EMS/CLAYTON/GB0006
12/14/79 12/14/79 3:00 9 2

10 BI + THE MULTIPROCESSORS/STEVE JENKINS.../GB0004
7/12/79 7/18/79 8:55 5 3
15 BIT MAPS FOR PERSONAL VAX-BUY IT!/PARKE, MARSHALL/GB0002
4/9/79 4/10/79 2:13 5 8
28 BOOK REQUEST - DARTMOUTH/THOMAE/GB0002
4/18/79 4/18/79 0:51 2 1
10 BRAZIL - THANK YOU LETTER/STEINBERG/GB0005
10/15/79 11/2/79 5:37 5 4
13 BRAZIL - THANK YOU LETTER/VISSER/GB0005
10/16/79 11/2/79 5:37 5 4
15 BRAZIL - UNIVERSITY OF CAMPINAS/MACHADO/GB0005
10/17/79 10/17/79 14:23 3 2
16 BRAZIL - UNIVERSITY OF RIO/MARINHO/GB0005
10/17/79 11/6/79 6:56 4 6
14 BRAZIL - UNIVERSITY OF SAO PAULO/MOSCATO/GB0005
10/17/79 11/8/79 11:05 5 10
36 BRITISH SCI.MUSEUM--GIVE-8/BORROW PARTS?/JANE RAIMES/GB0004
8/20/79 8/21/79 0:00 3 4
3 BRITISH SCIENCE MUSEUM--SENDING -8/JANE RAIMES/GB0005
10/11/79 10/12/79 5:28 3 4
69 BROWN U ACCEPTANCE TO DEPT. OF CS SYMPOSIUM/WEGNER/GB0003
7/9/79 7/9/79 0:21 3 2
25 BROWN U INAUGURAL SYMPOSIUM/PETER WEGNER/GB0004
7/30/79 7/31/79 0:55 3 4
43 BROWN UNIVERSITY--REJUVENATING COMPUTER SCIENCE/GB0004
9/5/79 9/6/79 2:12 16 10
64 BSO INFORMATION--EMS-FILE/GB0002
3/15/79 3/15/79 0:43 4 1
26 BTL-CONVERSATION ON MAX MATHEWS/CLAYTON.../GB0002
4/17/79 4/18/79 3:08 6 2
64 BTL--THANK-YOU LETTER /SETHI/GB0003
6/27/79 6/28/79 15:12 5 4
63 BTL VISIT (WIREWRAP & I/C SCHEME FOR C.S 6/22(EMS) /GB0003
6/26/79 7/10/79 4:43 7 3
52 BUDGET ADJUSTMENTS-WANT BACK FAIR/SQUARE--
EMS/THOMPSON/GB0002
5/8/79 5/9/79 0:11 4 4
73 BUDGET FOR FY80 (EMS)/SAVIERS/GB0003
7/10/79 7/10/79 4:53 1 1
46 BUDGET FY80-81 ENG. REDISTRIBUTION &
COMMENTS/EBOD,OOD/GB0002
5/7/79 5/7/79 2:28 24 10
52 BUSINESS & SOCIAL RESEARCH INSTITUTE/VEDIN/GB0004
9/14/79 9/14/79 2:34 3 1

13   CAD MACHINES AND PERSONAL VAX--THOUGHTS ON/PUFFER/LACROUTE/GB0001
2/12/79 2/14/79 13:41 14   5
50   CAD TOOLS, SELLING/BJ.../GB0001
3/22/79 3/22/79 3:19   2   1
65   CAD-YOUR SUGGESTION TO BREADBOARD PC LAYOUT--EMS/KUSIK/GB0002
3/15/79 3/15/79 0:49   5   1
60   CALTECH-RE:FUNDING SILICON STRUCTURES(J.GRAY)/RC,RP.../GB0002
5/14/79 5/14/79 1:10   8   4
37   CAMERA PASS/ALEXANIAN/GB0003
5/30/79 5/30/79 2:17   2   3
54   CAPITAL EQUIPMENT PURGING/JOHNSON,CROWTHER.../GB0004
9/18/79 9/19/79 6:33   3   3
5   CCA--EMBARASSING TALK WITH MARRILL--EMS/CRAWFORD.../GB0004
7/12/79 7/12/79 14:07 12   4
31   CDC'S VISIT (TOM KAMPE)CROUSE, KEVILL.../GB0002
4/23/79 4/23/79 6:20   9   8
51   CDC - WINSTON HODGE/FULLER,STRECKER,BINGHAM,OOD/GB0003
6/11/79 6/12/79 16:03 4   4
58   CHICAGO OFFICE VISIT AND THEIR OBSERVATIONS/GB0004
9/25/79 9/26/79 5:04   13   7
59   CHRISTMAS MESSAGE/GB0006
12/17/79 12/20/79 9:59   2   11
20   CI-HIGH COST OF THE CI-BUT KEEP GOING/RODGERS,FULLER...--EMS/GB0005
10/22/79 10/23/79 16:26   3   6
71   CINCINNATI MICROWAVE/GB0006
12/26/79 12/27/79 1:56   3   3
41   CMU ALLEN NEWELL'S COMMENTS ON MEETING/WITMORE.../GB0002
5/1/79 5/2/79 1:24   9   6
60   CMU EXPENSES FOR 9/19/79/JACKMAN/GB0004
9/25/79 9/26/79 5:57   3   3
24   CMU RESEARCH GRANT--CMU/CYERT/GB0002
4/13/79 4/13/79 9:52   3   1
57   CMU-SALE/PROJECT--EMS/WITMORE.../GB0002
5/10/79 5/10/79 0:21   6   1
6   CMU, SITUATION AT PER OUR CONVERSATION OF 2/6/79/McCREDIE/GB0001
2/7/79 2/14/79 14:16 11   9
59   CMU--SPICE UPDATE + MUSEUM ARTIFACTS/WACTLAR/GB0004
9/25/79 9/26/79 6:36   10   7
39   CMU STRATEGY BACKGROUND 4/3079 MEET /EMS-WITMORE.../GB0002
4/26/79 4/26/79 7:54   52   10

43 CMU - VAX'S YOU ORDERED FOR CSD/ARPA-NEWELL/GB0002
5/1/79 5/1/79 7:09 2 1
42 COMMENTS ON OUR DISCUSSION/WESLEY/GB0003
6/4/79 NO/DA/TE 8 4
8 COMMERCIAL GROUP STRATEGIC PLANNING INFO--EMS/CADY/GB0003
5/16/79 2/12/79 6:19 10 2
60 COMMUNICATION CUT-OFF ON PRODUCTS?--EMS/VLACH,ALUSIC/GB0006
12/18/79 12/19/79 9:32 1 4
45 COMPENSATION--MONOTONICITY OF PAY-A PROBLEM?--
EMS/OC,BURNS/GB0005
10/31/79 10/31/79 3:35 3 4
24 COMPETITORS--ENG.+MNFG ORGANIZED TO FACE-
JAPAN,IBM,TI/GB0005
10/22/79 10/26/79 14:47 11 10
57 COMPUTER ENGINEERING QUESTIONS/PHISTER/GB0003
6/19/79 NO/DA/TE 4 4
23 COMPUTER POWER (PERSONAL VISIT)--GOOD FILE/KAROLY/GB0002
4/12/79 5/2/79 3:13 2 3
53 COMPUTER RESEARCH EDUCATION/CSTB STUDY/GB0006
12/17/79 1/18/80 12 9
56 COMPUTER SCIENCE/TECHNOLOGY BOARD MEETING--EMS/BELL/GB0006
12/17/79 12/19/79 9:40 4 5
19 COMTEX - FOR THE MERCURY MONITOR--EMS/VAN ROEKENS/GB0006
11/26/79 11/29/79 4:49 2 4
21 COST OF OWNERSHIP TOGETHER TO SELL--EMS/SHIELDS.../GB0006
11/26/79 11/29/79 2:33 3 4
34 COST TARGETS--EMS/ROSING/GB0005
10/26/79 10/26/79 14:55 1 4
68 CONSULTANT-HENDRICKS STUDY/ANALYSIS--EMS/CRAWFORD/GB0002
3/5/79 3/5/79 6:29 8 1
16 CONSULTING ARRANGEMENT--PAUL PENFIELD-MIT/J.BELL.../GB0002
4/11/79 4/12/79 2:57 5 6
22 CONTRIBUTION (CORP)OF COMPUTER TIME/K.OLSEN--GOOD
FILE/GB0002
4/12/79 4/12/79 6:24 3 1
30 CONTRIBUTION OF COMPUTER TIME--WE DO IT?/EMS-
CRAWFORD/GB0002
4/20/79 4/23/79 7:18 19 9
20 CONTRIBUTION OF COMPUTER TIME/KEN OLSEN.../GB0002
4/12/79 4/12/79 6:13 3 4
65 CROSS PRODUCT PROGRAMS/DISTRIBUTION/GB0003
7/3/79 7/6/79 16:06 11 8
50 CRT APPROVAL FOR VLSI ADV. DEV.--EMS/ULF/GB0002
5/7/79 5/7/79 0:49 3 4
30 CSS VS. P/L (FOR PROCESS I/O) AND CEN.

ENG./DEMMER.../GB0003
5/29/79 6/4/79 2:27 9 6
61 CUSTOMER - ANOTHER ASK-ANY-USER IDEA/LENG,WITMORE.../GB0002
5/14/79 5/14/79 1:05 5 4
43 CUSTOMER NEEDS VAX MACHINES/WITMORE--EMS/GB0006
12/7/79 12/7/79 3:33 3 4
22 CX REVIEW AND DOCK MERGE/SMITH,SHIELDS,KNOWLES/GB0004
7/26/D7 7/28/79 2:14 14 9

27 DATAPRODUCTS CORP--RE CHARLES BABBAGE INST/TOMASH/GB0006
11/30/79 1/18/80 9:38 8 8
29 DAVIS--PEOPLE GERALD DAVIS MET(HIS NOTES)/GB0002
NO/DA/TENO/DA/TE 14 6
46 DEC, A SHRINKING ECOLOGICAL NITCH/SIEWIOREK-CMU RAMP/GB0003
6/7/79 6/7/79 5:36 12 6
9 DEC,VISITING(OVERSEAS)OFFICES,PLANTS,ENG./JOHNSON.../GB0005
10/15/79 10/17/79 8:45 6 7
41 DECAIR'S KAMIKAZEE FLIGHTS THAT SHOULDN'T BE SCHEDULED/PUFFER/GB0003
6/4/79 NO/DA/TE 7 4
58 DECNET ARTICLES/LOVELAND/GB0002
5/10/79 5/10/79 1:08 3 2
20 DECNET-PATCH PHILOSOPHY ON 11/M 3.2--EMS/BRESLIN/GB0006
11/26/79 11/29/79 1:43 1 5
8 DECUS AUSTRIALIA/JOHN EDWARDS/GB0002
4/6/79 4/9/79 5:58 4 7
44 DECUS LIBRARY GROUP MEETING/CHUCK CONLEY, PETER CONKLIN/GB0001
3/13/79 3/13/79 2:06 7 4
6 DIGITAL MORALE/OC,OOD/GB0005
10/15/79 10/17/79 8:31 3 5
69 DIGITAL-PRESS PERMISSION REPRINT FROM C.E.--EMS/CM,MCN/GB0002
3/26/79 3/26/79 6:40 4 1
70 DISK CRISIS PRIORITIES IN UNDERSTANDING--EMS/KEVILL/GB0002
11/27/78 11/27/78 6:45 6 1
47 DISKS -- ALTERNATIVE FOR MEDIUM SYSTEMS/DEMMER.../GB0001
3/16/79 3/16/79 2:09 4 2
20 DOLPHIN, VENUS + SETTING PRIOIRITIES--EMS/ULF/GB0003
1/28/79 1/28/79 6:36 5 1
6 DOLPHIN VS. MINNOW DILEMMA--EMS/FAGERQUIST/GB0003
11/18/78 2/12/79 6:19 6 2
47 DOD SOFTWARE PROGRAM--EMS/J.BELL/GB0005
11/1/79 11/1/79 1:27 2 6
27 DP BROCHURE AND PRESENTATION TO

BOD/DEMMER,PLOWMAN.../GB0005
10/23/79 10/23/79 10:26 3 3
72 DP--MORE ON THE DEFINITION OF DP--EMS/PLOWMAN.../GB0006
12/27/79 12/28/79 1:57 3 6
45 DUPONT - REQUEST FOR DISTRIBUTED DATA PROCESSING/CULLEN/GB0003
6/6/79 6/6/79 4:30 3 5

21 EBOD-NEXT GO AROUND DATA/TOMASIC, MIKE.../GB0001
2/28/79 3/6/79 4:17 23 11
24 EBOD PRESENTATION/INTRODUCING SYSTEMBUS 80/GB0004
8/2/79 8/2/79 15:03 4 3
18 ECC REQUEST FOR COMPUTER ENGINEERING BOOK/HUGO/GB0004
7/24/79 8/30/79 0:54 2 3
5 ECKERT-MAUCHLY AWARD/CMU-PROF. DOUG JENSEN/GB0001
2/1/79 2/1/79 2:56 10 5
18 ECL FOR VENUS, GETTING THE POOP ON/BUSIEK,ULF.../GB0002
4/11/79 4/12/79 3:00 7 2
36 ECO-GASTRONOMY: SYSTEM OF THE LOIRE,SPRING, AND BICYCLES/GB0003
5/30/79 6/1/79 5:01 38 9
56 EDITORS AND FORMS LANGUAGES/OOD.../GB0004
9/21/79 9/26/79 5:49 8 8
75 EMS--10/15 TO 10/31 SENT BY G.BELL/GB0006
1/2/80 1/2/80 10:14 4 3
76 EMS--11/1/79 THRU 11/29/79 SENT BY G.BELL/GB0006
NO/DA/TE1/7/80 9:14 12 7
5 EMS-MAIL AND JUNGUE MAIL--EMS/CRAWFORD/GB0003
1/13/79 2/12/79 6:20 5 2
2 EMS-MUMPS PRODUCT STABILITY INFORMATION--EMS/CHRISTY/GB0003
4/2/79 6/12/79 17:02 4 3
51 EMS DESIGNER/MUMPS PROJ. LEADER--EMS/JOHNSON,CRAWFORD.../GB0005
10/31/79 10/31/79 9:01 2 5
18 EMS (VS WPS) AND OUR FUTURE PRODUCT/OOD.../GB0005
10/18/79 10/23/79 16:27 9 15
24 ENG. + MANUFACTURING ORGANIZED TO FACE FUTURE COMPETITORS/GB0005
10/22/79 10/26/79 14:47 11 10
12 ENG./MANF. INTEGRATION IN THE PLANTS/SMITH,PUFFER--EMS
11/26/79 11/29/79 5:01 3 5
38 ENGINEERING NETWORK BEING PART OF--EMS/CLAYTON/GB0006
12/3/79 12/4/79 0:04 5 2
12 ENGINEERING REQUESTS TO MANUFACTURING PAST & FUTURE/OC/GB0004

7/16/79 8/3/79 14:12   34   9
52   ETHERNET ADVANCED DEVELOPMENT--EMS/BELL,PORTNER/GB0005
10/31/79 10/31/79 9:01   2   6
37   ETHERNET,XEROX-DEC ANNOUNCEMENT OF--
EMS/CLAYTON,FULLER/GB0005
10/29/79 10/29/79 5:03   2   4
29   EUROPEAN ENGINEERING-
THOUGHTS/KELLEHER,PORTNER,MEYER.../GB0003
5/29/79 6/4/79 2:19   8   3
49   EUROPEAN EXPENSE/BERGER/GB0003
6/8/79 6/8/79 5:07   3   1

73   FACILTIES DEC CORPORATE GUIDELINES--EMS/GB0006
12/27/79 12/28/79 1:59   4   6
5   FIELD MATRIX/DAVIS/GB0005
10/15/79 10/17/79 8:37   2   6
39   FUJITSU LABORATORIES LTD.--VISIT/ALSO TWX'D--KAWATO/GB0003
6/4/79 6/8/79 0:00   3   3
4   FUJITSU LITERATURE & PARTS/DR. F. KUROSAKI/GB0002
4/2/79 4/12/79 3:01 3   3
45   FULLER, SAM--NOMINAITON ALAN T. WATERMAN AWARD/GB0006
12/10/79 12/10/79 7:33   7   5
52   FUTURE TERMINALS
ARCHITECTURE/CLAYTON,WILLIAMS,DELAGI.../GB0003
6/12/79 6/13/79 16:26 5   5

32   GEMS--EMS/CRAWFORD/GB0006
12/3/79 12/4/79 0:07 2   2
63   GIGI BREADBOARDS--EMS/CLAYTON,PICOTT/GB0006
12/18/79 12/19/79 9:51   1   4
27   GOALS FOR FY79/OPERATIONS COMMITTEE/GB0004
7/30/79 7/30/79 2:50 22   8
23   GOALS FOR OOD FY79/OPERATIONS COMMITTEE/GB0004
6/13/78 7/27/79 3:04 7   8
28   GOALS FOR OOD FY80/GB0004
8/3/79 8/6/79 0:58   7   3
68   GOALS--FOR OOD FY80/OPERATIONS COMMITTEE/GB0003
7/9/79 7/10/79 4:25 6   5
23   GRAPHICS TERMINAL PROGRESS--EMS/HALIO/GB0003
1/13/79 1/13/79 6:55 5   1
2   GRAPHICS: WHY WE RECOMMEND WHAT WE'RE DOING/AK,WH/GB0002
4/2/79 4/6/79 0:40   11   6

44   HAMADA'S VISIT/FROST/GB0006
12/10/79 12/11/79 2:42   4   8

16   HASBROUCK, REPLY TO /BEVIER HASBROUCK/GB0004
                    7/19/79 9/20/79 7:55 2   2
5   HIGH END CHARTER 3/27/79 MEETING/LENG,FAGERQUIST.../GB0002
                    4/3/79 5/11/79 1:52 11   5
65   HITACHI RESEARCH LAB/HAMEDA/GB0004
                    10/4/79 10/4/79 16:03 3   3
45   HLL FOR USER MICROPROCESSOR PROGRAMS IN TERMINALS/GUTZ/GB0002
                    5/4/79 5/7/79 2:39   4   4
35   HSC50 APPROACH-SOME CONCERNS I HAVE ABOUT/KEVILL.../GB0001
                    3/5/79 3/6/79 5:00   13   3   4
HYDRA-DISCUSSION WITH DAVE CUTLER--EMS/PORTNER/GB0003
                    1/10/79 2/12/79 6:20 4   2
9   HYDRA-IMPORTANCE OF--EMS/PORTNER/GB0003
                    5/16/79 2/12/79 6:18 4   2
10   HYDRA-INTEREST OUTSIDE TELCO--EMS/VAN ROEKENS/GB0003
                    5/16/79 5/17/79 2:35 3   8
48   HYDRA PARTS AS MID-LIFE KICKER TO 780?--EMS/LACROUTE/GB0006
                    12/12/79 12/12/79 0:17   4   2
25   HYDRA REMOTE DIAGNOSTICS..EMS/BUSIEK.../GB0006
                    11/28/79 11/29/79 1:26   2   4

74   IBM--DEDUCING IBM'S POLICY ON PUB. FOR OUR USE--EMS/GB0006
                    12/31/79 12/31/79 12:01   3   5
11   IBM--JOSEPHSON DEVICE COMPUTER--EMS/CADY/GB0003
                    1/19/79 2/12/79 6:18 5   5
39   IBM TRENDS--GETTING A GOOD TRACK OF/DICK CASE-ULF FAGERQUIST/GB0001
                    3/5/79 3/6/79 4:31   4   2
41   IBM WATCHERS/ALL ENGINEERING MGRS./GB0001
                    3/22/79 3/22/79 2:29 43   4
45   IBM WATSON LABS,BIRNBAUM (HEAD CS RESEARCH, /OLSEN.../GB0004
                    9/10/79 10/11/79 0:32 8   6
34   IBM'S GOT IT TOGETHER: TIME TO GET ORGANIZED/OOD.../GB0001
                    3/5/79 3/6/79 4:03   12   7
46   IEEE AWARDS BOARD--NOMINATION SAM FULLER/GB0006
                    12/10/79 12/10/79 7:34   4   3
53   IEEE - NATIONAL ENGINEERING FOUNDATION/WEINSCHEL/GB0005
                    11/5/79 11/9/79 0:33 16   14
16   IEEE-SPEAKER REQUEST AT SIGARCH.../PLOWMAN.../GB0001
                    2/12/79 2/13/79 11:18 8   5
55   INDEX FROM CI FOR DISKETTE:GB0001 /GB0001
                    4/4/79 5/14/79 3:35 19   9
6   INDEX FROM CI FOR DISKETTE:GB0002 /GB0002

4/4/79 5/16/79 1:46 26 9
7 INDEX FROM CI FOR DISKETTE:GB0003 /GB0003
5/15/79 7/3/79 7:59 25 11
6 INDEX FROM CI FOR DISKETTE:GB0004 /GB0004
7/12/79 10/5/79 2:54 27 11
32 INDEX FROM CI FOR DISKETTE:GB0005 /GB0005
10/26/79 11/1/79 11:06 19 6
4 INDEX FROM CI FOR DISKETTE:GB0006 /GB0006
11/14/79 1/18/80 13:25 29 10
53 INFORONICS THANK YOU/BUCHLAND/GB0003
6/13/79 6/14/79 6:42 3 2
33 INSTRUCTIONAL BASIC PROJECT--EMS/RUDY/GB0006
12/3/79 12/4/79 0:06 3 2
3 INTERCONNECT NEW BUS--EMS/FULLER/GB0003
12/20/78 2/12/79 6:20 4 2
67 INTERCONNECT PROBLEM COMMITMENT WORK,SOLVE--EMS/WD,BJ/GB0002
1/15/79 1/15/79 6:18 3 1
36 INTERCONNECT, THE BACKBONE OF THE STRATEGY/BAUER.../GB0001
3/5/79 3/6/79 4:28 8 5
53 INTERDISCIPLINARY COMPUTER RESEARCH/EDUCATION/GB0006
12/17/79 1/18/80 14:28 12 9
25 INTERFACE TO VMS SOFTWARE DEVELOPERS UNIV.--EMS/LP/GB0003
3/2/79 3/2/79 7:02 4 1
59 INTERFACES--LIST OF SIGNIFICANT ONES UNDER DESIGN/BJ/GB0
5/11/79 5/14/79 3:28 4 4
7 IOWA STATE TESTIMONIAL AD/TOWLE, GIORDANO/GB0002
4/5/79 4/5/79 10:45 3 2
49 IRCAM - POSSIBLE MEETING DURING MAY EUR. TRIP/CHOWNING/GB0002
5/7/79 5/7/79 0:49 3 4
35 IRCAM - THANK YOU NOTE/BRIGETTE,CHOWNING,RISSELT/GB0003
5/29/79 6/4/79 6:31 3 6

48 JAPAN ESSAY COMMENTS/MIT-TRIBUS/GB0001
3/19/79 3/22/79 2:12 8 11
54 JAPAN ESSAY ENCLOSED/MIT-MATTILL/GB0001
3/29/79 3/29/79 14:24 2 3
23 JAPAN ESSAY ENCLOSED+COMMENTS ON YOUR ARTICLE/MIT-TRIBUS/GB0001
2/20/79 2/22/79 9:01 15 9
27 JAPAN ESSAY REQUEST - XEROX/WHITE/GB0002
4/18/79 4/18/79 0:48 2 1
24 JAPAN ESSAY SUBMISSION--FORTUNE MAGAZINE/DONOVAN/GB0001
2/20/79 3/29/79 12:30 5 7

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  25   JAPAN TALK-HARVARD, THANKS/ALDEN/GB0002
                           4/17/79 4/17/79 1:54  2    3
  30   JAWS--CONGRATULATIONS AT THIS DECISION POINT--
EMS/CLAYTON/GB0005
                           10/24/79 10/25/79 17:05    2        5
  3    JUNGLE IN JANUARY, WHAT I HEARD/OOD/GB0001
                           1/30/79 1/30/79 11:22 15   3

  70   KEUFFEL + ESSER COMPANY/SALES DEPT./GB0003
                           7/9/79  7/9/79 0:22   4    3
  34   KNUTH BOOK, FORWARD FOR /GB0004
                           8/20/79 8/27/79 6:03  8    5

  36   L.COST (ICCS)--EMS/VAN ROEKENS.../GB0005
                           10/29/79 10/29/79 5:30     3        4
  2    LA120 & MEMORIES-LEAD IN
PRICE/DELIVERIES/GUTMAN/COTTON/GB0001
                           1/30/79 3/28/79 3:27  6    6
  68   LA34--EMS/CLAYTON/GB0004
                           10/5/79 10/5/79 2:32  3    1
  4    LA34+BUILT IN MODEM FIRST IMPRESSION--
EMS/WILLIAMS,RC/GB0004
                           7/12/79 7/12/79 9:06  7    2
  8    LASL - THANK YOU.../PERRY/GB0006
                           11/26/79 12/28/79 8:03     4        5
  14   LASL - THANK YOU.../SPARKS/GB0006
                           11/26/79 11/29/79 5:16     4        5
  13   LASL TOUR/BUTLER/GB0006
                           11/26/79 11/29/79 5:16     3        5
  35   LCG STRATEGY STATEMENT/EMS-LENG/HEBERT/GB0002
                           4/23/79 4/23/79 4:53  5    3
  32   LCG VERSUS P/L FOCUS IN
EUROPE/PETERSCHMIDT,CHOONAVALA/GB0003
                           5/29/79 6/4/79 2:01   5    3
  53   LDP ON GRAPHICS SW INTERFACE--EMS/HALIO,MCBRIDE.../GB0002
                           5/8/79  5/9/79 0:14   4    2
  9    LLL-CDC6600, 7600, STAR/CRAY PIECES/MICHAELS, GEORGE/GB0001
                           2/9/79  2/9/79 1:56   2    1
  69   LONG RANGE PLANS - 5 YEAR NOTES--EMS/OOD/GB0006
                           12/20/79 12/27/79 8:41     7        6
  7    LOS ALAMOS VAX REQUIREMENTS/RUPP,CLAYTON...--EMS/GB0006
                           11/26/79 11/29/79 1:32     2        5
  37   LOW END/S. OLSEN,CLAYTON,DELAGI/GB0002
                           4/23/79 4/26/79 0:46  8    7
  23   LSI-11'S AT LOS ALAMOS--EMS/MACKEEN.../GB0006
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11/26/79 11/29/79 2:39 2 4
26 LSI FOR VAX-USE HMOS--EMS/BJ/GB0003
11/16/78 11/16/78 7:07 4 2
30 LSI - MORALE AT WX/CUDMORE/CLAYTON..../GB0004
8/6/79 8/8/79 10:02 3 3
13 LSI VAX CHIP ANOTHER HIGHER PRIORITY PROJECT--EMS/RC/GB0003
11/27/78 2/12/79 6:17 2 3

9 MAGAZINE CANCEL--LOCATOR OF USED MACHINERY & EQUIP./GB0004
7/12/79 7/12/79 16:34 3 3
73 MAIL PRODUCT LINE--EMS/OLSEN/GB0004
10/5/79 10/5/79 2:41 2 1
52 MAKE VS BUY GUIDELINES UPDATE (FROM 3/5/76)/OOD.../GB0001
3/26/79 3/28/79 4:34 9 4
55 MANAGING COMPUTATION--BOOK/BROCHURE--EMS/WITMORE.../GB0006
12/17/79 12/18/79 0:22 4 2
39 MANUFACTURING/ENGINEERING DINNER MEETING--EMS/PORTNER/GB0006
12/5/79 12/5/79 5:33 5 5
57 MANUFACTURING - SPRINGFIELD/TS04/TU77--EMS/SAVIERS.../GB0004
9/21/79 9/21/79 7:01 2 1
51 MASS STORAGE COST/SYS PRICE--RULES OF THUMB/REDBOOK,OOD.../GB0001
3/26/79 3/28/79 4:31 12 8
27 MASS STORAGE FOR PERSONAL VAX--EMS/MARSHALL,SAVIERS/GB0003
2/28/79 2/28/79 7:10 5 1
14 MASS STORAGE-FUND,BAD DECISIONS-LETS' GET ON WITH IT/EMS-JK,GS/GB0003
3/2/79 2/12/79 6:00 17 2
66 MEETING CONFIRMATION--OFFICE SEC OF DEFENSE/FISHER/GB0004
10/4/79 10/5/79 2:15 3 4
17 MERCURY + MULTIDROP--EMS/MCNAMARA/GB0003
4/2/79 2/12/79 5:58 2 2
15 MERCURY SUBSYSTEM + INTERCONNECT--EMS/MCNAMARA/GB0003
2/15/79 2/15/79 5:43 9 1
33 METRICATION - WHERE ARE WE?/TAYS/GB0003
5/29/79 5/30/79 8:39 3 4
11 MICROPRODUCT DEVELOPMENT STAFF THANK-YOU/WESLEY,ZEH/GB0004
7/12/79 7/18/79 4:11 4 2
76 MILLIONAIRE, PLEASE LOOK FOR --EMS 11/7/79/DOUGALL/GB0006
NO/DA/TE1/7/80 9:14 12 7
16 MINC PRIORITIES IN SYSTEMS--EMS/RC,MCBRIDE/GB0003
11/27/78 2/12/79 5:59 7 2
19 MINNOW, LET'S GO AHEAD!/GB0002

4/12/79 4/13/79 14:56 7 3

34 MINNOW-NO/EMS-LENG, ULF/GB0002

4/23/79 4/23/79 4:54 3 2

42 MNEMODEX SYSTEM/GORDON/GB0004

8/30/79 8/30/79 4:48 2 2

42 MOTOROLA MCA VERSUS FAIRCHILD 100K--EMS/CROUSE/GB0006

12/12/79 12/12/79 0:15 6 2

38 MRP ON VAX--WHAT'S THE STORY?/GRIMES/GB0001

3/5/79 3/6/79 4:29 2 2

7 MUSEUM COMMITTEE AGENDA/DISTRIBUTION/GB0005

10/15/79 10/31/79 4:34 4 4

56 MUSEUM JOBS--DIGITAL COMPUTER MUSEUM - PHASE TWO/GB0005

11/7/79 11/7/79 2:45 14 5

17 MUSEUM LECTURE/BOOK SERIES/GB0004

7/23/79 7/23/79 6:41 15 3

66 MUSEUM PARTS FROM WOBURN/ROY/GB0003

7/6/79 7/6/79 17:25 3 4

21 MUSEUM PROJECT/ROCKWELL--GOOD FILE/GB0002

4/12/79 4/12/79 6:15 2 2

14 MUSEUM PROJECT/ROCKWELL -- BAD FILE/GB0002

4/9/79 4/10/79 0:52 2 2

62 MUSEUM THANKS/WORKERS/GB0004

9/26/79 9/27/79 2:57 4 5

59 MUSEUM THOUGHTS/FILE/GB0003

6/21/79 6/21/79 3:59 12 2

30 NAE NOMINATION FORMS/CMU-DR. DANIEL BERG/GB0001

2/28/79 3/1/79 2:56 2 2

33 NATL.RES. COUNCIL--MEMBER C.SCIE.&TECH.BRD/GOLDHABER/GB0004

8/7/79 8/7/79 6:59 3 3

21 NAVAL RESEARCH LABORATORY/SLAGLE/GB0005

10/22/79 10/23/79 12:20 3 3

45 NEBULA PLAN--SERIOUS QUESTIONS/LOU PHILIPPON/GB0001

3/16/79 3/16/79 2:17 4 3

3 NETWORK AND DDP PROTOCOLS VERIFICATION--
EMS/PLOWMAN.../GB0004

7/12/79 7/12/79 14:04 6 2

61 NETWORK + DDP PROTOCOL VERFICATION--EMS/PLOWMAN.../GB0003

6/25/79 6/25/79 6:52 3 1

32 NEW 11/44 PROCESSOR--DRAFT/GB0005

10/26/79 11/1/79 11:06 19 6

42 NEWELL, ALLEN - NAE NOMINATION/LIEBOWITZ/GB0002

5/1/79 5/1/79 2:57 3 1

76 NI FOR INTERCONNECTION--EMS 11/7/79 /PVR/GB0006

NO/DA/TE1/7/80 9:14 12 7

49 NI FOR INTERCONNECTING COMET/MERCURY--EMS/GILBERT,VANROEKENS/GB0005
11/5/79 11/6/79 0:58 1 5
22 NI-GETTING NI APPROVED BY O.C./ADAMS,RODGERS,FULLER/GB0006
11/29/79 11/29/79 4:28 6 12
53 NOMINATION SAM FULLER,CORNELL UNIVERSITY/BALLANTYNE/GB0004
9/17/79 9/17/79 4:24 3 2
46 NOMINATION SAM FULLER--ALLAN T. WATERMAN AWARD/GB0004
9/10/79 9/10/79 1:59 7 2

9 OC AGENDA/PORTNER--EMS/GB0006
11/26/79 11/29/79 1:35 2 4
55 OFFICE DESIGN--OFFICE OF CENTRAL ENGINEERING/GB0005
11/7/79 11/7/79 2:20 11 5
15 OHIO UNIVERSITY--PLEASE CONTACT JIM BELL/ RAJU/GB0004
7/19/79 7/25/79 5:17 4 5
61 OOD--CHARTERS,PHILOSOPHY,KEEPING PEOPLE/OLSEN/GB0004
9/26/79 10/10/79 0:35 7 9
12 OREGON SOFTWARE MINICOMPUTER INC./WHITNEY/GB0002
4/9/79 4/10/79 0:56 2 2
41 ORG.ANNOUNCEMENT--HOLMAN,SAVIERS,FULLER/ENG.MGRS/GB0004
8/29/79 8/29/79 5:16 7 1
56 ORGANIZATION ANNOUNCEMENT FOR OOD=LP+GB/ENG.MGRS/GB0002
5/10/79 5/17/79 0:34 8 9
33 ORGANIZATION--THOUGHTS ON ASSOCIATE HEAD OF OOD/FILE/GB0002
4/23/79 5/2/79 2:32 7 5

2 PAPER-ESTABLISHING A NATIONAL HIGH TECHNOLOGY/OOD.../GB0006
11/8/79 11/8/79 13:40 3 2
22 PAPER, NATIONAL HIGH TECHNOLOGY, A C. INDUSTRY--NEW (10-22-79)
10/22/79 10/22/79 15:30 70 1
11 PAPER, NATIONAL HIGH TECHNOLOGY, A C. INDUSTRY--OLD (10-15-79)
10/15/79 NO/DA/TE 50 9
64 PAPERS-MPS CONCEPT (SCHALKE)--EMS/HOLMAN/GB0006
12/19/79 12/19/79 12:24 3 3
11 PARABLE--TWO LIEUTENANTS: A PARABLE ON A PARABLE/GB0001/HOLD
2/12/79 2/25/79 3:22 5 4
14 PASCAL -- UC/SD/DELAGI/GB0004
7/18/79 7/18/79 4:58 3 2
50 PASCAL STRATEGY/JOHNSON,KEATING,WHITE.../GB0004
9/13/79 9/14/79 6:52 4 4
2 PBS - GB MAIL ANALYSIS/GB0005

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                         10/11/79 10/15/79 9:18     66       24
  39   PBS - SLIDES PART II/GB0005
                         10/29/79 10/31/79 6:14     18       13
  38   PBS - SLIDES/GB0005
                         10/29/79 10/31/79 6:18     20       10
  29   PDP-11/23 FONZ ANNOUNCEMENT/CLAYTON.../GB0001
                         2/22/79 2/28/79 4:06  3     3
  43   PDP-11/70 CIS POST MORTEM/DEMMER, RODGERS/GB0001
                         3/12/79 3/13/79 3:14  4     2
   3   PDP-11/70 WHY WE PROBABLY HAVE TO DO ON
CHIP/MC,OOD.../GB0002
                         4/2/79  4/6/79 0:54   11    6
  33   PERSONNEL, KEEPING VERSUS RECRUITING--
EMS/MEYER,DAVIS/GB0005
                         10/26/79 10/26/79 13:28    2        4
  12   PERSONNEL, RESIGNATION--BRUCE HURWITZ/BJ,LP--EMS/GB0005
                         10/16/79 10/23/79 16:26    2        4
  55   PERSONNEL--X'S REASONS TO LEAVE DEC/GB0004
                         9/21/79 9/21/79 6:06  8     4
  60   PICTUREPHONE MEETING SERVICE + OUR VIDEO
CONF./BERTOCCHI.../GB0003
                         6/25/79 6/26/79 16:30 14    4
  44   PL/1 AT DECUS--EMS/CUTLER/GB0005
                         10/31/79 10/31/79 3:32     2        4
  43   PL/1--EMS/PORTNER,LYLE,JOHNSON/GB0005
                         10/31/79 10/31/79 2:07     1        5
  12   POLICY ON 10'S, 20'S AND VAX'S WITHIN
ENGINEERING/PUFFER/GB0001
                         2/12/79 2/25/79 3:26  7     6
  20   POST OFFICE AND MAIL COLLECTOR/PLOWMAN,ALUSIC,CRAWFORD
/GB0001
                         2/28/79 3/2/79 14:13  3     2
  39   PRINTER--CENTRONICS QUIETWRITER/CROUSE ET AL/GB0004
                         8/21/79 8/21/79 1:13  6     1
  28   PRODUCT ANNOUNCEMENT/COMMITMENT POLICY/MKTG. COMM./GB0001
                         2/20/79 2/22/79 8:50  6     4
  32   PRODUCT MANAGER MANAGER & STRATEGY COORDINATOR /PUFFER
/GB0001
                         2/28/79 2/28/79 15:33 6     1
  34   PRODUCT SLIPPAGES--EMS/LACROUTE/GB0006
                         12/3/79 12/4/79 0:06  4     2
  33   PRODUCTS -- DILEMMA/GB0001
                         3/2/79  4/2/79 10:52  22    11
  31   PRODUCTS -- HOSTILE FEELING TOWARD OURS/OOD.../GB0001
                         2/28/79 3/2/79 14:28  8     6
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49 PRODUCTS OLD-- HELPING DIE/S.OLSEN,B.LANE,J.HOLMAN/GB0001
3/19/79 3/19/79 14:07 5 2
5 PROJECT REVIEWS - CONGRATULATIONS...--EMS/GB0006
11/14/79 11/14/79 8:40 3 4
19 PROMOTIONAL LITERATURE RESPONSIBILITY/KENT/GB0005
10/22/79 10/22/79 8:28 2 2
34 PSI - ADDRESSING YOUR USERS IN BERLIN/JESCKE/GB0003
5/29/79 5/30/79 8:10 3 4
19 PSI THANK YOU/JAESCHKE/GB0004
7/24/79 7/26/D7 5:48 2 2
51 PURDUE UNIVERSITY/KESSLER,ROSEN/GB0006
12/17/79 12/21/79 15:39 16 11

26 RANDELL, RE YOUR CONSULTING/RANDELL/GB0005
10/23/79 10/23/79 16:08 7 4
42 RED BOOK 2-YR PLAN, PROVIDE FINANCIAL DATA?/PMC/OOD/GB0001
3/12/79 3/13/79 3:16 9 7
40 REGARDING MCA'S, VENUS & 2080'S/RELIABILITY/HOFF.../GB0002
5/1/79 5/2/79 2:23 7 4
20 RM80, RA80, RA81, AND UDA/LACROUTE,DEMMER/GB0004
7/26/D7 7/26/D7 6:35 5 3
44 RENSSELAER POLYTECHNIC INSTITUTE/FRANKLIN/GB0004
9/10/79 9/10/79 1:25 3 1
72 REVIEW/DP:WELLS,VARICK/ORIGINS OF COMPUTER INDUSTRY/GB0003
7/10/79 7/11/79 11:02 33 13
3 RP07-CONGRATULATIONS ON DELIVERY--EMS/BLATCHLEY.../GB0006
11/9/79 11/9/79 5:20 3 4
62 RPG - REVIEW PLAN--EMS/STONE/GB0006
12/18/79 12/19/79 9:49 2 4

62 SCS-11--EMS/MARCUS,CADY,JOHNSON/GB0003
6/26/79 6/26/79 13:11 5 1
50 SCIENCE ATTACHE SUPPORT, DIRECTOR/BLACKBURN/GB0006
12/17/79 12/21/79 15:27 5 5
57 SCIENCE MAGAZINE/ABELSON/GB0005
11/7/79 11/8/79 11:35 6 9
58 SILICON STRUCTURE PROJECT/(PRES)&(DEAN)OF ENG.
CALTECH/GB0003
6/19/79 NO/DA/TE 5 9
52 SMITHSONIAN--PRESERVING ARTIFACTS, COMPUTER HISTORY/GB0006
12/17/79 12/20/79 15:06 3 8
36 SOFTWARE FLAKY IN THE WPS--EMS/PORTNER/GB0006
12/3/79 12/3/79 14:52 3 1
40 SRC--SCIENCE RESEARCH COUNCIL,RUTHERFORD LAB/HOPGOOD/GB0004
8/23/79 8/24/79 7:26 3 2

51 STANFORD INTERFACE ON VLSI + TEX WORK/KUSIK,HALIO.../GB0004
9/13/79 9/14/79 5:53 3 2
27 STOCK OPTION PLAN FIXING BEFORE NEXT GRANT/DAVIS/HINDLE/GB0001
2/20/79 2/22/79 8:31 5 4
48 STOCKEBRAND IN ALBURQUERQUE FACTORS--EMS/JACK SMITH
5/7/79 5/7/79 0:49 3 2
19 STRATEGY (BASIC) AND TRANSISTION MACHINE--EMS/CADY/GB0003
1/23/79 1/23/79 6:33 4 1
22 STRATEGY-PROCESSORS (IE MR+TW)--EMS/WD,ULF/GB0003
3/30/79 3/30/79 6:45 4 1
17 STRATEGY & RATIONALE -- BASIC PRODUCT/REDBOOK/GB0001
2/14/79 2/14/79 12:15 69 14
21 STRATEGY STATEMENT FOR DECUS--EMS/ULF,LENG,CADY/GB0003
4/4/79 4/4/79 6:40 4 1
50 STRATTON VIDEOTAPES/TAYS/GOOR/PEARSON/GALE/GB0003
6/11/79 6/12/79 17:12 6 6
10 ST AGNES HOSPITAL/DR. JOSEPH GIARRATANO/GB0002
4/9/79 4/9/79 1:26 3 6
8 SUBSCRIPTION CANCELLATION FORM LETTER/GB0004
7/12/79 10/17/79 15:17 2 9
40 SUNY AT BINGHAMTON--REPLY TO U REQUEST/PROF.PHILIP KRAFT/GB0001
3/5/79 3/6/79 5:14 13 4
18 SWAVE--EMS/GLORIOSO,STOCKEBRAND/GB0006
11/26/79 11/29/79 4:47 3 5
28 SYRACUS UNIVERSITY-DEPT. SEMINAR PROGRAM/OLDFIELD/GB0006
11/30/79 11/30/79 7:29 3 1
44 SYSTEM INTERCONNECT AND TEWKSBURY CHARTER/DEMMER.../GB0002
5/2/79 5/2/79 2:54 5 5

51 TALK INVITATION - DIS. COM. SYSTEMS/VICK/GB0002
5/7/79 5/14/79 0:59 3 4
7 TECHNICAL PAPERS PRESENTATION--EMS/CUDMORE.../GB0004
7/12/79 7/12/79 14:16 3 1
64 TECHNISCHE HOGESCHOOL DELFT/VANDEGOOR/GB0004
9/27/79 9/27/79 6:02 3 2
32 TELECONFERENCING (VIDEO) SYSTEM/KOTOK/GB0004
8/6/79 8/10/79 3:28 7 7
15 TERADYNE/LASSITER, DR. JOSEPH/GB0001
2/12/79 2/14/79 14:14 4 3
40 TERMINAL LOW COST FOR FACTORY BUSINESS--EMS/JAFERIAN/GB0006
12/6/79 12/7/79 3:17 2 4
38 TERMINAL SPECIALS (E.G. LA124)/GB0004
8/20/79 8/21/79 0:03 3 2

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  28   TERMINALS-COLOR AND THEIR USE IN CAD--EMS/GB0005
                           10/23/79 10/23/79 16:25    2        7
  8    TERMINALS OBSOLETE TO TPL AND RIO/CROWTHER--EMS/GB0005
                           10/15/79 10/23/79 16:30    2        3
  61   TERMINALS-REV. OF LONG RANGE PLANS--EMS/CLAYTON.../GB0006
                           12/18/79 12/20/79 11:22    5        7
  11   TEWKSBURY GROUP MORALE/DEMMER/GB0002
                           4/9/79  4/18/79 1:20   9    8
  29   TEX--CONFIRMING YOUR STRATEGY TEX TYPESET SYS.--
EMS/FORD/GB0005
                           10/23/79 10/23/79 14:27    2        4
  26   TEX/FRIDAY--EMS/GB0006
                           11/29/79 11/30/79 7:24     3        3
  35   TEX--LET'S BUILD PRODUCT AND INTERNAL TYPSETTING/GB0004
                           8/20/79 8/27/79 5:51   7    4
  37   THANK YOU FOR ABACUS/CALCULATOR COMBO/WATANABE/GB0004
                           8/20/79 8/21/79 0:32   2    2
  44   THANK YOU LUNCH/DECNET PROGRAM CONTRIBUTORS/GB0003
                           6/5/79  6/12/79 17:07  7    7
  43   THANKS FOR STRATTON MOUNTAIN IV/TAYS/GB0003
                           6/4/79  NO/DA/TE       6    5
  11   THANKS/STOCKEBRAND/GB0006
                           11/26/79 11/29/79 1:13     2        2
  55   THAYER SCHOOL OF ENGINEERING/DARTMOUTH/BOYLESTAD/GB0003
                           6/15/79 6/15/79 3:43   3    3
  75   THICK FILM--LOOKS GOOD (VIA KO) 10/18/79 /RC-EMS/GB0006
                           1/2/80  1/2/80 10:14   4    3
  29   TITLES-SOME POSSIBLE TITLES FOR LARRY/OLSEN/GB0004
                           8/6/79  8/6/79 3:38    4    2
  31   TPS - YOUR TPS PRESENTATION/DALEY--EMS/GB0005
                           10/24/79 10/24/79 7:09     2        6
  26   TRAX--WE'VE BLOWN THIS ONE/PORTNER/GB0001
                           2/20/79 2/22/79 8:47   4    3
  35   TRAX 1.5--CONGRATULATIONS--EMS/CADY/GB0005
                           10/29/79 10/29/79 5:34     2        4
  46   TRAX 1.5 PROPOSED DIRECTION--EMS/JOHNSON,DALY.../GB0005
                           10/31/79 11/1/79 11:47     3        6
  17   TRS-80 II - CUSTOMER COMMENTS--EMS/STAN OLSEN.../GB0006
                           11/26/79 11/29/79 4:43     2        4

  14   U OF DELAWARE/WARTER, PETER/GB0001
                           2/12/79 2/14/79 14:09  7    3
  24   U OF NEW MEXICO - JUNK PARTS--EMS/WITMORE,ECKHOUSE/GB0006
                           11/26/79 12/18/79 0:04     2        5
  38   U OF WASHINGTON - VIEW OF POSSIBLE
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VAX11780'S/RITCHIE/GB0003
                          6/4/79  6/5/79 2:15   4     5
  4    U OF WISCONSIN/MUCCI/GB0001
                          1/30/79 1/30/79 15:01  3     1
  9    U OF WISCONSIN MADISON/MURRAY THOMPSON/GB0002
                          4/6/79  4/20/79 7:11  5     4
  24   U. WISCONSIN TREATING IN A HUMAN WAY--
EMS/SCHWARTZ.../GB0003
                          3/2/79  3/2/79 6:59   4     2
  36   UNIT'S VIDEODISK WORK!/RIGGLE/GB0002
                          4/23/79 4/24/79 1:32  4     4
  28   UNIVERSITA' DI PISA - POSSIBLE JOINT
EFFORT/MONTANARI/GB0003
                          5/17/79 5/17/79 4:44  3     4
  21   UNIVERSTIY OF CAMBRIDGE COMPUTER LABORATORY/WILKES/GB0004
                          7/23/79 7/25/79 5:17  7     6

  47   VAX-11 ENG./MAN. PROGRAM REVIEW--EMS/PORTNER/GB0006
                          12/11/79 12/14/79 4:10     9        8
  47   VAX/VMS ARCHITECTURE,WHO HAS CHARTER /FULLER.../GB0004
                          9/11/79 9/11/79 8:28  3     3
  6    VAX AND 10/20 INTERCONNECTION--EMS/GB0006
                          11/14/79 11/14/79 8:41     3        3
  8    VAX AT MIT FOLLOW UP NOTICE/MUMMOLO/GB0001
                          2/9/79  2/9/79 1:23   2     2
  38   VAX--GETTING ADEQUATE VAX'S THIS FISCAL
YEAR/ULF,WD.../GB0002
                          4/26/79 4/27/79 0:33  8     6
  31   VAX - HI END PERIPHERALS ON VAX/DEMMER, ULF.../GB0003
                          5/29/79 6/4/79 1:53   6     4
  10   VAX PCL LINK SUPPORT/LOS ALAMOS/VAN ROEKENS...--EMS/GB0006
                          11/26/79 11/29/79 1:39     2        6
  35   VAX PCL LINK SUPPORT ON DECNET--EMS/BUTLER/GB0006
                          12/3/79 12/4/79 0:05  2     2
  10   VAX--SEGMENTING WHETHER/HOW 10/20 CUSTOMERS CAN
USE/ULF/GB0001
                          2/12/79 2/14/79 14:11  11    7
  37   VENUS-GETTING THE RIGHT DEVELOPMENT--EMS/FAGERQUIST/GB0006
                          12/3/79 12/4/79 0:05  8     2
  55   VENUS,VAX,MCA DIRECTION & STRATEGY--EMS/DEMMER,HOFF/GB0002
                          5/9/79  5/9/79 0:12   10    4
  25   VIEWGRAPHS CATEGORIES/SLIDES IN OVERHEAD BOOK FILE/GBOOO1
                          2/20/79 3/21/79 1:04  8     5
  30   VLACH'S 5 YEAR PLAN DRAFT (POST OFFICE)--EMS/VLACH/GB0006
                          12/3/79 12/3/79 12:09 2     4
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42 VMS-DISTRIBUTING DEVELOPMENT--
EMS/JOHNSON,HEFFNER,CARCHIDI/GB0005
10/30/79 10/31/79 2:08 3 6
54 VMS ON NEBULA--CONGRATULATIONS--EMS/SOFIO.../GB0005
11/7/79 11/7/79 1:05 3 5
13 VOTE AND SAGE PROJECTS TOGETHER/KUSIK,FULLER,JOHNSON/GB0004
7/18/79 7/18/79 4:59 3 3
70 VT100 - MID LIFE KICKER TO VT100--EMS/CLAYTON.../GB0006
12/20/79 12/20/79 14:28 5 4
22 VT162:POSSIBLE GATEWAY MODULE INTERFACE--UNIT RECORD
DEVICES/GB0001
2/28/79 3/2/79 14:17 5 3
50 VT78 FLOPPY-FAN IN--EMS/CLAYTON,SAVIERS,SMITH/GB0005
10/31/79 10/31/79 9:01 2 5

75 WANG GRAD. SCHOOL BOARD, A REP? 10/17/79 /BELL-EMS/GB0006
1/2/80 1/2/80 10:14 4 3
57 WANG-INSTITUTE ACADEMIC ADVISORY COMMITTEE/WANG/GB0006
12/17/79 12/18/79 0:32 11 5
31 WAR ROOM AND COMMON (TO US) OOD LIBRARY/FILES/GB0006
12/3/79 12/3/79 14:36 9 7
40 WATCHING STRATTON AND STRATEGIES VIDEOTAPES/MEYER/GB0003
6/4/79 NO/DA/TE 3 4
31 WHIRLWIND - HISTORICAL REPORT YOU WROTE?/WILDES/GB0004
8/6/79 8/8/79 10:03 4 5
37 WHITE TORNADO/BUBBLES ...VS NEW EDITING
TERMINAL/GILMORE.../GB0001
3/5/79 3/6/79 4:52 6 3
47 WHITE TORNADO DESIGN FOR WORD PROCESSING/CLAYTON,S
OLSEN/GB0
5/7/79 5/7/79 1:09 7 3
70 WILKES OFFER--EMS/JIM BELL/GB0004
10/5/79 10/5/79 2:36 3 1
63 WILKES THANK YOU LETTER/WILKES/GB0004
9/26/79 9/27/79 5:59 7 10
65 WP PLAN--EMS/PORTNER/GB0006
12/20/79 12/20/79 14:31 2 4
16 WPS 200 - FLAKY SOFTWARE--EMS/PORTNER,BJ,CLAYTON/GB0006
11/26/79 11/29/79 4:39 2 4
67 WPS REVIEW--EMS/PORTNER/GB0006
12/20/79 12/20/79 14:33 2 4

76 XEROX/DEC ANNOUNCEMENT OF ETHERNET--EMS 11/6/79/RC/GB0006
NO/DA/TE1/7/80 9:14 12 7
7 XEROX - ETHERNET/PAKE, DR. GEORGE/CAMPBELL, JAMES/GB0001

		2/7/79 2/9/79 1:08		7	15
32	XEROX--MORE ON XEROX ORGANIZATION/KNOWLES.../GB0002				
		4/23/79 4/23/79 6:26		5	4
68	XEROX--PERSONAL PREJUDICE VS.COMMAND/CLAYTON.../GB0006				
		12/20/79 1/18/80 9:56		2	5
63	XTEN PETITION BY XEROX--EMS/CADY,MARCUS/GB0002				
		3/15/79 3/15/79 0:38		4	1
72	YALE CONTRIBUTION--EMS/JIM BELL/GB0004				
		10/5/79 10/5/79 2:40		4	1
56	YOUR TRIP TO THE WEST/CLAYTON/GB0003				
		6/19/79 6/19/79 1:19		14	6

Digital **Interoffice Memo**

Subject: **Grant's Comments**

To: Lorrin Gale
Date: 4 OCT 76

From: Gordon Bell

Dept: OOD
Loc.: ML12-1
Ext.: 2236

Grant's comments:

Considering LSI as strictly a packaging alternative a 1001C hex module takes about 1 man-gear of engineering = $100K. Or $1K per package.

the 31 1C equiv. ECC chip costs about $120K to develop. Or $4K per equiv. SSI/MSI package. cost about $90K.

Parts costs LSI vs SSI/MSI about equal. LSI takes longer, makes ROI harder to get. May save board space, therefore $.

Conclusion: CAD needs to improve by a factor of 3-4.

Why not talk with him?

GB:ljp

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+---------------------------+                              GB0002/2
|   |   |   |   |   |   |   |
| d | i | g | i | t | a | l |   i n t e r o f f i c e   m e m o r
a n d u m
|   |   |   |   |   |   |   |
+---------------------------+
```

Subject: **Graphics: Why We Recommend What We're Doing**

To: Win Hindle, ML10-2/A53
Andy Knowles, ML10-2/A52

Date: 4/3/79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

Since there is some controversy a to whether we should be spending Central Engineering money on the VT125 instead of the VT100L, let me indicate why I believe it is essential that we go ahead as we are:

0. HP is there. Others are too. We'll lose system sales without it.

1. We were given the Graphics Charter several years ago and have been successively beaten up year by year because we have built no products.

2. It is the follow-on to the VT100. In the printing terminals, and in our computers we continue to build constant cost, higher performance or more capability products as the first priority product. Invariably, these products are more successful than when we build lower product cost products, because they fit into our existing marketing and distribution structure. The VT03, 05, 52, 100 sequence is the relatively constant price model. The

VT100 adds a lot to the 52 (note the 50 at a lower price wasn't particularly successful), and the demand is twice as high as the 52 even though the costs aren't that different, reflecting a response to features.

3. All a VT100L will do is to cause phase-in/phase-out problems and cause us to lose NOR as users buy the same product at a lower cost.

4. Graphics in terminals is inevitable and necessary. We have the people and product idea to establish the standard and get the whole tube market over to graphics. Hence, the real market is here, not a lower cost 100.

5. With the cost of people sitting at a terminal, the cost of ownership favors getting the maximum productivity and use by having the most functions.

6. We have a companion product, GIGI, that further supplements the Graphics standard and graphics line. Instead of doing a 100L, GIGI should be put into even higher volume to get us an even bigger market.

7. There is a lot being spent on Graphics now in DEC. We badly need it to avoid loss in the Technical Market, and if someone like IBM adds graphics to their terminals, the need will be accute in the Commercial Group. I believe the Terminals Group would be far better selling a VT125 with Graphics than competing in the glass Teletype market which they are not in and have ignored.

Dick, Roy, Len, Charlie and the group working in this area are doing a great job. Let's support their direction and get the terminals market by having unique, great products. We can always do the cost reduction bit (like the 8/L, 8/S, 9/L, VT50) after a great product is in the market.

GB:ljp

CC: Bill Chalmers, MR2-2/M67
Dick Clayton, ML12-2/E71
Bruce Delagi, MR2-1/M64
Len Halio, ML1-2/H26
John Leng, MR1-1/A65
Julius Marcus, MK1-2/C37
Bill McBride, MR2-3/E70
Roy Moffa, ML1-2/H26
Stan Olsen, MK1-2/C36
Stan Pearson, ML12-2/E71
Jerry Witmore, PK3-1/M40

D I G I T A L INTEROFFICE MEMORANDUM

DIST: Win Hindle ML10-2/A52 Andy Knowles ML10-2/A52

Bill Chalmers MR2-2/M67 Dick Clayton ML12-2/E71
Bruce Delagi MR2-1/M64 Len Halio ML1-2/H26
John Leng MR1-1/A65 Julius Marcus MK1-2/C37
Bill McBride MR2-3/E70 Roy Moffa ML1-2/H26
Stan Olsen MK1-2/C36 Stan Pearson ML12-2/E71
Jerry Witmore PK3-1/M40
00 BURT DECGRAM ACCEPTED S 17929 O 100 22-MAR-81 23:16:17

****
* d i g i t a l *
****

TO: BILL STRECKER

cc: SAM FULLER
BOB KUSIK
ALLAN TITCOMB

DATE: SUN 22 MAR 1981 23:15 EST

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: RE: MORE ON ALAN KAY VISIT

The ooffice systems group in ZK have used a 100 to simulate the ct100 graphics with multiple screens, etc.

I'm pushing building a graphics architecture definition that could be implemented in various places: nebula microcode, vax code or in the suvax processor. For now, I think we should put the architecture in vax code and get the arch right using the bit maps and high res tube, then put it in microcode in the high performance processor when it runs. This would let us get a system out now with nebula and high resoluction and work the right interface. Otherwise we'll spend enormous time trying to get the grpahics processor debugged, coded and produced ... costing us a year or so.

GB2.S5.22

EMS 13-JAN-79 14:33:50 540 1

To: Len Halio
CC: Dick Clayton, Bill McBride
From: Gordon Bell
Date: SAT 13-JAN-79 14:33:50 EDT
Subject: Graphics terminal progress.

I'm really impressed with the progress here. I conveyed this to Andy and to Jerry Witmore. Jerry wants to take on the role of Market sponsor to ge a product defined and done with haste. Furthermore both of them are enamoured with the possibility of haveing a complete range which now contains (in my head): 1. Gigi as the ultimate, low cost, graphics included terminal 2. VT125 aas the main line, high volume terminal for every offic and professional 3. Tektronix 4027 buyout high cost, color...but modified to our stand ared 4. a Terminal that we were/are buying out that is high reolution graphics for the engineering market...Si is out there buying now... and Jerry will convince him and John ot be compatible with the architecture

Note, we have a once in a lifetime opportunity to build a family of terminals
and put together a terminal architecture becasue there is nneed, knwoledge,
and projects in place. It is critical that someone be assigned (left free)
during the next 6 mos to be theh tight fisted architect of the hardware and
software. It has to reside in 1 head....plus we have to be doing the
dataplotting off to the side. How can this be structured?

I'll send a memo to the world with this plea...and direction. (see that Roy
and Charlie get this one)...Why aren't they members. of EMS? Bill will you
contact Jerry annd John and then possibly Si, with Jerry. LDP is also
relevenat , but I assume that Bill McBride represents them We should not push
too much to solve every problem a on the first draft of the terminal and
software architecture. The right approach for this kind of definition is to
put down all we know, solving all the problems outlined above and then to
evolve it when the other needs come out. The framework is robust enough to
proceed this way, because it is so open ended.

Command:

00 BURT DECGRAM ACCEPTED S 21035 O 27 14-SEP-80 11:05:19

****
* d i g i t a l *
****

TO: BILL PICOTT DATE: SUN 14 SEP 1980
11:01 AM EDT

FROM: GORDON BELL
cc: see "CC" DISTRIBUTION
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: GET GRAPHICS ARCHITECTURE AND PRODUCTS FOR KO AND SUVAX!

I would like you to take the responsibility for convening the groups to deal with what I think we need in the graphics products area. Currently, I see five independent efforts:

0. Gigi I and VT 125, with glimmer of GIGI II, which I want to hereby define as KO graphics.

1. KO- we have defined and must have 2 or 3 grahics generators for the design in order to compete effectively as a personal computer. The general characteristics are designed. We must immediately get specific in order to know how the whole family fits together.

2. CRG designed high resolution graphics- intent to build 10 with the attendant cost and maintainence problems. This one is clear, stop it and move the resources to 1 today!

3. Suvax graphics- lots of capability, much of the work for 1 is in it, hence I want to find a way to transfer some knowledge to work on 1. Must have for Suvax. Looking for a Mfg. home. CSS is a candidate.

4. CSS- lots of hardware, no architecture, some occasional

software, travelling swiftly along the road to nowhere. Does
represent a resource to build high performance (not the high cost, low performance stuff now being built).

We must have a hardware and software architecture, otherwise we
are going to continue to fail with these products. Please address how you are going to do this, NOW!

"CC" DISTRIBUTION:

GERALD V BUTLER	DICK CLAYTON	BILL DEMMER
ULF FAGERQUIST	BERNIE GEAGHAN	BOB GLORIOSO
JIM MARSHALL	WAYNE ROSING	

CONTINUED--RE: GRAPHICS
****
* d i g i t a l *
****

TO: BOB GLORIOSO DATE: MON 15 SEP 1980
7:19 PM EDT

FROM: GORDON BELL
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: RE: RE: GET GRAPHICS ARCHITECTURE AND PRODUCTS FOR KO AND SUVAX!

I do not want to look beyond the vt200 at all now. I want it asap. Given that we have no acceptable product development capability, I do not want to spend anything on A/D. Stony said they plan to build several At any rate, I want to go full speed on the vt200 high resolution graphics as per our plan for the 200 and we need the breadboarding of it!
g.

CONTINUED RE: GRAPHICS
****
* d i g i t a l *
****

TO: BOB GLORIOSO DATE: MON 15 SEP 1980
7:20 PM EDT

FROM: GORDON BELL
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: RE: RE: GET GRAPHICS ARCHITECTURE AND PRODUCTS FOR KO AND SUVAX!

Agreed. We need lots of help and work, not play.

GB1.S7.5
Archivist-Librarian reports to Exhibits Co-ordinator.

Approximately 50-55 cubic feet of papers have been sorted, filed and documented on floppies.

Storage room for these materials is located on the 5th floor of the elevator tower (?).

l. Reference manuals and papers are stored in acid-free boxes by
    a. Company name
    b. computer
    c. in alphabetical or numberical ordder

2. Within each box there are file folders by
    Co. name/name of machine or number/any sub-division

3. In future may be further located by Range (wall location) and Section (within Range)

Incoming documentary materials either donated or loaned are accessioned on the ACCLOG and integrated into the respective record series. (?)
(Photos and video tapes are not being cataloged at this time.)

An acknowledgment letter and two copies of donation or loan contract are sent out. One copy of the contract will be returned for our files.

Audio tapes are not on floppy at this time, but kept on a paper list listing the following information: AT: name of tape:year. There are about two dozen tapes which contain Gallery Talks, Bits and Bites, Pioneer Computer Lectures and . Kept in file drawer and some in Gregor's desk.

Small library is located in Business Manager's office in alphabetical order.

Nothing has been done yet regarding photographs and video tapes.

Archive proposals of work in progress and in future are sent to the Director and Exhibits Coordinator.

Tours: occasional, maximum 25 people; usual 10-15 people

Acid-free boxes and folders used for storage of papers provide protection from acid migration and the atmosphere. Catalogs for ordering of boxes, folders are in Gregor's desk. Ordered now from Conservation Resources, Alexandria, Va. and

University Products, Holyoke, MA.

Floppies used: Name of
Please correct, complete,add
How information is called up
What's on them

ARCHIVES GOLD Abbrev:AR
I.D. (What's the I.D.-give example)
Co. Name
How acquired
Location
A.R. # (What's this?)
Photographs

ARCHIVES PROPOSALS (Provide necessary info here)

ACCLOG Gold Abbrev:AC
Accession #
Date
Name
Description of Material Loaned
How we got it?
Acknowledgment Date

acknowledged

BOX LISTING (Provide necessary info here)

ACKNOWLEDGMENT LETTER GOLD:Library

either DC Donation Contract, AL Acknowledgment Letter, ILC Incoming Loan Constrct, OLC Outgoing Loan Contract

OTHERS?

Future plans: cross-referencing among photos, audio-tapes, video-tapes, books and papers.

arranging collection into ranges and section

No collection is complete so room for expansion should be allowed in the storage area.

GROSCH'S LAW COULD HOLD

ASSUME:

PERFORMANCE = MEMORY-DATA-RATE X MEMORY-SIZE

MEMORY-SIZE 4K/25 X PRICE (IN $)

MEMORY-DATA-RATE 2M/25 X PRICE (IN $)

PERFORMANCE = $(8 \times 10^9/625) \times PRICE^2$

LAW HOLDS IF PROCESSING IS ADDED FOR EACH 4K CHIP...TO FULLY OCCUPY ACCESSES.

LAW HOLDS IF COST OF PROCESSOR = 0 OR MEMORY SIZE.

1. **BY LARGE PROCESSOR**
2. **BY FULLY INTERCONNECTED, DISTRIBUTED PROCESSOR**
3. **TOTALLY SEPARATED MACHINES**

ALSO NOTE A STRAIGHT LINE IS A REASONABLE APPROXIMATION TO A SQUARE LAW OVER AN ORDER-OF-MAGNITUDE RANGE.

****

TO: DICK CLAYTON DATE: SUN 26 OCT 1980
8:12 PM EST
LARRY PORTNER FROM: GORDON BELL
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: GETTING TO A SINGLE 11 SYSTEM'S GROUP

Dick and I talked today about how the 11 group would evolve.
I
want Dick to get an organization in place that can deal with
the
current charter of personal computers BEFORE dealing with the
larger question of Departmental computers in cabinets from
the
03-70 and running rt, rsts and m overall.

I'd see this as having a strong software person who would
direct Gil, deal with softare projects, inteface to other
software programs like KO/wps, the special P/L applications
groups, and take the responsibility for software for KO.
This group would get larger with time as we begin to migrate
other software on to the KO. Nevertheless, we should keep
the KO focussed on being a personal machine, versus having
it be a departmental computer on which rsts and m run...
although we may run these systems on ko in abounded fashion.

A seperate 11 systems group focussed on departmental
computers
would include all the Q and U bus development, together with
the multiprogrammed operating systems would be established.
This would be gradually phased away as VAX takes over this
product space. People would move from this group both to
VAX and to the Personal computer. It would be responsible
for the software so that users would migrate/coexist with
VAX. Also, it would also be responsible for various support
of the personal systems such that our existing customers

would want to buy KO's because of greater productivity
for their existing 11 computers.

It would make life easier for Dick to have this ability to manage
the interface so that we get the personal computer work done using these people who really understand 11's.

Fact: Given our position in the personal computer space on hardware... especially with terminals, I have trouble in recommending that we do this because I believe Dick has his hands full in getting the hardware team, getting the hardware,
and then getting the software organization. Also, I see little
interaction with the current 11 software organization.

What I would like to do is to agree on a person who will ultimately report to Dick, and to intitially hire that person who will handle the 11 departmental computing work. This person would initially report to Larry as we get the organization
set up. When Dick has the personal work going, he would take this over.

I'd like to get going now on building an aggressive personal computer group, and I don't want anything to get in the way.

Let's discuss how we proceed.

GB1.S7.57

September 9, 1984

Dr. Ugo O. Gagliardi, President
General Systems Group, Inc.

51 Main Street
Salem New Hampshire 03079-3195

Dear Ugo:

I enjoyed the brainstorming with you, Ted, Archie and the Italtel people. It certainly was a hard day. I hope it was beneficial to Italtel.

I was a especially impressed with Maurizio who appears to really understand the products and technology. Mrs. Bellisario was especially insightful and focused; it was a pleasure to work with her for the day. It seems like Italtel has the potential to be a major company under her leadership. The only disappointment was that I learned very little about the state-of-the-art and details of their switch and capability. I hope to receive more information about their product and company. Encore has forthcoming computing products that I believe will fit well with their switching architecture, thus I hope we can get together later to explore this.

I'm anxious to see the Macrodata/Olivetti computer that you gave the Museum, and hope it has supporting historical data and documentation. We are also delighted with GSG's decision to become a member.

Enclosed are several brochures for your visit to Olivetti, in addition, I'm asking Michael Oleksiw to call you to prepare a custom proposal for joining the Museum. Most likely, it will be necessary to have them visit the Museum before they commit. Please extend this invitation. Also, I'm inviting Italtel to join the Museum.

Attached are my expenses for the day.

Sincerely,

Gordon Bell
Chief Technical Officer

CC: Michael Oleksiw, The Computer Museum

Dr. Ugo O. Gagliardi, President
General Systems Group, Inc.
51 Main Street
Salem New Hampshire 03079-3195

Expenses for Italtel Meeting, September 6, 1984

Airfare	100
Hotel	153.55
Taxi's (NY)	21.25
Bus (NY)	5
Bus (Boston)	10
Consultation Fee (per agreement)	1100
Total	1389.80

Gordon Bell

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| d | i | g | i | t | a | l |   i n t e r o f f i c e   m e m o r
a n d u m
|   |   |   |   |   |   |   |
+---------------------------+
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To: Gus Ashton, PK3-2/M18   Date: 17 JAN 79

From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-
2236

The ad I saw gives cost per bit of semiconductors. That's <u>not</u> our prices. I don't have a plot for our 11 memory prices, but you might use the PDP-10 prices. (The chapter on the PDP-10 in Computer Engineering has such a plot.)

GB:ljp

September 14, 1978

Nobuhiro Hamada
810 Isobe, Hitachi-Ota
Ibaraki, 313 JAPAN

Dear Nobuhiro:

Last week I returned from a trip, which included Japan to find your letter to me in July, your August 29 post card and the lovely Japanese fan. I'm sorry we weren't able to meet either at CMU or in Japan.

Your paper on the Design of Cooperative Operating Systems for CM* looks quite interesting. I've sent it around to others who are designing systems of this type. I can see the approach is something of an extension to the hardware modules and structures work that we've been interested in at CMU.

Again, thanks for the fan. Perhaps we'll meet someday. I've tried to gather some of the handbooks you wanted.

Sincerely,

Gordon Bell
Vice President, Engineering
Professor, Computer Science and Electrical Engineering
Carnegie-Mellon University, on leave

GB:ljp
ID#0270

GB3.S10.29

00 CORE DECGRAM ACCEPTED S 002549 O 672 04-DEC-82 16:46:58

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! d ! i ! g ! i ! t ! a ! l !        I n t e r o f f i c e   M e m o
!___!___!___!___!___!___!___!
```

TO: see "TO" DISTRIBUTION

cc: see "CC" DISTRIBUTION

DATE: SAT 4 DEC 1982 4:24 PM

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5183715678

SUBJECT: HARDWARE SPECIFIC PRODUCTS FOR APPLICATIONS GROUPS

Aren't you tired of listening to Ken complaining about getting
market specific products such as Cash drawers that would be useful, and indeed I would think essential in particular markets?

Why can't we make a list of what the products are that are needed in these areas and then simply go about getting them? For starters, it would seem that it would be a great idea to buy them out, and possibly to define and use some standard interfaces like RS232 to connect them easily to all of our computers.

For commercial, the list might include: Cash drawers, credit card readers/mag stripe readers, bar code (ala CSS... see we have one), document readers, fax interface (i/o), bank teller terminals, etc. At the very minimum, we'd have a list of these devices that we support at an interface level.

For Factory, why don't we simply adopt the AB form factor and make a controller out of 11's to drive their electronic equipment? I hate to see us go after another bus and the attendant high investment to get the relevant power conditioning
and transducer modules. Given the numerous systems we now support within the P/L and CSS, it would seem that this is a very high priority item.

For LDP, I know we all agree there's a crisis in being able to provide cost-effective i/o. What could we buy out? Why not buy an Analogic AP500 to do the front end processing? or is it simply too expensive to OEM?

A BACKWARD INTEGRATE/TOP DOWN VERSUS FORWARD INTEGRATE/BOTTOM UP
APPROACH

Let me strongly advocate that as systems sellers, we want to provide the complete solution to a customer buy either doing it directly (eg. making a cash drawer) or preferrably by

reference selling one. The main thing is to decide the system
component, provide the software interface and then have us either sell it to them, or let the customer buy it from the component supplier. I.e. I strongly don't believe we want to make these components ourselves... we simply want to make it easy to buy and use them!

"TO" DISTRIBUTION:

GERALD V BUTLER   ROGER CADY   BILL LONG
JULIUS MARCUS

"CC" DISTRIBUTION:

WIN HINDLE   KEN OLSEN   JACK SHIELDS
JACK SMITH

****
* d i g i t a l *
****

TO: SAM FULLER   DATE: SUN 22 FEB 1981 17:33 EST

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: TRY THIS TAXONOMY FOR HARDWARE

I added two more pages to get the world. It has all you have plus more. See what you think. Let's talk about it on Mon. Hope you get it, as it violates the ems spacing rules.

We would take this and then evaluate groups accordingly, whether its essential to them, whether they can easily buy it or whether it would be nice to have and where they are -+=..
or some other grade..

```
                   BASE TECHNOLOGY OF COMPONENT OR SUB ASSEBLY

Technology Name     T/T 16-bit  VAX/VMS     Com
                    T   PC  16b PC  Mid Lg. Net MASS STORAGE
                                                T   PC  Mid
Lg. COMPONENTS

Sem PI Pwr Pkg
                    .   .   .   .   .   .   .   .   .   .   .
.   . .   .
SEMICONDUCTORS
   VLSI-MOS         e-  n-  n-  n-  n-      n-  n-  n-  n-
e+
   Gate Arrays      n-      n-  n-  e=  e=  e-  n-  n-  n-
n- n-
   Special Custom
MEMORY
   Cost-oriented
   Large, MOS
   Very fast
PHYSICAL Intrcnct
   Chip carriers
   PCB's
   Modules
   Backplanes
   Inter-box,cab
POWER SUPPLIES
   Low power
   Elect. quiet
   Hi pwr, Hi eff
ELECTRICAL CKTS
   Logic
   Analog
   Voice i/o
DIGITAL SYSTEMS
   Microprogmd arch
   Processor arch
MECHANICS & EM
MECHANICAL PKG
   Prod. specif
   Cabinet
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NOTE THE FOLLOWING PRODUCT SPECIFIC TECHNOLOGIES

SEMIS: photo lithorgraphy, ion-implantation, dry/wet chem etch, ... ???

MASS STORE: mag heads, mag media, info theory, file system?,

COMMUNICATIONS: digital filters, multi-drop optics, encrytion/ security,
digital switching, voice switching, modem design, high speed lines
TERMINALS AND TRANSDUCERS: keyboards, touch input, telephony, impact printing,
non-impact printing, paper handling, crt displays, lcd (and other) displays

ENGINEERING PROCESS CAPABILITY

T/T 16-bit VAX/VMS Com
T PC 16b PC Mid Lg. Net MASS STORAGE
T PC Mid

Lg. COMPONENTS

Sem PI Pwr Pkg

. . . .

. . . .

Digital CAD
CAD Arch
Network anal
System Perf.
System Analysis
System Design
Arch. spc/verfy
Firmware
Logic Design
Discr simul
Microprogramng

LOGICAL-PHYSICAL
PCB Design
Analog PCB
Other PI Layout
VLSI Layout
Gate Array

Electrical CAD
Semi ckt.
Elect. Ckt.
Control theory
Magnetic sim.

Mech. CAD/CAM
Finite analysis
Finite Diff.
Heat transfer
N/C Mill

TESTING
Sys. verific
Environment
RFI
Acoustic

MANUFACTURING PROCESS TECHNOLOGIES

```
                    T/T 16-bit  VAX/VMS     Com
                    T   PC  16b PC  Mid Lg. Net MASS STORAGE
                                                T   PC  Mid
Lg. COMPONENTS

Sem PI Pwr Pkg
                    .   .   .   .   .   .   .   .   .   .   .
.   . .   .
SEMICONDUCTORS
   VLSI-MOS
   Bipolar GA
   ECL GA
   Solder bump
   FTA chipes
PHYSICAL Intrcnct (implies assembly and test of)
   Chip carriers
    Thin film dep
   PCB's
     Multi-layer
     Control Imped.
   Modules
   FTA Modules
   Backplanes
   Cables
   Inter-box,cab
SPECIAL TEST
   System
   Network
   RFI
POWER SUPPLIES
ANALOG CIRCUITRY
MECHANICS & EM
   Castings
   Plastic Molding
   Machined parts
   Stampings
   Etching
   Ship cartons
MATERIALS FLOW AND HANDLING
```

SERVICE AND USE TECHNOLOGIES

```
Technology Name    T/T 16-bit  VAX/VMS     Com
                   T   PC  16b PC  Mid Lg. Net MASS STORAGE
                                               T   PC  Mid
Lg. COMPONENTS

Sem PI Pwr Pkg
                   .   .   .   .   .   .   .   .   .   .   .
.   . .   .

HUMAN FACTORS
   Self-help
   Manuals
   Productivity
RAMP
   Reliable
   Non-Stop
   Availability
   Maintainability
USER-DESIGN
   Perf. tools
   Network maint.
USER-BUILDABLE
USER-MAINTAINABLE
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ENGINEERING PROCESS MANAGEMENT

Technology Name   T/T 16-bit VAX/VMS   Com
                   T   PC 16b PC Mid Lg. Net MASS STORAGE
                                               T   PC Mid
Lg. COMPONENTS

Sem PI Pwr Pkg
                   .   .   .   .
. . . .
PROJECT CONTROL
HRP
Technical Education
Space Planning
Computing Resources

?? WHAT ARE THE CRITICAL ONES WE WANT TO FLAG ???

Note the table is the evaluation of the 15 product eng. groups in terms of product, cad process, mgmt process, etc.

GB2.S4.36
Digital **Interoffice Memo**

Subject: **Hardware/Software Activity (?) in Microprocessor Interface Support and Potential Products**

To: Ed Fauvre
Lorrin Gale
Roy Moffa
Steve Teicher

Date: 4 OCT 76
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

F/U 10/11

In discussing the microprocessor support with Celeste, it's clear we're losing ground at much faster than real time. I.e., the users of the 8080 are hiring Applications Programmers (e.g., BSR's, LA120, DK) because the group isn't supplying them. Furthermore, the activities need in support alone are growing very fast (e.g., need for programming standards). There is also significant need for hardware support!

1. Ed, did we make a mistake in the organizational position? Should Celeste (as Microprocessor Applications and Support Programming) be moved to CAD, LSI, or within systems programming versus individual users?

2. How are we going to get full-support (i.e., both software and hardware)?

   a. Coding standards?

   b. The Intel $10K system for debugging? If we do nothing, we'll have 30 of these in DEC soon...and the 8080 is going to be interim.

   c. Should we not do b, and do the hardware (based on 11V03) and finally Krypton?

   d. Roy, isn't this something you'll have to have for 11 designs (and also useable with right interface for the 8080)?

   e. Right now, several groups are doing hardware development systems based on 11's. Who's going to do this hardware?

   f. Coupling between hardware/software? who? I'd like people who read this to respond. I'm frustrated with inactivity, and want to charter or have someone else charter these activities so we can get action. There's none now!

   g. A standard test system for

manufacturing.

GB:ljp

CC: OOD Jim Bell
Rich Fiorentino Bill Green
Marve Horovitz Andy Knowles
Glenn Leedy John Mackeen
Cleste Magers Bill Munson
Bill Thompson Rob VanNaarden
Ed Vrablik

HARDWARE AND SOFTWARE SALES

BY ARCHITECTURE

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$2900M
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10/20  6%          !
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VAX-11             !
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32%                !
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PDP-11              !
                                 ! VAX-11     8%            !
                    !            !
                                 !---------------!          !
32%                 !
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                                 !    PDP-11   !            !
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! DEC 10   14%      !           !---------------!          !
TERMINALS           !
!                   !           ! PDP-8      6%            !
                    !           !
! PDP-11   54%      !           !---------------!          !
26%                 !
!---------------!   !           !             !            !
! PDP-8    23%      !           !TERMINALS  22%            !
                    !           !
!TERMINALS  9%      !           !             !            !
                    !
-----------------   -----------------         -----------------
     FY74                            FY79
FY84
```

December 9, 1976

Mr. Harold S. Stone
University of Massachusetts
School of Engineering
Dept. of Electrical Engineering
Amherst, Mass. 01002

Mr. Bruce W. Arden,
Professor and Chairman,
Princeton University
Dept. of Electrical Engineering
Brackett Hall, Engineering Quadrangle
Princeton, New Jersey 08540

Dear Harold and Bruce:

The revised copy, Draft 4 is an incredible improvement over the sum-of-parts. I would hope Harold can now do a fairly major revision on this to further integrate, reduce, and tune it to be a first rate section. It looks like there's hope now. I can almost see a structure.

I've enclosed an essay that you might extract parts from which has

among other things: an explanation of why or how we get newly named computers (e.g., minis and micros) from the technology; the levels-of-integration; and a discussion on a performance measure. Since I'm not sure of the eventual outcome of the essays or even their existence and am unhappy with their current quality, please do not reproduce or use them <u>except</u> for COSERS work. (Bruce, some of this might be helpful for your section.)
If this is of any use, a forthcoming section maps all machines into a 6 to 12 dimensional space which is essentially the resources of a machine, and can be nicely plotted on a 6 decade, log Kiviat graph. (The first 6 are: Pc(access/sec); Mp(size); Ms(size); T.human(data-rate); T.computer(data-rate); and T.external(data-rate). It should be noted it holds for microprogrammed, macroprogrammed, and language machines alike. The reader can easily see the difference of computer (information processing) structures like typewriters, teletypes, hand-held calculators, real time, timeshared, store-and-forward switching, high performance, etc. computers, as well as the language machines from a performance and structure viewpoint using human pattern recognition. It doesn't (yet) capture notion of reliability.

I'm enclosing the pages I've made marks on. I'd like to see the tables next go around. I'd like to stick with the word "memory" throughout, and never use "storage".

As to where it belongs, here or in the overall section, I believe there needs to be a strong structuring of the ideas that have been introduced into computer hardware. They really are quite simple and natural when presented right. That is, the great ideas really need to be divided into a few great (revolutionary) ideas, and then everything is a refinement (evolution) on those ideas. The revolutionary categories:

1.The whole notion of a machine ala Turing, and possibly the stored program computer is evolutionary. For example we're coming back now and rejecting some of the original ideas - stack vs 1 AC or separating data and program simply to protect the data (or program). This is where the notion of levels of language interpretation should come in: basic hardware or sequential switching circuit: the micro machine; the macro machine; the operating system (and sometimes a virtual machine); the language machine and the subsequent higher level language machines that get built up from these structures.

A section on this would really address and show how we move software constructs from the language (and use) into hardware. These include stacks, index registers, various data-types (e.g., arrays, strings, floating point)...the great ideas. It would also include how one can map an entire language into the hardware of a machine's instruction-set. This accounts for microprogramming, and virtual machines, for example.

2.Memory hierarchies - a broad principle of the nature of how information is stored and processed in most physical systems including humans. Namely, that an information processing system has varying amounts of information that can be accessed in varying times and at varying costs (since economic man is building it). This principle accounts for the application of memory technology into a hierarchy of basic needs: registers, the cache, main memory (and then in pages or segments), secondary memories of various sorts, tertiary and archival store.

3.Parallelism - the notion that there are many operations that can be performed at the same time and generally brought together to form a single system (e.g., arrays, vectors, sets, multi-program or multi-tasks, independent programs).

4.Fractional parallelism/time-multiplexing (i.e., the sharing of a single computer for what appears to be independent activities). This includes multiprogramming and timesharing, but it also calls for the invention of the correct synchronizing primitives.

5.Redundancy to provide arbitrarily reliable information processing structures (includes parity, ECC, TMR, voting, etc.).

6.Device technology - this would show how the levels of interpretation, and other parts of the machine have provided a natural structure for use. We should point out that some parts (e.g., IC's) evolve rapidly because we're the dominate user, whereas disk storage is generic to our structures...and only evolves 1/2 as fast. Also we must point out that technology just does the following for us:

a. Allows us to build higher performance, constant cost, machines which integrate software concepts and needs.

b. Allows us to build lower cost, minimal performance structures (e.g., mini, micro and calculators).

While I don't claim that it can yet be a revolution, it's revolutionary to me to realize there are only a few pure, information processing components (i.e., links, switches, memories, transducers, and data operators) and from these we build more complex structures of the same type, and even other primitives (controls, then processors, and computers). From these we can describe and analyze everything from a teletype to a large scale computer. I think we've missed an opportunity in the report to orient the world and show them that we have a science based on primitives that we understand and synthesize with. I'd like to see the hardware section do more to help dispell the mystery.

Just as we dehumanized the report to credit individuals, should we do it for companies...(e.g., page 57) with the provision that we must have photographs?

I've attached some copies of slides on multicomputers, networks, multiprocessors to help the area around page 70.

It might be worth contacting Dave Evans to get photographs of displays which are used in Flight Simulators. These tend to have highest performance. Also the sector is dry and needs some photos.

I'd sure like to see family trees which tie together various technologies, e.g., semis, memory (like the sketch I sent last month), transducers.

In the paper I sent earlier, I outlined a number of problems in computer systems design that I thought were worthy of hardware research. Some of them not already in should be included. For example, before we can do much with computer design as an engineering discipline, we have to have a better way to describe the characteristics of an information processing task so that it can be allocated to various uniprocessor or other structures that we conjure up to handle the job. I feel we would get something that could ultimately work much better than the seat-of-the-pants method we use now.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:ljp

Attachments
February 4, 1980

Messrs. Dobson and Pennington
Harris Semiconductor Group
P.O. Box 883
Melbourne, Florida 32901

Dear Messrs. Dobson and Pennington:

I'm sorry we didn't have the opportunity to discuss WP at Harris when we met a week ago Friday. I've reviewed your letters of 12/6/79; 1/4/80 and status of 1/25/80. The problems seem to cluster into three timescales:

1. Getting the WPS200 running smoothly.

2. Enhancing the existing WPS78 and WPS200.

3. Specific direction (e.g. Voice, FAX, OCR) over next 5 years and beyond.

On point 3, we are committed to becomming the significant supplier in the office market which, to me, simply means having those products necessary to succeed. By this, I mean we have the drive, manufacturing, and understanding. This includes standards, components (i.e. terminals, CPU's disks, network), performance analysis and measurement, human factor understanding and a very strong programming group who understands interactive computing and distributed processing. Similarly DEC now runs the largest Electronic Mail System anywhere, I believe with over 2000 subscribers on 3 nodes...and we are developing products in this area to complement WP. This belief in the long term has been what's prompted the recent organizational change (note the attached press release).

I have personally spent a great deal of time in this area and am going to make sure our products are right. Based on experience in shared and standalone interactive computing, WPS200 (the largest 248 system of 4 RL01's, 2 DP's, 2 LQP's, 8 VT100's, 3 dial in/out Communication lines, and 1 hardwired line to our DP/EMS systems is installed in my office area), and the WPS78 (and its successors) I want us to rethink the question of shared versus standalone and how WPS systems couple to DP systems. A week ago, I was convinced we should move to larger, shared systems with integrated DP facilities along the lines implied by your vendor long term questionnaire. Today, based on my feeling about large WPS200's (assuming they work well), I'm less sure!

Here, I'd like to interact with you after we've got some hard data and have internal consistency, yet some flexibility so we can test it with knowledgeable customers like you.

A very aggressive, cost-effective standalone system based on your latest PDP-8 CMOS chip will form the nucleus of our WPS, beginning in a year. Re your 1/25/80 question of commitment to Office Automation, I must say: Yes, very committed.

On point 2, given that we have to market a high volume of systems in the WP and Retail marketplaces, we must add capabilities along some of the lines you suggest. In some instances, customers feel we have made commitments for various extensions. Right now, we're sorting out the requirements for releases 5 and 6. We'll be happy to discuss the future when the product enhancement direction has been scheduled, but in no case will we make a commitment to deliver <u>until</u> the capability has been desiged, implemented, and tested!

Point 1 - getting your WPS200 reliable, documented, trainable, and becoming a part of the DEC organization vis a vis communication. Stan Olsen is working diligently to solve the organizational and communications with the users problem via the Word Processing Product Line. The Engineering organization under Bob Daley and Bruce Stewart, in Merrimack, is working on the software and user documentation. We have more people working on version 4 now than a week ago. Some of the effort includes a remote terminal emulator which enables a PDP-11 to behave as WP terminals, so that automatic testing can occur. Currently we do not have a complete work plan to address <u>all</u> the known problems. This should be forthcoming by mid February. When it arrives I will make sure it is communicted to you.

In summary, we are doing everything possible to make our current products in the field reliable so that you'll be happy and therefore more WPS can be sold and installed. We are planning enhancements to these base products so that they can be competitive as possible in the next few years. (Also, we must have products that use the PDP-8 chips in the quantities we've committed to you.) Our general product strategy of interactive and distributed processing is aimed at the office. We intend to be an innovative, quality supplier in this marketplace. I hope we can continue to have you as a customer.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:swh
GB1.S1.36
Attachment - Press Release

CC: P.T. Anderson, Harris Semiconductor Group
Stan Olsen, DEC
Jack Gilmore, DEC
Charles Wyckoff, DEC
Bruce Stewart, DEC
Robert Daley, DEC

February 26, 1980

Messrs. Dobson and Pennington
Harris Semiconductor Group
P.O. Box 883
Melbourne, Florida 32901

Dear Messrs. Dobson and Pennington:

A copy of the WPS 200 Version 4.3 Maintenance Release Plan dated 8 February, is enclosed, as per my letter to you of February 4, 1980. You will note that the plan is reasonably complete, but lacks some of the dates that depend on external groups for Quality Assurance, etc. The plan is being continuously updated to get these dates. I have discussed the plan with members of the WPS development group, but I have not personally reviewed the plan in terms of the various problems and resources we are committing to it. Overall, we believe we have as many people as can be productively applied to the problem. There are four full-time people and five half-time people working on the release. I am meeting with the developers this week and if I believe we aren't able to meet these commitments, I will contact you. Currently, the weekly schedules are being met.

You will note that we are going into internal Quality Assurance 31 March. Because it will be August before we have a complete release to the field, Stan Olsen is advocating that we distribute a document describing the failures so that users can avoid them.

Our restructuring is helping segment our resources into the various problems and future plans. Also, there will be organizational announcements shortly in the marketing domain that will also help our field communications problems.

Overall, I am quite positive that we are progressing to be a serious supplier of WP Systems.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:swh
GB1.S2.22
Attachments

CC: P.T. Anderson, Harris Semicondutor Group
Robert Daley, DEC
Jack Gilmore, DEC
Stan Olsen, DEC
Bruce Stewart, DEC
Charles Wyckoff, DEC

30 June 1984

Managing Director
Harrods
Knightsbridge
London, England SW1X 7XL

Dear Sir:

Attached are copies of the two bills of sale (Invoices 20572626-7) for Coleport Blue Wheat Tableware I purchased from C12213, in dept 772, on 14 March 1984. They were supposed to arrive within ten weeks.

Where are they?

Sincerely,

C Gordon Bell
Page Farm Road
Lincoln, Massachusetts 01773
USA

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Subject: **Word Processing, MINC and Apple at Harvard**

To: Dick Clayton, ML12-2/E71
Gary Cole, PK3-1
Jack Gilmore, MK1-1/J14
Len Halio, ML1-2/H26
John Leng, MR1-1/A65
Roy Moffa, ML1-2/H26
Joel Schwartz, MR2-4/M51
Allan Wallack, MR2-3/M84

Date: 1/17/79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

As strictly party talk with Laarie Bogorad (495-4292) and J W Hastings (495-3714) of Harvard's Bio Lab at 16 Divinity in Cambridge, I found:

1. Somehow they don't have

a very high opinion of MINC. For some reason it doesn't do what they want it to, or appears too restrictive. We are using their lab as a demo area for customers to view it, so it would be really important to find out what it is that bothers them.

2. They think the APPLE is great. They do like the prices of $300 for 16Kb of memory, but there are other things too. (They also bought add-on at $85 for 16Kb.) What is it about the APPLE? Can we get one or at least a description? One thing was the graphics, and the ability to have color, even though they didn't buy the option.

3. They really want Word Processing on 11's to add to their existing systems. They are doing true word processing and really want it as opposed to SOS, TECO, and EDIT. It seems like if we could get a system put together here, we would have a great, instantaneous market everywhere. It is conceivable the DX11 package, together with the VT100 with the White Tornado gives us the best deal...namely, no new software (which has to withstand piracy, etc.) and best of all we sell a specialized terminal for it. They will also then want it to be applicable to all their old terminals, but that's life.

4. Most of all with Word Processing, they want a school they can send their secretaries to. They don't want to teach them, and they want to use the systems themselves, but mostly they want publication of papers and reports to continue in the same old fashion where the secretaries do the editing. Jack, you should get it together with the technical people... and the terminal may be the vehicle.

D I G I T A L INTEROFFICE MEMORANDUM

DIST: Dick Clayton ML12-2/E71 Gary Cole PK3-1
Jack Gilmore MK1-1/J14 Len Halio ML1-2/H26
John Leng MR1-1/A65 Roy Moffa ML1-2/H26
Joel Schwartz MR2-4/M51 Allan Wallack MR2-3/M84

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TO: GENE SPADI @WAOX

DATE: THU 5 MAY 1983 2:27 PM DST

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

cc: see "CC" DISTRIBUTION

MESSAGE ID: 5198965393

SUBJECT: HARVARD

GB5.34

Please get all necessary parties together and handle/settle this issue.

I will be away for a month commencing May 9 and want out of the

loop.
MJ is returning Prof. McKenney's call (495-2908) and apprising him of
the fact I will be away and that you will be in touch with him.

Copies of all correspondence to me on this matter are being sent to
you.

Thanks and good luck.

"CC" DISTRIBUTION:

SAM FULLER JAY HAIRE DIETER HUTTENBERGER
BERNIE LACROUTE MICHAEL POE @LTNX BOB TROCCHI
TOM WILLIAMS

WPS USERS - Leave HP mode and type <CR>

January 16, 1980

Anthony G. Oettinger
Harvard University
Program on Information Resources Policy
200 Aiken
Cambridge, MA 02138

Dear Tony:

Ken asked me to answer this. I've checked the list of attendees (enclosed). I'd think 15 should be the limit. I've looked at your paper. The taxonomy was interesting and should be published more widely. Why don't you use your taxonomy and see who's critical to cover it, relatively uniformly?

Given that a small, representative group is likely to produce better results, I'd say we should let IBM and CBEMA represent computing. I would like to see the <u>results</u> of the workshop made widely available. If this is not the case, then we might want to attend. If we are invited, the invitation could be sent to me.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:swh
GB2.S1.13

CC: Ken Olsen
Enclosure: Invitation List

July 19, 1979

Bevier Hasbrouck
314 Lafayette Avenue
Swarthmore, PA 19081

Dear Mr. Hasbrouck:

I've discussed the possibility of your submitting a scheme to us with Sam Fuller and we have agreed not to proceed with exploring your idea.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:swh
GB0004/16

July 19, 1979

Bevier Hasbrouck
314 Lafayette Avenue
Swarthmore, PA 19081

Dear Mr. Hasbrouck:

I've discussed the possibility of your submitting a scheme to

us with Sam Fuller and we have agreed not to proceed with exploring your idea.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:swh
GB0004/16

July 6, 1978

Dr. Harry G. Hedges
Member, Computer Science Board
Michigan State University
Computer Science Department
Computer Center
East Lansing, Michigan 48824

Dear Dr. Hedges:

Thank you for your kind offer, however, I don't think I could be away for four weeks (despite the fact that it would be very beneficial).

Several of us are finishing a book (due in September) on Computer Engineering in which we try to write most of what we know about computers -- even though it's just about DEC computers. The book might be useful, and it's possible that we might get the various contributors (e.g., Sam Fuller) from here to come and give their various viewpoints. The book has received many very good intermediate reviews, but it remains to be seen how it'll finally be received.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:ljp
ID#0153
November 24, 1981

Dr. Thomas M. McWilliams
5665 Bridgeport Circle
Livermore, CA 94550

Dear Dr. McWilliams:

Thanks for winning this prize... and making it possible to include me. The judges really made a wise choice.

Since your share looked proportionately small, I propose to hold the $500 and use it for a dinner account with you. I look forward to good eating on your account. Let me know when you'll be here next.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:mal
ID#GB3.S1.46

November 24, 1981

Mr. Wilson K. Talley
Fannie and John Hertz Foundation
P.O. Box 2230
Livermore, CA 94550

Dear Mr. Talley:

All I can say is thank you for making such a wise decision in selecting Tom. I too feel honored to be associated with him and to have received the honorarium.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

cc: Dr. Thomas McWilliams

GB:mal
ID#GB3.S1.45

HEURISTICS FOR BUILDING GREAT PRODUCTS

Products goodness is somewhat like pornography, it can't fully be described, but we're told people know it when they see it. There are lots of heuristics in the book, Computer Engineering. Since quality and competitive products must be our number one focus in these next generations, these heuristics are intended to help us. Only the five following need be attended to:

.a responsible, productive and creative engineering group;

- understanding product metrics (competitiveness);
- understanding the design constraints;
- knowing when to create new direction, when to evolve, and when to break with the past; and
- ability to get the product built and sold.

ENGINEERING GROUP

As a company whose management includes mostly engineers, we encourage engineering groups to form and design products. With this right of organizing, there are some responsibilities:

- basic notion of excellence and quality;
- understanding leadership who understands the product space and who has engineered successful products;
- having skills and disciplines required in the respective product area, eg. ergonometrics, acoustics, radiation, microprogramming, data bases, security, reliability;
- having skills on board to make the proposal so that we adhere to the cardinal rule of Digital, "He Who Proposes, Does"; Approving a plan, based on no implementers violates this.
- having open-ness, external reviews, clearly written descriptions of the product for inspection;
- as a corollary of being prepared with leadership and skills, we occasionally enter very new areas, requiring research and advanced development; Product commitment should not be made until fully operational breadboards exist.
- as a corollary, start up groups with no previous or poor previous track record, may need review.

PRODUCT METRICS

Since most of our products are evolutionary, engineering is responsible for knowing their product area, in terms of:

- major competitor cost, performance and functions together with what they will introduce over the next 5 years;
- leading edge, innovative small company product introductions.

DESIGN CONSTRAINTS

Design constraints such as acoustics, radiation, are basically useful because they limit choice of often trivial design decisions. We should meet the following design constraints, and if unacceptable, go about an orderly change:

.DEC Engineering Standards covering most physical structures and design practice for producibility; These assimilate the critical external standards such as VDE, and FCC as rapidly as possible.
.information processing and communications standards, such as Cobol, Codasyl, IEEE 488, EIA;
.information processing standards as determined by the key supplier, such as IBM SNA; For example, all eight versions of VISICALC we are implementing, should be compatible with external VISICALCs.
.the architecture of existing DEC products; For example, future editors should be compatible with the past editors, unless it can be shown experimentally that there is a significant (x2) benefit to change. These include:

> .ISPs of the 8, several 11's, 10/2, VAX-11, 8048, 8080 and are likely to include a 16-bit micro;
> .physical busses for interconnect; Fundamentally this insures that future products can evolve.
> .file, command language, human interface, calling sequence, screen/form management, keyboard, etc.

.we must not be undone by historically poor standards which constrain us to poor products; Currently, the 19" rack and the metal boxes we put in it, and then ship on pallets to our customers, act as constraints on building cost-effective PDP-11 Systems. This "mind set" standard is impeding our ability to produce products that meet the 20% cost decline. A target should be the shipment of systems in cardboard boxes which the customer assembles.
. ability to be implemented easily in any natural language, given that we are selling products in all countries.

WHEN TO CREATE A NEW PRODUCT DIRECTION OR WHEN TO EVOLVE THE OLD

Given all the constraints, can we ever create a new product, or is everything just an evolutionary extension of the past? Also do we know or care where product ideas come from? There are a whole set of places to look for products, but that's another set of heuristics, and the object of these heuristics is simplicity. The important aspect about product ideas is:

. Ideas must exist to have products!

It is hard to determine whether something is an evolution or just an extension. If you look at our family tree of products, like the one for our computing systems, and which every product group should have and maintain, the critically successful products all occur the second time around. Some examples: 6,KA,KI,KL,2080; Tops 10,Tenex,20; 5,8,8S,8I/L,8E/F/M; OS8-RT11; 11-20,40,34; RSX-A... M; TSS-8,RSTS; various versions of Fortran, Cobol and Basic all follow this; LA30,36,120; VT05,50/52,100; RK05,RL01/2.

Some heuristics in designing good products:

.all products whether they be revolutionary (we have yet to have any that are really in this category), or creating a new base, or evolutionary, should:

.offer at least a factor of two in terms of cost-effectiveness over a current product; If we build unique products that do not compete with ourselves, then we will have funds to build really good products.
.be based on an idea which will offer an attribute or set of attributes that no existing products have; For example, the goals and constraints for VAX included factor of two algorithm encoding and also offering ability to write a single program in multiple languages. VT100 got distinction by going to 132 columns and doing smooth scrolling.
.build in generality, and extensibiility; We have not, historically been sufficently able to predict how applications will evolve, hence generality and extensibility allow us and our customers to deal with changing needs. We have built several dead end

products with the intent of lower product cost, only to find that no one wants the particular collection of options. In reality, even the $200 calculators offer a familty of modular printer and mass storage options. For example, our 1-bit PDP-14 had no ability to do arithmetic or execute general purpose programs. As it began to be used, ad hoc extensions were installed to count, compare, etc. and it evolved into a digital computer.

.build complete systems, not piece parts. The total system is what the user sees. A word processing system for example includes: mass storage, keyboard, tube, mdoems, cpu, documentation including how to unpack it, the programs, table (if there is one, if not then the method of using at the customer table), and shipping boxes.

. a new product base, such as a new ISP, physical interconnection specification, Operating System, approach to building Office Products must:

.start a family tree for which we expect significant evolution to occur on, otherwise the investment for a point product is so short term and hence is likely to not payoff. In every case where we have successful evolutionary products, the successors are more successful than the first member of the family.

.a product family can evolve several ways as described on page 10 of Computer Engineering; The evolutionary paths are lower cost, and relatively constant performance; constant cost and higher performance; and higher cost and performance. In looking at our successful evolutions:

.lower cost products can't get by without adding functionality too, as in the VT100;

.constant cost, higher performance products are likely to be most useful, as economics of use are already established and a more powerful system such as the LA120 will allow more work to get done;

.a product evolution is likely to need termination after sucessive implementations, because new concepts in use have obsolesced its underlying structure. All structures decay with evolution, and the trick is to identify the last member of a family, such as the 132 column card, and then not build it. This holds for physical components, processors, terminals, mass storage, operating systems, languages and applications. Some of the signs of product obsolescence:

.it has been extended at least once, and future extensions render it virtually uninteligible; (For example, PDP-8 was extended three times.)
.significantly better products using other bases are available;

SELLING AND BUILDING THE PRODUCT
Buy in of the product can come at any time. However, if all the other rules are adhered to, there is no guarantee that it will be promoted, or that customers will find out about it and buy it. Some rules about selling it:

.it has to be producible and work; This, although seemingly trivial rule is often overlooked when explaining why a product is good or not.
.a business plan with orders and marketing plans from several marketing persons and groups needs to be in place; Just as it is unwise to depend on a single opinion in engineering for design and review, it is even more important that several different groups are intending to sell the product. Individual marketers are just as fallible as unchecked engineers.
.never build a product for a single customer, although a particular customer may be used as an archetype user. Predicating a product on a sale is the one sure way to fail!
.it should be done in a timely fashion according to the committed schedule, at the committed price and with the committed functions.

Now isn't it clear why building great products should be so easy?

Are there any heuristics that should be added? or are patently wrong? or need clarification?

Comments please!

GB2.S4.5

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.information processing standards as determined by the key supplier, such as IBM SNA; For example, all eight versions of VISICALC we are implementing, should be compatible with external VISICALCs.

.the architecture of existing DEC products; For example, future editors should be compatible with the past editors, unless it can be shown experimentally that there is a significant (x2) benefit to change. These include:

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.we must not be undone by historically poor standards which constrain us to poor products; Currently, the 19" rack and the metal boxes we put in it, and then ship on pallets to our customers, act as constraints on building cost-effective PDP-11 Systems. This "mind set" standard is impeding our ability to produce products that meet the 20% cost decline. A target should be the shipment of systems in cardboard boxes which the customer assembles.
. ability to be implemented easily in any natural language, given that we are selling products in all countries.

WHEN TO CREATE A NEW PRODUCT DIRECTION OR WHEN TO EVOLVE THE OLD

Given all the constraints, can we ever create a new product, or is everything just an evolutionary extension of the past? Also do we know or care where product ideas come from? There are a whole set of places to look for products, but that's another set of heuristics, and the object of these heuristics is simplicity. The important aspect about product ideas is:

. Ideas must exist to have products!

It is hard to determine whether something is an evolution or just an extension. If you look at our family tree of products, like the one for our computing systems, and which every product group should have and maintain, the critically successful products all occur the second time around. Some examples: 6,KA,KI,KL,2080; Tops 10,Tenex,20; 5,8,8S,8I/L,8E/F/M; OS8-RT11; 11-20,40,34; RSX-A... M; TSS-8,RSTS; various versions of Fortran, Cobol and Basic all follow this; LA30,36,120; VT05,50/52,100; RK05,RL01/2.

Some heuristics in designing good products:

.all products whether they be revolutionary (we have yet to have any that are really in this category), or creating a new base, or evolutionary, should:

- .offer at least a factor of two in terms of cost-effectiveness over a current product; If we build unique products that do not compete with ourselves, then we will have funds to build really good products.
- .be based on an idea which will offer an attribute or set of attributes that no existing products have; For example, the goals and constraints for VAX included factor of two algorithm encoding and also offering ability to write a single program in multiple languages. VT100 got distinction by going to 132 columns and doing smooth scrolling.
- .build in generality, and extensibiility; We have not, historically been sufficently able to predict how applications will evolve, hence generality and extensibility allow us and our customers to deal with changing needs. We have built several dead end products with the intent of lower product cost, only to find that no one wants the particular collection of options. In reality, even the $200 calculators offer a familty of modular printer and mass storage options. For example, our 1-bit PDP-14 had no ability to do arithmetic or execute general purpose programs. As it began to be used, ad hoc extensions were installed to count, compare, etc. and it evolved into a digital computer.
- .build complete systems, not piece parts. The total system is what the user sees. A word processing system for example includes: mass storage, keyboard, tube, mdoems, cpu, documentation including how to unpack it, the programs, table (if there is one, if not then the method of using at the customer table), and shipping boxes.

. a new product base, such as a new ISP, physical interconnection specification, Operating System, approach to building Office Products must:

- .start a family tree for which we expect significant evolution to occur on, otherwise the investment for a point product is so short term and hence is likely to not payoff. In every case where we have successful evolutionary products, the successors are more successful than the first member of the family.

.a product family can evolve several ways as described on page 10 of Computer Engineering; The evolutionary paths are lower cost, and relatively constant performance; constant cost and higher performance; and higher cost and performance. In looking at our successful evolutions:

.lower cost products can't get by without adding functionality too, as in the VT100;
.constant cost, higher performance products are likely to be most useful, as economics of use are already established and a more powerful system such as the LA120 will allow more work to get done;

.a product evolution is likely to need termination after sucessive implementations, because new concepts in use have obsolesced its underlying structure. All structures decay with evolution, and the trick is to identify the last member of a family, such as the 132 column card, and then not build it. This holds for physical components, processors, terminals, mass storage, operating systems, languages and applications. Some of the signs of product obsolescence:

.it has been extended at least once, and future extensions render it virtually uninteligible; (For example, PDP-8 was extended three times.)
.significantly better products using other bases are available;

SELLING AND BUILDING THE PRODUCT

Buy in of the product can come at any time. However, if all the other rules are adhered to, there is no guarantee that it will be promoted, or that customers will find out about it and buy it. Some rules about selling it:

.it has to be producible and work; This, although seemingly trivial rule is often overlooked when explaining why a product is good or not.

.a business plan with orders and marketing plans from several marketing persons and groups needs to be in place; Just as it is unwise to depend on a single opinion in engineering for design and review, it is even more important that several different groups are intending to sell the product. Individual marketers are just as fallible as unchecked engineers.

.never build a product for a single customer, although a particular customer may be used as an archetype user. Predicating a product on a sale is the one sure way to fail!

.it should be done in a timely fashion according to the committed schedule, at the committed price and with the committed functions.

Now isn't it clear why building great products should be so easy?

Are there any heuristics that should be added? or are patently wrong? or need clarification?

Comments please!

GB2.S4.5

HEURISTICS FOR BUILDING GREAT PRODUCTS

Product goodness is somewhat like pornography, it can't fully be described, but we're told people know it when they see it. If we can agree on heuristics about product goodness and how to achieve it - then we're clearly ahead. Five sets of dimensions for building good products need be attended to (roughly in order of importance):

- maintaining a responsible, productive and creative engineering group;
- understanding product metrics (competitiveness);
- understanding design goals and constraints;
- knowing when to create new directions, when to evolve products, and when to break with the past; and

. having the ability to get the product built and sold.

ENGINEERING GROUP

As a company whose management includes mostly engineers, we encourage engineering groups to form and design products. With this right of organizing, there are these responsibilities:

. staffing with a chief designer/chief programmer who will formulate and lead the resolution of the problems encountered in the design; no matter how large the project, it must be lead from a "single head".

. having the skills on board to make the proposal so that we adhere to the cardinal rule of Digital, "He Who Proposes, Does"; Approving a plan, without the chief designer and sound team violates this! The plan must include the project organization.

. having management and a technical team who understand the product space and who have engineered successful products;

. understanding excellence and quality;

. understanding the performance and the learning curves that apply to design, design production processes, and manufacturing processes; the organization must be staffed with people who understand the product, the design process (CAD and management discipline) and the production introduction process. For complex projects employing more than a single design team (less than six engineers), a written design methodology must exist and include: all design processes as documents forming the design, design conventions, conflict resolution, criteria for task completion, the PERT structure, etc.

. having supporting skills and disciplines required in the respective product areas, eg. ergonometrics, acoustics, radiation, microprogramming, data bases, security, reliability;

. being open by having external reviews, and clearly written descriptions of the product for inspection;

for new product areas, we require breadboards in addition to the above heuristics. When the product gestation time equals the generation time, a full advanced development effort is most likely required to be successful.

. a group with no previous achievement must start small, be reviewed and grow when it has demonstrated success;

. continuous training to handle the increase in complexity that comes with technology.

PRODUCT METRICS KNOWLEDGE

Engineering is responsible for knowing the product area:

. metrics (cost, cost of ownership, cost to operate and use); we have classic failures because a CPU cost has been minimized, only to find the total system cost has barely changed 10% and the total cost to the customer is only 5% lower!

. major competitor cost, performance and functions together with what they will introduce within 5 years;

. leading edge, innovative small company product introductions;

. reasons why the product will succeed against present and likely future competition; sure success in the market is to introduce a needed function (eg. 32-bit address) by which all other products have to be measured.

. productivity, quality and design process metrics by which the project can be managed.

DESIGN GOALS AND CONSTRAINTS

The most important heuristic about goals and constraints is that they be written down and updated from the day the project starts. Virtually every product failure and period of product floundering is a result of no clear goals and constraints since everyone has a different idea of the product.

Design constraints are generally set as various kinds of standards. These are useful because they limit the choice of often trivial design decisions, and let us deal with the free choices. Goals are equally important. We should meet the standards unless they are unacceptable, and if so go about an orderly change. Standards can be grouped into four distinct sets:

. DEC Engineering Standards; These cover most physical structures and design practice for producibility, and assimilate critical external standards, such as UL, VDE, and FCC.

. official information processing and communications standards, from EIA, CBEMA, ANSI, ISO etc. such as Cobol '74, Codasyl, IEEE 488;

. defacto industry wide information processing and communication standards such as IBM SNA, Visicalc;

. standards implied by the architecture of existing DEC products:

  .architecture of computers, terminals, mass store and communications links; these include 8, 11's, 10/20, VAX, 8048, 8080, 8086, 68000; VT52, VT100, keyboards, Regis; MCP; HDLC, CI, SI.
  .physical interconnect busses such as CT, Q, U, NI, CI, etc. These insure that future system products can evolve from component or computer options.
  .operating system interface file commands, command language, human interface, calling sequence, screen/form management, keyboard, etc.

. These insure our customer software investment is preserved.

. Products must be designed for easy translation into in any natural language since we are an international company.

. In all cases, poor standards create to poor products, even though they may have made sense at one point of time. The historical English measures is a good case in point; Currently, the 19" rack and the metal boxes Digital makes to fit in them, and then ship on pallets to customers, act as constraints on building cost-effective PDP-11 Systems. This historical "mind set" standard is impeding the ability to produce products that meet the 20% cost decline. All products must have the goal of customer installability and maintainability.

WHEN TO CREATE AND WHEN TO EVOLVE

Given all the constraints, can we ever create a new product, or is everything just an evolutionary extension of the past? If revolutionary do we know or care where product ideas come from? The important aspect about product ideas is:

. Ideas must exist to have products! If we don't have innovative ideas to redefine or extend a market, then we should not bother building a product.

It is hard to determine whether something is an evolution or just an extension. The critically successful products all occur the second time around. Some examples: PDP 6,KA10,KI10,KL10,2080; Tops 10,Tenex,TOPS20; PDP5,8,8S,8I/L,8E/F/M; OS8-RT11; 11/20,40,34; RSX-A... M, M+; TSS-8,RSTS; various versions of Fortran, Cobol and Basic all follow this; LA30,36,120; VT05,50/52,100, 101 etc.; RK05,RL01/2.
A product tree showing product roots, gestation time and product life should be maintained by each engineering group.

GOODNESS

. All products whether they be revolutionary, creating a new base, or evolutionary, should:

. <u>offer at least a factor of two in terms of cost-effectiveness over a current product</u>; if each product is unique (not in competition with other products within the company), then we will have funds to build really good products.

. <u>be based on an idea which will offer an attribute or set of attributes that no existing products have</u>; For example, the goals and constraints for VAX included factor of two algorithm encoding and also offering ability to write a single program in multiple languages. VT100 got distinction by going to 132 columns and doing smooth scrolling.

. <u>build in generality, and extensibility;</u> Historically we have not been sufficiently able to predict how applications will evolve, hence generality and extensibility allow us and our customers to deal with changing needs. We have built several dead end products with the intent of lower product cost, only to find that no one wants the particular collection of options. In reality, even the $200 calculators offer a family of modular printer and mass storage options. For example, our 1-bit PDP-14 had no ability to do arithmetic or execute general purpose programs. As it began to be used, ad hoc extensions were installed to count, compare, etc. and it finally evolved into a really poor general purpose digital computer.

.

<u>be a complete system, not piece parts</u>; The total system is what the user sees. A word processing system for example includes: mass storage, keyboard, tube, modems, cpu, documentation including how to unpack it, the programs, table (if there is one, if not then the method of using at the customer table), and shipping boxes. All to often we evolve a product because the CPU and memory cost has declined only to find the system cost has decreased only a few percent.

<u>Product Evolution</u>

. A product family evolution is described on page 10 of Computer Engineering along the paths of lower cost, and relatively constant performance; constant cost and higher performance; and higher cost and performance. In looking at our successful evolutions:

. <u>lower cost products require additional</u> <u>functionality too</u>, as in the VT100;
. <u>constant cost, higher performance products are likely to be the most useful</u>, as economics of use are already established and a more powerful system such as the LA120 will allow more work to get done;

<u>Revolutionary New Product Bases</u>

. Good system products can only exist if we have good components. We should not depend on system markups and functionality to cover poor components and high overhead.
. We must carefully decide what components to make versus buy. It is very hard for an organization to be competitive without competing in the marketplace, hence unless we sell it, we should buy it.
. a new product base, such as a new ISP, physical interconnection specification, an Operating System, approach to building Office Products, must:

. <u>start a family tree from which significant evolution can occur</u>; The investment for a point product is so high that the product is very likely not to payoff. In every case where we have successful evolutionary products, the successors are more successful than the first member of the family.

<u>Product Termination</u>

. A product evolution is likely to need termination after successive implementations, because new concepts in use have obsoleted its underlying structure. All structures decay with evolution, and the trick is to identify the last member of a family, such as the 132 column card, and then not build it. This holds for physical components, processors, terminals, mass storage, operating systems, languages and applications. Some of the signs of product obsolescence:

.it has been extended at least once, and future extensions render it virtually unintelligible; (For example, PDP-8 was extended three times.)
.significantly better products using other bases are available;

SELLING AND BUILDING THE PRODUCT

Buy in of the product can come at any time. However, if all the other rules are adhered to, there is no guarantee that it will be promoted, or that customers will find out about it and buy it. Some rules about selling it:

. it has to be producible and work; this, although seemingly trivial rule is often overlooked when explaining why a product is good or not.
. a business plan with orders and marketing plans from several marketing persons and groups needs to be in place; just as it is unwise to depend on a single opinion in engineering for design and review, it is even more important that several different groups are intending to sell the product. individual marketers are

just as fallible as unchecked engineers.

. never build a product for a single customer, although a particular customer may be used as an archetype user; predicating a product on one sale is the one sure way to fail!

. it should be done in a timely fashion according to the committed schedule, at the committed price and with the committed functions;

. it must be understandable and easy to use. The small size, complete hardware books were the DEC trademark that established the minicomputer. We must revive these such that a particular user never need access more than one. Simplicity must be the rule for our documentation.

Now isn't it clear why building great products should be so easy?

Are there any heuristics that should be added? deleted? or need clarification?

GB2.S4.5
GB3.S1.61

Preliminary Draft for Comment by Digital Engineering Community

HEURISTICS AND COMMENTS FOR BUILDING GREAT PRODUCTS

Gordon Bell, Vice President, Engineering

Product goodness is somewhat like pornography, it can't fully be described, but we're told people know it when they see it. If we can agree on heuristics about product goodness and how to achieve it - then we're clearly ahead. Five sets of dimensions for building great products need be attended to (roughly in order of importance):

. a responsible, productive and creative engineering group;

. product and design metrics (competitiveness);

. design goals and constraints;

. product evolution, revolution and death; and

. the ability to get the product built and sold.

ENGINEERING GROUP

As a company managed primarily by engineers, groups are encouraged to form and design products. With this right, are responsibilities.

The Team must have:

- a chief designer/chief programmer to formulate and lead the resolution of the problems encountered in the design; No matter how large the project, it must be lead from a "single head". We often make two errors in leadership: having no clear technical leader/problem resolver, and abdicating to a committee.

  Committees do not do design! They are never held responsible, nor are they rewarded or punished. Committees can review.

- management who understand the product space and who has engineered successful products; The two most important jobs are:

  - making sure that everyone knows their job; and

  - setting and reviewing work on a timely basis, ie. MBO.

- team skills and resources to implement the proposal so that we adhere to the cardinal rule of Digital, "He Who Proposes, Does"; A plan must include the chief designer, team, project organization and resources (eg. computers). Supporting skills and disciplines are essential in the respective product areas, eg. ergonometrics, acoustics, radiation, microprogramming, data bases, security, reliability.

- an understanding of the design, design production (eg. CAD) processes, and manufacturing processes; Learning curves apply to all processes! The organization must be staffed with people who understand the product, the design process (CAD and management discipline) and the production introduction process. One or two out of three isn't enough.

Behaviorally, the team must:

. do it right the first time; Being correct has the highest payoff everywhere: timeliness, quality, lack of rework, and mfg. cost.

. execute the project in a timely fashion; Virtually ALL of our projects are late because we start too late, don't get it done on time because some critical invention is required, take too long to get it introduced, etc. For the very long, very late projects, the failure is lack of planning, tools and organization. Finally, people burn out. This suggests we:

  . limit projects to two years by a small team. We often make an aggressive business plan, then hire the team. They then find out they have neither tools nor technology to do the project.

  . not predicate a project on scheduling inventions in the design, process and CAD areas. If we can't see how to do the work in 2 years, then let's not start the project! This means the product must be cut down to fit the tools, people and process. Advanced developement is to insure that we can do development.

. have a written design methodology that includes: all design processes in the form of manuals, design conventions, conflict resolution, criteria for task completion, PERT structure, etc.;

. be open and have external reviews, and clearly written product d

breadboards in addition to the above heuristics. When the product gestation time equals the generation time, a full advanced development effort is the only way to be successful.

. start small, be reviewed and grow on its demonstrated success;

. learn, in order to handle the increase in complexity that comes with technology. Until there's a formal sabbatical program, individuals would do well to consider taking the equivalent of a semester of technical courses each 10 years.

PRODUCT METRICS KNOWLEDGE includes:

. products for which there'll be no competitor;

. all product cost metrics (cost, cost of ownership, cost to operate and use);

. all product performance and cost/performance metrics; These are the goodness measures of a product and tell how easily it will be to sell, and if we have improved. Cost and performance is measured against a state-of-the-art line represented by the first shipment of a more advanced product. Alternatively, when there's no direct comparison, the time goodness is determined from the day the product could have shipped. For example, because of parts availability, Nebula and CT could have shipped two and three years ago based on component availability.

- reasons why the product will succeed against present and likely future competition; sure success in the market is to introduce a needed function (eg. 32-bit address) by which all other products have to be measured.
- major competitor products by cost, performance and functionality; This should cover the past and future five years.
- leading edge, innovative, small company products;
- productivity, quality and design process metrics for projects.

DESIGN GOALS AND CONSTRAINTS

Design constraints are generally set as various kinds of standards. These are useful because they limit the choice of often trivial design decisions, and let us deal with important free choices, the goals. Goals are vitally important because they target our uniqueness.

Poor "mind-set" standards can create poor products, even though they may have made sense at one time. The historical English measures is a good case in point. Currently, the 19" rack and the metal boxes Digital makes to fit in them, and then ship on pallets to customers, act as constraints on building cost-effective PDP-11 Systems. This historical "mind set" standard often impedes the ability to produce products that meet the 20% per year cost decline curve.

- Goals and constraints must be written down and updated from the day the project starts. Virtually every product failure and period of product floundering is a result of no clear goals and constraints since everyone has a different idea of the product.
- A product can only have a few goals and constraints. The ranking is usually: it must work and have improved cost of ownership, be the shortest time to market, highest performance and lowest cost.

We must adhere to standards which we either follow or set!

- <u>If a standard exists, follow it or change it for all!</u> We lost the IEEE Floating Point format. It is likely we will eventually have to support it.

- <u>If a standard is forming go all out to set it.</u> When formed, then follow it. We didn't make DDCMP a standard. When HDLC came, we didn't use it. The result: expensive, low performance products.

Standards can be grouped into four distinct sets:

- DEC Engineering Standards; These cover most physical structures and design practice for producibility, and assimilate critical external standards, such as UL, VDE, and FCC.

- professional society, industry and area information processing standards, from EIA, CBEMA, ECMA, ANSI, ISO etc. such as Cobol '74, Codasyl, IEEE 488;

- defacto industry wide information processing and communication standards such as IBM SNA, Visicalc;

- standards implied by the architecture of existing DEC products to insure our customer software investments are preserved include:

  - architecture of computers, terminals, mass store and communications links; Our current ISP's include 8, 11's, 10/20, VAX, 8048, 8080, 8086, 68000; VT52, VT100, keyboards, Regis; MCP; HDLC, CI, NI, SI.

  - physical interconnect busses for computers and for interconnecting them CT, Q, U, NI, CI, etc. These insure that future system products can evolve from component and computer options between generations.

  - operating system interface file commands, command language, human interface, calling sequence, screen/form management, keyboard, etc.

- <u>Products must be designed for easy translation into in any natural language since we are an international company.</u>

- <u>All products must have be customer installable and maintainable.</u>

- <u>Portability is an important goal.</u> Personal computers must be portable! We must achieve this for all systems ASAP!

WHEN TO CREATE, WHEN TO EVOLVE AND WHEN TO STOP PRODUCTS

Engineering is responsible for designing evolutionary products in our markets AND for producing products that are natural to our tradition of supplying the most interactive, cost-effective computing. If a new product such as personal computing emerges and we do not have a product, engineering has failed, independent of being asked for it!

Given all the constraints, can we ever create a new product, or is everything just an evolutionary extension of the past? If revolutionary do we know or care where product ideas come from? The important aspect about product ideas is:

. Ideas must exist to have products! If we don't have ideas to redefine or extend a market, then we should not build a product.

It is hard to determine whether something is an evolution or just an extension. The critically successful products are likely to occur the second time around. Some examples: PDP 6,KA10,KI10,KL10,2080; Tops 10,Tenex,TOPS20; PDP5,8,8S,8I/L,8E/F/M; OS8-RT11; 11/20,40,34,44; RSX-A... M, M+; TSS-8,RSTS; various versions of Fortran, Cobol and Basic follow this; LA30,36,120; VT05,50/52,100, 101 etc.; RK05,RL01/2.

. A product tree MUST be maintained by each engineering group showing roots, gestation time and life.

Goodness and Greatness

All products whether they be revolutionary, creating a new base, or evolutionary, should:

. be elegant and high quality; Russ Doane's working definition is: "every feature contributes two benefits", like a double pun. Quality means no excess. Elegant, high quality designs, do double duty with a minimum use of resources. Quality is also the absence of errors, by being right the first time so that it doesn't have to be inspected or redone.

. offer at least a factor of two in terms of cost-effectiveness over a current product; We have classic failures because a CPU cost has been minimized, only to find the total system cost has barely changed 10% and the total cost to the customer is only 5%

lower! If each product is unique then we will have funds to build good products.

. be based on an idea which will offer an attribute or set of attributes that no existing products have; For example, the goals and constraints for VAX included factor of two algorithm encoding and also offering ability to write a single program in multiple languages. VT100 got distinction by offering 132 columns and smooth scrolling.

. build in generality, and extensibility; Historically we have not been sufficiently able to predict how applications will evolve, hence generality and extensibility allow us and our customers to deal with changing needs. Extendable products also permit mid-life kickers to products. We have built several dead end products with the intent of lower product cost, only to find that no one wants the particular collection of options. In reality, even the $200 calculators offer a family of modular printer and mass storage options. For example, our 1-bit PDP-14 had no arithmetic ability, nor could it be a general purpose computer. As customers used it, ad hoc extensions were needed to count, compare, etc. and it finally evolved into a really poor, general purpose digital computer.

. be a complete system, not piece parts; The total system is what the user sees. A word processing system for example includes: memory, keyboard, tube, modems, cpu, documentation including how to unpack it, the programs, table (if there is one, if not then the method of using at the customer table), and shipping boxes.

. be a great system because the components are great; We should not depend on system markups and software functionality to cover poor components and high overhead.

.if we don't make it, buy it; We must carefully decide what

components to make versus buy. It is very hard for an organization to be competitive without competing in the marketplace, hence unless we sell it, we should buy it.

Product Evolution

A product family evolution is described on page 10 of Computer Engineering along the paths of lower cost, and relatively constant performance; constant cost and higher performance; and higher cost and performance. In looking at our successful evolutions:

. lower cost products require additional functionality too; A lower cost product, with constant performance or constant function is risky because a new customer base and new way of marketing may be required. Some other company may, however, be successful with the concept. The PDP-8, based on new technology, was radically more successful than its higher priced predecessor, the PDP-5, because it was 2/3 the price and 6 times more performance. The PDP-8/S was a failure at 2/3 the price and 15 less performance than the PDP-8. There are similar stories about the LA 34, VT50/52 and PDT as replacement products.

. constant cost, higher performance products are likely to be the most useful; Economics of use, the marketing channel and customer base are already established and a more powerful system such as the LA120 will allow higher productivity (see Computer Engineering for the understanding and economics). In the 11's there was a successful evolution: 20, 40, 34 anChied 44. Not the 60. The 11/70 was probably our greatest success; it was billed as a mid-life kicker to the 11/45-55.

Revolutionary New Product Bases

. A new product base, such as a new ISP, physical interconnection, Operating System, approach to building Office Products, must start a family tree from which significant evolution can occur. The investment for a point product is so high that the product is very likely not to payoff. In every case where we have successful evolutionary products, the successors are more successful than the first member of the family. Point products with no follow-on will probably fail all roi tests.

Product Termination

. A product evolution is likely to need termination after successive implementations, because new concepts in use have obsoleted its underlying structure. All structures decay with evolution, and the trick is to identify the last member of a family, such as the 132 column card, and then not build it. This holds for physical components, processors, terminals, mass storage, operating systems, languages and applications. Some of the signs of product obsolescence:

. It has been extended at least once, and future extensions render it virtually unintelligible.

. Better products using other bases are available.

SELLING AND BUILDING THE PRODUCT

"Buy in" of the product can come at any time. However, if all the other rules are adhered to, there is no guarantee that it will be promoted, or that customers will find out about it and buy it. Some rules about selling it:

. it has to be producible and work, AND be useful to software; This, although seemingly trivial rule, is often overlooked when explaining why a product is good or not. If it is a piece of hardware that requires software to support it, the hardware must be available to the programmers who must support it. Software engineers approach new hardware with much caution! The often ask: is it significant? is it needed? why isn't it compatible with the past? If a hardware is viewed with distrust by software engineers it may be met with the same distrust by customers!

. a business plan with orders and marketing plans from several marketing persons and groups needs to be in place; Just as it is unwise to depend on a single opinion in engineering for design and review, it is even more important that several different groups are intending to sell the product. Individual marketers are just as fallible as unchecked engineers. This rule can and must be violated for revolutionary products!

. never build a product for a single customer, although a particular customer may be used as an archetype user; predicating a product on one sale is the one sure way to fail! Paraphrasing a remark by former GM executive Charles Wilson: if it's good for General Motors, it may only be good for GM.

. it must be done in a timely fashion according to the committed schedule, price and functions as previously described;

. it must be understandable and easy to use. The small size, complete hardware books were the DEC trademark that established the minicomputer. We must revive these such that a particular user never need access more than one. Simplicity must be the rule for our documentation.

What heuristics are missing? What heuristics do you disagree with?

What heuristics could be removed? reordered?

Could I please have your feedback before this becomes a final draft?

3/15/82 Mon 8:47

GB3.S2.5

Preliminary Draft for Comment by Digital Engineering Community

HEURISTICS AND COMMENTS FOR BUILDING GREAT PRODUCTS

Gordon Bell, Vice President, Engineering

Product goodness is somewhat like pornography, it can't fully be described, but we're told people know it when they see it. If we can agree on heuristics about product goodness and how to achieve it - then we're clearly ahead. Five sets of dimensions for building great products need be attended to (roughly in order of importance):

. a responsible, productive and creative engineering group;

. product and design metrics (competitiveness);

. design goals and constraints;

. product evolution, revolution and death; and . the ability to get the product built and sold.

ENGINEERING GROUP

As a company managed primarily by engineers, groups are encouraged to form and design products. With this right, are responsibilities.

<u>The</u> <u>Team</u> must have:

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Behaviorally, the team must:

.do it right the first time; Being correct has the highest payoff everywhere: timeliness, quality, lack of rework, and mfg. cost.

. execute the project in a timely fashion; Virtually ALL of our projects are late because we start too late, don't get it done on time because some critical invention is required, take too long to get it introduced, etc. For the very long, very late projects, the failure is lack of planning, tools and organization. Finally, people burn out. This suggests we:

.limit projects to two years by a small team. We often make an aggressive business plan, then hire the team. They then find out they have neither tools nor technology to do the project.

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. have a written design methodology that includes: all design processes in the form of manuals, design conventions, conflict resolution, criteria for task completion, PERT structure, etc.;

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PRODUCT METRICS KNOWLEDGE includes:

. products for which there'll be no competitor;

. all product cost metrics (cost, cost of ownership, cost to operate and use);

.all product performance and cost/performance metrics; These are the goodness measures of a product and tell how easily it will be to sell, and if we have improved. Cost and performance is measured against a state-of-the-art line represented by the first shipment of a more advanced product. Alternatively, when there's no direct comparison, the time goodness is determined from the day the product could have shipped. For example, because of parts availability, Nebula and CT could have shipped two and three years ago based on component availability.

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DESIGN GOALS AND CONSTRAINTS

Design constraints are generally set as various kinds of standards.

These are useful because they limit the choice of often trivial design decisions, and let us deal with important free choices, the goals.

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Poor "mind-set" standards can create poor products, even though they may have made sense at one time. The historical English measures is a good case in point. Currently, the 19" rack and the metal boxes

Digital makes to fit in them, and then ship on pallets to customers, act as constraints on building cost-effective PDP-11 Systems. This historical "mind set" standard often impedes the ability to produce products that meet the 20% per year cost decline curve.

. Goals and constraints must be written down and updated from the day the project starts. Virtually every product failure and period of product floundering is a result of no clear goals and constraints since everyone has a different idea of the product.

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.If a standard exists, follow it or change it for all! We lost the IEEE Floating Point format. It is likely we will eventually have to support it.

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.architecture of computers, terminals, mass store and communications links; Our current ISP's include 8, 11's, 10/20, VAX, 8048, 8080, 8086, 68000; VT52, VT100, keyboards, Regis; MCP; HDLC, CI, NI, SI.

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Engineering is responsible for designing evolutionary products in our markets AND for producing products that are natural to our tradition of supplying the most interactive, cost-effective computing. If a new product such as personal computing emerges and we do not have a product, engineering has failed, independent of being asked for it!

Given all the constraints, can we ever create a new product, or is everything just an evolutionary extension of the past? If revolutionary do we know or care where product ideas come from? The important aspect about product ideas is:

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It is hard to determine whether something is an evolution or just an extension. The critically successful products are likely to occur the second time around. Some examples: PDP 6,KA10,KI10,KL10,2080; Tops 10,Tenex,TOPS20; PDP5,8,8S,8I/L,8E/F/M; OS8-RT11; 11/20,40,34,44;

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A product family evolution is described on page 10 of Computer

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SELLING AND BUILDING THE PRODUCT

"Buy in" of the product can come at any time. However, if all the other rules are adhered to, there is no guarantee that it will be promoted, or that customers will find out about it and buy it. Some rules about selling it:

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HEURISTICS AND COMMENTS FOR BUILDING GREAT PRODUCTS

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- a responsible, productive and creative engineering group;
- product and design metrics (competitiveness);
- design goals and constraints;
- product evolution, revolution and death; and
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<u>Behaviorally</u>, the team must:

. <u>do it right the first time;</u> Being correct has the highest payoff everywhere: timeliness, quality, lack of rework, and mfg. cost.

. <u>execute the project in a timely fashion;</u> Virtually ALL of our projects are late because we start too late, don't get it done on time because some critical invention is required, take too long to get it introduced, etc. For the very long, very late projects, the failure is lack of planning, tools and organization. Finally, people burn out. This suggests we:

  . <u>limit projects to two years by a small team.</u> We often make an aggressive business plan, then hire the team. They then find out they have neither tools nor technology to do the project.

  . <u>not predicate a project on scheduling inventions in the design, process and CAD areas.</u> If we can't see how to do the work in 2 years, then let's not start the project! This means the product must be cut down to fit the tools, people and process. Advanced developement is to insure that we can do development.

. <u>have a written design methodology</u> that includes: all design processes in the form of manuals, design conventions, conflict resolution, criteria for task completion, PERT structure, etc.;

. be open and have external reviews, and clearly written product descriptions for inspection;

For new product areas, we require breadboards in addition to the above heuristics. When the product gestation time equals the generation time, a full advanced development effort is the only way to be successful.

. start small, be reviewed and grow on its demonstrated success;

. learn, in order to handle the increase in complexity that comes with technology. Until there's a formal sabbatical program, individuals would do well to consider taking the equivalent of a semester of technical courses each 10 years.

PRODUCT METRICS KNOWLEDGE includes:

. products for which there'll be no competitor;

. all product cost metrics (cost, cost of ownership, cost to operate and use);

. all product performance and cost/performance metrics; These are the goodness measures of a product and tell how easily it will be to sell, and if we have improved. Cost and performance is measured against a state-of-the-art line represented by the first shipment of a more advanced product. Alternatively, when there's no direct comparison, the time goodness is determined from the day the product could have shipped. For example, because of parts availability, Nebula and CT could have shipped two and three years ago based on component availability.

. reasons why the product will succeed against present and likely future competition; sure success in the market is to introduce a needed function (eg. 32-bit address) by which all other products have to be measured.

. major competitor products by cost, performance and functionality; This should cover the past and future five years.

. leading edge, innovative, small company products;

. productivity, quality and design process metrics for projects.

DESIGN GOALS AND CONSTRAINTS

Design constraints are generally set as various kinds of standards. These are useful because they limit the choice of often trivial design decisions, and let us deal with important free choices, the goals. Goals are vitally important because they target our uniqueness.

Poor "mind-set" standards can create poor products, even though they may have made sense at one time. The historical English measures is a good case in point. Currently, the 19" rack and the metal boxes Digital makes to fit in them, and then ship on pallets to customers, act as constraints on building cost-effective PDP-11 Systems. This historical "mind set" standard often impedes the ability to produce products that meet the 20% per year cost decline curve.

- Goals and constraints must be written down and updated from the day the project starts. Virtually every product failure and period of product floundering is a result of no clear goals and constraints since everyone has a different idea of the product.
- A product can only have a few goals and constraints. The ranking is usually: it must work and have improved cost of ownership, be the shortest time to market, highest performance and lowest cost.

We must adhere to standards which we either follow or set!

- If a standard exists, follow it or change it for all! We lost the IEEE Floating Point format. It is likely we will eventually have to support it.
- If a standard is forming go all out to set it. When formed, then follow it. We didn't make DDCMP a standard. When HDLC came, we didn't use it. The result: expensive, low performance products.

Standards can be grouped into four distinct sets:

- DEC Engineering Standards; These cover most physical structures and design practice for producibility, and assimilate critical external standards, such as UL, VDE, and FCC.
- professional society, industry and area information processing standards, from EIA, CBEMA, ECMA, ANSI, ISO etc. such as Cobol '74, Codasyl, IEEE 488;

. defacto industry wide information processing and communication standards such as IBM SNA, Visicalc;

. standards implied by the architecture of existing DEC products to insure our customer software investments are preserved include:

  . architecture of computers, terminals, mass store and communications links; Our current ISP's include 8, 11's, 10/20, VAX, 8048, 8080, 8086, 68000; VT52, VT100, keyboards, Regis; MCP; HDLC, CI, NI, SI.

  . physical interconnect busses for computers and for interconnecting them CT, Q, U, NI, CI, etc. These insure that future system products can evolve from component and computer options between generations.

  . operating system interface file commands, command language, human interface, calling sequence, screen/form management, keyboard, etc.

. <u>Products must be designed for easy translation into in any natural language since we are an international company.</u>

. <u>All products must have be customer installable and maintainable.</u>

. <u>Portability is an important goal.</u> Personal computers must be portable! We must achieve this for all systems ASAP!

WHEN TO CREATE, WHEN TO EVOLVE AND WHEN TO STOP PRODUCTS

Engineering is responsible for designing evolutionary products in our markets AND for producing products that are natural to our tradition of supplying the most interactive, cost-effective computing. If a new product such as personal computing emerges and we do not have a product, engineering has failed, independent of being asked for it!

Given all the constraints, can we ever create a new product, or is everything just an evolutionary extension of the past? If revolutionary do we know or care where product ideas come from? The important aspect about product ideas is:

. <u>Ideas must exist to have products</u>! If we don't have ideas to redefine or extend a market, then we should not build a product.

It is hard to determine whether something is an evolution or just an extension. The critically successful products are likely to occur the second time around. Some examples: PDP 6,KA10,KI10,KL10,2080; Tops 10,Tenex,TOPS20; PDP5,8,8S,8I/L,8E/F/M; OS8-RT11; 11/20,40,34,44; RSX-A... M, M+; TSS-8,RSTS; various versions of Fortran, Cobol and Basic follow this; LA30,36,120; VT05,50/52,100, 101 etc.; RK05,RL01/2.

- A product tree MUST be maintained by each engineering group showing roots, gestation time and life.

Goodness and Greatness = NO CRAPPY PRODUCTS!
All products whether they be revolutionary, creating a new base, or evolutionary, should:

- be elegant and high quality; Russ Doane's working definition is: "every feature contributes two benefits", like a double pun. Quality means no excess. Elegant, high quality designs, do double duty with a minimum use of resources. Quality is also the absence of errors, by being right the first time so that it doesn't have to be inspected or redone.
- offer at least a factor of two in terms of cost-effectiveness over a current product; We have classic failures because a CPU cost has been minimized, only to find the total system cost has barely changed 10% and the total cost to the customer is only 5% lower! If each product is unique then we will have funds to build good products.
- be based on an idea which will offer an attribute or set of attributes that no existing products have; For example, the goals and constraints for VAX included factor of two algorithm encoding and also offering ability to write a single program in multiple languages. VT100 got distinction by offering 132 columns and smooth scrolling.
- build in generality, and extensibility; Historically we have not been sufficiently able to predict how applications will evolve, hence generality and extensibility allow us and our customers to deal with

changing needs. Extendable products also permit mid-life kickers to products. We have built several dead end products with the intent of lower product cost, only to find that no one wants the particular collection of options. In reality, even the $200 calculators offer a family of modular printer and mass storage options. For example, our 1-bit PDP-14 had no arithmetic ability, nor could it be a general purpose computer. As customers used it, ad hoc extensions were needed to count, compare, etc. and it finally evolved into a really poor, general purpose digital computer.

- be a complete system, not piece parts; The total system is what the user sees. A word processing system for example includes: memory, keyboard, tube, modems, cpu, documentation including how to unpack it, the programs, table (if there is one, if not then the method of using at the customer table), and shipping boxes.
- be a great system because the components are great; We should not depend on system markups and software functionality to cover poor components and high overhead.
- if we don't make it, buy it; We must carefully decide what components to make versus buy. It is very hard for an organization to be competitive without competing in the marketplace, hence unless we sell it, we should buy it.

Product Evolution

A product family evolution is described on page 10 of Computer Engineering along the paths of lower cost, and relatively constant performance; constant cost and higher performance; and higher cost and performance. In looking at our successful evolutions:

- lower cost products require additional functionality too; A lower cost product, with constant performance or constant function is risky because a new customer base and new way of marketing may be required. Some other company may, however, be successful with the concept. The PDP-8, based on new technology, was radically more successful than its higher priced predecessor, the PDP-5, because it was 2/3 the price and 6 times more performance. The PDP-8/S was a failure at 2/3 the price and 15 less performance than the PDP-8. There are similar stories about the LA 34, VT50/52 and PDT as replacement products.

. <u>constant cost, higher performance products are likely to be the most useful</u>; Economics of use, the marketing channel and customer base are already established and a more powerful system such as the LA120 will allow higher productivity (see Computer Engineering for the understanding and economics). In the 11's there was a successful evolution: 20, 40, 34 anChied 44. Not the 60. The 11/70 was probably our greatest success; it was billed as a mid-life kicker to the 11/45-55.

<u>Revolutionary New Product Bases</u>

. <u>A new product base,</u> such as a new ISP, physical interconnection, Operating System, approach to building Office Products, <u>must start a family tree from which significant evolution can occur.</u> The investment for a point product is so high that the product is very likely not to payoff. In every case where we have successful evolutionary products, the successors are more successful than the first member of the family. Point products with no follow-on will probably fail all roi tests.

<u>Product Termination</u>

. <u>A product evolution is likely to need termination after successive implementations, because new concepts in use have obsoleted its underlying structure.</u> All structures decay with evolution, and the trick is to identify the last member of a family, such as the 132 column card, and then not build it. This holds for physical components, processors, terminals, mass storage, operating systems, languages and applications. Some of the signs of product obsolescence:

. It has been extended at least once, and future extensions render it virtually unintelligible.

. Better products using other bases are available.

SELLING AND BUILDING THE PRODUCT

"Buy in" of the product can come at any time. However, if all the other rules are adhered to, there is no guarantee that it will be promoted, or that customers will find out about it and buy it. Some rules about selling it:

- <u>it has to be producible and work, AND be useful to software;</u> This, although seemingly trivial rule, is often overlooked when explaining why a product is good or not. If it is a piece of hardware that requires software to support it, the hardware must be available to the programmers who must support it. Software engineers approach new hardware with much caution! The often ask: is it significant? is it needed? why isn't it compatible with the past? If a hardware is viewed with distrust by software engineers it may be met with the same distrust by customers!
- <u>a business plan with orders and marketing plans from several marketing persons and groups needs to be in place</u>; Just as it is unwise to depend on a single opinion in engineering for design and review, it is even more important that several different groups are intending to sell the product. Individual marketers are just as fallible as unchecked engineers. This rule can and must be violated for revolutionary products!
- <u>never build a product for a single customer</u>, although a particular customer may be used as an archetype user; predicating a product on one sale is the one sure way to fail! Paraphrasing a remark by former GM executive Charles Wilson: if it's good for General Motors, it may only be good for GM.
- <u>it must be done in a timely fashion</u> according to the committed schedule, price and functions as previously described;
- <u>it must be understandable and easy to use</u>. The small size, complete hardware books were the DEC trademark that established the minicomputer. We must revive these such that a particular user never need access more than one. Simplicity must be the rule for our documentation.

What heuristics are missing? What heuristics do you disagree with?

What heuristics could be removed? reordered?

Could I please have your feedback before this becomes a final draft?

3/13/82 Sat 19:47:01 GB3.S2.5
****
* d i g i t a l *
****

TO: PETER VAN ROEKENS DATE: THU 28 FEB 1980 1:35 PM EST
FRANK HASSETT FROM: GORDON BELL
cc: see "CC" DISTRIBUTION DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1 A51

SUBJECT: HG, OR HGII

Given the slips in Hg, and the inevitability of HgII (Hg on an NI), should we reconsider Hg and go straight for HgII? This is more in line with DMC - based breadboard.

Also, why shouldn't MR contract (bid) to build it, given their experience in concentrators?

GB:swh
GB1.S2.35

"CC" DISTRIBUTION:

TOMAS LOFGREN BILL STRECKER DAVE RODGERS
GEORGE PLOWMAN JOE CARCHIDI SAM FULLER
DICK HUSTVEDT

****
* d i g i t a l *
****

TO: MAURICE WILKES DATE: SUN 16 MAY 1982

2:47 PM EDT

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: RE: RE: ON HIERARCHIES

For certain kinds of tasks in organizations, maybe salary adminstration and some critical decisions, I really believe in hierarchical control. Maybe it's an issues of how much comes under the control of the hierarchy. I don't want very much to. In fact, for several years now I've tended to think of myself as a city planner rather than an architect in this regard because I can't get involved in the design of all the buildings. The task is to find the right interfaces, see that they are defined and then encourage development in a very decentralized fashion.

I do believe that much has to be hierarchical, especially many of the computer systems we build.

The main thing about Ethernet is that it looks like a number of quite independent groups can decide on their own intercommunication quite independent of any top level need.

They need it though and when they have it will start to recognize the need to communicate with others. This has best been done by providing the ability to communicate, not forcing it.

Right now, we have a mess in our order processing both because
we simultaneously (royal we here is my peers... not me) tell the marketing people to solve their own problem and at the same time tell the central data procecssing people to do it too. So its's a critical massless, incompetent mess.

Here, I'm advocating putting in some formal interfaces and building a Digital Backbone Network so that each group can work on it's own part and then communicate when they have it together. This is how we do many of the interface standards works in engineering.

GB3.S5.35

GB0002/5

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COMPANY CONFIDENTIAL

Subject: **Meeting On High End Charter 3/27/79**

To: Bill Demmer, TW/D19
Ulf Fagerquist, MR1-2/E78
John Leng, MR1-1/A65
Larry Portner, ML12-3/A62

Date: 4/3/79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

CC: OOD,
Brian Croxon, TW/C04
George Hoff, MR1-2/E47
Steve Jenkins, TW/C04
Jud Leonard, TW/C04
Dave Rodgers, TW/C04

The alternatives we discussed:

1. 10/20/VAX coupled nets and 10/20 follow on.

2. VENUS (high end VAX based on 780 structure and Jud's design).

3. Global network architecture for Interconnecting machines at all levels.

4. Technical market hardware/software.

5. Personal and VLSI VAXs.

6. Peripherals.

7. Significant attack on Cost of Ownership and Field Integration!

Our recommendations:

0. The main thrust of MR will continue to be the 10/20 customer base (#1 above). Several alternative machines must be considered:

   a. New technology gate array (both ECL and bipolar).

   b. Off-the-shelf ECL.

   c. Cost reduction of KL through a cost-effective power supply, bigger RAMS for microcode and for main memory, and use of 11/24 (versus 11/40).

d. Buyout (license) of Foonly systems.

e. Minnows interconnected via ICCS to KL's and VAX's.

1. Marlboro will be the site of the Venus work. Venus as a project will be moved there. (Subsequent decisions are indicated in the memo on 3/30/79.)

2. Several task forces will take place:

a. Interconnect-led by BJ, with Alan Kotok. Work will be centered in TW, preferrably under the leadership of Dave Rodgers. Work will center as a program in a fashion similar to VAX and Hydra.

b. George Hoff and Brian Croxon should work on 7.

c. A program for 5 will be started.

The criteria used in the recommendation included the fact that 1/3 of the system's engineering talent resides in MR and we want to retain this center as a combined hardware/software team. Also, the technology for gate arrays centered there and VENUS is most likely going to use them in some form. (John Leng and I have reservations about gate arrays generally and MCA in particular. This decision will be reviewed before we proceed to use them in VENUS.) MR has the experience for handling machines of the complexity now buildable for 100K. MR is used to building machines like the 780 that are used in a centralized, mainframe fashion.

I do have several additional concerns that must be addressed as we make the organization changes:

1. Manufacturing. VENUS is an 11/780 replacement. As such it is high volume and represents about 40% of our revenue, and will be produced in a high volume plant. Under no circumstances should we consider use of the MR manufacturing for anything but 36-bit computers and VAX breadboarding.

2. Engineering is not used to high volume and interfacing to these plants. It is essential that the VENUS team move to MR, and that MR be staffed with people who understand the high volume world. Note a factor of 5-10 more machines per year will be produced than what MR is now used to.

3. 10/20 follow-on. I believe minimizing hardware investment here is the right thing for our users. KL10 cost reduction and Minnow feel ok and even necessary to me. Possibly getting the 2020 into the ICCS may be of higher priority in order to start addressing the software networking and coexistence.

4. FS. Different attitudes.

GB:ljp

+---------------+
! **d i g i t a l** ! **i n t e r o f f i c e m e m o r a n d u m**
+---------------+

Subject: **High End VAX and/or High End 10s, 20s, and 30s**

To: Bill Demmer/Ulf Fagerquist
CC: OOD, Andy Knowles, John Leng

Date: 28 APRIL 78
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

In looking at the field support, start-up and other costs I continue to worry whether we can afford the plethora of larger machines now, proposed, and ultimately desired.

I would like you to explore building a basic computer or large number of common components that can execute either 10 or VAX/11 programs.

This should be part of the EBOD presentation.

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

	Jim Bell	ML3-2/E41	Dick Clayton	ML12-2/E71
	Jim Cudmore	ML1-4/E30	Bill Demmer	TW
	Ulf Fagerquist	MR1-2/E78	John Kevill	ML1-3/E58
	Julius Marcus	MK2/C37	John Meyer	ML12-1/A11
	Larry Portner	ML12-3/A62	Bob Puffer	ML12-2/E38
	Andy Knowles	MR2-2/A52	John Leng	MR1-1/A65

As the Computer Museum leaves the space in MR2, we should plan a solely Digital exhibit. There are two possiblities (and a mixture):

ARTIFACTS BASED (LIKE CURRENT COMPUTER MUSEUM)
This would tell the evolutionary story of our products and the processes used to make them. When IBM started one of their recent ad campaigns on how they invented various technology of the computer, it triggered me to make a list which we might exhibit:

PDP-1, CRT's (first commercial interactive, precision and color),
mini as in the 5, 8 family, note that the inventor of the first microprocessor (Intel 4004 programmed it)
first commercial timesharing system,
on line program creation (editing) and debugging (DDT) and device independence (DDT) and basic structure which CP/M uses
UART (invented for ITT's ADX system) and use of Teletype,
LINC (and bringing over from Lincoln Lab) - the first personal computer, and DECtape (or LINCtape), we

should show the evolution to MINC and successors
first use of computer for controlling testing of modules and memories (PDP-4)... now a whole industry
Industrial modules and controllers (PDP-14)
PDP-11 architecture, including Unibus and family, evolving into VAX, use of caches in small machines, evolution of minis to super minis with mainframe power
Minicomputer timesharing springing from TSS-8 and RSTS, the basis of modern distributed processing
LSI-11, and reduction of minis to micros
DECnet
Use of networks within manufacturing
Word processing
The large cluster for 10/20/VAX/HSC and include Ethernet
Disk technology and includes tree
Terminal technology (and tree)
Module and circuit technology (starts with Lincoln Lab and includes use of ttl/s for first high performance machine)
interconnect technology (Wirewrap and multiwire users)
design aids over the last 25 years

HISTORY OF DIGITAL
A display of this sort would include products, but would be a more complete story of the growth of the company with growth graphs, the organization and key events in the life of the organization. It could include memorabilia, cover stories in managment and technical magazines, replics like those used in the PC announcement, films like the story of Avram (or one that could be put together with the cuttings of the film) which would try to say what the company was like in 1982, etc. Care would have to be taken to make it really lively versus being like the 3 volume history of P&G.

The Charles Babbage Institute is attempting to get into the business history of the industry. It's encouraging each company to archive documents and record its evolution. We could provide a service by trying it so that others would know how to do it. Such an archive could have some of the business school case studies.

What about trying to design such an exhibit? (Or trying to get John Jones to do it if he's still interested in eventually writing a book on Digital.)

A PUBLISHED HISTORY OF DIGITAL/PRODUCTS
Bernie Galler, the editor of the Annals of Computing History has been asking me for this paper. I thought I did this in the book, Computer Engineering, but it clearly is a book about the products. I dropped all people from it because of the conflicts in how we all remember the past. I'm going to send Bernie a copy of Computer Engineering and see what he would want relative to it.

Again, are you interested in writing or getting someone to write such a paper? (If a display were made in the museum, the paper would be relatively easy.)
.
July 9, 1980

Saul Moskowitz, President
6 Mugford Street
Marblehead, MA 01945

Dear Mr. Moskowitz:

Following is my itemized order from your Spring 1980, Catalog 120:

ITEM #	NAME	PRICE	INS	POST	TOTAL
216	LOWRY-BOWYER TELEMETER	195	.25	2.37	197.62
233	FULLER CALCULATOR	145	.25	1.85	147.10
236	GUNTER RULE	155	.25	1.43	156.68
239	IRS AGENT SLIDE RULE	215	.50	1.43	216.93

241 THACHER'S CALCULATING INSTRUMENT 625 1.50
3.58 630.08

REF.BOOK

d. Wheatland, "The Apparatus of Science
at Harvard 1765-1800 20 .00 3.00
23.00

$1355 2.75 13.66
1371.41

Enclosed is my check for $1371.41 to cover all expenses of the above order. Please ship to:

Gordon Bell ML12-1/A51
Vice President, Engineering
146 Main Street
Maynard, MA 01754

Sincerely yours,

Gordon Bell

GB:mjf
GB1.S5.21
12 May 1983

Professor Bernard A. Galler
Computing Center
The University of Michigan
1075 Beal Avenue
Ann Arbor, Michigan 48109

Dear Bernie:

It was great to interact with you these last few days about "preserving history". It has given us a great deal to think about in terms of the magnitude of effort in archiving the critical artifacts for the "public" and scholars who visit the museum.

Gwen and I have been discussing your invitation to present a paper at JCIT. Right now, I think I must decline because of the time commitment to the museum (especially in light of a decision to move the museum to its own building in Boston) and because I am deeply involved in product development at Digital. I had been drifting more into broader and more general issues of computing, including the industry, and now am getting back into more detailed technical problem solving.

Enclosed is a paper I wrote for developing countries on the establishment of computing industries, which I submitted to Science several years ago (but they didn't publish). Israel is well beyond this position, but there are lessons there which they may not wish to re-learn. You're welcome to the paper.

Also enclosed is the book, Computer Engineering, in which several of us compile the stories of the evolution of DEC's machines. In regard to writing an article for the Annals, you might look at this as a starting point, and then have us go from there.

Sorry we can't come to Israel next May, but think I'd better help the museum in this next stage, and design some crucial products.

Sincerely,

Gordon Bell
Vice President, Engineering

GB5.36

Enclosures-2
11 April 1983

Mr. Larry Press
SigPC Notes
Box 5429
Santa Monica, CA 90405

Dear Larry Press:

Enclosed is a book written by several of us that gives dates of several machines you reference. It also references key articles. You can get the dates of other machines from the book, Computing Structures, by Allen Newell and I. An article in Creative Computing gives the origin of -- Spacewars -- first written for the PDP-1 (circa 1962). Note that it's still operational at the Computer Museum.

I hope you clearly distinguish/define personal computing, workstations, single user computers, timesharing, interactive computing.

Also enclosed is a copy of the Museum Report and some brochures on The Computer Museum. If you aren't already a member, let me urge you to join or to become a founder. If in your research, you find critical artifacts for the Museum, we'd appreciate knowing about them.

Sincerely,

Gordon Bell
Vice President, Engineering

GB5.10

00 CORE DECGRAM ACCEPTED S 005622 O 448 09-MAY-83
17:23:46

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TO: KEN OLSEN DATE: MON 9 MAY 1983
2:45 PM DST

FROM: GORDON BELL
cc: DIGITAL MUSEUM DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

MESSAGE ID:
5199370774

SUBJECT: DIGITAL ARTIFACTS AND COMPANY HISTORY EXHIBIT

GB5.40

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documents and record its evolution. We could provide a service by
trying it so that others would know how to do it. Such an archive
could have some of the business school case studies.

What about trying to design such an exhibit? (Or trying to get John
Jones to do it if he's still interested in eventually writing a book
on Digital.)

A PUBLISHED HISTORY OF DIGITAL/PRODUCTS
Bernie Galler, the editor of the Annals of Computing History has
been asking me for this paper. I thought I did this in the book,
Computer Engineering, but it clearly is a book about the products. I
dropped all people from it because of the conflicts in how we all
remember the past. I'm going to send Bernie a copy of Computer
Engineering and see what he would want relative to it.

Again, are you interested in writing or getting someone to write such
a paper? (If a display were made in the museum, the paper would be

relatively easy.)

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TO: OPERATIONS COMMITTEE: DATE: TUE 15 FEB 1983
10:43 AM EST

PEG: FROM: GORDON BELL

TMC MEMBER DIST: DEPT: ENG STAFF

EXT: 223-2236

LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5191028967

SUBJECT: LEARNING FROM CDC AND CRAY

GB4.S1.31

Neil Lincoln, designer for the CDC 205, described to our engineers their effort to build supercomputers hampered and harassed by the company. Our efforts at the high end don't sound so bad now. Also, I think our engineers appreciate that their management really cares and provides them with tools (2 terminals/person) versus card punches. We also care about doing things right and understanding technology.

He also talked to me on the history and folklore on how Eckert-Mauchley Computer Company and Electronics Research Associates became Univac. Eckert was an arrogant easterner and didn't believe the Minneapolis crew could do anything. They argued over binary (Minneapolis) vs decimal (Phil.) and ultimately drove the ERA group to form CDC after taking their proposal for a large machine and building LARC.

CDC's behavior may have caused Cray to leave. He told many Cray stories, but the most interesting attribute I deduced about Cray were:

1. his ability to constantly try to build better machines; and

2. his sensibility to throw every other one away -- 6600 (6800), 7600 (8600), Cray 1 (several tries) Cray 2 (Cray also designed the 160 and 1604).

Lots of failures are because one designs and markets evolutionary, poor products instead of starting over.

He was concerned about CDC management, who came up via a technical route, erred because the required knowledge had changed and because

CDC does less manufacturing. They're into credit, Plato-CAI, hams, hydro-ponic gardening, military contracting, plug-compatibles, joint ventures, funding losers like Microbit (at 5M/yr) their jobs, etc.

It seems there's too much ego involved to get out of the hobbies that all lose money. (Our hobbies aren't nearly as expensive, and they don't appear to cost quite as much.)

Recently I had to introduce Bob Trocchi to their education leader to discuss Tutor software, because they wouldn't talk to him. I called Bob Price, the President and within 30 minutes a meeting was scheduled. The one catch: Bob and I had to meet with them first to set the stage because Bob thought that all product work had to go via his office. I had to travel to Minneapolis. He also wanted me to brief him on Alpha Omega, our joint research plan. We discussed this in some detail and he was ready to change a part he didn't like. I said no, because:

1. The current sponsors agree and we have to start to work.

2. This is really an outline. The plan and work has to be specified and done by the group (and I would even entertain radical redirection).

Although he's quite bright, he doesn't seem to understand research, A/D for technology transfer, A/D and development. Also he didn't understand the area, and wondered why I did (it's something I've worked years on).

Thus, it would seem that - they suffer two seemingly incongruous problems: 1. under management -- too many areas; 2. over management -- getting involved and having to make decisions on everything. These both cause a 3rd, being superficial in the products and technology.

I also see them and others in a strategy malaise with no real clear direction: supercomputers are hard to build; the service business evolved because they had a base; they're coming after us with their old repackaged 6600/7600's; IBM compatibles are what everyone else is doing (also seeded by all the IBMers), stores are interesting; ... there are too many options and they now have no real expertise anywhere except as dabblers.

These first two are what I worry about: not having enough time, and then edicting solutions when things are a muck. I'm glad we don't dabble outside of computing -- but some of the applications we don't understand or use could take us that way.

Overall, we should win against most competitors because we really do

insist on quality and thoroughness.

WPS USERS - Leave HP mode and type <CR>

October 4, 1979

Nobuhiro Hameda
Hitachi Research Lab
4026 Kuji-cho
Hitachi shi Ibaraki-ken 319-12
JAPAN

Dear Nobuhiro:

Thank you for your letter of September 20th. I am sorry I will not be able to attend as I will be travelling in South America.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:swh
GB0004/65

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+---------------------------+                                 GB0002/45
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Subject: **HLL FOR USER MICROPROCESSOR PROGRAMS IN TERMINALS**

To: Steve Gutz, ML3-5/E82 Date: May 4, 1979
Bill Segal, ML3-5/E82 From: Gordon Bell

Dept: OOD

CC: Dick Clayton, ML12-2/E71 Loc: ML12-1/A51 Ext: 223-2236

Bruce Delagi, MR2-1/M64
Roy Lomicka, ML5-3/E12
Walt Tetschner, ML5-3/E12
Art Williams, ML1-3/E62

Please contact Roy Lomicka. He's using Pascal for the above, is interested in BLISS but like most can't use it because it costs too much in terms of personal time and machine availability.

He also has ideas on how to get it to be more useful and how to have migration among BLISS and Pascal.

GB:swh

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Dick Clayton	ML12-2/E71	Bruce Delagi	MR2-1/M64
Steve Gutz	ML3-5/E82	Roy Lomicka	ML5-3/E12
Bill Segal	ML3-5/E82	Walt Tetschner	ML5-3/E12
Art Williams	ML1-3/E62		

Home Files

West wall

#1

Competition	IBM	Intel	
Gate arrays	High speed circuits		
Chip based 11's	VAXs	Scorpio	
High speed computers		semis	semis
Venus	Venus	10/20	

#2

Performance	performance	-
p	p	pi
History book	Eng. Factory	Spring '82 prod rev.
Mfg. interface	ood	ood
gb essays & papers	gb	ramp/hydra

#3

AI	Japan	MVAX
Seahorse/PC's		
xcon	cad	the eng net
design methodology	Q&P	Structured Hw and sw
db & applic prog	testing & q/a	security
end use, appl env	user env	nets & dp

#4

The strategy implic	file, prnt sve, pcc	hum fact, lcn/ws,
ao	ao	ao
	mP, mC	
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busses	pluto, gates, comm	ethernet

#5

tool kit, pc sw	pc hw	le end vt/ct
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T.voice	term arch	vt/la
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East middle (misc files)

East right (books)

North
corp files, redbooks, stragegy, lrps, eng invest
5 May 1983

Mr. Donald W. Davies
National Physical Laboratory
Teddington Middlesex TW11 OLW
England

Dear Donald:

I was delighted that you and Mrs. Davies could visit us here and speak at the museum, and give the two talks at Digital. Enclosed is an honorarium for the talks at Digital. The researchers and engineers at Digital were delighted with the talks with you on security and networking.

We would like to have a museum lecture after the fall of 1984 on the packet switching network development. This would occur after the museum is moved to its new home.

As you think about what you might do on retirement, I hope you might consider working here or being a consultant in some capacity.

Again, thanks for the stimulating interaction.

Sincerely,

Gordon Bell
Vice President, Engineering

GB5.29

Enclosure

January 4, 1979

Dr. Ellis Horowitz
Acting Chairman,
Computer Science Department
Salvatori Computer Science Center
University of Southern California
University Park
Los Angeles, California 90007

Dear Dr. Horowitz:

I have known Dr. Parnas since 1966 and feel that he would be an excellent addition to any Computer Science Department. I recommended that he be given tenure at CMU. During the time I have known him, he has worked deeply in a number of areas including simulation, parallelism, operating systems, and most recently on the structure and engineering of software systems, doing early work on modulating. Since I've not kept abreast of his recent work, my recommendation is based on his work prior to 1973.

He supervised a number of Ph.D. dissertations at CMU, and on the whole I believe his students were above average. He interacted well with most members of the CMU department, especially Habermann, Siewiorek, Wulf, Newell, myself, and graduate students.

In terms of various criteria, I believe that he is an above average university-level teacher as one would measure by listening to his lectures and student motivation. I believe that his greatest strength is his research as measured by the ideas that are generated in his papers and by the level of motivation in the graduate students with whom he works. I think he has also contributed to the computer science profession through committees, lectures, and consulting.

Sincerely,

Gordon Bell
Vice President, Engineering
Professor, Computer Science
and
Electrical Engineering
Carnegie-Mellon University,
on leave

GB:ljp
ID#401
November 24, 1981

Dr. Ellis Horowitz
Computer Science Department
Salvatori computer Science center
University of southern California

University Park
Los Angeles, CA 90007

Der Dr. Ellis Horowitz:

I still feel the same way.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:mal
ID#GB3.S1.47

p.s. I would really like to see his recent work.

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Subject: **How fast can software be built? What is it worth?**

To: Larry Portner, ML12-3/A62   Date: 26 OCT 78
    Ulf Fagerquist, MR1-2/E78   From: Gordon Bell
CC: Peter Christy, ML12-3/A62   Dept: OOD
    Bill Demmer, TW/D19   Loc: ML12-1/A51 Ext: 223-2236
    Ed Fauvre, MK-2/E6
    Bill Heffner, TW/C10
    Bill Johnson, ML21-3/E87

Bill Keating, ML12-3/A62
Dick Snyder, MR1-2/E37
Mike Tomasic, ML12-2/E71 follow up 11/9/78

Development Speed

John Leng (rightfully) is somewhat scared of the strategy because of the software. He believes that no matter how many people on a project, it can only be done so fast. However, software production has gotten better and we should understand how and why.

In order to push the implementation of the strategy very hard, we are going to have to better understand just how fast we can get various pieces of software. I would like to approach this solely on the basis of characterizing software projects we know about. Can we look at:

1. Tops 20 and VAX/VMS
2. The BASIC +2's on 10 and 11
3. Fortrans on 10, 11 and VAX
4. Some editors
5. BLISS's.

In all these, the issues would be how much did we spend?
How long did it take?
How was the quality?

Value

We must account for our software base on 10's and 11's. I've thought about several Forrester-type models and they make sense, but need to be made specific. Can you get someone to model this?

We need this understanding in order to move faster, now that we've started.

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST: Peter Christy ML12-3/A62 Bill Demmer TW/D19

Ulf Fagerquist MR1-2/E78 Ed Fauvre MK-2/E6

Bill Heffner TW/C10 Bill Johnson ML21-3/E87

Bill Keating ML12-3/A62 Larry Portner ML12-3/A62

Dick Snyder MR1-2/E37 Mike Tomasic ML12-2/E71

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To: John Kevill, ML3-6/E94

CC: Grant Saviers, CZ
Mass Storage POT

Date: 9 JAN 79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

follow up 1/23/79

How does HP supply:

1. 5, 20, 50, 120 and rumored 300 Mbyte disks.

2. They also have TU58 before us.

3. Floppies

4. Tapes at 45 ips.

for their smaller budget?

GB:ljp

Storage Systems POT

Dave Best	TW/A08
Frank Bicchieri	PK3-1/F51
John Buckley	MK1-2/K36
Tom Campbell	MR1-1/M72
Mike Gutman	ML3-6/E94
Bob Jack	ML1-3/E58
John Kevill	ML3-6/E94
Mike Mensh	MK1-1/D29
Bill Munson	TW/C10
Grant Saviers	CZ
Charlie Spector	ML5-2/M17

D I G I T A L INTEROFFICE MEMORANDUM

DIST: Dave Best TW/A08 Frank Bicchieri PK3-1/F51
John Buckley MK1-2/K36 Tom Campbell MR1-1/M72
Mike Gutman ML3-6/E94 Bob Jack ML1-3/E58
John Kevill ML3-6/E94 Mike Mensh MK1-1/D29
Bill Munson TW/C10 Grant Saviers CZ
Charlie Spector ML5-2/M17

HARDWARE AND SOFTWARE SALES BY LAYER

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GB0001/35

d i g i t a l   **i n t e r o f f i c e   m e m o r a n d u m**

Subject: Some Concerns I Have About the HSC50 Approach

To: Distribution

Date: 3/6/79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

Several things bother me about this product, but first let me avow that I: do not have a hit out on the product; respect the people working on it; will probably not forget the circumstances surrounding the way it it got started and where it is; and have not made up my mind on it.

Background Concerns

As a computer engineer, it really bothers me because we are adding a special box into a system that can only perform a particular function. This generally means higher costs, special system software, being locked into the structure, and the inability to migrate parts of the existing operating system, file manager or data base system out to the special box. Furthermore, at a time when all the systems are themselves being collapsed to only a few boards, we are adding a much larger system than the systems it serves, to do a special function...thus we aren't making a gain in cost. This is brought home extremely vividly by observing that a complete Minnow with 512 Kwords of primary memory and R80 is smaller than the HSC. If the HSC didn't exist, would we figure out a way to build structures, even for high end Dolphins such that support the high swapping rates? E.g., out of the multi Minnow (or Nebula) approach? Moreover, instead of transferring requests for pages, a user would probably transfer data base requests and I would expect the system to get a lot more work done. Note that in the 4331, IBM is saying something called "Distributed Data Base SW + HW to/from 43XX and 370". Could this be what I'm advocating?

Some questions that come to mind:

1. What are the real needs for it?
2. What happens if we didn't get it? What would the system look like?
3. Will it really be able to deliver for a reasonable cost, or are we building another proprietary Massbus?
4. Will it be so expensive to keep designing to that we will not be able to afford the reasonable devices that the world measures us by? What is the total cost to complete?
5. Could we test whether we can afford it by transferring the budget into the systems groups right now?
6. Though it's where IBM has been,

is it where IBM is going? Is it applicable to our price domain?

7. Is there an upper bound on the complexity and ultimate functions of HSC (i.e., physical records, RMS, and finally DBMS)? Can we afford these programs again?

8. It feels to me there is a really serious alternative to it by using one of our existing small systems in the form of Nebula, Minnow, the 11/23 or 11/24. Such a system would do all the control functions in exactly the same way that HSC does and would handle as many devices as the particular system could handle. It wouldn't be designed for worst case of the Dolphin where many pages per second are needed, but instead, would deliver all the pages that the disk and/or CCD cache with it could supply. Performance would be enhanced by adding multiples of these systems, rather than relying on making a central one bigger and faster. Would such a system work? How?

9. Are there similar issues for the Mercury? How does it look?

10. Can anybody make me feel better, cause this approach feels just awful?

I don't expect anyone to do anything because John, Bill and Ulf apparently believe we are going the right way. Clearly Sam, BJ, Alan, and Bill Strecker agree too.

However, in case there is an alternative approach could I get a couple of people to work with me to search it out by running some experiments and doing some cost analysis?

GB:ljp

<u>Distribution</u>

Bill Demmer, TW/D19
Ulf Fagerquist, MR1-2/E78
Sam Fuller, TW/A08
Bill Johnson, ML3-5/H33
Bill Keating, ML12-3/A62
John Kevill, ML3-6/E94
Alan Kotok, MR1-2/E47
Bernie Lacroute, TW/A08
Ralph Platz, CZ
Larry Portner, ML12-3/A62
Grant Saviers, CZ

Ken Sills, ML3-6/E94
Bill Strecker, TW/A08
Pete vanRoekens, TW/B10

D I G I T A L INTEROFFICE MEMORANDUM

DIST: Bill Demmer TW/D19 Ulf Fagerquist MR1-
2/E78
Sam Fuller TW/A08 Bill Johnson ML3-
5/H33
Bill Keating ML12-3/A62 John Kevill ML3-
6/E94
Alan Kotok MR1-2/E47 Bernie Lacroute
TW/A08
Ralph Platz CZ Larry Portner ML12-
3/A62
Grant Saviers CZ Ken Sills ML3-
6/E94
Bill Strecker TW/A08 Pete vanRoekens
TW/B10

****
* d i g i t a l *
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TO: see "TO" DISTRIBUTION DATE: MON 5 JAN 1981
7:03 PM EST

FROM: GORDON BELL
cc: BILL DEMMER DEPT: OOD
BERNIE LACROUTE EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: HSC-50 BUSINESS PLAN

Unless I'm mistaken, I'd bet there is no way to make the
HSC50
a profitable item. The number of large systems we sell is to
small to swing it. Products are coming out like I was asking
for based on a backend database machine, despite the clear
prediction from the technical folks that this wasn't possible
or the right way to do the job. Putting another 11 there to

do the back end doesn't feel good. The alternatives could be to wait for Scorpio and put it there, using the DBMS on VAX
plus the other numerous DB software coming out on VAX. This would give added life to HSC. The other concern about HSC in the high end is that we will have to have the IBM channel interface to sell to the govt. If we sell there, then we can use this approach instead of HSC.

As an alternative, it has been suggested that we use COMET as the HSC. Frankly, I'd like to look at this one. Note we have a prototype of this already, where a second VMS is talking
to VMS and behaving as HSC. Clearly we can do something like
this and get the performance by various kludge techniques to get more bus bandwidth. Alternatively, we can simply have more
Comets so that we don't have to get so much overall performance.

Conceptually, no one could argue against the Comet = HSC50 approach, as it gives us all kinds of advantages. The only argument I have is how well would it work? Or how?

What you think? Can we take a look at it?

(Could you send me the business plan on HSC please?)

"TO" DISTRIBUTION:

MIKE GUTMAN DEMETRIOS LIGNOS RALPH PLATZ GRANT SAVIERS

GB2.S1.28

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Subject: **High Data Rate in HSC50**

To: Bill Demmer, Ralph Platz,
Wayne Rosing

Date: 18 SEP 78
From: Gordon Bell
Dept: OOD
Loc.: ML12-1

Ext.: 2236

follow up 10/02/78

Given the high data rate required in HSC50 (see NDS), can the two use the same bus, backplane and cabinet?

Also, NDS doesn't get what I thought would fall out: It can be used stand alone and wind up with a small 11 system.

GB:ljp

CMU (H T KUNG) SYSTOLIC PROCESSORS

Friday, I attended a review of Kung's work, with people from ONR, Lockheed, GE, TI, Westinghouse, Intel and TRW. I made some interesting contacts with TRW and Lockheed that might be interesting as joint ventures or as buyers of Hydra. These folks are all working on systolic arrays (which I think may be due to Kung's incredible PR). All have or are building these beasts.

I've been working with H T Kung at CMU, looking at Systolic Processors (data pumps), and these seem to have a similar structure to array processors. (I really can't give you a crisp definition of what a Systolic processor is). It's unclear whether there's a real computer structure (i.e the Systolic Processor), a theory, or what. They all compute like mad, IF somebody spends the time to get the program. It looks like there are lots of cases that can't be programmed. Kung's 10 (Hydra size) board processor looks like it will compute at a 100 Mflop rate for a few well-defined problems. The machine is one of the most complex I know of and it's unclear that it will get done because of the engineering.

I've been advocating that we build this for Kung at ULTRA. Now, I'm skeptical because it looks quite hard... and may not be programmable for any reasonable set of problems! There is no way the group working on it will get it working because they lack the engineering (hardware and software) skills.

I'm going back to spend a day looking at the architecture in more detail because there are some interesting ideas there, especially in the notion of address generation. I doubt if we could get them to make the machine architecture reasonable.

THE UNIVERSAL HOST PROJECT
One of the faculty has been working on a very fast, quite general purpose, microprogrammable computer for the last couple of years. I've been trying to get them to stop it because of the incredible difficulty of the projects (at least 2 times harder than Hydra!) since they have a 25 ns ECL bus, and their own, 10 mips, special purpose bit-sliced micrprocessor that's oriented to generating addresses for signal processors. The review panel all commented on the idiocy of the project, without having the vast (versus half-vast) resources.

GB9.48

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SUBJ: Hudson Lobby Display

TO: Ann Courtright, HL1-2/S09

Date: 7/1/80 Tue
From: Gwen Bell
Dept: Digital Computer Museum
MS: MR2-L/A89 Ext:

231-4036

EMS: @CORE

Delighted that you are developing a display for CSD/LSI for Hudson. One way to make the promise of a "distributed museum" at least a partial reality is through cooperation with groups such as yours. I'd like to suggest the following scenario:

-- Four kinds of exhibits could be considered: 1) specialized large scale exhibits unique to each of the Hudson plants that the Museum could point to; 2) smaller exhibits (such as large scale photographs) that could be done in limited editions 2-5 and displayed at both Hudson plants, the Museum, and selected other locations; 3) audio/video presentations that could then be distributed to the museum and other sites; 4) and some exhibits from the Museum (such as our three minute video tape) that would broaden and add to the spectrum at Hudson -- and point from Hudson to the Museum in Marlboro.

-- A substantive schema should be developed for Hudson 1 and 2 with consultation with experts outside of DEC as well as inside. (I know Carver Mead has some ideas, for example.)

-- We would be pleased to come to a substantive review and believe that coordination through Charlie Conn's group in Industrial Design can help us to achieve appropriate standardization.

GKB:swh
GB1.S5.19

ID#392

| d | i | g | i | t | a | l | i n t e r o f f i c e m e m o r a n d u m

Subject: **Hydra**

To: Pete vanRoekens, TW/B10 Date: 14 DEC 78

From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

CC: Roger Cady, MK1-2/E25
Joe Carchidi, TW/D08
Bill Demmer, TW/D19
Bill Keating, ML12-3/A62
Larry Portner, ML12-3/A62

I understand the dilemma on Hydra now and concur with getting a really good product definition before we get the schedule. Bills have to understand and help with this. This seems to imply a branch on the VMS tree, versus a later release. A VMS release ultimately gets VMS too big because it doesn't need all the redundant operations. We have to get at the schedule versus product issue at the steering committee. Right now we must work on defining the right product. Also, I'm still worried about getting a better definition for TRAX-32.

Can we do a breadboard where the reliability functions are placed in the run time package layer? (Isn't this possible with a large, shared VM?)

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST: Roger Cady MK1-2/E25 Joe Carchidi TW/D08
Bill Demmer TW/D19 Bill Keating ML12-3/A62
Larry Portner ML12-3/A62 Pete vanRoekens TW/B10

HYDRA Documentation Hierarchy
(Relating to the Definition of the Hydra Software Project)

HYDRA SOFTWARE SCHEDULE

1. The goal for May 30 is to:
    1. provide the Hydra Technical Summary or the Hydra Product Brochure that summarizes the functions of Hydra as seen by a user or buyer
    2.identify and define the Functional Specifications for the entire system (especially the software) that forms Hydra
    3. assign responsiblity for each document type, including the Functional Specs
    4. hopefully, have a rough estimate of the time and effort required to implement the functions, including their integration and testing
    5. identify outside modules such as the languages, debuggers, etc. that have to be obtained

2. This effort will be followed by detailed Design Specifications which further refine the Functional Specifications and enables a software engineer to implement a given module.

3. Finally, a Project (Development) Plan will be made for the entire project which includes the Test Plan and Schedule.

4. The Project (Development) Plan will be executed.

DOCUMENTATION GOALS

The Goals for the Documentation are:

0. To have an owner for every document.
1. To be precise, yet concise and correct in order to minimize the time for the writer and reader. The dominant cost of information will be the propagation of erroneous information among engineers.
3. To specify everything on a breadth first basis. When information is unknown, a placeholder name will be given together with a simple description of the accuracy and precision of the information.
4. To practice the notions ala Parnas of "information hiding" and "need to know" by not giving needless information.
5. Have a format for each of the document types so that the design of the document, per se, is not a significant task. The emphasis is on the content, not the form. A consistent document format will aid the reader and insure that the writer has included the relevant data.
6. Have a completely orthogonal set of document types so that there is, ala Parnas "Everthing is specified in exactly ONE place". This means any changes have to be only made in one place and a reader would know where to obtain each kind of information. A paper by Parnas on this is forthcoming. I propose we import his document types intact, too.

DOCUMENT TYPES

The various documents (until we get the Parnas types) are defined as follows:

ONE TECHNICAL SUMMARY FOR HYDRA HARDWARE AND SOFTWARE, ESSENTIALLY A (NARRATIVE BILL OF MATERIALS)
Summmarizes the product as seen by the user. It is both an internal (to Hydra) and external (marketing) document. Similar to the VAX/VMS Technical Summary. It is readable, includes some rationale about the product, together with features and benefits.

It contains a Bill Of Materials of all the parts that form the system (eg. MPEXEC, UNIX, Emacs, C debugger, backpanel, streaming tape, CPU module). This is the definitive document that defines the product.

Written by Dave Fanger. Approved by Rich Billig

Under the control of Shanin, Chapin, and Moore

ONE PRODUCT BROCHURE
Taken entirely from the Technical Summary. Is not used within Hydra by anyone other than the marketing group, and necessarily lags the Technical Summary.

REFERENCE MANUAL (ONE PER MAJOR SYSTEM EG. C, COMMAND LANGUAGE)
Normally a document that is available to customers to define a particular machine (eg. assembly language, Fortran, C). We are not concerned with it's form or substance at this time, or how it differs from a FS.

FUNCTIONAL SPECIFICATION (ONE PER MAJOR PROJECT WITHIN HYDRA) (TA's SYSTEM SPECIFICATIONS ARE EQUIVALENT TO THIS, I BELIEVE)
A document that describes the "function" of a particular set of hardware or software (eg. a compiler, UNIX, CPU module, mPExec, memory management). The FS may include the design goals, perhaps some of the key design decisons, how various parts of a module fit together in order that a Hydra or

external "user" can best understand how to use the module. It may have examples. It's unclear how close this is to a Reference Manual, when it reaches its final design.

Performance monitoring and error recording call information access should be included whether its a procedure call, shared memory, or message passing port.

The Functional Specification goes through various "states" as the project progresses:

> FUNCTIONAL SPECIFICATION (PLACEHOLDER)- The initial realization that a particular process is required. This defines "roughly" what the module does (is used), is called and responds. The name, Unix 4.2 is an example of this level of spec.
>
> FUNCTIONAL SPECIFICATION (INITIAL DESIGN)- In the initial design, the various procedure calls are outlined together with the various parameters and error return mechanisms. The goal is to have something that is sufficiently concrete, that other modules can be "designed" using the various calling mechanisms. Version 0.3 of MPEXEC is an excellent example of this.
>
> FUNCTIONAL SPECIFICATION (DESIGN AND CODING COMPLETE)- Virtually identical to a Reference Manual because it specifies, exactly the function of a module and how it is used. The Memory Specification is an example of this.
>
> FUNCTIONAL SPECIFICATION (Version 1.0 ...)
> Version 1, denotes a product that's in the field.

DESIGN SPECIFICATION (ONE PER FUNCTIONAL SPEC)
A document that is hidden from all users and is only brought out for a design review, because it includes notes on how a module is built, perhaps some notes on alternatives, the data structures used to represent various objects presented to the user interface, and a method to test the design.

PROGRAM / LOGIC DIAGRAM SET (ONE PER FUNCTIONAL SPEC)

The actual implementation of hardware module or software.

TEST PLAN
Specification on how to test a particular module, including the test of constituent modules of the entire system. This may include the design of a system (ie set of modules) complete with Functional Specs.

PROJECT PLAN (TA's DEVELOPMENT PLAN)
This is a living doucment which contains a revision number. A plan for a module. It would contain timing estimates and possibly dates, on the work needed to completely implement a module, including:

- . UNIT IMPLEMENTATION
  - .Detailed Design, yielding Design Specs and Final Functional Specs
  - . Code
  - .Unit test of component parts of the compete system
- . SYSTEM TESTING

G Bell (for Steve Chapin, Steve Emmerich, Ike Nassi, Dave Schanin)
24 May 1984
We had a pretty thorough review of the hardware on Tuesday 11/20, and I feel much more positive about its ultimate convergence. The memo to the Hydra board on 18 July had the effect of Hydra starting to learn how to schedule and manage resources. Len is introducing more realism into Dave (and the rest of the team).

Their prediction that the Memory board will enter relayout on 12/15, followed by the processor board on 12/30. The current EMC and SCC boards will go into relayout 1/15, but the two machines: Beta 1 and Beta 2 (for internal use) will use old scc and emc's, and new dpc and smc. The 7/18 prediction was these would all enter relayout on 1/15.

Here's the current history and predictions:

Date	Sequent	2/6 GB	5/1 HSch$	7/18 GB	9/1 HSch	11/21 GB
Start	2/83		11/83	11/83		
Spec	7/83		1/84?	1/84		

Hdw up+					12/84	1/85
Up	1/84		9/84	1/85	>12/84	3/85
Beta(ext)	7/84	3-9/85*	12/84	5/85	3/85	5/85
FCS	11/84		1/85	10/85	5/85	8/85

$ Date given to Sperry in a document.
+Hardware is up solid enough to not be wasteful of programmer time. Diagnostics run and there are rudimentary handlers.
*Probability(.6-.9)

I believe the machine is going to eventually work and there doesn't appear to be any fatal flaws. There will be a continuation of nasty bugs that take time to find because we are building right at the edge of the logic and programming technology. We should do a careful review of the EMC and its programming asap. I don't think the architecture of the board was reviewed carefully if at all.

We also must do monthly status reviews to look at the gotcha's.
Rather than having special reviews, I would like to get Len and Russ to have really thorough reviews that we could attend.
HYDRA--

1. What structured/unstructured interaction do you want?

2. Interaction with lamP. They could come visit on 13th and 14th.
3. Interaction with Motorola and National to get what we want.

4. Performance hooks:
   a. floating point is the most critical
   b. vectors ala Masscomp
   c. ability to get a SKY special processor... contact when hardware
   d. high performance graphics processors... we need someone here now. This represents a significant OEM relationship opportunity.
   e. video input is critical

f. xerox printer is necessary and requires computes
5. Josh Fisher compiler requires: lockstep instructions and ability to
communicate variables between processors every few instructions--
ideally registers, but could be global Mp. What is cost, penalty?
6. It is highly desireable to operate HYDRA and lamP as relatively,
hardware protected multicomputers (with independent kernels) and
assuming errors in each of the kernels that could address other
Mp.

7. What's happening on packaging and cabling? (especially for
LAN/Comm)
8. Is it necessary to have a provision to add simple I/O in the form
of Motorola's I/O Channel or the STD Bus for cost or cabling?

9. What are the UNIX extensions?
10. Would Modula 2 make sense? It has mP operations.
Subject: Review of Hydra Operating System Software, 7 May 1984
To: Dave Schanin, Bob Puffer, Julius Marcus, Henry Burkhardt
CC: Steve Chapin, Steve Emmerich, Ike Nassi
From: Gordon Bell

Steve, Ike, Dave and I reviewed Steve Chapin's plan all day.

Action Items

0. Recruiting continues to improve. Needs are still 1 tools, 2-3 O/S and 1 network and 1 diagnostics persons. Two acceptances are likely this week. Everyone must help recruit!

1. Hydra is limping along with National's tools that have lots of "bugs" and "features". The cost was about 2 people and 1 month delay. A debugger is badly needed for the test bed. This is considered part of the

languages effort for now.

2. A high quality compiler may be needed for the product, as compilers continue to improve. Tartan Labs has a product that was offered to us as a free Beta site. Bill Wulf believes they have the quality product. Are we utlilizing it? Foundation is coming up with a plan for all languages including assemblers for the translators, loaders, runtime and debuggers. We need it. A new C may be essential to meet satisfy the quality demanded by the market.

3. Emacs is being used by Hydra, and will, no doubt, be part of the product, in addition to vi and se. Hydra will take responsibility if Emacs is a product. For now, it is.

4. Encore licenses --- ie. Henry or Karl need to immediately work the issue of UNIX and other software licenses for all of Encore since the prices may go up from ATT shortly.

5. System V (versus 4.2) plan is inadequate (see also Sperry concerns). Just having the library will not be enough. All the utilities and environment will be required. We can probably forget the 4.1 library. This should be deferred until we have Steve Emmerich's position paper.

6. The "tentative" current plan is to build about 10 testbeds for Hydra. A testbed is about 1/3 of what it should be with a 10 Mhz part, making the overall performance about 1/4 Mip, or about the same performance of a VAX 730. This should support about 2-3 heavy development users, or about 8 office users (about what a 730 does -- we have 16 terminals on the Encore 730 with 4 Mbytes). Other Encore companies should order them as appropriate. Hydra needs: 2 for Unix, 2 for networks and 6 for program development. This means that 2 people are required to build (in HYDRA manufacturing) and support (in Dudley's organization) the product. This is an excellent way to start behaving as a company.

7. A new approach is being used for mPExec and Unix which makes Unix a process. This is along the lines of Syte and Pyramid. It also is aimed at lowering the schedule risk. The schedule is to come for this

approach.

We discussed the approach to porting 4.2 (and System V) to a multiprocessor environment, using the National architecture. It is:

0. Go for a product that can be enhanced, but is generally right, versus going for anything that is interim and will be thrown out. The goal is to make a first ship in January. This means going for reliablity and the right structure, and then enhancing this structure. The FCS will work well, but not up to the level of a product a year later.

1. Port from VAX 4.2 to National architecture. This is to be complete and solid by June. It is operating now with most of the critical utilities. This has taken about 6 weeks longer than expected at this point due to poor National tools, flaky testbed hardware and to a lesser degree lack of hiring and learning. Steve felt that that the group accurately scheduled but didn't anticipate the poor tools and hardware. He sees no future "gotchas" in the software. Future schedules do not assume an improvement in tools!

2. Build useful single processor testbeds / user machines for Hydra and other Encore companies. These will be used for LAN DLA development, testing the O/S and for system software use within Hydra.

3. Run mPEexec on the uniprocessor testbed in September, and then convert it to run on a dual-processor Multibus testbed in Oct.

4. Move mPExec to Hydra.

5. The original view of mPExec as a platform on which to "jack-up" and hold Unix is being modified. The current view, which we all subscribe to is that UNIX is another process, and that a Unix user process call Unix and Unix calls mPExec (running in system space). The new schedule for this approach will be forthcoming soon.

6. mPExec spec will be completed by June 1, so we must resolve all ambiguities by then! Ike has a counter-proposal called Ports, which is designed to operate in a distributed environment. Ike, Steve, and Tony are meeting on Tuesday and Thursday afternoons to discuss mpexec and its evolution.

Some other issues came up:

0.Hopefully, the schedule slips is behind us and we can move into a mode of predictability as more comes under local control. The tendency to work from the fixed FCS date in January and schedule backwards is worrisome, especially in light of history. The only way to understand where we really are in terms of schedule is to posit this new one and then operate against it for the next 6 weeks or so to see how we do.

1. The approach to specs is sparse. Only a spec, eg. mPExec, which affects more than one module is documented.

2. A formal test suite is needed. We need to persue.

3. Unix is converted from an "events-based" process control, to a semaphores and messages approach.

4. The approach to to the product design is evolutionary: get it working, then form multiple processes that can be executed in parallel. This will take maybe a year to tune. We badly need to start gathering information now so that we can tune it.

5. Beware the C.io and C.diagnostics programs. These could easily become the bottlenecks to shipping.

6. We are going with TCP/IP and would like to evolve to included XNS for all their goodies. We need to have a Remote Procedure Call mechanism and for now, this might have to be invented (versus using Courier).

7. Several of us have concern about seperation of responsiblity for mPExec and UNIX. The author believes there should be two groups with a well-defined interface. mPExec should be treated as an extension to the hardware and programmed by about 2 people.

+---------------+
! **d i g i t a l** ! **i n t e r o f f i c e m e m o r a n d u m**
+---------------+

Subject: **Task Force for Hydra: A RAM + Expandable Computer (non stop)**

To: OOD, Roger Cady, Pete vanRoekens

CC: Marketing Committee

Date: 12 MAY 78
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

Pete vanRoekens has agreed to head a task force to define the goals and constraints of this product. He will report to Roger Cady for this product/program definitional effort. Furthermore, I expect Roger Cady to be responsible to me for this effort.

In order to further co-ordinate this effort, he will meet with Roger Cady, Bill Demmer, and I weekly regarding short term resource needs, product definition and the establishment of the development project/program.

At the completion of this phase (Phase 0), the reporting relationship will be switched so that Peter will report within OOD for the implementation phase.

GB:ljp

PEOPLE

Hydra's enthusiasm and drive is contagious. They are verbal in computing, marketing and business. They take suggestions well, and respond appropriately. They are enjoyable to work with. I like them as individuals and as a team.

The team is young. They haven't "done" it before. This means we have to get them to ask for help and we have to press for decisions earlier so as to not spend so long... Brooks said: "you only run out of time".

Believe we'll soon need the mechanical engineer. The packaging is non-trivial. Am worried about purely electrical engineering problems including power, bus, emi, etc. I'm not sure if anyone understands the systems/performance aspects of computing. Still no UNIX experts. I'd like to have lots of them.

HARDWARE

. lots of surprises-- the design is fine now, but these take time to find and resolve

.board changed from 100 (Dave's pre ECC plan), 150 -> 180 -> now 255... and holding

.board partitioning has moved around. The current one which adds another board type feels good at last.

. bus changed from 100 -> 50 -> 80 ns and from 32 bits to 64 bits. The faster 50 ns cycle would have probably been better. I have no idea about how a wide bus affects performance-- it should be faster, especially for dp floating but can't prove it. We'll clearly sell it. The bus may be overdesigned for HYDRA, but hopefully is worth it for lamP. It does cost.

. The National chip isn't understood very well by anyone, including National. They are very cooperative and I've gotten them to accelerate their schedules to gather performance data. It's rumoured that they are working on an multiprocessor too. If true, then I want to find this out... and operate accordingly. This may explain why they give us so much attention. Understanding the chip is vital for their next products, our systems and lamP.

. Hydra has a structure that will not have performance problems, but it's critical to know how it will act for other chips and for lamP. I'm going to push the hell out of Dan to get this model. Every model I make gives a different answer!

. The design is complex... therefore

.We need to get a stronger commitment to a Quality Design Methodology. I wish we had bought the Lou Cohen Quality teaching company to teach them. Quality Design means: top down design, commitment to NO errors-- do it right the first time, formal checking with walk throughs, and when it comes to protyping-- checking with a simulator.

.Their simulator is poor! I'm going to try to get another one from VALID, but they're committed to Xerox (Versetec-- not known as a CAD company). But it is cheap. Russ and I visited VALID. I wanted them to get their system or import the ideas on hierarchical design. They have.

THE PRODUCT AND CRITICALITY OF SCHEDULE

. They don't have a reasonable way to schedule yet. A project of this size and complexity has to have inchstones measureable in days that are checked and co-ordinated. Their schedule tasks are too fuzzy and have to be much more crisp. Our very high priority is to get a scheduling system.

. **Encore Hydra vs Sequent:**

- 8 vs 16 processors
- 32 vs 16 Mbytes;
- 100 (50+ useable) vs 25-40? Mbyte/sec bus
- 255 vs 144 square inch boards
- 20 vs 12 slots
- ? vs ? price ... hopefully not in ratio of price
- 12 vs 21-24 month schedule
- 11/83 vs 2/83 company start
- ? vs 60 people (now)
- standard vs use of custom logic
- Xerox vs Mentor logic system
- extendable to lamP vs ? extendability
- first real project vs first and second timers
- none vs much UNIX and CS experience
- Dave Schanin vs Dave Rodger (former DEC engineer who was a leader on the VAX 780 and Ethernet)
- Steve Chapin vs ? on software...

. Note the competitors:

- Sequent intends to ship in Q4, with hardware apparently running now.
- Another vendor might have a dual processor that could be introduced in the fall and deliverable in the June 85. This dual could perform at 16 Hydra or greater.

.DEC has been quoting 64 processors to Universities with deliveries possibly as early as June (but I think this is optimistic). 16 of these can be clustered to give 1024 using the Computer Interconnect. This is a function of the MicroVAX chip which has a high likelihood of working when it comes out of the oven in Feb-Mar. Our business plan will give DEC the necessary goad/goal to move faster. This may also impact our next round of financing!

BOTTOM LINE
Delivering in 84 is super critical to us... much more than I thought earlier today! This means that all of us have to go flat out asap to make sure there are no false starts and we make every right decision.

EMS 10-JAN-79 17:53:37
260 1
To: Larry Portner
From: Gordon Bell
Date: WED 10-JAN-79 17:53:37 EDT
Subject: Discussion with dave cutler

As your indicated, dave isn't interested in the Hydra job for a multiitude of
reasons. However, he's concerned about us crying Product Wolf one more tim

sen He did agree to two things: 1. Consult to you and I (Mainly you) to help
get a viable organization so that the integrity of VMS is preserved as Hydra
is built. This would include working with the development person in
establishing ground rules. He has both M/m+ m/D and VMS/M experience here
that is invaluable.

2. Work with us as we go into this product resolution/definition phase to help
both in arbitration and product integrity. He will spend the month or two that

this takes.

Right now, I'm still planning to have the small meeting with technical people
to examine differences between latest Hydra Spec and the Hydra task force.
Fuller is writing the diffrerences document. This will be 1/2 day on hte
17th. It includes Sam, Dave, I, Joe, Dick and Joost Tell me if there is a
problem here.

Pete is also included, and Pete is still as uptight as ever.   He sees his
dream as a separate, focused product/development   as not being realistic
given all the concerns about Hydra as part of the corporate strategy and
Hydras   as compatible with VMS inside and out.

Command:

EMS   10-JAN-79 18:28:47 430 1

To: Larry Portner
CC: Peter van Roekens, Bernie Lacroute
From: Gordon Bell
Date: WED 10-JAN-79 18:28:47 EDT
Subject: Importance of Hydra

Dave Cutler and I talked about the above. He had two comments. We
(engineering management and Product lines) are crying wolf again. He also
quoted the small market that tandem was addressing. (5% was quoted in a
magazine).

The product lines aren't together on this at all. Even though there is money
for Hydra, the key limits are constrained software engineers. If we want to

get the impaortance raised, then slip release 2 to go for Hydra earlier...to
show the importance of Hydra. As an editorial aside, I think he has much
insight that we ignore as a society all the time (business does it with
energy) when we think we can trade money for anything else...in this case
people resources. Therefore, Hydra should have a budget on what can be
slipped in effect in other areas when we get into this people resources bind.
At a personal level, given release 2, I would talk about a slip to get Hydra
further faster...and I think we want to oopen this up with the VAX/vmmmsss
product managers. What do you say Bernie...How important is Hydra and
getting started in distributed processin to us?

Command:

EMS   11-JAN-79 22:02:01 310 1
To: Peter van Roekens
CC: Roger Cady, Bernie Lacroute, Larry Portner
From: Gordon Bell
Date: THU 11-JAN-79 22:02:01 EDT
Subject: Interest of Hydra outside Telco

(Send a copy of this to Bob Savell and John Adams and Charlie Spector) I
just discussed the importance of Hydra, in passing with the above of IPIPG (

IPG (less Charlie) and they believe in and need it urgently, hence we could go
on any limb of trading resources such that we get Hydra and slip other VMS
releass, I believe.   They want to move on it, and are even talking about

building a breadboard, or specialized/restricted product using the hardware only..and not touching VMS or the file system. I think Pete has to begin to get out of the Telco umbrella who is perceived as the godfather that isn't even going to sell it because their customer is UNIX based. Here, again the product manager structure has to start /get involved in Hydra and assess some of the priorities. Also, we have to get other product line input about the needs.

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+---------------------------+                                  ID#323
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+---------------------------+
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Subject: **IBM 38 and 8100-How Do We Stack Up?**

To: OOD,
Andy Knowles, ML5-2/A53

CC: Operations Committee

Date: 10/29/78 Sun 6:32:05
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

Now that we have our strategy and general direction in place, it's time to check it with what we know of the competition. Both the 8100 and 38 will hit us soon, but we have time to fine tune products and to reset any major problem areas (eg. communications interfaces, disks). I would like to devote the OOD meeting on Thursday November 9 to this, such that we can present our findings to the Marketing or Operations Committee by mid-November, assuming they are interested. The agenda, I'd like to see:

1. Presentation of what

IBM has (and when) and what our nearest products are based on 74, 2020, Comet, 44, Minnow and Nebula. What operating systems do we use to compete? Rather than get someone from the competitive group to tell us about the IBM system, one of us (or Julius or Andy) might present the IBM system, and Bill, Ulf and Larry should position us on the base system and software.

2. The component suppliers should speak too:

a. What disk(s), when, and how much?

b. How will our memory technology and prices compare at .5 Mbyte level?

c. What will we use for communications hardware and how's it compare?

d. How's the terminal picture including the specials?

e. What's the capability and performance of the software systems?

3. Should we change any directions?

I believe the first two descriptive topics could be with a relatively large group. Item 3 should probably be done with a relatively small group and especially include those responsible for each of the areas.

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Al Bertocchi	PK3-2/A56	Dick Clayton	ML12-2/E71
Jim Cudmore	ML1-5/E30	Sheldon Davis	PK3-1/C16
Bill Demmer	TW/D19	Ulf Fagerquist	MR1-2/E78
Win Hindle	ML5-2/A53	Bill Johnson	ML21-3/E87
Ted Johnson	PK3-2/A55	John Kevill	ML1-3/E58
Andy Knowles	ML5-2/A53	John Leng	MR1-1/F35
Bill Long	ML5-2/A53	Julius Marcus	MK2/C37
John Meyer	ML12-1/A11	Ken Olsen	ML12-1/A50
Stan Olsen	MK1-2/A57	Larry Portner	ML12-3/A62
Bob Puffer	ML12-2/E38	Jack Smith	ML1-4/A54

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! d ! i ! g ! i ! t ! a ! l !         I n t e r o f f i c e
M e m o
!___!___!___!___!___!___!___!
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TO: ED KRAMER

DATE: MON 6 JUN 1983 9:33 AM DST

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION

DEPT: ENG STAFF

EXT: 223-2236

LOC/MAIL STOP: ML12-

1/A51

MESSAGE ID: 5202114274

SUBJECT: IBM AT UNIVERSITIES (AND TECHNICAL MARKET) A STRATEGY?

GB5.55

IBM has moved back into an even more significant force in the technical marketplace than prior to the 1950's consent decree. For
example, CalTech got a gift of a 4351 + Floating Point Systems array
processor. Similar gifts are common; and we all know how they fought
at CMU and MIT. The rumor now is that they'll use the IBM PC with
16016 Softcard at CMU since the 68K based one wasn't useful.

A battle is shaping up at Stanford where they have the largest, but
ineffectively used mainframes. Also, they've given away about 200 PC's to Humanities and Business faculty. We haven't been in the humanities, but the PC's are an attempt to remove the 10.

Their product strategy:

1. PC's on 8086 until they can get their 801 and become unique again
   using the CMU software. Make sure they can run the software developed at MIT on our VAX gift in a UNIX environment.

2. Supply UNIX on 4300's to regain the technical marketplace from us.

3. Lock in with Series 1, System 38 and 370 in small to large corporations.

4. Try to make it all work together with SNA and their eventual

LANs.

I think we need to have some sort of marketing strategy as it's clear
they have one. What you say?

"CC" DISTRIBUTION:

FU 6/10   FOREST BASKETT   EMC:
DIETER HUTTENBERGER   OPERATIONS COMMITTEE: PRODUCT STRAT COMM:

WPS USERS - Leave HP mode and type <CR>

We got into the heart of the issue: IBM has made the commitment to the project. Doug noted that IBM moved very fast after receiving the proposal, and on the other hand we knew of the project and their desire to work with us for about a year, even though the proposal had not been made. We're second in the pipeline to agree to do a Technical Proposal with them! CMU does not believe that both DEC and IBM can do a Technical Study there in parallel, hence the question:

> Is there anything we can do to prevent IBM from making their Technical Study, or should we simply agree that they should go first and we will request a similar Technical Study period following IBM?

WHAT IBM IS GOING TO DO
IBM has proposed to be their partner on this project, subject to being able to reach agreement during the Technical Proposal making phase. They are meeting for a day during the first week of November in order to review and approve a memorandum of agreement ... for the technical study phase. They have designated a single individual to head the Technical Proposal group and have asked CMU to provide space for the 12 individuals they want to relocate in Pittsburgh. They study is supposed to take 3 to 6 months. Doug has worked with IBM before, and has been sceptical whether IBM can be flexible enough and understands the importance of the area enough, but so far he has been surprised and has stated that IBM may have changed.

WHAT WE MIGHT (MUST) DO IF WE WANT TO DO THIS PROJECT
Right now, we run the risk of not being able to be asked to make a Technical Proposal because we can not convince CMU that we can or are willing to do the project. I don't see how we can convince them otherwise in the short period between now and when they are meeting with IBM to make an agreement. We can not sit by even now, otherwise, by default they might enter into a non-cancellable agreement with IBM which says the two must go ahead subject to an adequate proposal.

Therefore there are significant risks now that IBM will get the project by default. We will be unable to convince them that we are serious enough, hence they won't even bother to allow us to make a Technical Proposal! We must still work during this time to determine how to even stay in the race.

Doug is calling me on Tuesday morning at 9:30, hence I would like to get together on Monday morning to decide what we say.
00 BURT DECGRAM ACCEPTED S 9529 O 01 26-APR-81 01:50:24

****
* d i g i t a l *
****

TO: ENG STAFF: DATE: SUN 26 APR 1981 0:30 EST

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

cc: JIM CUDMORE
OPERATIONS COMMITTEE:
STEVE TEICHER

SUBJECT: B. O. EVANS' PRESENTATION ON JAPANESE SEMICONDUCTORS

On Friday, B. O. Evans, an IBM VP and person who headed the 360 and numerous other developments presented IBM's assessment of the Japanese Semiconductor industry to Ken, Win, Ted and I. It was clear, fact filled, very dense and high quality. The results:

- Japan's research spending is co-ordinated and at the same level as IBM's and the combined merchant semiconductor industry.
- Their spending has been co-ordinated to get them in caught up. Here, they operated for 5 years as Japan Inc., until they all disbanded to go back to their respective companies.

Japan is currently ahead in 64 K rams and this is only the beginning in the MOS area. They are hanging back in micros because they can copy them and not invest in the software.

. Japan will achieve 1 micron before 84, as evidenced by ISSCC papers, which are the best predictor. IBM is scared because they have NEVER been behind in semiconductors.

. Japan leads in every aspect of semiconductor design, device design, processing and processing equipment. They also are close to IBM in packaging, the key to using semiconductors.

. Through ARPA's VHSIC Program, the universities are starting to work, but it's not fundamental enough, it's aimed too much at design and architecture, difuse, un-disciplined and inadequate. He believes it's far too little, too late.

He has presented to various computer and semiconductor companies and to the Defense Science Board and to other National Committees including NAE. His proposal:

. Go into a mode that is very much like that used for war-time research.

. Put the work at the universities. Fund it out of Industry, Government and the Universities. Have industrial staffing.

. Operate the whole thing as a program in a very structured, top-down fashion aimed at results!

The response from the various sectors:

. Industry isn't concerned enough yet. The semis are asking

for tariff protection. They aren't competitive and they all
aspire to become computer suppliers.

. Government isn't concerned.
. Universities don't want any goals or control or interaction.
They want money with no strings.

I propose we should write a letter of support for the approach and start doing the things necessary to get such a program going.

gordon

PS
A recent Business Week article reports the formation of a MITI lab, like that that did the semiconductor work, for building a supercomputer that is aimed at 66 times Cray power by 1990. It's clear to me they can do it!

GB2.S6.15

GB0001/39

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|   |   |   |   |   |   |   |
+---------------------------+
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Subject: Keeping track of IBM trends

To: Dick Case, MK1-2/N38

CC: Ulf Fagerquist, MR1-2/E78

Date: 3/5/79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

As per our discussion, it seems necessary to update our model of IBM and how it is moving. To this end, I'd like to get a table from which we can then do a number of plots. It would be for all their products, including:

360, 370, 3xxx, 43xx, the new H series (speculations)
Series 1,
Systems 3, 10, 15, 32, 34, 38
51xx
8100
System 7

For each system we would have the basic introuduction material, but the table would have:

 introduction date and fcs
 minimum, maximum, and average system price together with the monthly maintainence
 main memory in bytes for minimum and maximum configurations
 performance both at raw cpu and system load levels

We should also have a table showing the disk and tape introductions, and the prices, capacities, and controller characteristics.

GB:ljp

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+---------------------------+                          GB0001/41
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```

Subject: **IBM WATCHERS**

To: All Watchers of IBM*

Date: 3/19/79
From: Gordon Bell/Richard Case

Dept: OOD/CSM
Loc: ML12-1/A51 Ext: 223-
2236/

MK1-2/N38 264-7307

There are many groups and individuals within Digital who are analyzing IBM products, technologies, policies, and services and their effects on the industry and our company. These studies and this knowledge should be shared across all groups within DEC. The purpose of this memo is to begin to gather and organize the "IBM Watchers."

Richard Case, of Commercial Systems Marketing, is the corporate IBM Competitive Analyst, replacing Larry Tashbook. Part of his job is to act as a central focus or "clearing house" for the many IBM watchers within Digital...hence an IBM watcher watcher.

If you have been looking into some aspect of IBM, Richard would like to know about your efforts. If you need to know information about our largest competitor, he would like to help you get the answers. If you need, have, or are purchasing IBM equipment, he would like to co-ordinate that hardware within the company.

Please fill in the attached questionnaire and send it to:

Richard Case, MK1-2 N38

along with any written reports or memos you think he and others would be interested in reading. Any sensitive information will be screened.

Richard will:

1. Publish a newsletter with IBM articles of interest.

2. Maintain and publish an index/database of subjects and people

and distribute information as it becomes available.

3. Let you know (before IBM does) if anyone else is buying the
same equipment you are.

4. Help to co-ordinate research and planning to avoid duplication of effort and expenses.

*Please disseminate as you feel appropriate

IBM Watcher Questionnaire Return to: Richard Case, MK1-2 N38

Name: ______________________________ Mail Stop: ________ Phone: ___________

Title: ____

PLease check all that apply to you and write in areas of interest not shown:

Systems/Products/Software

____ 370s ____ 4331 ____ 4341 ____ 8100 ____ 5110

____ S/38 ____ S/34 ____ S/32 ____ Series/1

Others:

Technology

____ CPUs ____ Chips ____ Modules ____ Disks ____ Tapes

____ Printers ____ Terminals

Others:

Policies

____ Leasing ____ Rentals ____ Stock ____ Personnel

____ Commissions ____ Management

Others:

Services

____ Sales Organization ____ Field Service

____ Software Services ____ Supplies

Others:

What IBM market directions are you interested in? (SBS, Office of the future)

Any other areas of Interest

Any past IBM experience?

Please send any written work you have done in analyzing IBM.

(Over)

IBM Watcher Questionnaire   Return to: Richard Case,
MK1-2 N38

Please check where your interests would fit on this graph:

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$ Price                              IBM per product cost

  4M -      Up |               |          |        |         |
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|-----------|
1.6M -      Up |               |          |        |         |
|           |
           |--------------|---------|--------|---------|---------|-
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625K - 1.6M |              |         |        |         |         |
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250K - 625K |              |         |        |         |         |
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100K - 250K |              |         |        |         |         |
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 40K - 100K |              |         |        |         |         |
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 16K -  40K |              |         |        |         |         |
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6.2K -  16K |              |         |        |         |         |
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2.5K - 6.2K |              |         |        |         |         |
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  1K - 2.5K |               |         |        |         |         |
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400$ -   1K |               |         |        |         |         |
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                                            |
           Chips, Modules,   Options, Systems|Operating  Language
Application
           Packaging,      Periph- Hardware|System
           Sub-components    erals        |
                                            |
                      Hardware              |          Software
```

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Lu Abel	ML3-2/E27	Norma Abel	MR1-2/E37
Kami Ajgaonkar	ML5-5/E97	Annette Albright	TW/E16
Dick Albright	ML21-3/E87	Hank Allard	ML5-2/E93
Don Alusic	MK1-2/K34	Phil Arnold	CZ
Al Avery	TW/A08	Bill Avery	MR2-4/E79
Paul Bauer	ML3-3/B91	Mary Beatrice	ML21-3/E87
Bob Beck	MK1-2/E6	Dick Becker	ML3-6/E94
Jim Bell	ML3-2/E41	Bob Bellman	ML12-3/A62
Leo Bennett	ML4-4/E99	Dave Best	TW/A08
Dick Best	ML3-3/H14	Len Beyersdorfer	ML21-4/E10
Ron Bingham	MR1-2/E85	Joe Bitto	PN
Carl Blatchley	ML1-3/E58	Mike Brading	RG
Rowland Brandwein	MK-2/D3	Mary Breslin	ML5-5/E39
Dick Brewer	ML5-3/E12	Norm Brimhall	ML5-5/E39
Jack Brown	ML3-6/E94	Reid Brown	TW/C10
Bert Bruce	ML1-1/E24	Jerry Butler	NU
Roger Cady	MK1/E25	Joe Carchidi	TW/D08
Peter Christy	ML12-3/A62	Van Chu	ML3-6/E94
John Clarke	ML1-2/E60	Dick Clayton	ML12-2/E71
Roy Clites	ML5-5/E97	Dan Clont	ML5-5/E97
Ralph Coffman	ML4-3/A20	Walter Colby	ML12-2/E71
Peter Conklin	TW/A08	Dave Cotton	ML5-3/E12
Ron Criss	MR1-2/E37	Don Crowther	ML5-5/E72

Brian Croxon	TW/C04	Jim Cudmore	ML1-5/E30
Bob Daley	MK	Dick Davies	RG
Jim Deblasio	ML5-2/E77	Bill Demmer	TW/D19
Michel Depeyrot	ML3-3/B91	Frank Digilio	ML1-3/E62
Marcia Donaldson	MR1-1/M55	Mike Donnelly	ML3-3/H23
Arun Dube	ML1-5/E30	Dave Dutton	ML21-2/E32
Mike Elkins	CZ	Ulf Fagerquist	MR1-2/E78
Ed Fauvre	MK1-2/E06	Paul Feresten	ML3-6/E94
Guy Fincke	ML12-1/A11	Brian Fitzgerald	MK
Bob Flynn	ML12-2/E71	Cindy Foster	ML21-3/E87
Don Freniere	TW/C03	John Friedrich	ML5-2/H15
Sam Fuller	TW/A08	Lorrin Gale	TW/D19
Wayne Galusha	ML3-6/E94	George Gerelds	ML5-3/E22
Abe Gershnow	ML1-3/E62	Ed Gianetto	ML21-3/E87
John Gilbert	TW/E07	Jim Gillett	PX (Phoenix)
Richard Glantz	MR1-2/E37	Brad Glass	TW/E10
Bob Glorioso	ML3-2/E41	Phil Goldman	ML3-6/E94
Dick Gonzales	ML6-2/E66	Roy Graham	ML5-5/E97
Bob Gray	MK	Bill Green	ML1-4/B34
Ian Gunn	MD	Mike Gutman	ML3-6/E94
Steve Gutz	ML3-5/E82	Len Halio	ML1-2/H26
Judi Hall	ML5-5/E76	Judy Hall	ML21-3/E87
Martin Hall	PK1/P84	Ron Ham	MK1-2/J6
Don Haney	ML1-2/E65	Jim Harnedy	MK-

2/E6
Frank Hassett TW/C10 Bill Heffner
TW/E10
Steve Heiser MR1-2/E37 John Hess ML1-
3/E63
John Hittell ML21-3/E87 George Hitz ML21-
2/E64
Per Hjerppe MR1-2/E78 George Hoff MR1-
2/E78
Marv Horovitz ML21-4/E10 Bill Howerton ML12-
3/A62
Bob Hranek ML1-5/B98 Leslie Hruby MR1-
2/E78
Jim Hughes ML3-5/E82 Peter Hurley MR1-
2/E37
Bob Jack ML1-3/E58 Mike Jean ML21-
3/E87
Bill Johnson ML3-5/H33 Glenn Johnson ML21-
4/E10
Steve Johnson ML5-5/E97 John Jorgensen MR1-
2/E78
Bill Keating ML12-3/A62 Justin Kelleher ML12-
3/A62
Bill Kelly ML3-6/E95 Ed Kenney
TW/F17
John Kevill ML3-6/E94 Lynn King ML5-
2/E93
Lou Klotz ML1-2/E60 Oleh Kostetsky ML5-
5/E39
Mitchell Kur ML12-2/A16 Bob Kusik ML3-
5/H33
Dom Lacava ML12-3/A62 Jim Lacey ML21-
4/E10
Bernie Lacroute TW/A08 Jim Lawrence ML8-
4/E86
Ed Lazar ML5-3/E12 Ray Lechevet ML5-
2/E77
Richard Leslie MR1-2/E78 Howard Lev ML12-
3/A62
Demetrios Lignos CZ Tomas Lofgren MR1-
2/E89
Richard Loveland ML12-2/E71 Si Lyle MR1-
1/M42
Joe Madden ML3-6/E23 Dick Maliska MR1-
2/E68

Maurice Marks   ML3-5/E82   Jim Marshall
TW/A03
Bill McBride   MR2-4/E14   Art McCray
TW/E10
Ed McDonough   MO-2   Don McInnis
TW/A08
Ray Melanson   ML4-2/E90   John Meyer   ML12-
1/A11
Jack Mileski   ML12-3/A62   Bob Misner   MK1-
2/B6
Roy Moffa   ML1-2/H26   Gene Mondani   ML1-
5/E30
Bill Moran   ML5-2/E77   Hank Moran   ML5-
5/E39
John Morgan   MK1-2/A8   Dick Morris   ML21-
2/E64
Wolfgang Muller   GE   Bill Munson
TW/E10
John Murray   ML1-3/E63   Paul Nelson   ML5-
3/E12
Bob Niro   PK3-1/M34   Ken Nisbet
TW/D19
Pauline Nist   TW/D19   Carl Noelcke   ML3-
3/H14
Kathy Norris   TW/A08   Bob Nussbaum   ML5-
5/E76
Jim Padian   MK1-2/H03   Nathan Parke
TW/B02
Stan Pearson   ML12-2/E38   Laura Persily   ML12-
2/E71
Charles Picariello ML4-4/E99   Richard Pietravalle MK-
2/D3
George Plowman   ML5-5/E97   Larry Portner   ML12-
3/A62
Roger Pothier   MR1-2/E74   Terry Potter   ML3-
3/H24
Lloyd Powell   ML3-6/E94   Horace Prindle   MR1-
2/E78
Bob Puffer   ML12-2/E38   Steve Radoff   ML1-
3/E58
Curt Rawley   ML12-2/E71   Dick Reilly   ML4-
4/E99
Terry Retford   RG   Paul Rey   ML8-
4/E86
Glenn Reyer   MK-2/D3   Mike Riggle   ML1-

3/E58
Dave Rodgers TW/C04 Bob Rorke ML21-
4/E10
Charlie Rose ML5-2/M40 John Rose ML12-
3/A62
Wayne Rosing TW/A03 Steve Rothman
TW/C06
Bob Rottmayer ML4-1/B32 Ken Russ ML11-
2/E83
Geoff Sackman ML1-4/A97 John Sackman ML4-
4/E99
Mike Sadofsky ML5-5/E97 John Sartory ML4-
4/E99
Bob Savell ML5-2/E50 Grant Saviers CZ
Henk Schalke TW/C17 Dick Schneider ML11-
4/E53
Dave Schroeder MK Bill Seaver ML5-
3/E12
Bill Segal ML3-5/E82 Tom Shanahan ML2-
2/A15
Herb Shanzer ML21-1/E81 Ken Sills ML3-
6/E94
Andrew Skinner RG Ed Slaughter TW
Joe Smith ML11-4/E53 Kevin Smith ML3-
6/E94
LeRoy Smith ML4-2/E27 Dick Snyder MR1-
2/E37
John Sofio TW/D02 Ned Somerville MR1-
2/E78
Ed Spuler MK1-2/C2 Joe St. Amour ML1-
5/E29
Gil Steil ML5-5/E76 Chuck Stein ML5-
5/E97
Tom Stockebrand AB Ollie Stone ML21-
3/E87
Pete Straka ML21-4/E10 Bill Strecker
TW/A08
Steve Sur MR1-1/A43 Phil Tays ML11-
4/E53
Walter Tetschner ML5-3/E12 Mike Titelbaum ML1-
2/E65
Dave Tolman MR1-1/M49 Bob Travis MK
Rollins Turner ML3-2/E41 Pete vanRoekens
TW/B10
Armen Varteressian TW/E45 Joe Viula MR1-

2/E78
Jim Wade RB Jane Ward ML12-
3/A62
Ted Webber MK-2/D3 Mike Weinstein ML5-
5/E97
Pat White ML12-3/E51 Art Williams ML5-
3/E12
George Wood AC/E44 Ed Wright ML12-
B/B75
Linda Wright TW/E07 Dick Yen TA
Chuck Youse ML1-3/E63 Ted Zajdel PK3-
1/M12

EMS 19-JAN-79
13:39:08 410 1
To: Roger Cady
From: Gordon Bell
Date: FRI 19-JAN-79 13:39:08 EDT
Subject: IBM -- Josephson Device Computer

IBM may have a Josephson Device Computer at the end of the next 15 years. It
is fantastically fast. Will send you specs of first target (25
ps cycle time). The technical problem seems to be mainly one of packaging!
It isn't clear how/what to do about secondary/ tertiary memory.

Command:

EMS 12-FEB-79
20:48:40 400 1
To: Bernie Lacroute, Mike Powell, Brian Croxon, Dave Rodgers, Bill Demmer
CC: Mary Jane Forbes, Ed Fauvre, OOD
From: Gordon Bell
Date: MON 12-FEB-79 20:48:40 EDT
Subject: Stopping the 11/74 and moving ahead with 11/70 multiprocessor
----

Today the Operations Committee voted to support the
Commercial Product Line,
Product Management, Service and Manufacturing recommendations
to stop the
11/74. The 11/70 multiprocessor will proceed ahead as
planned.

I am sorry that we did not decide earlier because it would
have meant that we
could have worked on products which would have gone to
market. However,
given that we are not marketing the 74, there is a
significant increase in
emphasis on marketing the 11/780 and I believe that this
effort will have
higher payoff.

I want to thank all of you who have been involved in the
engineering of the
74 and ask that you hang in there over these next few weeks
while we
structure the new engineering projects which are in a
general direction of
more VAX and better network support. Although it is unclear
as to the
specific project, we require significant work in the
interconnection and
front ending of computers, mass storage , and in both low and
high end VAX
systems including a VLSI VAX. Again, I am sorry about the
decision, I think
it is basically right and that we should proceed to develop
significant new
hardware.

Command:

October 9, 1980

Lewis M. Branscomb
IBM Corporation
Old Orchard Rd.

Armonk, NY 10504

Dear Lewis,

It was great to chat with you and hear your talk last week at the ICCC80 meeting. The Brazil paper that you had read was written after the enclosed paper on Japan. I think you might be interested in this as well. All of our efforts will be needed in keeping the US in the forefront...or viable.

The Digital Computer Museum, that Gwen and I started about a year ago, is aimed towards the computer professional, preserving and displaying materials of special historical interest. As part of the program we're video taping lectures on the first 10 computers. The next one, by John Atanasoff is on November 11, and then Konrad Zuse is coming on March 4, in case you can plan a trip to the museum coinciding with one of these unique events. (Our newsletter and brochure are enclosed for your information.)

I would like to make a personal plea that you could help me so that our Museum can make use of the services of Roberto Guatelli of New York, who builds calculator and computer models for IBM.
Michael Sullivan agrees in principle that Guatelli should be able to do some work for us, but has not yet cleared this through his superiors. A letter to Michael is enclosed describing exactly what we would like. I hope you think this is appropriate and will help us. I can see only positive benefits to IBM. As we need an exhibit that slows the card-based origin of computing. Also, two of the items will be needed when IBM decides on the artifacts for the 100th anniversary of Hollerith.

Cordially,

Gordon Bell
Vice President, Engineering
Keeper, Digital Computer Museum

GB:swh

GB1.S7.29
Enclosures: Japan paper
Letter to Michael Sullivan
Museum Brochure and Newsletter
October 10, 1980

Jerrier A. Haddad
IBM Corporation
Old Orchard Rd.
Armonk, NY 10504

Dear Jerrier,

Do hope that you can come to see the exhibits at the Digital Computer Museum at some time. A copy of our newsletter is enclosed announcing John Atansoff's lecture on November 11 and Konrad Zuse on March 4. Both should be very interesting.

Can you help me as Keeper of the Digital Computer Museum? We would like Roberto Guatelli to make some models for us, but apparently Michael Sullivan will has not been able to get the appropriate approvals. I can see only a positive benefit for IBM since the models we need are to show the card-based orgin of computing.

For example, two of the items we'd like will be required by IBM when it celebrates the 100th anniversary of Hollerith.

Please help.

All the best.

Sincerely yours,

Gordon Bell
Vice President, Engineering
Keeper, Digital Computer Museum

GB:swh
GB1.S7.27

Enclosure: Museum Newsletter
October 10, 1980

Michael J. Sullivan, Manager
Corporate Exhibit Programs
IBM
Old Orchard Road
Armonk, NY 10504

Dear Michael,

Friday, October 3, we had lunch with Roberto Guatelli and Joe. We were hoping that they would agree to do some work for the Digital Computer Museum, but they said that they were not free to do anything for us until it was approved by IBM.

Specifically we would like the following:

- A replica of the Pascal calculator;
- A quarter scale model of the Jacquard loom, especially showing the card control mechanism;
- A scale model of card control mechanism of the Babbage analytic engine;
- A second copy of the Hollerith machine if one is ordered by IBM Germany.

In addition, from time to time, we would like to be able to commission Guatelli to make other things.

On all items obtained from Guatelli we would be willing to give IBM appropriate credits.

I hope you can decide quickly and in our favor.

Cordially,

Gordon Bell
Vice President, Engineering
Keeper, Digital Computer Museum

GB:swh
GB1.S7.28

CC: Lewis Branscomb
Jerrier Haddad

GB0001/34

| d | i | g | i | t | a | l | i n t e r o f f i c e   m e m o r a n d u m

Subject: IBM's Got It Together: Now's the Time to Get Organized

To: OOD,
Jack Smith, ML1-4/A54
Dave Thorpe, ML1-4/P11

Date: 3/6/79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

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FOR DISCUSSION ONLY

For the first time, it feels like we have a very strong competitor in IBM. The recent announcements are in our price class with the same approach to computing that we have. While in the past, it felt like IBM considered the 250K boundary as sacred, so it could sell centralized systems to the top of an organization, now they are building systems that can be utilized by all parts of it because the prices and capabilities are right. Something we've been doing all along. Having contained Burroughs, Univac, Honeywell and forced them down into the mini range, they can now focus and come after us all with one offering.

It seems they have considered their key markets:

1. Their conventional base with the 43xx's as 370's as an alternative to minis. Note, the 43xx's can also be used in a distributed data base to either other 43xx's or to 370's (larger systems).

2. The 8100's are for communication intensive applications, e.g., office automation, many terminals, factories, real time.

3. Some hot entries, including array processing to get back into the scientific market. This, overall helps their image and gets them ideas to feed their future marketplace. We had gotten too strong there and it was beginning to affect future buyers.

4. Their small organization solutions with a modern computer in the System 38. Though comparatively low volume, it can be used to understand the single level memory system where the users are less sophisticated and undemanding.

5. The Series 1 is insignificant just to confuse things. It uses old technology, but they can fight with it. It still has better technology.

Also, there are undoubtedly more systems to come:

1. The small business/personal. The 51xx isn't that strong.

2. The hot, high end. This is harder, because of the big backlog in the 30xx's. I'll bet they were ready with something, but are sitting back on their backlog. The 30xx's weren't really that significant as warmed over 370's, but again there's no competition so why push things.

3. Some really good terminals. There has been nothing really good to hang on these systems yet.

4. Really good word processing.

Why it's so frightening, technologically:

1. <u>They appear to have automated</u> the hell out of <u>manufacturing</u>. Remember the Marvelous Module Making Machine that I urged us to work on for the last 5 years? They appear to have it. It is the only way to get the number of products this quickly.

2. <u>The automation of the design process</u> is equally impressive. It has tube-based logic input, automatic generation of test patterns and simulation, and at the system level, automatic generation of diagnostics.

3. <u>The gate array chips are impressive</u>, one chip though bipolar has the speed of ECL. Overall they are doing their designs with only 2 basic chip types, both of which are better than what we have in Comet and in the MCA.

4. Where they can't do it automatically, <u>manufacturing is also done by good product positioning</u> <u>with a</u> very <u>few</u>, <u>very high volume products</u>. While one would expect some very high end mass storage devices to be announced subsequently, <u>they have only announced 4 mass memory units to cover virtually our whole range</u>: a 1 megabyte floppy (load only), 50 and 600 Mbyte fixed disks, and 1 tape unit for storage and backup. It's not clear what the cost and price separation is. (By contrast, we are introducing or would like to introduce many products in a narrower space. Here, we definitely have to take their lead and eliminate some of the redundancy.)

GB:ljp

Attachment

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Dick Clayton	ML12-2/E71	Jim Cudmore	ML1-5/E30
Bill Demmer	TW/D19	Ulf Fagerquist	MR1-2/E78
Bill Johnson	ML3-5/H33	John Kevill	ML3-6/E94
John Meyer	ML12-1/A11	Larry Portner	ML12-3/A62
Bob Puffer	ML12-2/E38		
Jack Smith	ML1-4/A54	Dave Thorpe	ML1-4/P11

00 CORE DECGRAM ACCEPTED S 002849 O 369 11-OCT-82 14:23:40

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION

DATE: MON 11 OCT 1982 1:31 PM EDT

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5178324329

SUBJECT: IBM'S AGGRESSIVE BEHAVIOR WITH UNIVERSITIES & RESEARCH

IBM has changed it's posture significantly with respect to
research and interfacing to universities. It is behaving and
selling itself as a responsive, aggressive, high technology
leader. In effect, it is returning to a position it once had
in
the early era where it built Mark I for Aiken at Harvard, the
SSEC for Wallace Eckert at Columbia, the Sage in conjunction
with
MIT, the 360/67 for Michigan. Furthermore, it is giving
4300's
to universities at the drop of a hat.

Now, it's going to build the ultracomputer for Jack Schwartz,
NYU, who also consults at IBM Research; the Connection
Machine
for MIT (a very large semantic network); and it's quite
likely to
get the CMU contract for the high performance personal
computers.
Finally, it's just announced a block mux to Unibus adapter
which
allows Unibus options to plug into 4300's and 370's. I
believe
the goal here is to be able to unplug 11's and use 370's so
the
experimental world can go to IBM.

WHAT CAN WE DO?
I now believe this kind of arrangement (university specifies
and
writes software and uses-- industry builds hardware) is ideal
and
the only one that works! The Japanese companies cooperate
with
their universities (and the Paris World Computer Center for
example) in this way too. When the university builds
hardware
(no matter what we give them), the results are poor... and we
don't assimilate the ideas. We should have done the building
for
CMU, LASL (another marginal design), etc. in multiprocessors.

We
might have built the LISP machines for MIT and avoided a new set
of competitors. Finally, we are no longer building the higher
risk, designs that could be done with customers such as LASL. I
think we need a group to do this kind of work within Research!

GB3.S8.7

"TO" DISTRIBUTION:

GERALD V BUTLER	RICHARD CASE	BILL LONG
OPERATIONS COMMITTEE:	PEG:	RAD:
TMC	TMC VIA HARD COPY	

****
* d i g i t a l *
****

TO: TERRY CULLEN

cc: see "CC" DISTRIBUTION DATE: THU 31 JAN 1980 4:35

FROM: GORDON BELL
DEPT: OOD EXT: 223-2236
LOC/MAIL STOP: ML12-1 A51

SUBJECT: I/C EXHIBIT FOR YOUR AWARENESS PROGRAM (>1)

An exhibit would have:

1. What it connects (i.e. where it's used in the system).

2. The need and advantages (and any limitations).

3. Cables, connectors, and how it is cabled into system or box.

4. Photo of use in breadboard or in context of use.

5. Circuit diagram and EMI characteristics.

6. Any modems (e.g. in Ethernet).

The interconnects to show are:

1. Standard Disk Bus

2. NI with a coax, modem at tap and cable to the computer.

3. NI used for interconnecting our small systems. - Let's mock up such a system.

4. BI - backplane, cable (if we now have one). Some system mock-up.

5. CI - also show tap on the wall. Are we now using the SDB cable?

6. Mercury - the elegant modules and backplane and how this eliminates the communication cable mess at the computer. Do we have any interfaces yet which have built-in modems to further reduce the marker of boxes at the site?

7. VT100, LA120, and LA34 and line printers using Comm. or whatever. Built in modems ala new terminals (LA34, VT100?) and VT100 with hard copy output.

Also let's look at the new modular jacks and cables used for EIA and/or 20ma and EIA 423 when no modems are used. We'd also give system block diagrams of all the systems and a single one ala your 1 page poster.

Let's also show block diagrams and photos of:

1. MINC - process I/O plus A/C and Interconnect.

2. Mock up of VT278 with modem or phone connection.

3. An 11/23 system with modem or phone connector.

4. PDT-150 with modem or phone connector.

GB:swh
GB1.S1.21

"CC" DISTRIBUTION:

BERNIE LACROUTE BILL STRECKER DAVE RODGERS
BILL DEMMER GEORGE PLOWMAN JOHN ADAMS
WAYNE ROSING MIKE WEINSTEIN
THE END

<u>IC GENERATION</u>

<u>DIGITAL CALCULA</u>

FIVE OR MORE REGISTER
<u>Slide Rule Calculator</u>, Texas Instruments, 1973, Gift of Mike Riggle (D237.81).

<u>DIGITAL COMPUTER</u>

<u>Advanced Scientific Computer Exhibit</u>, Gift of Texas Instruments;

- ASC Emitter Coupled Logic Board, Texas Instruments, 1971, (D238.80).
- ASC ECL Mother Board, Texas Instruments, 1971, (D239.80).
- ASC ECL Mother Board, Texas Instruments, 1971, (D240.80).
- ASC Logic & Harness Connector Bulkhead Cabinets, Texas Instruments, 1974, (D224.80).
- ASC Disk, Texas Instruments, 1974, (D225.80).

Word length: 32 bits

Memory size: Memory Control Unit (MCU) provides facilities for controlling access from eight processor ports to a central memory having a 24-bit address space (16 million words).

Data transfer rate: 50 million words per second per port; total transfer capacity of 400M words per second.

Clock rate: 12 MHz

Central Processor: Provides both scalar (single operand) and vector (array) instructions at the machine level. 48 programmable registers consisting of 16 base address registers, 16 arithmetic registers, 8 index registers, 8 vector parameter registers.

Instruction format: Multiple pipelined instruction processing units. Instruction size, 32 bits with 16-, 32-, or 64-bit operands.

Technology: Pipeline architecture.

Power consumption: 500 KW

Size: 4000 square foot floor area (includes main frame, disks, operating system, etc).

Number produced: Seven.

Price: $8M-15M

Project start: March 1966

Project leader: Harvey Cragon

First delivery: 1971

Software: Fortran Compiler (NX and FX)

Use: Large scale scientific and technical problems.

Achievements: Pipeline processing capabilities as architectural attribute. Super computer capabilities along lines of CRAY-1, Star-100. Modular, high speed general purpose data processing system used for large scale scientific and technical problems.

PDP-11/20, Digital Equipment Corp, (D140.80).

- PDP-11/20 Logic Modules, Digital Equipment Corp, 1970, (D141.80).
- PDP-11/20 Module Artwork, Digital Equipment Corp., 1969, 100x94 cm, Mylar in Plexi, (B77.72).

PDP-11/45, Digital Equipment Corporation, (D

Word Length: 16 bits

Memory Size: MOS primary memory/memory management unit (KT11) with addressing capability for up to 256K bytes.

Speed: Execution speeds of up to 3 million instructions per second.

Clock rate: 150 nsec (30 nsec) 3.33 mps (max)

Arithmetic element: 16 general purpose registers, 3 programming modes - user, kernel, supervisor.

Instruction format: Single operand, double operand, multi-mode 16-bit instructions. PDP-11 instruction set. FP instruction set with 6 additional registers (46 instructions) in the FP processor

Power: 120v at 60Hz

Project Start: June 1970

Project Leaders: Dick Clayton, Product Line Manager; Bruce Delagi, Engineering Manager

Predecessor: PDP-11/20

Contemporaries: PDP-11/05, 11/40

Successors: PDP-11/70, 11/44

Software: RT-11, RSX-11/D, RSX-11/M, RSTS and layered software

First shipment: June 1972

Achievements: Pc speed to match 300 ns bipolar memory; high speed microprogrammed parallel FPP; memory management unit - KT11; first use of TTL/Shottky logic; dual bus structure to allow for intermix of solid state and core memory for optimal perfomance

COMPONENTS

Integrated Circuit Manufacturing Steps Card, Digital Equipment Corp, (D37.80).

CONSOLE

PDP11/45 Console Panel & BOARD, Digital Equipment Corp, 1973, Plastic, (D199.80).

LOGIC MODULES

PDP-8/I Logic Module 220, Digital Equipment Corp, 1970, Gift of Harry Moyer (D102.80).

CCC Logic Module, Computer Controls Corp, 1965, Gift of Gordon Bell (D111.80).

CCC Logic Module, Computer Controls Corp, 1965, (D194.80).

STAR Logic Module, Control Data Corp, Gift of Lawrence Livermore Laboratories (D218.80).

CDC 6600 Transfer Board, Control Data Corp, Gift of Lawrence Livermore Laboratories (D223.80).

Cray I Interface Module, Cray Research, Inc, 1976, Gift of G. Michaels and W. Becker, Lawrence Livermore Laboratories (D226.80).

PRIMARY MEMORY

Thin Film Memory, RCA, 1966-1970, Gift of Gordon Bell (D112.80).

Memory Driver, (D210.80).

PDP-11 Planar-structured Core Memory, Digital Equipment Corp, 1975, (D241.80).

SECONDARY MEMORY

Prototype RL01 Disk Drive, Digital Equipment Corp, 1975, Gift of Hertrich Development, Inc. (D163.80).

IBM Data Cell Cartridge, IBM, 1969, Gift of Lawrence Livermore Laboratories (D220.80).

A direct access storage device which stores data on individual magnetic strips. These strips are contained in removable, interchangeable data cells. The IBM 2321 Data Cell Drive has 10 data cells with 20 subcells per cell, each subcell has 10 magnetic strips. Each data cell can contain 39.2 million bytes or 78.5 packed decimal digits. A single 2321 data cell drive can have on-line access to a maximum of 392 million bytes or 784 million packed decimal digits and signs. (See IBM Manual GA26-3574-2 and GA26-5988-7.)

<u>IBM 2321 Data Strips</u>, IBM, 1969, Gift of Lawrence Livermore Laboratories (D219.80).

<u>IBM 1360 Photo-digital Storage System Module</u>, IBM, 1967-1969, 2.5x2x5 cm, Gray, Plastic, Gift of Lawrence Livermore Laboratories (D221.80).

A storage module has 32 chips of film, each chip contains 32 fields and each field has 128k bits(?). The Storage System is equivalent to magnetic tape 800 bpi. There are 10k cartridges in photostore on line. There is random access to any bit. The reading rate is 2x10**6 bps.

<u>CDC 38500 Cartridge</u>, Control Data Corp, Gift of Lawrence Livermore Laboratories (D222.80).

The original CDC 6600 was built under contract to Lawrence Livermore. Multiple arithmetic and logical units and ten peripheral processors, which were small computers themselves, made the 6600 a very powerful and fast computer. Peripheral processors direct, monitor and time-share the central processor.

DMCAT2.4

+---------------+
! **d i g i t a l !   i n t e r o f f i c e   m e m o r a n d u m**
+---------------+

Subject: **Inter-Computer Communications Switch (ICCS) Goals/Constraints for RAME Computer**

To: Roger Cady, Bill Demmer, Pete VanRoekens (RAME)

Date: 1 MAY 78
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

CC: OOD, Bill Keating,

Reliable Available Maintainable

Expandable Computer Task Force

follow up 5/15/78

Background

I would like to have Sam Fuller, Bob Stewart and Bill Strecker define the ICC Bus immediately as part of the non-stop, RAME Computer Task Force. Although the reliable computer group has not yet moved rapidly, it is clear that the ICC Switch (probably a Bus) is needed with virtually any approach we use to providing high available systems -- unless we believe that a small multiprocessor will serve the marketplace. This is the only risk in beginning the ICCS without further definition from the top, but I believe it is negligible and I would rather have more detailed information that a focused localized task force would bring, rather than predicating a top-down architecture on what may not be implementable.

The bus as I see it is subject to goals (G), constraints (C), and certain implications (I):

G0. Provide high data bandwidth communications among main computers, file computers and front end computers at sufficiently high bandwidth to permit file transfers and paging-oriented operation. There should be no hierarchial relationship among machines, thus only one type of interconnection is required.

I. Disk data rates appear to be 1 Mbyte now, and going to 2 Mbytes in 1982. 10 Mbytes/single bus is what I'd feel comfortable with.

G1. Be oriented to the next 10 years (at least two implementations).

G2. Provide reliable communications by having alternative routing (wires) for communications and be adequately checked so that reliable transmission is insured.

I. This could be a simple parity scheme with retransmission or it could have error correction.

C3. Use existing cables and transmission technology so that an advanced development project isn't required to start the task.

I. Implies parallel transmission.

G4. Be adaptable in the future to serial or fiber optic technology when such is available.

G5. At the top most level, the user would give commands that are a subset of the DECnet commands.

G6. Oriented to a range of implementations over by being implementable at the low end with not more than one hex board (1978) of currently available logic to get an interface to a Unibus.

C7. Permit more than 16 computers to communicate with one another, although when the number of computers exceeds a nominal cable driving and/or receiving capability, special techniques (options or repeaters) may be employed.

G8. Be speed independent so that small C's are not constrained to have large buffers or expensive interfaces for very high data rate transfers.

I1. Use some sort of receiver controlled clock so that a transmitter can't overrun a small system.

I2. Permit a range of trading off various capabilities in the interface by using software instead of hardware.

C9. Be distance independent and not

confined to a single cabinet.

I. Have provisions for both internal and external cabinet cables.

C10. All interfaces would have embedded diagnostics for the line and interface so that MTTR is not increased for controller or link failures.

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Jim Bell	ML3-2/E41	Dick Clayton	ML12-2/E71
Jim Cudmore	ML1-4/E30	Bill Demmer	TW/D19
Ulf Fagerquist	MR1-2/E78	John Kevill	ML1-3/E58
Julius Marcus	MK2/C37	John Meyer	ML12-1/A11
Larry Portner	ML12-3/A62	Bob Puffer	ML12-2/E38
Roger Cady	MK	Bill Keating	ML12-3/A62
Pete vanRoekens	ML12-2/E71		

00 CORE DECGRAM ACCEPTED S 000257 O 21 14-AUG-82 12:00:12

****
* d i g i t a l *
****

TO: BILL JOHNSON
BERNIE LACROUTE
cc: BOB DOCKSER
SAM FULLER
OPERATIONS COMMITTEE:

DATE: SAT 14 AUG 1982 11:30 AM EDT
FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5172535031

SUBJECT: COLLABORATION WITH ICL TO ESTABLISH A MAIL STANDARD

Rob Wilmot, President of ICL called me about our continuing on with standards for Ethernet. He wants to establish applications standards in this area so that there would be real meat behind the Ethernet approach. In this way, we'd build on the Ethernet standard that is now reality and make it even more meaningful.

The standard he wants to work on right now is MAIL!

I think we should proceed to discuss what this standard might look like, but the actual agreement should come to the Operations
Committee.

Would you Telex him with the responsible person for mail standards and then get together to scope the goals?

The pros of doing it:
1. Build on the momentum of Ethernet
2. Getting a standard... which we badly need for the plethora of
mail systems in house we aren't successfully standardizing worth
a damn. This would free lots of resources.

The cons:
1. It would permit the various Ethernet suppliers (eg. ICL, HP, Xerox, Siemens, CII, Philips, Olivetti) to say: We will support the mail standard and will have products that work with it.

What do youse think regarding the importance of this outside of
DEC?

3 January 1983

Dr. David A. Zein
Chairman, IEEE Computer & Technology Meeting
IBM Corporation
D/818,B/300-45A
East Fishkill, route 52
Hopewell Junction, New York 12533

Dear David:

Thank you for the invitation to speak at the IEEE Mid-Hudson Section Meeting on Computers and technology (CAT) to be held May 19-20, 1983.

I regret that I am really flat out, overcommitted and can't come at this time. Again, thanks for the honor.

Sincerely,

Gordon Bell
Vice President, Engineering

GB4.S1.4

27 April 1983

Mr. Edward A. Torrero
Senior Editor
IEEE Spectrum
345 East 47th Street
New York, New York 10017

Dear Ed:

Sorry I can't take on a writing task, but would review the issue when you get it.

What about a discussion on the U.S. inability to exploit and manufacture the results of research (especially versus the Japanese)?

How will we couple to the Japanese research versus how they couple to ours?

What about England as a source of ideas (especially versus the French effort)?

Sincerely,

Gordon Bell
Vice President, Engineering

GB5.17
Kim Igoe

Dear Kim Igoe,

Enclosed please find the questionnaire and check for $350 necessary to go forward with the Museum Assessment Program.

To help you, I am enclosing three sets of everything along with the MAP questionnaire: one for the AAM and one for each of the two on-site surveyors that you suggest. I have tried to be as complete as possible so that the surveyor can come to the site prepared and so that we can plan the visit to really get into some depth and set some priorities for ourselves. I believe that the trustees and I have a good idea of where we want to be some years hence; and now the question is the best, most efficient road to get there.

For the above reasons, I would like a surveyor who has helped an institution grow -- from an idea to a major established museum. Personally, Mike Spock is very helpful to have on our Board for this very reason -- he keeps warning me of the various pitfalls of growth along the way. Mike actually suggested that we start the MAP procedures and I am sure that he will be happy to be helpful in this project, provided he is in town, and I will be asking his advice about the final selection of a surveyor.

If possible, I would like to get some names before Christmas and select a person and a date for early in the year, so that we can compile all the information and have a report and our own proposal in the mail to The Computer Museum's Board in the spring.

Thank you for your help,

Cordially,

Gwen Bell

September 29, 1983

J. N. Snyder
Head of Department
Department of Computer Science
University of Illinois at Urbana-Champaign
1304 West Springfield Avenue
Urbana, IL 61801-2987

Dear Dr. Snyder:

I am very grateful to you and your department for inviting me to give the Eighth Gillies Lecture. Please extend my special thanks to Mrs. Snyder for the wonderful party and dinner on Sunday. I do hope it was up to Professor Gillies' standards. It was truly an honor to be in the company of the seven previous lecturers.

The very short time at the university with your impressive faculty and students was truly stimulating, but all too short. Hopefully the next visit will be longer. I particularly enjoyed the discussions on the Cedar Project, and I hope that the machine can somehow be built.

Of course the Computer Museum is deeply indepted to the department for the ILLIAC artifacts, and I hope that each of you will visit the museum in the future. I was impressed with your library and encourage you to send us books and reports that you retire from the library. Some of the Museum reports and brochures are enclosed.

Let me urge you to join the Museum as a member or founder and help preserve computing history.

Sincerely,

Gordon Bell
Chief Technical Officer
& Computer Museum Board Member

Enclosures - Computer Museum literature
Expense report

cc: Prof. David J. Kuck
Mrs. Donald Gillies

GB7.14

September 29, 1983

Professors Chung Lang and Jane Liu
Department of Computer Science
University of Illinois at Urbana-Champaign
1304 West Springfield Avenue
Urbana, IL 61801-2987

Dear Professors Liu:

I enjoyed our interaction at the Gillies Lectures.

I hope you'll visit the Computer Museum in the near future such as the TX-0 celebration on November 12. (Let me know.)

Enclosed is a sample report and brochures on the Computer Museum. Let me also encourage you to donate any books and papers you might have of historical significance.

Let me urge you to join the museum and help preserve computing history.

Sincerely,

Gordon Bell
Chief Technical Officer
& Computer Museum Board Member

Enclosures - Museum literature

GB7.14

September 29, 1983

Dr. R. S. Michalski
Department of Computer Science
University of Illinois at Urbana-Champaign
1304 West Springfield Avenue
Urbana, IL 61801-2987

Dear Dr. Michalski:

I enjoyed our visit at the time of the Gillies Lectures. Enclosed are some reports and a brochure on the Computer Museum. I hope you'll consider joining and giving your important papers and artifacts for safe keeping.

I have passed on your request for various copies of my slides to Gwen Bell, Director of the Museum. I will add as many of my lecture slides as possible and as appropriate to the museum collection.

A catalog is forthcoming and you will note it has several of these slides.

Please join the Museum and help us preserve history.

Sincerely,

Gordon Bell
Chief Technical Officer
& Computer Museum Board Member

GB7.14

September 29, 1983

Professor Saburo Muroga
Department of Computer Science
University of Illinois at Urbana-Champaign
1304 West Springfield Avenue
Urbana, IL 61801-2987

Dear Professor Muroga:

I thoroughly enjoyed the visit with you on Tuesday and the discussion of the computing evolution. The book on the Abacus and your other artifacts and library were especially nice.

As you know, the Computer Museum is dedicated to the preservation of important information processing artifacts. As such, we would be honored to accept and care for any papers, books, objects you have, including the various Abacii and Abacus references, the Toko WoKen Wire memory, Parametrons used in the machines you designed and other books from your library.

I am enclosing several reports and brochures on the Museum, and would like to encourage you to join and become a founding member. I would also ask you to present the brochure to friends who visit you from Japan because we want to acquire more Japanese artifacts of all types. The Museum also especially wants more Japanese visitors and members. In this regard, we have invited one of Japan's computer industry leaders to become a member of our Board.

I was pleased to accept the two books by you and have placed them in the Computer Museum.

Again, I enjoyed our visit.

Sincerely yours,

Gordon Bell
Chief Technical Officer
& Computer Museum Board Member

GB7.14

September 29, 1983

Ms. Jeanne Adams
Chairman Fortran 8X committee
University Service Center
Colorado State University
Fort Collins, Colorado 80523

Dear Ms. Adams:

Could you please send me a copy of the current FORTRAN 8X draft together with proposals for extensions?

What is the status of the draft vis a vis the time when it will become a standard?

Sincerely yours,

Gordon Bell
Chief Technical Officer

J. N. Snyder
Head of Department
Department of Computer Science
University of Illinois at Urbana-Champaign
1304 West Springfield Avenue
Urbana, IL 61801-2987
-

Professors Chung Lang and Jane Liu
Department of Computer Science
University of Illinois at Urbana-Champaign
1304 West Springfield Avenue
Urbana, IL 61801-2987

-

Dr. R. S. Michalski
Department of Computer Science
University of Illinois at Urbana-Champaign
1304 West Springfield Avenue
Urbana, IL 61801-2987

-

Professor Saburo Muroga
Department of Computer Science
University of Illinois at Urbana-Champaign
1304 West Springfield Avenue
Urbana, IL 61801-2987

-

Ms. Jeanne Adams
Chairman Fortran 8X committee
University Service Center
Colorado State University
Fort Collins, Colorado 80523

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SUBJ: **Individual Development Planning Kickoff**

TO: OOD

Date: 1/29/80 Tue
From: Gordon Bell & Larry Portner
Dept: OOD
MS: 12-1/A51/12-1/T32
Ext:2236/2471
EMS: @CORE

We have reviewed the Individual Development Planning (IDP) Process that is part of the Human Resource Program Plan being designed under OOD wide sponsorship. In order to kick-off the IDP Process, we are asking each of you to proceed to construct your own development plan along the lines specified in the attached document.

Although the construction of a development plan is the province of the individual, we strongly support each of you making a plan, because we believe it will:

1. be useful in your own career planning;

2. be a model for the rest of your organization and the company;

3. help us understand the problems in such an approach;

4. be a key document in recruiting from internal sources.

Note, that to start the process, each of you should list the questions that you'd like us to answer for this purpose (see page 4 for some examples). Each of us will write our own responses independently (the advantage of having two bosses!). Finally, we will proceed to meet separately and/or individually with you in order to get at a final plan.

We urge you to take this first step soon so that it can be implemented with your own direct reports this summer (i.e. see the implementation schedule on page 7 of the attached document).

John Meyer or Guy Fincke will be contacting each of you in February to review the I.D.P. Process and to answer any questions you may have in that regard.

GB:swh
GB1.S1.11
Attachment

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+---------------------------+                 GB1.S1.13
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e
|   |   |   |   |   |   |   |         m e m o r a n d u m
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SUBJ: **Digital Computer Museum**

TO: Dick Schneider, ML11-4/E53
CC: Jamie Parker, ML12-1/A51
Ext: 223-2236

Date: 1/15/80 Tue
From: Gordon Bell
Dept: OOD
MS: ML12-1/A51
EMS: @CORE
Follow Up: 1/18/80

Industrial design was called in on the museum project to bring their expertise and keep the amateurs from making mistakes. However, as the amateur, a number of mistakes have been made that are embarrassing to me. I want to take this memo to spell out the principles that I thought we had been working from and then to specifically review the current status.

Three principles were established at the outset that may not have been explict. But they were clear to me and many of the compromises that occured were when these were not followed. I am restating them so that they can be used from now on.

1. The Digital Computer Museum will be information rich -- using every opportunity to illustrate content; minimizing expenditure, space, and time on non-informative items.

2. The Digital Computer Museum will be an example of good design for showing off computers and artifacts relating to computers. Color, lighting, signage and decoration should focus attention on the displays.

3. The ROI will be based on a long-lasting preservation of the history of computing, not on "show booth like", short-lived displays and materials. This includes trading off to minimize daily, weekly...yearly maintenance.

On review of the museum after less than six months, I find that the kind of decisions on which industrial designers should have had expertise were poorly made. After taking two eminent computer historians through the museum I am embarrassed to have to apologize for a job that I considered at the time was done by professionals. Please see if you consider these the problems to be solved?

.<u>Signage and posters</u>. All signs and dry-mounted posters are buckling or were poorly done in the first place. A system has to be developed that will last.

Large signs were made with a lot of unused white space with no purpose and that presently interferes with the lighting. These need to be cut down, in addition to being better preserved without buckling.

Pictures above the PDP-l were "framed" with masking tape that is now peeling. These need reframing somehow. (I discussed this explicitly before mounting!)

The British Museum poster needs to be properly preserved and hung. A uniform framing system for all posters and other similar material such as photos needs to be recommended.

Outside, expensive typesetters were used, without developing our in-house facilities, spending $6,000 on signage that has had a very short life. The museum staff will and is developing its own interface with DEC typesetting. Now we can only get a close approximation to Memphis type.

.<u>Lighting</u>. The lighting varies from terrible (in the cases) to ok (for the TX-O). The bad lighting in the cases is compounded by the use of large cardboard signs with almost no information on them that masks the minimal light coming through the bottom of the cases. The principle of maximizing the information content was clearly violated in developing these large-sized signs that now also look messy. The counter-productive effect of bottom lighting on reading signs should have been a principle understood by industrial designers and explained to others. Industrial design did not question this nor were experiments established to determine the effectiveness of this lighting. The small expensive spots provided by Click will not correct the overall poor lighting in these cases. Suggestions for improving the lighting in the large cases must be presented after experiments have been made!

The lighting and development of the towers will be undertaken by the museum staff in conjunction with on-site maintenance and electrical people in Marlboro. Experimentation is the only way!

.<u>Decorating</u>. I consistently stated that the museum and its artifacts had to stand out without spending money on non-content items. Yet Industrial Design insisted on spending money on plants. On review, some of the plants -- in hokey boxes -- had been moved (inadvertently I hope) by maintenance in front of displays interfering with the main purpose of the museum. Here we have to maintain, water, care for something that's not only irrelevant, but interferes with the view!

Similarly industrial design insisted on spending money on a central carpet leading to the desk -- one visitor pointed out how inappropriate this was (the carpet to the queen). I also noticed that the rug is disfunctional and gets crumpled when large items are brought in through that entrance. The plain stone floor would be fine. Also, visitors come in from the outside glare, stub their toes, and fall on the soft carpet created to cushion falls it creates!

The seating area and its rug still look fine -- but I query how long it will be before the red fabric chairs start to look shabby. No roi was presented using a longer lasting material, i.e. leather.

It had been specified that the coffee tables were to do double duty to serve as display cases. This was not done. The museum staff is having these modified by the carpenters in Marlboro to hold and display early manuals.

.<u>Cases</u>. Only one set of cases were presented. These were an expensive investment meant to fit in with the columns. Without an alternative suggestion -- and roi, everyone bought in to these cases. There was no analysis of the problems of viewing small artifacts from two sides or the use of the cases for our purposes. (Now we are putting in cases 1/2 this width.) Then on implementation glass tops were put in without any alternative -- such as mirrorlite -- that might have maximized and reflected the light up out on the bottom. The expensive glass on the top has no functionality whatsoever.

The formica sliding doors on the bottom have now buckled with time, heat and humidity effecting the expansion/contraction of the plywood differently than the formica. The doors do not all completely close and leave unsightly lines of light on the side. This makes the cases look shoddy. Ditto for the tops of the towers (although there's no heat.

.<u>Posters</u>. The transformation of the DEC tree and calculator timeline into posters seem to be ok, but are taking time and expense. We hope that these will be accurate and information rich and that a solution will be worked out for their large-scale presentation in the Museum so that they will have equal value with the NSF tree. The deadline for having these up is April 1.

.<u>The Future</u>. I had hoped that this would be a good situation for industrial design to use their imagination and focus on the issue of spotlighting the computer and its history. I would like to trust you as experts in areas where those of us working on the museum are amateurs.

```
.___.___.___.___.___.___.___.
!   !   !   !   !   !   !   !
! d ! i ! g ! i ! t ! a ! l !        I n t e r o f f i c e
M e m o
!___!___!___!___!___!___!___!
```

TO: GERALD V BUTLER   DATE: TUE 4 JAN 1983
10:26 AM EST
ROGER CADY   FROM: GORDON BELL
WIN HINDLE   DEPT: ENG STAFF
JULIUS MARCUS   EXT: 223-2236
KEN OLSEN   LOC/MAIL STOP: ML12-
1/A51

MESSAGE ID:
5186857171

SUBJECT: INDUSTRIAL TERMINALS AND CONTROLLERS

GB4.S1.8

Our customers in Australia perceive we have no industrial terminals,
and Burroughs does! I know we have some older ones and CSS makes a
bar code reader. Bar codes can be printed on all new LA's, but we
don't advertise it or support it in software especially.

Also we have
voice entry VT100's that could have been marketed!

Before we go after the controller, let's simply advertise what we have
and go after what we need in the ticket, direct entry, voice, cash
drawer etc. area. They say, offer the set that Burroughs does. (This
may just be marketing?)

Industrial Controllers

Having thought about this a bit, why don't we simply start a standard
by getting with someone (e.g. Allen Bradley, GE) and start making
controllers that are compatible with their power busses?

There are several other simple, busses already to use. The HP simple
serial one, the Philips' HiFi bus. Ethernet chips running a simple
protocol are being used for component interconnect too inside Xerox
printers.

Failing these, let's start a standards effort and get controller
suppliers/users to go for it?

Your group convinced me we need a product, but I have yet to see a
goals statement for such a product.

INDUSTRIES INVOLVED IN (INCREASED) INFORMATION PROCESSING

SEMICONDUCTORS

DIRECT;

ADD-ON AND EMULATION OF CONVENTIONAL COMPUTERS

INDIRECT TO <u>ALL</u> INDUSTRIES

<u>COMPUTER</u>

MAINFRAME

(terminal nets)

MINI

PERSONAL COMPUTERS

SERVICES

<u>COMMUNICATION</u>

NEW PHONE-BASED

ACS

OTHER SERVICES NETWORKS

<u>OFFICE EQUIPMENT</u>

TYPEWRITERS --> WORD PROCESSING

FAX --> COMMUNICATING XEROX

<u>TV-BASED CONSUMER ELECTRONICS</u>

GAMES --> PERSONAL COMPUTERS

CATV AS COMMUNICATIONS

+---------------+

! d i g i t a l !   i n t e r o f f i c e   m e m o r a n d u m
+---------------+

Subject: **System's Information Architecture**

To: Bob Puffer

CC: Leo Bennett, Oleh Kostetsky,
Larry Portner

Date: 11 JULY 78
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

follow up 07/25/78

Could you ask Larry whether Oleh could get involved with the Curt Rawley architecture project?

It needs some clarity, wisdom and common sense system's design introduced into it...as it currently smells like the CAD IDEA system over again only grander.

GB:ljp

Digital **Interoffice Memo**

Subject: **Competitive Information Availability on Microfilm**

To: Gus Ashton
Jim Bell
Karen Feingold
Tom Siekman

Date: 4 OCT 76
From: Gordon Bell
Dept: OOD
Loc.: ML12-1
Ext.: 2236

F/U 10/12

In order to get much wider, more convenient access to both ours and other computer manuals, could we look at microfilming?

We need to give our product and development managers and engineers easy access to these machines which we don't now have!

What's the story on copyrighting?

GB:ljp
27 April 1983

Mr. Chris Boon
Information Futures Limited
Mountbatten House
Victoria Street
Windsor
Berkshire SL4 1HE England

Dear Mr. Boon:

Thanks for the invitation to present a technology seminar. Unfortunately, I'm recovering from a by-pass operation and don't believe I'm up to presenting a seminar at this time.

Sincerely,

Gordon Bell
Vice President, Engineering

GB5.16

June 13, 1979

Lawrence F. Buckland, President
Inforonics
550 New Town Road
Littleton, MA 01460

Dear Larry:

Let me thank you very much for donating your PDP-1 machine to our museum project. It is in great condition and will be used in an exhibit at our Marlboro facility - hopefully, by the end of the summer.

I'm sorry for the delay in writing to you - the machine did arrive safe and sound. I'll let you know when the exhibit is in place.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:swh
GB0003/53

February 20, 1980

Bob Muller
Manager, Review Division
INFOTECH
Infotech Limited
Nicholson House

Maidenhead
Berkshire SL6 1LD
ENGLAND

Dear Bob:

I am interested in presenting a paper in November. Enclosed is an abstract for a paper on Distributed Processing. How does it sound?

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:swh
GB1.S2.14
April 14, 1981

C. Boon
Managing Director
Pergamon Infotech Limited
Nicholson House Maidenhead
Berkshire SL6 1LD England

Dear Mr. Boon:

At the invitation of INFOTECH, I attended and delivered a lecture at a conference, sponsored by them, on November 26 and 27, 1980 at Nicholson House, Maidenhead, Berkshire. They agreed to pay my expenses. A bill for my airfare, $919.20, was submitted to them at my departure (November 27, 1980).

I have not received payment for this expense. When I called INFOTECH and talked with an associate of Bob Muller and Carol Start, I was informed to bring this lack of payment to the attention of Floyd, Nash and Company, 218 Strand, London, WC24 1DG,ENGLAND. They in turn sent a GENERAL PROXY statement (copy attached) which I executed and returned. I have heard nothing since.

When may I expect payment of this outstanding bill of $919.20 which INFOTECH owes me?

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:swh
GB2.S5.16

March 4, 1981

Floyd, Nash and Company
218 Strand
London, WC24 1DG
ENGLAND

Dear Sir:

At the invitation of INFOTECH, I attended and delivered a lecture at a conference, sponsored by them, on November 26 and 27, 1980 at Nicholson House, Maidenhead, Berkshire. They agreed to pay my expenses. A bill for my airfare, $919.20, was submitted to them at my departure (November 27, 1980). I have not received payment for this expense. When I called INFOTECH this morning, and talked with an associate of Bob Muller and Carol Start, I was informed to bring this lack of payment to your attention.

Please be advised that INFOTECH owes me $919.20.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:swh
GB2.S3.17

<N>MCC PRESENTATION-GOALS/OBJECTIVES BY PRICE/BELL/GB3.S.61
10/13/82 10/13/82 13:26 4 1
<>

<N>JAPAN: CONTACTS SUMMER OF 1978 (JULY)/GB3.S5.5
10/13/82 10/13/82 13:21 7 2
<>

<N>AFIPS CALL FOR PAPER ON LINC & PDP-8/GALLER/GB3.S5.76
7/14/82 8/11/82 14:50 3 6 <>

<N>JAPAN: TOKYO PRESS CONF.+DEC HISTORY PERSPECTIVES 6/24/82/GB3.S5.75
7/12/82 10/12/82 8:58 26 18 <>

<N>JAPAN: THOUGHTS ON GREAT PORT TERM/PERS COMP/OLSEN/GB3.S.74
7/12/82 10/5/82 16:47 40 16 <>

<N>JAPAN: THANK YOU TO MR. T. KUROKI DEC JAPAN/GB3.S.73
7/12/82 7/19/82 16:24 1 3 <>

<N>JAPAN: COMPANY/PEOPLE VISITED HISTORY/INDEX, 6/82 /GB3.S.72
7/12/82 11/24/82 11:14 60 23 <>

<N>ITINERARY: JAPAN/TAIWAN JUNE 19 THRU JULY 8/GB3.S5.41
6/17/82 7/14/82 8:10 14 10 <>

<N>MCC RESEARCH PROGRAM LASL: DR. ROBERT EWALD/GB3.S5.69
6/15/82 8/18/82 11:23 5 18 <>

<N>MCC RESEARCH PROGRAM & LASL /OC/GB3.S5.68
6/15/82 8/18/82 10:59 6 5 <>

<N>U OF NEWCASTLE, DISCLOSURE FOR SECURE DIST SYS/STRECKER/GB3.S5.60
6/14/82 6/14/82 11:44 4 2 <>

<N>VAX-11: PERFORMANCE DATA ON VAX-11.../CUTLER/GB3.S5.59
6/11/82 6/11/82 14:06 4 2 <>

<N>REVIEW: MORE ON WHAT NOT TO DO/CORBEN/GB3.S5.58
6/11/82 6/11/82 10:35 8 2 <>

<N>NYIT: VIEWING THE NYIT FILM ON COMP..../OC/GB3.S5.57
6/11/82 6/11/82 10:33 4 2 <>

<N>VT201: AND VS100/VT200 SERIES: ../AVERY/GB3.S5.56
6/11/82 6/11/82 10:31 5 2 <>

<N>MANUFACTURING A/D AND MANUFACTURING../CLAYTON/GB3.S5.55.55
6/11/82 6/11/82 10:28 5 2 <>

<N>UNIX: SUPPORT/EMC:/GB3.S5.54
6/11/82 6/11/82 10:23 4 2 <>

<N>CALTECH: VISITING COMMITTEE TRIP../DEMMBER/GB3.S5.53
6/11/82 1/5/83 16:34 8 4 <>

<N>REVIEW OF PRODUCTS AND PROJECTS.../BRENDER/GB3.S5.52
6/11/82 6/11/82 14:08 6 5 <>

<N>DECMATE I & II: VS THE WANGWRITER/CIOFFI/GB3.S5.51
6/11/82 6/11/82 10:20 4 3 <>

<N>VAX MARKETING: (& DEV.) VAX'S/CADY/GB3.S5.50
6/11/82 6/11/82 10:10 6 2 <>

<N>CALTECH: FASTER VAXES AND SCIENTIFIC COMPU/BASKETT/GB3.S5.49
6/11/82 6/11/82 10:08 8 2 <>

<N>CT: YOUR FIRST CT & MARKETING/AVRAM/GB3.S5.48
6/11/82 6/11/82 10:06 3 2 <>

<N>VS100 AS THE FIRST VT200 (COULD I.../HUETTNER/GB3.S5.47
6/11/82 6/11/82 9:46 3 2 <>

<N>KEYBOARD: WHAT DO YOU THINK ABOUT .../RON HAM/GB3.S5.46
6/11/82 6/11/82 9:43 5 2 <>

<N>SIGNAL INTEGRITY: DON MARSHALL.../METZGER/GB3.S5.45
6/11/82 8/17/82 16:47 4 5 <>

<N>SACRED COWS: AND GOLDEN CALVES/OLSEN/GB3.S5.44
6/11/82 6/11/82 9:37 8 2 <>

<N>PC'S: MAKING COST-EFFECTIVE PC'S. LIKE.../KALB/GB3.S5.43
6/11/82 6/11/82 9:34 5 3 <>

<N>EDUCATION: ENGINEERING SUMMER SCHOOL.42
6/11/82 7/28/82 13:04 5 3 <>

<N>PRODUCTIVITY VIA FEWER BUT HIGHER QUALITY MESSAGES/OC
/GB3.S5.40
6/10/82 8/25/82 12:03 6 5 <>

<N>ADS - VAX OFFICE WORKER /OC, BERUBE /GB3.S5.18
6/10/82 11/22/82 8:26 8 7 <>

<N>MUSEUM: GETTING SYMBOL FROM ROY ZINGG, IO../DCM/GB3.S5.39

6/9/82 6/9/82 15:37 4 2 <>

<N>EDUCATIONAL COMPUTER: IDEA, CUT A.../AVER/GB3.S5.38
6/9/82 6/9/82 15:33 4 2 <>

<N>MICROVAX: THE BOTTOM LINE.../OC/GB3.S5.37
6/9/82 6/9/82 15:31 2 2 <>

<N>NATIONAL: CHIPS AS MICROVAX.../EMC/GB3.S5.36
6/9/82 6/9/82 15:27 14 2 <>

<N>HIERARCHIES/MAURICE WILKES/GB3.S5.35
6/9/82 6/9/82 15:12 5 2 <>

<N>CLUSTERS: YOU MAY NOT HAVE GOTTEN THIS IDEA../DEMMER/GB3.S5.34
6/9/82 6/9/82 15:10 6 2 <>

<N>PRODUCTIVITY: RE SW PROD. AND A JOB SHOP.../KEATING/GB3.S5.33
6/9/82 6/9/82 15:08 5 2 <>

<N>EDUCATIONAL COMPUTER: EDU MARKET../AVRAM/GB3.S5.32
6/9/82 6/9/82 15:06 6 2 <>

<N>PRODUCT LAYERS: WHERE EVERY GROUP.../HENRY ANCONA/GB3.S5.31
6/9/82 6/9/82 15:03 9 2 <>

<N>EDUCATION: MANAGEMENT IIA: WHAT IS IT?/BERNSTEIN/GB3.S5.30
6/9/82 6/9/82 14:58 12 2 <>

<N>RISC/MAURICE WILKES/GB3.S5.29
6/9/82 6/11/82 14:07 5 4 <>

<N>QUALITY PROGRAM AND INSPECTORS VE.../BJ/GB3.S5.28
6/9/82 6/9/82 14:51 5 2 <>

<N>DECSIM: MAKE VS BUY AND SELLING.../GOLDFEIN/GB3.S5.27
6/9/82 6/11/82 14:07 5 3 <>

<N>ETHERNET: DEC'S BACKBONE NETWORK AND ET.../DENNY BJORK/GB3.S5.26
6/9/82 11/17/82 12:10 7 3
<>

<N>LECTURE SERIES: DEC TECNICAL LECTURE SERIES FOR../PEG/GB3.S5.25
6/9/82 6/9/82 14:41 5 2 <>

<N>LISP: LISP AND THE MARKET/CHAMPINE/GB3.S5.24
6/9/82 6/9/82 14:39 4 2 <>

<N>VT200: WHY ISN'T OPAL THE VT200?/AVERY/GB3.S5.23
6/9/82 7/23/82 10:26 4 4 <>

<N>VAX/VMS: RELEASE 1 BOOK/ORPHAN/ANKLAN @CNS1/GB3.S5.22
6/9/82 6/9/82 14:33 6 2 <>

<N>BROWN: TREATING WITH RESPECT/CHAMPINE/GB3.S5.21
6/9/82 6/9/82 14:30 6 2 <>

<N>JAPANESE: THE ADVANTAGE:IS IT REA.../BOD/DEMO/GB3.S5.20
6/9/82 11/22/82 8:33 7 8 <>

<N>MANUFACTURING: MEETING TO LAYOUT.../OLSEN/GB3.S5.19
6/9/82 6/9/82 14:26 5 2 <>

<N>TSONGAS - COMMENTS ON YOUR GLOBE EDITORIAL/GB3.S5.17
6/9/82 6/9/82 13:56 23 6 <>

<N>TSONGAS - TRANSMITTAL LETTER RE HIS GLOBE EDITORIAL/GB3.S5.16
6/9/82 6/9/82 11:13 7 4 <>

<N>U OF CONNECTICUT: CORP. CONT. MAY HELP/PETE MCFADDEN/GB3.S5.15
6/4/82 6/23/82 13:15 4 4 <>

<N>BOB SPENCE: RECOGNITION LETTER/GB3.S5.13
6/2/82 6/2/82 15:32 2 3 <>

<N>INVITATION-NO-J. RUSSELL NELSON,ARIZONA STATE UNIV./GB3.S5.9
6/2/82 6/18/82 9:50 1 2 <>

<N>NASA-NO RE SPACE SHUTTLE EXPERIMENT CANNISTER/
TZANNOS/GB3.S5.12
6/1/82 6/1/82 14:46 2 2 <>

<N>NYIT DR. SHURE: THANKS FOR HOSPITALITY/GB3.S5.11
6/1/82 6/2/82 14:46 4 5 <>

<N>BRUCE?/THANKS FOR PRES. WOULD YOU CARE TO LECTURE/GB3.S5.10
6/1/82 1/5/83 16:31 4 7 <>

<N>DEC REIMBURSEMENT $514. FOR CALIF. TICKET/CARLA MASON/GB3.S5.8

5/26/82 5/26/82 8:55 3 1 <>

<N>CALTECH EXPENSES PLUS HONORARIUM DONATION TO MUSEUM/GB3.S5.7
5/25/82 5/25/82 12:42 3 2 <>

<N>VAX'S - MARKETING (& DEVELOPING) TO SAVE US/SMITH ET AL/GB3.S5.6
5/24/82 9/18/82 13:09 5 6 <>

<N>DECMATE I & II VS THE WANGWRITER - THE KEY /OC/GB3.S5.4
5/24/82 8/17/82 15:27 3 6 <>

<N>MUSEUM: BUILDING/HOME COMMITTEE/BLOCH,/GB3.S6.60
8/10/82 8/16/82 16:13 7 12 <>

<N>JAPAN: FUJITSU, CONFIDENTIAL INFO/YASAFUKU/GB3.S6.52
8/2/82 9/14/82 16:09 3 6 <>

<N>MCC: MOTIVATION FOR ALPHA OMEGA/GB3.S6.49
8/2/82 11/16/82 10:37 7 7
<>

<N>MCC: ALPHA OMEGA SUPPORT MEMO/PEG ET AL/GB3.S6.48
8/2/82 9/24/82 11:27 5 17 <>

<N>MCC: MCC REQUEST FOR SUPPORT FROM DEC / OC /GB3.S6.47
8/2/82 9/24/82 11:25 7 18 <>

<N>NYIT - THANKS FOR COMING/SHURE/GB3.S6.46
8/2/82 8/11/82 14:43 3 4 <>

<N>ITINERARY: CALIFORNIA 8/8/82 TO 8/11 WITH KALB/GB3.S6.41
7/28/82 8/10/82 13:22 2 7 <>

<N>DARTMOUTH - THANKS FOR THE COURSE/RICHMOND/GB3.S6.42
7/28/82 7/28/82 13:17 6 6 <>

<N>ITINERARY: PARIS/LONDON, 8/24/82 THRU 9/9 /GB3.S6.40
7/28/82 8/27/82 16:58 9 27 <>

<N>VAX: COMPETITIVENESS NOW AND IN FUTURE, HIGH PERF/KC /GB3.S6.39
7/28/82 8/19/82 11:26 14 12 <>

<N>UNIX STANDARDS, BRITISH POLICY /CARCHIDI /GB3.S6.38
7/26/82 7/26/82 16:12 5 1 <>

<N>MARKETING: COMMERCIAL/KO/GB3.S6.37
7/26/82 7/26/82 16:08 8 1 <>

<N>CM'S AS PERFORMANCE ALTERNATIVE TO BIG
MACHINES/FULLER/GB3.S6.36
7/26/82 7/26/82 16:02 7 1 <>

<N>DESIGNING: TRAINING FOR NAUTILUS DOING REAL
DESIGNS/CROXON/GB3.S6.35
7/26/82 7/26/82 15:44 6 1 <>

<N>MARKETING: PROPOSED ADS FOR COMMERCIAL USERS/BERUBE/GB3.S6.34
7/26/82 9/22/82 8:59 15 2 <>

<N>MCC: MORE ON MCE PRESENTATION BY CDC /EMC:/GB3.S6.33
7/26/82 7/26/82 15:19 6 1 <>

<N>GATE ARRAYS, CMOS: WHO,HOW AND NEED TO VLSI?/BASKETT/GB3.S6.32
7/26/82 8/6/82 14:33 7 2 <>

<N>PRODUCTIVITY VIA FEWER BUT HIGHER QUALITY
MESSAGES/BERUBE/GB3.S6.31
7/26/82 7/26/82 15:11 7 1 <>

<N>MARKETING: LET'S DEFINE BY REVIEWING AND BY EXAMPLE
/KO/GB3.S6.30
7/26/82 7/26/82 15:06 6 1 <>

<N>LATTICE LOGIC, WORKING WITH /BHALERAO /GB3.S6.29
7/26/82 7/26/82 15:01 6 1 <>

<N>MARKETING: ISSUES ABOUT DOING THE BASICS/ KC /GB3.S6.28
7/26/82 7/26/82 14:54 9 1 <>

<N>PROLOG TODAY! / ECKHOUSE /GB3.S6.27
7/26/82 7/26/82 14:49 2 1 <>

<N>PROJECTS: WHICH TO DO, READING OF MCNAMARA /GB3.S6.25
7/26/82 7/26/82 14:38 8 1 <>

<N>KEYBOARD, CAN WE BUY THE BROTHER? /AVERY/GB3.S6.24
7/26/82 7/26/82 13:32 7 1 <>

<N>JAPAN: NOTES ON VARIOUS COMPANIES/RESEARCH ORGS/PEG:/GB3.S6.23

7/21/82 11/15/82 18:02 10 13
<>

<N>JAPAN: ENGINEERING IN--LET'S MOVE/SAVIERS ET AL/GB3.S6.22
7/21/82 10/5/82 16:57 27 6 <>

<N>JAPAN IMPRESSIONS / OC + PEG /GB3.S6.21
7/20/82 10/5/82 16:54 12 15 <>

<N>TAIWAN: THANKS 5 LETTERS 7/82 TRIP/GB3.S6.19
7/20/82 8/2/82 16:31 27 9 <>

<N>ITINERARY SAN FRANCISCO, MCC MEETING, 7/25 &26/GB3.S6.18
7/20/82 7/30/82 8:51 2 9 <>

<N>JAPAN: MITSUI THANKS/GB3.S6.17
7/20/82 7/21/82 9:17 4 6 <>

<N>JAPAN: FUCHI THANKS /GB3.S6.16
7/20/82 9/7/82 12:03 4 7 <>

<N>JAPAN: U OF TOKYO/DR. GOTO /GB3.S6.15
7/20/82 9/7/82 14:56 4 8 <>

<N>JAPAN: FUJITSU & MITI THANK YOU /GB3.S6.14
7/20/82 8/2/82 16:30 3 8 <>

<N>JAPAN: NTT WE'D LIKE TO BE A SUPPLIER /GB3.S6.13
7/20/82 7/20/82 14:27 3 3 <>

<N>JAPAN: SONY THANK YOU /GB3.S6.12
7/20/82 9/9/82 10:42 5 15 <>

<N>JAPAN: MORIZONA THANK YOU/GB3.S6.11
7/20/82 8/17/82 8:39 2 7 <>

<N>JAPAN: WATANABE THANKS/GB3.S6.10
7/20/82 7/21/82 9:15 4 4 <>

<N>JAPAN: CHINA COMPANY THANK YOU /GB3.S6.9
7/20/82 7/20/82 14:07 8 3 <>

<N>JAPAN COMPANY/PRODUCT COMPETITIVE MATRIX MEMO/GB3.S6.8
7/19/82 8/24/82 13:47 3 9 <>

<N>REFERENCE: RAJ REDDY /GB3.S6.7
7/19/82 7/21/82 15:45 3 2 <>

<N>CHALLENGES FOR IN THE NEXT 0 TO 5 YEARS /GB3.S6.6
7/19/82 10/5/82 16:53 18 6 <>

<N>JAPAN CHART COMPANY/PRODUCT COMPETITIVE MATRIX/GB3.S6.4
7/14/82 11/24/82 11:12 33 22
<>

<N>JAPAN THANK YOU 12 LETTERS 7/82 TRIP/GB3.S6.3
7/14/82 8/2/82 16:31 47 22 <>

<N>JAPAN THANK YOU 6 LETTERS 7/82 TRIP/GB3.S6.2
7/14/82 8/2/82 16:31 26 24 <>

<N>OA,RE-CENTRALIZED ORDER PROCESSING, EMS 8/1,BJORK/GB3.S7.62
9/27/82 9/27/82 17:45 5 1 <>

<N>VS200, GET COLOR QUICK,EMS 8/2,BUTLER+/GB3.S7.61
9/27/82 9/27/82 17:44 3 1 <>

<N>BUDGET PROBLEM, DEALING WITH, EMS 8/2, EMC:/GB3.S7.60
9/27/82 9/27/82 17:43 5 1 <>

<N>ALPHA OMEGA...DRAFT FOR COMMENTS, EMS 8/4, DELAGI+/GB3.S7.59
9/27/82 9/27/82 17:39 4 1 <>

<N>MARKETING OUR OFFICE PRODUCTS, EMS 8/4, SPENCER+/GB3.S7.58
9/27/82 9/27/82 17:38 19 1 <>

<N>MARKETING ADS CONTENT, EMS 8/4, HINDLE+/GB3.S7.57
9/27/82 9/27/82 17:36 12 1 <>

<N>VS100 AND PERSONLA NEBULA, EMS 8/7, CHAMPINE+/GB3.S7.56
9/27/82 9/27/82 17:33 8 1 <>

<N>BUS, GETTING A WINNING STRATEGY, EMS 8/7, DEMMER+/GB3.S7.55
9/27/82 9/27/82 17:28 10 1 <>

<N>VT192 - SCHEDULE, EMS 8/9 /AVERY+/GB3.S7.54
9/27/82 9/27/82 17:26 7 1 <>

<N>GATE ARRAYS, BETTER PRODUCTS THROUGH,EMS 8/9,FOLSOM+/GB3.S7.53
9/27/82 9/27/82 17:24 25 1 <>

<N>ALPHA OMEGA...SEMINAR TO PRESENT/GET IDEAS,EMS 8/12/FULLER+/GB3.S7.52
9/27/82 9/27/82 17:20 5 1 <>

<N>WORKSATIONS ON A WINNING TRACK, EMS 8/14/SMITH/GB3.S7.51
9/27/82 9/27/82 17:17 4 1 <>

<N>ICL COLLABORATION TO ESTABLISH MAIL STD,EMS 8/14/LACROUTE/GB3.S7.50
9/27/82 9/27/82 17:16 4 1 <>

<N>CFM PRODUCTS AND A/D TO GET MORE, EMS 8/14,CHRISTY ET AL/GB3.S7.49
9/27/82 9/27/82 17:14 8 1 <>

<N>MULTICOMPUTERS, CONSTRUCTING EXPERIMENT,EMS 8/16/FULLER/GB3.S7.48
9/27/82 9/27/82 17:12 4 1 <>

<N>ISI, ENVIRONMENT (TALK W BALZER) EMS 8/18/ CHAMPINE ET AL/GB3.S7.47
9/27/82 1/5/83 16:48 6 2 <>

<N>COMPUTERS FOR MANUFACTURING, EMS 8/21/82 /CADY /GB3.S7.46
9/27/82 9/27/82 17:06 6 1 <>

<N>WPS-CT300 PHASE 0 OF POINT PRODUCT, EMS 8/21/DOCKSER ET AL/GB3.S7.45
9/27/82 9/27/82 17:04 5 1 <>

<N>VAX EXTENDED, DUCHAMP'S VECTOR INSTRUC. EMS 8/21/FULLER/GB3.S7.44
9/27/82 9/27/82 17:02 5 1 <>

<N>CFM: CYLES FOR THE MASSES, EMS 8/22/82 /CHRISTY ET AL/GB3.S7.43
9/27/82 9/27/82 16:59 18 1 <>

<N>AI SOFTWARE IDEA FOR ADVERTISING /GB3.S.41
9/24/82 9/27/82 8:31 3 2 <>

<N>ALPHA OMEGA AGENDA, 10/5&6, LOS ALAMOS/GB3.S7.40
9/23/82 9/23/82 0:03 9 6 <>

<N>ITINERARY - LASL, 10/5 & 6/1982, AO/GB3.S7.34

9/18/81 10/1/82 9:27 3 6 <>

<N>ITINERARY: AUSTRALIA 12/12/82 THRU 1/1/83/GB3.S7.33
9/18/81 12/10/82 11:38 4 13
<>

<N>MCC TRANSMITTAL LETTER, $4K FOR INCORPORATION/GB3.S7.32
9/17/82 11/22/82 12:19 2 5
<>

<N>BRINCH-HANSEN: LETTER TO- SORRY I CAN'T ATTEND/ GB3.S7.30
9/15/82 11/22/82 11:08 2 4
<>

<N>ALPHA-OMEGA:ALPHA-OMEGA AND CFM/HUSTVEDT,LIPCON,POE,MACK
GB3.S7.29
9/13/82 9/17/82 13:10 2 3 <>

<N>CRAPPY PRODUCTS:THE SIDE EFFECTS OF SLIPS AND VOIDS/OC +
GB3.S7.28
9/13/82 10/13/82 12:17 10 5
<>

<N>CLARK:RECOMMENDATION LETTERFOUNDATION GB3.S7.27
9/13/82 9/13/82 13:40 5 6 <>

<N>OPPENHEIM:EXCERPT FROM AN OPPEN. PROSPECTUS/OC, PEG...
GB3.S7.25
9/13/82 9/13/82 15:45 3 3 <>

<N>FOUR WHEELS:OF REINCARNATION--PEG, RAD, TMC,... GB3.S7.24
9/10/82 8/16/82 9:25 28 15 <>

<N>WCC:WORLD COMPUTER CENTER AND WPS-SOURNAC GB3.S7.23
9/10/82 11/16/82 14:31 7 9
<>

<N>APPLICATIONS PRODUCTS: DOING THEM RIGHT-OC, PEG... GB3.S7.22
9/10/82 10/6/82 12:57 17 11 <>

<N>LA100:WHAT'S THE STORY?-SMITH/AVERY/RING GB3.S7.21
9/10/82 9/13/82 14:47 1 5 <>

<N>VT:OVERFUNDING-HUETTNER/AVERY/SMITH GB3.S7.20
9/10/82 10/6/82 13:05 4 7 <>

<N>U OF CAMBRIDGE THANK YOU/DR. HOPPER & HERBERT/GB3.S7.19
9/10/82 9/13/82 12:06 5 4 <>

<N>WCC:THANK YOU: JJ SERVENT-SCHEINER & N NEGROPONTE/GB3.S7.18
9/10/82 9/22/82 9:24 5 12 <>

<N>ABSTRACT: LOCAL AREA NETS, DISTR.PROCESSING & 5TH GEN/GB3.S7.17
8/24/82 9/7/82 9:17 2 7 <>

<N>SUMNEY/TECH. POS. OF US COMP. SEMICOMP. CO./GB3.S7.15
8/23/82 9/28/82 11:56 3 4 <>

<N>VT192: FINALIZING SPEC BEFORE WE SLIP SCHED./AVERY/GB3.S7.14
8/19/82 9/14/82 16:09 6 4 <>

<N>VT192: PUTTING THE MODEM OPTION BACK IN/AVERY/GB3.S7.13
8/19/82 8/19/82 11:21 4 1 <>

<N>PRINTER: FINDING $'S TO BREADBRD LQP/SHEET FEED/AVERY/GB3.S7.12
8/19/82 8/30/82 14:07 3 3 <>

<N>TERMINAL: WHY WE MUST BUILD GREAT PORTABLE/AVERY/GB3.S7.11
8/19/82 8/19/82 11:18 19 1 <>

<N>STRATEGY: SOME CHALLENGES IN THE NEXT 0-5 YEARS/OLSEN/GB3.S7.10
8/19/82 8/19/82 11:29 19 2 <>

<N>JAPAN: MISC. MSGS. FROM JAPAN & ENG/KOBAYASHI/GB3.S7.9
8/19/82 8/19/82 11:10 11 1 <>

<N>JAPAN: CONTINUING TO BUILD JAPANESE PROFILES/KOBAYASHI/GB3.S7.8
8/19/82 8/19/82 11:07 4 1 <>

<N>JUPITER PRIORITIES/HJERPPE/GB3.S7.7
8/19/82 8/19/82 11:00 5 1 <>

<N>NICOUD--ECOLE POLYTECHNIQUE: RESPONSE TO JEAN-DANIEL /GB3.S7.5
8/17/82 9/1/82 10:33 2 5 <>

<N>MCC: ALPHA OMEGA PROPOSAL TRANSMITTAL LETTER /AO COMMITTEE/GB3.S7.4
8/16/82 11/23/82 8:33 4 30 <>

<N>MCC: ALPHA OMEGA PROPOSAL/GB3.S7.3

8/12/82 10/4/82 9:47 145 35 <>

<N>ITINERARY: MCC MEETING DENVER, 8/19/82 /GB3.S7.2
8/11/82 9/28/82 13:08 4 14 <>

<N>VAX & PRIORITIES:PRODUCTS CHARTS & REORG/EMS-10/26/BJ/GB3.S8.76
11/18/82 11/18/82 10:23 5 2
<>

<N>TAIWAN: VERSUS AUTOMATION FOR COST/EMS-10/24/KO,J.SMITH/GB3.S8.75
11/18/82 11/18/82 10:28 6 3
<>

<N>VAX ARCHITECTURAL: EXTEN.&REDUCTIONS/EMS-10/24,DILEEP/GB3.S8.74
11/18/82 11/18/82 10:27 17 3
<>

<N>AI:MKT. & PRODUCTS-LET'S GO AFTER/EMS-10/12/ABEL,FULLER/GB3.S8.73
11/18/82 11/18/82 11:03 6 5
<>

<N>MIT:MTG. TO PROPOSE A PC PLAN/EMS-10/20/SAM,WIN,BJ/GB3.S8.72
11/18/82 11/18/82 11:04 3 3
<>

<N>VAX CENTER: ZK FOR PARALLEL.&EXT./EMS-10/19/CARCHIDI/GB3.S8.71
11/18/82 11/18/82 11:04 4 3
<>

<N>CMU LOSS:WHY SIGNIFICANT & NEXT STEP/EMS-10/18/AVERY,OC/GB3.S8.70
11/18/82 11/18/82 11:05 9 3
<>

<N>Q VS BI REPORT:THANKS/EMS-10/16/DEMMER,JESSEL,STRECKER/GB3.S8.69
11/18/82 11/18/82 11:06 5 2
<>

<N>TECH COMP CENTER:BENCHMARK & EXPERIMENT/EMS-10/13/GANNON/GB3.S8.68
11/18/82 11/18/82 11:07 7 2
<>

<N>JUPITER ANNOUNCEMENT: RECOMMEND ARCH/EMS-10/11/U.FAGERQUIST/GB3.S8.67
11/18/82 1/6/83 8:25 10 3 <>

<N>IBM'S:AGGRESSIVE BEHAV.W/UNIV. & RSCH/EMS-10/11/OC,BUTLER/GB3.S8.66
11/18/82 11/18/82 11:41 6 3
<>

<N>MIT:NEC IN NE,POOR RELATIONSHIP/EMS-10/11/KEILLOR/GB3.S8.65
11/18/82 11/18/82 11:46 6 4
<>

<N>VAX:VIA MICROPROGRAMMING/EMS-10/10/D.BHANDARKAR/GB3.S8.64
11/18/82 11/18/82 11:47 5 2
<>

<N>VAX ARCHITECTURE:EXTENDING-NAME/EMS-10/10/D.BHANDARKAR/GB3.S8.63
11/18/82 11/18/82 11:48 7 2
<>

<N>SHARED:11'S, SOME SPT FOR LOW END/EMS-10/10/GUTMAN,MARCUS/GB3.S8.62
11/18/82 11/18/82 11:49 5 3
<>

<N>SHARED:LPC(F&J VERSIONS) VS PC'S/EMS-10/9/M.GUTMAN/GB3.S8.61
11/18/82 11/18/82 11:53 7 3
<>

<N>SPEECH: KEN'S DATA FOR KO/EMS-10/3/A.CRAWFORD/GB3.S8.58
11/18/82 11/18/82 11:55 10 2
<>

<N>EDUCATION: MIT lifetime program,EMS-10/4/EMC/GB3.S8.57
11/18/82 11/22/82 12:14 7 3
<>

<N>ITINERARY: ALPHA OMEGA, MINN. 11/21-23/GB3.S8.38
11/18/82 11/19/82 14:44 2 8
<>

<N>YALE: CS DEPT. VISIT/EMS/11-16/MARCUS,FULLER/GB3.S8.60

11/15/82 11/23/82 11:22 10 11
<>

<N>WRL:CHARTER/EMS/11-16/FULLER,BASKETT/GB3.S8.54
11/15/82 11/23/82 11:25 7 8
<>

<N>VENUS: NEED, LLL MULTIPROCESSORS/EMS/11-16/DEMMER ET AL/GB3.S8.53
11/15/82 11/23/82 11:33 12 6
<>

<N>DEC 10/20 BUSINESS/KNOWLES/GB3.S8.52
11/15/82 11/15/82 14:03 16 3
<>

<N>STANDARDS/SEMIS & SYSTEMS DESIGN/PRAKASH BHALERAO,GB3.S8.51
11/15/82 11/15/82 13:40 3 2
<>

<N>LBL:CONSULTANT/MULTIPROCESSOR WORK OF MAPLES/STRECKER/GB3.S8.50
11/15/82 1/6/83 8:26 5 5 <>

<N>VAX,IMPLEMENTATION WHEN HARDWIRED & MICROPROGRAMMED/EMC/GB3.S8.49
11/15/82 12/6/82 16:35 31 8
<>

<N>JAPAN-MORE THOUGHTS/AGUERO/GB3.S8.48
11/15/82 11/30/82 11:56 14 9
<>

<N>FPS-JOIN MUSEUM?/WINNINGSTAD/GB3.S8.47
11/15/82 11/15/82 12:11 3 1
<>

<N>LLL-THANKS & GOOD LUCK ON IIA/WOOD M.WILLIAMS/GB3.S8.46
11/15/82 11/24/82 12:18 5 5
<>

<N>FPS - THANKS + OA IDEAS/TURNER/GB3.S8.45
11/15/82 11/15/82 12:04 5 9
<>

<N>LLL-MULTIPROCESSOR WORK/MICHAELS/GB3.S8.44

11/15/82 11/15/82 11:48 4 5
<>

<N>SRI, ALPHA OMEGA + JOIN MUSEUM?/MILLER/GB3.S8.43
11/15/82 11/15/82 11:19 4 3
<>

<N>AI & Expert Sys:LISP,PRODUCTS,NEEDS &MKTG./WEISS ET AL/GB3.S8.40
11/15/82 11/30/82 11:54 18 4
<>

<N>PRODUCTS: COMPETITIVE/MEMO/11-8/OC,EMC,PEG/GB3.S.37
11/8/82 11/23/82 12:10 16 6
<>

<N>ITINERARY: 11/7 THRU 11/13, SF&OREGON/GB3.S8.36
11/5/82 11/9/82 15:26 5 8 <>

<N>TEKNOWLEDGE BOD:/LTR ED FEIGENBAUM/11-2/GB3.S.35
11/2/82 11/23/82 12:12 3 5
<>

<N>INTERRUPTS: LTR HARVEY CRAGON/11-2/GB3.S8.32
11/1/82 11/23/82 12:58 5 4
<>

<N>VAX11 USER'S GUIDE: LTR DENNIS GELLER,BABSON/11-2/GB3.S.31
11/1/82 11/23/82 13:00 2 3
<>

<N>TRAINING: OVER 40 ENGINEERS/PEG/ GB3.S8.27
10/26/82 1/6/83 8:36 6 6 <>

<N>TRAINING: ENG. OBSOLESCENCE TRANSMITTAL MEMO/PEG ET AL/GB3.S8.25
10/26/82 1/6/83 8:36 3 4 <>

<N>TRAINING:ENGINEERING OBSOLESENCE/REYNOLDS/GB3.58.24
10/25/82 10/27/82 10:12 10 11
<>

<N>ITINERARY: MINN/SF/10/27/82--ALPHA OMEGA,TECKNOWLEDGE/GB3.S8.21
10/22/82 10/25/82 4:59 4 7
<>

<N>MUSEUM: CANADIAN AN/FSQ7 FIELD TRIP REPORT/GB3.S8.19
10/18/82 11/9/82 10:41 35 5
<>

<N>MUSEUM: DONATE LAND AS ENDOWMENT/MATHEWS/GB3.S8.18
10/18/82 10/19/82 8:46 11 14
<>

<N>ANTIQUE PAYMENT, PLANIMETER/M.KENNEDY/GB3.S8.17
10/15/82 11/30/82 13:30 2 6
<>

<N>ORG CHART--ENGINEERING/GB3.S8.16.16
10/14/82 1/5/83 14:45 9 19 <>

<N>RESEARCH:PAPERS IMPROVE R&D /SZAKONYI-WASH DC/GB3.S8.15.15
10/14/82 1/6/83 8:28 2 8 <>

<N>KO REPLY FOR:SOCIAL ECOLOGY
RESEARCH/THORSHEIM&ROBERTS/GB3.S8.14.14
10/14/82 1/6/83 8:30 3 6 <>

<N>NYIT, MORE COLLABORATION + A PRO/EMS:BENIGNI,AK/GB3.S8.13
10/13/82 11/8/82 14:05 7 3
<>

<N>OFIS DISCUSSION WITH DAVIES NOT GOOD/EMS:DOCKSER/GB3.S8.12
10/13/82 10/13/82 12:12 12 1
<>

<N>A1 DEMO THANKS--BE #1 IN OFFICE SALES/EMS:WYMAN+/GB3.S8.11
10/13/82 10/13/82 12:04 6 1
<>

<N>VENUS REVIEW CONGRATS...SINCE 5/81/EMS:GLORIOSO+/GB3.S8.10
10/13/82 10/13/82 11:56 5 1
<>

<N>AO DISCUSSION WITH FERNBACH&FEIGENBAUM/EMS:FULLER/GB3.S8.9
10/13/82 10/13/82 11:44 5 1
<>

<N>VAX PERFORMANCE, EFFORT TO IMPROVE/EMS:DEMMER ETAL/GB3.S8.8
10/13/82 10/25/82 8:59 7 2

<>

<N>LASL THANKS FOR HOSPITALITY/EWALD,BUZBEE/GB3.S8.5
10/11/82 10/11/82 13:10 3 4
<>

<N>TEKNOWLEDGE BOD, NOTES RE FEIGENBAUM/GB3.S8.4
10/4/82 11/18/82 16:28 4 4
<>

<N>ARPA - /LETTER TO DR. LEVINTHAL ET AL VIA ARPANET.3
10/4/82 11/5/82 13:37 5 13 <>

<N>TSONGAS: RE MIT MEETING/GB3.S8.2
10/4/82 10/18/82 9:07 8 13 <>

<N>MARKETING MAINFRAMES /WIN/GB3.S9.37
12/14/82 12/14/82 15:15 4 1
<>

<N>ETHERNET & LANS CLUSTERS: PRODUCTS & WAY GET THEM/EMC/GB3.S9.36
12/13/82 12/22/82 14:27 8 8
<>

<N>CFM:CYCLES FOR THE MASSES-DESCRIPTION STATEMENT/12-6/GB3.S9.25
12/13/82 1/6/83 8:48 4 3 <>

<N>PRODUCT STRATEGIES: FRAMEWORK FOR LOOKING AT/12/13/GB3.S9.24
12/13/82 1/6/83 8:49 27 7 <>

<N>SCORPIO: ORGANIZATION REVIEW/EMS/12-13/PEG,KEN/GB3.S9.33
12/13/82 12/22/82 14:25 17 5
<>

<N>BELL: TRUST/GB3.S9.35
12/10/82 12/10/82 9:21 2 2
<>

<N>BACHMAN:RECOMMENDATION/ J.CANTLON,MICH.UNIV/12-10/GB3.S9.32
12/10/82 12/10/82 8:25 4 2
<>

<N>EXPENSE VOUCHER, CHICAGO C. IN SCI CONF
12/7/82/SCHERAGO/GB3.S9.31
12/8/82 12/8/82 15:06 3 5 <>

<N>ITINERARY: PALM SPRINGS/MO/BOSTON 1/12/83 /GB3.S9.30
12/8/82 12/22/82 15:54 5 6
<>

<N>WPS SITE:LSG CUSTOMER, PITT.EXAMPLE/AK +/12-6/GB3.S9.28
12/6/82 12/7/82 10:25 21 6 <>

<N>SCORPIO:ORG REVIEW & INSTALLING TND/EQDM/LIGNOS/EMS/12-6/GB3.S9.27
12/6/82 12/13/82 10:55 12 5
<>

<N>WORKSTATION:BEFORE IT'S TOO LATE/EMS/CROXON/12-6/GB3.S9.26
12/6/82 12/6/82 14:05 8 4 <>

<N>UNIX: FOR MICRO 11 & DECUS/EMS/12/3/CONKLIN,GUTMAN,GB3.S9.11
12/3/82 12/29/82 8:49 3 7 <>

<N>BOOK: DEC COMP. ENVIRONMENT/EMS/12/1/FULLER,STRECKER/GB3.S9.23
12/1/82 12/6/82 9:43 5 2 <>

<N>SDF: SMITH, CHARLES DINNER THANKS SYSTEMS DEV FOUNDATION/GB3.S9.22
11/30/82 1/3/83 13:08 8 5 <>

<N>LAN, CLUSTER AND WAN DEFINITION - SLIDES/C.IN SCIENCE/GB3.S9.21
11/30/82 1/4/83 9:38 8 9 <>

<N>LINK:GAN,TV & NE NETWORKS/EMS/11-30/EMC/GB3.S9.20
11/30/82 11/30/82 9:52 4 2
<>

<N>JUPITER/OC PRESENTATION/11-29/GB3.S9.19
11/29/82 11/29/82 15:09 9 2
<>

<N>HIGH PERFORMANCE Q&A/OC PRESENTATION/11-29/GBE.29.18
11/29/82 11/29/82 15:05 44 3
<>

<N>COMPETITION:MID RANGE & HIGH END(SLIDES)-OC PRESENTA/11-29/GB3.S.17
11/29/82 11/29/82 15:04 4 2
<>

<N>FAGERQUIST - BACKGROUND/11/29/GB3.S9.16
11/29/82 1/6/83 8:59 4 3 <>

<N>TND: THE NEW DIGITIAL NEW ENGINEERING-SLIDES/OC/GB3.S9.15
11/29/82 12/16/82 14:09 9 11
<>

<N>REFERENCE: BILL JOHNSON FOR MANAGEMENT SCHOOL
CALIF/11/29/GB3.S9.6
11/29/82 1/6/83 8:51 5 3 <>

<N>CONFERENCE:DISTRIB COMPUTING/EMS/11-24/LACROUTE,PEG/GB3.S9.13
11/24/82 11/24/82 11:55 2 1
<>

<N>HARVARD:APPL.SCI VISITING C'EE/EMS/11-24/BORNSTEIN/GB3.S9.12
11/24/82 12/20/82 14:55 5 5
<>

<N>VAX:FORTRAN PERFORMANCE/EMS/11-24/DEMMER,BJ/GB3.S9.10
11/24/82 11/30/82 8:57 8 5
<>

<N>CI:AS A STANDARD INTERCONNECT/EMS/11-24/DEMMER,BJ/GB3.S9.9
11/24/82 12/20/82 14:53 4 7
<>

<N>REFERENCE: JOHN FISHER/LTR TO R.SCHANK,YALE/11-24/GB3.S9.7
11/24/82 11/30/82 8:55 4 5
<>

<N>REFERENCE:PHIL BERNSTEIN/PROF.PAUL MARTIN/HARVARD/GB3.S9.5
11/22/82 1/6/83 8:52 3 5 <>

<N>VAX:GETTING BACK INTO BUS/EMS-10/26/EMC/GB3.S9.4
11/18/82 12/8/82 10:47 5 4
<>

<N>TEKNOWLEDGE:ADVISORY BOARD/EMS-10/31/K.OLSEN/GB3.S9.3
11/18/82 11/22/82 9:18 6 4
<>

<N>PRODUCTS:WINNING-QUICK/EMS-10/26/BJ/GB3.S9.2
11/18/82 11/18/82 16:27 14 2

<>

<N>SCORPIO:ORGANIZATION REVIEW/EMS-12/6/DEMMER,BJ/GB3.S10.34
12/29/82 12/29/82 9:24 13 3
<>

<N>RESEARCH GROUP:BUILDING 1ST CLASS GROUP-12/6-FULLER-GB3.S10.33
12/29/82 1/6/83 9:02 5 3 <>

<N>WORKSTATION:GETTING BEFORE TOO LATE/12/6-B.CROXON/GB3.S10.32
12/29/82 1/6/83 9:02 8 4 <>

<N>DATAFLOW:GOING TO ARPA/EMS-12/4/FULLER/GB3.S10.31
12/29/82 12/29/82 9:20 4 2
<>

<N>DATAFLOW:RESEARCH/EMS-12/4/FULLER/GB3.S10.30
12/29/82 12/29/82 9:19 11 3
<>

<N>HARDWARE:PRODUCTS FOR AP/EMS-12/4/G.BUTLER/GB3.S10.29
12/29/82 12/29/82 9:14 7 3
<>

<N>AI:ARTIFICIAL INTELLIGENCE:EMS-12/3-B.JOHNSON/GB3.S10.28
12/29/82 12/29/82 9:00 7 2
<>

<N>WC FIELD (LASL WC11 COMPUTER)/EMS-12/3-AVERY/GB3.S10.27
12/29/82 12/29/82 8:57 7 2
<>

<N>BOOK:WHAT ABOUT THIS TO DO?/11/27-FULLER,STRECKER/GB3.S10.26
12/29/82 1/6/83 9:03 5 4 <>

<N>VAX:HELP ON IMPROVING/EMS-11/24/BOB ROCKWELL/GB3.S10.25
12/29/82 12/29/82 8:49 4 3
<>

<N>UNIX POLICY:EMS-11/22-BILL JOHNSON-GB3.S10.24
12/29/82 12/29/82 8:47 3 2
<>

<N>MIT: WELL, BUT COMMITMENT NEXT VISIT/11/20-HAIRE/GB3.S10.23
12/29/82 1/6/83 9:03 5 3 <>

<N>COGNITIVE SYSTEMS:R.SHANK/EMS-11/19/BOB NOLIN/GB3.S10.22
12/29/82 12/29/82 8:45 18 2
<>

<N>LBL:SPEAKER/CONSULTANT-EMS/11-16-CFM TF/GB3.S10.21
12/28/82 12/29/82 8:42 6 4
<>

<N>SABBATICALS:SHOULD WE?/EMS-11/16/EMC/GB3.S10.20
12/28/82 12/28/82 16:27 3 2
<>

<N>MIT:PC/EMS-11/15/FULLER,CHAMPINE/GB3.S10.19
12/28/82 12/28/82 16:26 4 3
<>

<N>VOICE:PLAYBACK/EMS-11/14-AVERY-GB3.S10.18
12/28/82 12/28/82 16:23 4 2
<>

<N>PRODUCTS:WINNING HIGH END CPU'S/EMS-11/14/KOTOK/GB3.S10.17
12/28/82 12/28/82 16:22 9 2
<>

<N>AI:EXPERT SYSTEMS:LISP/EMS-11/14-ABEL,PATEL/GB3.S10.16
12/28/82 12/28/82 16:21 19 2
<>

<N>MUSEUM:PETROFSKY + LINK DONATION/EMS-11/13-BERUBE/GB3.S10.15
12/28/82 12/28/82 16:17 9 2
<>

<N>SALES: PRODUCT LINE SUPPORT/EMS-11/13-OLSEN-GB3.S10.14
12/28/82 12/28/82 16:16 5 2
<>

<N>MCWILLIAMS,TOM: LLL/EMS-11/13-BASKETT-GB3.S10.5
12/28/82 12/28/82 15:45 9 1
<>

<N>UNIX:MORE COMPETITIVE/EMS-11/8-J.SHIELDS/GB3.S10.13
12/28/82 12/28/82 15:37 3 2
<>

<N>BERKELEY OPPORTUNITY:ETHERNET/EMS-11/3-STEVE DAVIS/GB3.S10.12
12/28/82 1/6/83 9:04 4 3 <>

<N>ARPA HELP IN H/S SEMIS:EMS-11/3-GLORIOSO-GB3.S10.11
12/28/82 12/28/82 15:34 5 2
<>

<N>LA12 VS ROBIN:EMS-11/3-AVERY-GB3.S10.10
12/28/82 1/6/83 9:01 8 4 <>

<N>CMU:SPICE & YALE & PPA/EMS-11/3-BJ,FULLER/GB3.S10.9
12/28/82 12/28/82 15:34 5 3
<>

<N>MILL:WALK-THROUGH/FINDINGS/EMS-11/3-BJ,SMITH-GB3.S10.8
12/28/82 12/28/82 15:35 5 3
<>

<N>MUSEUM:MANUALS,SOFTWARE/EMS-11/3-MUSEUM-GB3.S10.7
12/28/82 12/28/82 15:35 4 3
<>

<N>COGNITIVE SYSTEMS:USE AI/EMS-11/2-HUGHES/GB3.S10.6
12/28/82 12/28/82 15:35 6 3
<>

<N>MIT:AN OPPORTUNITY/EMS/11-1/AVERY/KO/J.SMITH/GB3.S10.4
12/28/82 12/28/82 15:35 4 3
<>

<N>UNIX:MORE COMPETITIVE/EMS-11/1-COURTIN/OC-GB3.S10.3
12/28/82 12/28/82 15:35 4 3
<>

<N>ABSTRACT: ETHERNET AND THE FIFTH GENERATION/GB3.S4.44
5/18/82 5/18/82 9:00 2 2 <>

<N>AUBURN UNIVERSITY EXEC REPORT OF NO VALUE/PROF LINK/GB3.S2.13
8/11/82 4/30/82 13:05 2 3 <>

<N>BELL: REPLACEMENT COST FOR RADIO/GB3.S4.12
5/3/82 5/14/82 16:55 2 6 <>

<N>BELL: WHAT GORDON LIKES AND DISLIKES/GB3.S2.19
2/16/82 5/12/82 12:45 7 8 <>

<N>BOOK: SOFTWARE ENGINEERING, WANT TO WRITE?/ANKLAN/GB3.S4.03
5/4/82 5/5/82 14:41 6 8 <>

<N>BUDGETS AND (EMC) ENG. MGMT COMMITTEE /FULLER/GB3.S4.36
5/17/82 6/3/82 15:45 5 4 <>

<N>BUSSES, WILL OURS DRIVE US OUT OF BUSINESS/FULLER/GB3.S1.31
11/17/81 11/17/81 15:03 5 2
<>

<N>CAD BUDGET XTRA 600K MULTI YEAR MULTIWIRE
SUPPORT/11/5/81/GB3.S2.30
2/19/82 2/26/82 3:59 3 3 <>

<N>CERBERUS COME TO THE RESCUE: SOME TO DO'S/JACK SMITH/GB3.S3.39
4/14/82 4/14/82 11:39 9 2 <>

<N>CHIPS, THIS AIN'T GOOD ENOUGH/CUDMORE/12/82/GB3.S2.52
2/26/82 5/12/82 11:19 5 4 <>

<N>CHRISTMAS CARD, TYPE CHRISTMAS=MERRY; NEW_YEAR/12/81/GB3.S2.51
2/26/82 2/26/82 4:08 3 3 <>

<N>CMU JOINT PROP. DISC.-DOUG VAN HOUWELLING/FULLER/GB3.S1.19
11/17/81 12/29/81 10:59 7 3
<>

<N>CMU JOINT PROP. FOR DEV. OF PERSONAL C./SLIDES/ GB3.S1.03
10/16/81 5/27/82 10:04 5 8
<>

<N>CMU JOINT VENTURE DISC. WITH ALLEN NEWELL/FULLER/GB3.S1.22
11/17/81 12/29/81 10:59 6 3
<>

<N>CMU JOINT VENTURE PROPOSAL-WOULD LIKE YOUR
SUPPORT/11/81/GB3.S2.38
2/26/82 2/26/82 4:02 5 3 <>

<N>CMU JONT VENTURE INTO TOTAL ENVIRONMENTAL COMPUTING/GB3.S1.26
11/17/81 12/29/81 10:58 5 3
<>

<N>CMU PROC. AHEAD-EXPL THE CMU/DEC RES. PROP./FULLER/GB3.S1.23

11/17/81 2/23/82 10:26 3 4
<>

<N>CMU PROPOSAL FOR JOINT DEV. OF PERSONAL COMP./FULLER/GB3.S1.33
11/3/81 5/12/82 12:55 5 5 <>

<N>CMU PROPOSAL--US AND THE NEXT ENG. SITE/FULLER/GB3.S1.28
11/17/81 1/8/82 12:33 4 5 <>

<N>CMU RE YOUR PROPOSAL ON ? /JORDAN,GRANGER/GB3.S4.02
4/26/82 5/6/82 10:02 3 12 <>

<N>CMU SUPPORTING MARIO'S PROMOTION/HABERMANN/GB3.S1.25
10/10/81 4/30/82 12:24 4 4
<>

<N>COMET IN MCA'S TO LEARN MULT. VAX IMPLEM./ARMSTRONG/GB3.S3.47
4/14/82 4/23/82 14:25 7 4 <>

<N>COMET MCA/DEMMER/GB3/S4.28
5/17/82 5/19/82 12:17 6 3 <>

<N>COMMITTEES NOD; C-I T/F;PRODUCTIVITY REV/GB3.S3.12
3/10/82 3/15/82 13:56 4 3 <>

<N>COMMITTEE: COMP. FOR SCI. ADV COMM
FRIEDLAND&FIEGENBAUM/GB3.S2.64
3/1/81 5/12/82 11:35 7 4 <>

<N>COMMUNICATIONS, COMPETITIVE RESP./DEMMER ET AL/GB3.S1.04
10/5/81 5/12/82 11:27 5 4 <>

<N>CONTRIBUTION: C. IN SCI&TECH CENTERS-MUSEUM/CONT.CO /GB3.S1.17
11/2/81 5/12/82 11:44 5 7 <>

<N>CONTRIBUTION: PLS FUND HAROLD COHEN / COMMITTEE/
1/30/82/GB3.S2.62
2/26/82 2/26/82 4:16 8 3 <>

<N>CONTRIBUTION: U OF NC FUNDING
HELP/CHAMBERLAIN/CAPOWSKI/GB3.S1.54
11/30/81 5/12/82 11:10 2 4
<>

<N>CORP. REPORT CARD-FY82-PRODUCT DEVELOPMENT/GB3.S3.26

3/26/82 5/12/82 10:59 4 6 <>

<N>CRAY GROUP WHO WANTS TO BUILD A VAX/DEMMER/GB3.S4.33
5/17/82 5/18/82 16:33 12 3 <>

<N>CRAY INTERVIEWING AT CRAY LAB, AN OPPORTUNITY?/BORNSTEIN/GB3.S3.43
4/14/82 4/14/82 13:20 5 2 <>

<N>CUSTOMER: DUPONT (PENSAK)FOR GOOD RELATIONS-ACT NOW/GB3.S2.04
2/2/82 6/1/82 17:09 7 5 <>

<N>DAVIS, GERALD SUMMARY MEMO TO GBELL RE: DEC MARKETS ETC.72
1/19/82 6/1/82 14:40 15 7 <>

<N>DAVIS, GERALD THANK YOU FOR DINNER /GB3.S1.73
1/22/82 6/1/82 14:40 2 5 <>

<N>DAWN, DECISION TO CONTINUE/WILL T./GB3.S1.20
10/8/81 4/30/82 12:36 2 8 <>

<N>DECSET A VIETNAM I PROP WE LEAVE! SCRIBES-WAY TO GO/DALEY/GB3.S3.40
4/14/82 4/15/82 14:21 3 3 <>

<N>DEC2080 SLIP CAN'T MEAN NI AND PLUTO WILL SLIP/ULF ET AL/GB3.S3.08
3/10/82 5/12/82 11:05 5 3 <>

<N>DEC2080 SLIP CAN'T MEAN NI & PLUTO WILL SLIP/GB3.S2.17
2/16/82 3/1/82 4:03 6 9 <>

<N>DG, OUR VAX STRATEGY AND THE NEXT DG MACHINES/12/81/GB3.S2.49
2/26/82 2/26/82 4:06 5 3 <>

<N>DPD, HERE IS A FRANK APPRAISAL/ABBOTT/GB3.S1.05
10/5/81 5/12/82 11:54 2 4 <>

<N>ECKERT MAUCHLEY AWARD GIVEN FOR PATTERSON WRITEUP/GB3.S2.21
2/16/82 6/1/82 17:07 4 10 <>

<N>ECKERT-MAUCHLY AWARD, THANKS FOR INTRO /PATTERSON /GB3.S4.10
5/3/82 5/4/82 12:09 5 9 <>

<N>ECKERT-MAUCHLY AWARD, THANKS TO JACK LIPOVSKI/GB3.S4.24

5/12/82 5/12/82 14:32 2 2 <>

<N>ECMA WILMOT MEETING/WILMOT/GB3.S3.38
4/14/82 5/12/82 10:03 3 3 <>

<N>EDUCATION: CS GOING INTO C. ENG ED. BUSINESS/12/81/KO/GB3.S2.54
2/26/82 5/12/82 11:47 5 5 <>

<N>ELECTRONIC MAIL IMPACT - RE CRAWFORD PAPER/ROBERT ROUSE/GB3.S3.20
3/16/82 5/27/82 10:09 4 2 <>

<N>EMS RESPONSE TO INTERNAL IMPLEMENTATION/CRAWFORD.49
1/11/82 1/11/82 16:13 3 3 <>

<N>ENGINEERING ORGANIZATIONS/GB3.S2.16
2/16/82 6/1/82 16:56 5 9 <>

<N>ENGINEERING PROBLEM LIST FOR MARCH OC WOODS/GB3.S3.19
3/15/82 3/15/82 14:58 9 3 <>

<N>ENGINEERING RE: ORGANIZATION/ENG. STAFF/GB3.S3.02
4/5/82 5/25/82 14:44 6 9 <>

<N>ENGINEERING SPECIFIC ORGANIZATION IDEAS/OC/GB3.S2.15
2/16/82 5/12/82 17:13 5 4 <>

<N>ENG. PROJECTS STRUCTURING (DRAFT)/1/11/82/CORBEN/GB3.S2.55
2/26/82 5/12/82 12:03 6 6 <>

<N>EQUIPMENT NEEDED FOR GUARANTE/CHARLIE ROSE/GB3.S1.41
11/18/81 4/30/82 13:28 3 4
<>

<N>ETHERNETS STARS FOR ENG & TYPESETTING REV/ENG STAFF/GB3.S4.38
5/17/82 5/18/82 16:32 7 3 <>

<N>ETHERNET FOR ENG NET & PRODUCT, 1 YEAR EARLIER/BILL AVERY/GB3.S3.44
4/14/82 5/11/82 10:18 6 4 <>

<N>ETHERNET PRESENTATION IN NY - THANK YOU/GB3.S2.18
2/16/82 2/23/82 10:41 5 8 <>

<N>ETHERNET SI'S CO & ETHERNET:DO IT OR DELEGATE/ENG

STAFF/GB3.S3.42
4/14/82 4/14/82 11:47 16 2 <>

<N>ETHERNET SPEECH-PRESS CONFERENCE/GB3.S2.09
2/8/82 5/17/82 17:25 79 7 <>

<N>ETHERNET, ICL PRES WILMOT ON USING
ETH./LACROUTE/11/81/GB3.S2.39
2/26/82 5/12/82 12:39 8 4 <>

<N>ETHERNET, UNIBUS OF FIFTH GENERATION/GB3.S1.79
1/25/82 5/18/82 14:15 133 21 <>

<N>ETHERNET--KEN'S PRES:HELP AND COMMENTS/JOHN ADAMS/GB3.S4.40
5/17/82 5/18/82 16:31 11 3 <>

<N>FAN A QUIETER: A MAJOR BREAKTHROUGH/GB3.S3.28
3/29/82 3/29/82 10:25 2 3 <>

<N>FIFTH GEN. PROG. INTEREST LETTER TO YAMAMOTO/GB3.S4.21
5/11/82 5/19/82 13:15 3 6 <>

<N>FLOPPY, DISCLOSURE OF ELEC. FLOPPY/SAVIERS ET AL/GB3.S1.14
11/12/81 5/12/82 11:50 2 7
<>

<N>GEMINI SIMULATION (COMMENTS ON YOUR STATUS RPT)/KUSIK/GB3.S1.65
1/14/82 1/14/82 9:14 2 1 <>

<N>GIGI SUPPORT-DON'T DO THIS/AVERY/11/8/81/GB3.S2.35
2/19/82 5/12/82 12:28 3 4 <>

<N>HERTZ, CONGRATULATIONS FOUNDATION/MCWILLIAMS/GB3.S1.46
11/23/81 5/12/82 12:26 2 2
<>

<N>HERTZ, FOUNDATION-RE: TOM MCWILLIAMS/TALLEY/GB3.S1.45
11/23/81 5/12/82 12:25 2 3
<>

<N>HEURISTICS FOR BUILDING GREAT PRODUCTS -- SLIDES/GB3.S3.18
3/15/82 3/23/82 11:18 29 10 <>

<N>HEURISTICS FOR BUILDING GREAT PRODUCTS-PRELIM. DRAFT/GB3.S2.05
2/2/82 5/12/82 12:28 43 14 <>

<N>HEURISTICS FOR BUILDING GREAT PRODUCTS/GB3.S1.61
1/12/82 2/2/82 10:38 31 15 <>

<N>HOROWITZ RESPONSE/I FEEL THE SAME WAY/GB3.S1.47
11/23/81 5/27/82 10:01 1 5
<>

<N>IBM COMMITMENT WHAT THEY'RE DOING/WHAT WE SHOULD DO/GB3.S1.18
11/12/81 5/12/82 11:53 6 7
<>

<N>IBM, THE NEXT IBM PERSONAL COMPUTERS (I'D
BUILD)/AVERY/GB3.S3.46
4/14/82 4/14/82 13:26 4 2 <>

<N>INVESTMENT & COMPLEXITY FOR GUIDING ENG/DEMMER/GB3.S4.35
5/17/82 6/3/82 15:46 11 5 <>

<N>INVITATION NO: BUTLER, COST & PARTNERS CAN'T ATTEND/GB3.S1.44
11/20/81 5/12/82 11:08 1 4
<>

<N>INVITATION NO: CAN'T SUPPT. VAX/780 COMP LAB/PROF
PEASE/GB3.S1.35
11/3/81 4/30/82 12:53 5 4 <>

<N>INVITATION NO: INMOS ARCHITECUTRE /BARRON /GB3.S1.64
12/8/81 6/1/82 15:38 3 6 <>

<N>INVITATION NO: RE: DEFENSE LOGISTICS CONF./CARLUCCI/ GB3.S3.36
4/8/82 5/12/82 10:52 3 5 <>

<N>JAPANESE ADVANTAGE: IS IT REAL?/BOD,OC/GB3.S4.17
5/5/82 5/19/82 12:34 7 6 <>

<N>JAPAN, DOMINATE COMP BY 1990 IF 5G EFF SUCCEEDS/ENG
STAFF/GB3.S2.61
2/26/82 5/12/82 12:41 6 4 <>

<N>KEYBOARD DAISY CAD AND OUR KEYBOARD/AVRAM/GB3.S4.34
5/17/82 5/18/82 16:33 5 5 <>

<N>KEYBOARD STRAIGHTENING IT OUT SO WE CAN GET ONE/GB3.S3.14
3/10/82 3/15/82 13:55 9 4 <>

<N>LATTICE LOGIC--USING CMOS GATE ARRAY DES SYS/LIPPERT/GB3.S4.23
5/13/82 5/18/82 16:35 7 3 <>

<N>LECTURE: MEAD ON VLSI & DIGITAL'S BUSINESS IN THE 80'S/GB3.S3.17
3/10/82 6/1/82 17:17 6 3 <>

<N>LISP AND AI MARKET-HIGH PERFORMANCE AI/GB3.S4.11
5/3/82 5/4/82 11:10 3 2 <>

<N>LNI REPEATER BY THANKSGIVING/11/6/81/GB3.S2.32
2/19/82 2/26/82 3:59 2 3 <>

<N>LRP ENGINEERING REVIEW - 3/18/82/GB3.S3.25
3/26/82 4/6/82 10:01 10 6 <>

<N>MANCHESTER DATAFLOW COMPTER/GURD /GB3.S3.29
3/29/82 6/1/82 17:14 3 5 <>

<N>MANCHESTER UNIVERSITY DATAFLOW MACHINE/SUAREZ/GB3.S3.05
3/8/82 3/9/82 15:19 6 3 <>

<N>MANCHESTER U. DATAFLOW MACHINE, LET'S SUPPORT IT/AVERY/GB3.S3.45
4/14/82 4/14/82 13:24 6 3 <>

<N>MANUFACTURING MKT--WILL IT BE NEXT MKT WE COVET/CADY/GB3.S4.30
5/17/82 5/19/82 12:30 7 4 <>

<N>MASS STORAGE AND BUILDING LOW END PRODUCTS/12/81/GB3.S2.53
2/26/82 2/26/82 4:09 6 2 <>

<N>MCE ALPHA OMEGA DRAFT TO DELAGI/GB3.S4.20
5/10/82 5/24/82 9:32 37 4 <>

<N>MCE CDC'S JAPAN'S 5TH GENERATION PROJECT,DERTOUZOS TO OC/GB3.S3.07
3/10/82 4/26/82 15:07 4 3 <>

<N>MCE (MICROELECTRONIC C. ENTERPRISE) TF MTG/CHENAIL/GB3.S4.32
5/17/82 5/18/82 11:55 6 4 <>

<N>MCF PETITION TO STOP MCF /LOWELL WOOD/GB3.S1.69
1/15/82 5/27/82 9:56 4 5 <>

<N>MICROS, RILEY'S COMMENTS ON THE 11, 16- & 32-BIT/12/81/GB3.S2.47
2/26/82 2/26/82 4:05 17 3 <>

<N>MICRO, TASK FORCE ON A COMPETITIVE MICROPROCESSOR/12/81/GB3.S2.45
2/26/82 2/26/82 4:04 10 3 <>

<N>MIT SEND TO JACK MACKEEN-WILL ARRANGE FOR LOAN/FRANCIS LEE/GB3.S3.04
3/8/82 5/12/82 11:07 2 14 <>

<N>MOCW AGENDA/ENG STAFF/GB3.S2.10
3/11/82 6/1/82 16:54 8 7 <>

<N>MOTO-OKA HELP, THANKS/DERTOUZOUS AND PENNFIELD/GB3.S2.07
2/2/82 5/12/82 11:48 3 8 <>

<N>MOTO-OKA PRESENTS 5TH GEN. PROJ./1/82/ENG USERS/GB3.S2.57
2/26/82 5/12/82 12:52 5 4 <>

<N>MOTO-OKA THANKS FOR PRES. 5TH GEN. RESEARCH PROG/MOTO OKA/GB3.S2.06
2/2/82 5/12/82 12:51 3 5 <>

<N>MUSEUM: ARTHUR BURKS LECTURE AT THE MUSEUM/GB3.S3.11
3/10/82 3/10/82 14:55 3 2 <>

<N>MUSEUM: COMPUTER SCIENCE & TECHNOLOGY CENTERS/11/10/81/GB3.S2.36
2/19/82 5/12/82 12:53 5 4 <>

<N>MUSEUM: FLOWERS LECTURE-OCT. 15 AT MUSEUM/ENG. USERS/GB3.S1.30
11/17/81 12/29/81 11:30 3 4
<>

<N>MUSEUM: OREGON MUS. OF SCI & TECH TEMPLETON/GB3.S1.34
11/3/81 5/12/82 12:58 2 6 <>

<N>MUSEUM: REQUEST FOR DEUCE DRUM PROF. MURRAY ALLEN/GB3.S1.07
10/19/81 5/12/82 9:50 3 5 <>

<N>MUSEUM: SYMBOL, NEW HOME FOR /PROF. STEWART,IOWA STATE/GB3.S4.04

5/4/82 5/11/82 9:51 3 5 <>

<N>MUSEUM: WES CLARK DESCRIBES LINC @ MUSEUM/11/14/81/GB3.S2.39.40
2/26/82 2/26/82 4:03 4 3 <>

<N>NAUTILUS CONCERNS/11/23/81/BOB STEWART/GB3.S2.44
2/26/82 5/12/82 12:56 7 4 <>

<N>NAUTILUS PLAN REVIEW/DON MCINNIS/GB3.S3.41
4/14/82 5/12/82 10:01 4 3 <>

<N>NBS MAIL--STANDARD/OC/GB3S.4.29
5/17/82 5/19/82 12:30 5 3 <>

<N>NETWORK SERV BUS--USING ENG AS A PROTOTYPICAL/GB3.S2 1/26/82.60
2/26/82 3/25/82 14:48 3 4 <>

<N>OFFICE APPLICATION--APPROACH TO DOING/1/16/82/GB3.S2.58
2/26/82 2/26/82 4:14 4 3 <>

<N>OFIS AND CT/WPS SOFTWARE/AVERY/GB3.S4.26
5/13/82 5/13/82 11:30 10 2 <>

<N>ORGANIZATIONS EVOLVING/ENG STAFF/GB3.S1.50
1/12/82 5/27/82 9:59 15 2 <>

<N>ORGANIZATIONS, THOUGHTS ON EVOLVING/ENG. STAFF/GB3.S1.48
1/11/82 1/11/82 15:03 15 6 <>

<N>ORGANIZATION CHART (ENGINEERING) SHOWING NEW EMC/GB3.S4.06
5/21/82 6/3/82 15:44 9 8 <>

<N>ORGANIZATION--ENG. CHANGES/ENG STAFF/GB3.S4.41
5/17/82 6/3/82 15:44 6 4 <>

<N>PAPER: DISTRIBUTED PROCESSING AND LIMITS TO ITS
GROWTH/GB3.S3.31
3/31/82 4/1/82 14:06 51 16 <>

<N>PAPER: INTRODUCTION TO PROCESSES REQUIRED TO GEN A C./GB3.S3.24
4/14/82 4/14/82 8:20 147 2 <>

<N>PC TIME SHARING CENTRAL/GROUP/PERSONAL DEFINITIONS/GB3.S2.24
2/16/82 3/1/82 3:58 5 3 <>

<N>PERSONNEL: BJ, NOMINATION FOR VP/OC/GB3.S2.25
2/16/82 5/12/82 12:42 9 6 <>

<N>PERSONNEL: CUTLER - YOU, CHIPS, BOARDS AND DECWEST/GB3.S3.16
3/10/82 5/12/82 11:01 9 3 <>

<N>PERSONNEL: ECONOMY-ADS IN GLOBE ON JOB OUTLOOK/GB3.S3.06
3/9/82 5/12/82 11:06 10 16 <>

<N>PERSONNEL: ENG. SALARIES SLIDES FOR OC/GB3.S3.22
3/23/82 6/1/82 17:15 4 4 <>

<N>PERSONNEL: HIRING WITHIN/WITHOUT, OUT-PLACE/BORNSTEIN/GB3.S4.31
5/17/82 5/19/82 12:29 5 5 <>

<N>PERSONNEL: INDIVIDUAL CONTRIBUTOR (LIST OF NAMES)/OC/GB3.S2.23
2/16/82 4/30/82 12:46 5 7 <>

<N>PERSONNEL: SPECIAL CONTRIBUTOR LIST/GB3.S3.13
3/10/82 3/10/82 14:58 5 2 <>

<N>PHILIPS, THANKS-HOSPITALITY IN EINDHOVEN/PENNENBORG/GB3.S1.11
10/6/81 5/12/82 17:02 5 20 <>

<N>PHILIPS, THANKS-HOSP. IN EINDHOVEN/DRS. TEER & BOSMA/GB3.S1.08
10/5/81 4/30/82 12:54 2 13 <>

<N>PHILIPS, THANK YOU/MR. HOFF/GB3.S1.09
10/5/81 5/12/82 17:03 3 7 <>

<N>PLUTO GREAT.SELL WIDELY AS COMM C./JOHN ADAMS/GB3.S4.39
5/17/82 5/19/82 8:47 5 4 <>

<N>PLUTO, GETTING A REAL START ON /LACROUTE/GB3.S1.32
11/17/81 12/29/81 11:28 5 3
<>

<N>PRODUCT DIFFERENTIATION FOR STORES-11/23/GUTMAN/GB3.S1.15
10/6/81 1/21/82 9:17 2 4 <>

<N>PRODUCT LINE MANAGERS--DATA ON REASON FOR/HINDLE/GB3.S4.37
5/17/82 5/18/82 16:32 5 4 <>

<N>QBUS, USING IT FOR BUILDING COMM SYSTEMS/BUTLER/GB3.S1.38
11/17/81 12/29/81 11:31 6 4

<>

<N>RECOGNITION AND PROFESSIONAL SOCIETIES/PEG/GB3.S3.34
4/8/82 5/12/82 10:55 3 4 <>

<N>RECOGNITION: TURNER'S ARTICLE ON IBM AWARD/DELAGI/GB3.S1.40
11/17/81 11/17/81 15:15 3 2
<>

<N>REFERENCE: FOR DR. MORRIS' PROMO-YES I AGREE/RIORDON/GB3.S1.62
12/4/81 5/12/82 17:09 2 5 <>

<N>REFERENCE: RECOMMEND RALPH PALMER-LOOKS WORTHY/LANDAUER/GB3.S3.23
3/24/82 5/12/82 10:59 2 3 <>

<N>RENTAL CAR FOR HOOPER/GB3.S1.43
11/20/81 3/4/82 12:39 3 4 <>

<N>REVIEW ENGINEERING MARCH. REVIEW THOSE WHO NEED/12/81/GB3.S2.48
2/26/82 2/26/82 4:05 8 3 <>

<N>REVIEW ENGINEERING NON-PRODUCT GROUPS 1/82/ENG STAFF/GB3.S2.59
2/26/82 5/12/82 12:03 8 4 <>

<N>ROYALTY PAYMENTS-CARNEGIE MELLON/OBRIEN/GB3.S1.10
10/5/81 5/12/82 17:09 2 5 <>

<N>SANDIA AND LASL--VAX, LAN, OFFICE & V18X/AVERY ET AL/GB3.S2.37
2/19/82 5/12/82 17:11 12 4 <>

<N>SCORPIO, DISCUSSION AT GVPC/11/21/81/GB3.S2.43
2/26/82 2/26/82 4:04 5 3 <>

<N>SEMICONDUCTOR STRATEGY, CAN WE ARRIVE AT?/GB3.S1.53
1/12/82 1/12/82 10:02 7 1 <>

<N>SEMICONDUCTOR, YOUR FAULTY PERCEPTION RE SELLING TINY/TJ/GB3.S1.36
11/17/81 6/1/82 16:35 8 4 <>

<N>SERVER, GETTING A PERSONAL COMPUTER/GUTMAN/GB3.S1.27
11/17/81 2/23/82 10:25 5 4
<>

<N>SIEMENS, NICE TO MEET YOU HERE/GRASSMAN/GB3.S4.05
4/26/82 4/30/82 10:51 3 3 <>

<N>STATE OF THE DESIGN-WHAT WE HAVE-WHAT WE WANT/GB3.S1.59
12/3/81 5/12/82 17:15 9 5 <>

<N>SUVAX AS COMP.PROD. IN OUR LIFETIMES/11/81/GB3.S2.29
2/19/82 2/26/82 3:58 5 3 <>

<N>SUVAX INTERIM-IN MY LIFETIME-FOR MAY ANNOUNCEMENT/11/81/GB3.S2.34
2/19/82 2/26/82 4:00 4 4 <>

<N>SUVAX, MEETING ON TERMINALS STATUS/CHAMPINE/GB3.S1.29
11/17/81 12/29/81 10:57 5 3
<>

<N>SUVAX, STATUS AS OF 3:45 P.M. 12/2/81/GB3.S2.46
2/26/82 2/26/82 4:05 5 3 <>

<N>TAIWAN, CT05-ENGINEERING/TETSCHNER/GB3.S1.39
11/17/81 11/17/81 15:13 3 2
<>

<N>TALK/BOOK: ARCH. & IMPL. WITHOUT BRACKETED AREAS/GB3.S4.16
5/4/82 6/1/82 10:24 115 2 <>

<N>TALK: PROCESS REQUIRED TO GENERATE A COMPUTER/SPEECH/GB3.S4.15
5/4/82 5/4/82 12:23 148 2 <>

<N>TERMINALS THOUGHTS ON FOR DUMB, WPS & TECH. USE/11/81/GB3.S2.41
2/26/82 2/26/82 4:03 12 3 <>

<N>TERMINALS, GETTING ARCH. SPECIFIED /AVERY ETAL/1/30/82/GB3.S2.63
2/26/82 6/1/82 16:55 4 5 <>

<N>THANKS: BOOK-BIRTHPLACES OF EUROPEAN SCI./HARRY GRAY/GB3.S1.67
8/14/81 5/12/82 12:44 4 9 <>

<N>THANKS: FOR TEACHING COURSE/CARVER MEAD/ GB3.S2.14
2/12/82 5/12/82 11:18 5 7 <>

<N>THANKS: MURRAY, DR. JOHN, TEACHING VLSI/GB3.S1.06
10/19/81 5/12/82 11:52 2 5

<>

<N>TMS/AVRAM/GB3.S4.42
5/17/82 5/19/82 12:06 4 4 <>

<N>TOOMBE, DEAN (TI) PHONE CALL OF 1/14/82/1/14/82/GB3.S2.56
2/26/82 2/26/82 4:13 4 4 <>

<N>U OF TEXAS-MAKING SCHOOL OF ENG PROF'NL/WOODSON,GLOYNA/GB3.S4.09
5/3/82 5/19/82 12:37 3 6 <>

<N>VAX 782 CONGRATULATIONS ON THE 782/GB3.S3.10
3/10/82 4/13/82 13:47 3 3 <>

<N>VAX, PROMOTING FOR PERSONAL COMP. SUPPORT DEV./11/5/81/GB3.S2.31
2/19/82 2/26/82 3:59 3 4 <>

<N>VAX, WHAT WOULD A SIMPLER VAX ACCOMPLISH/12/81/GB3.S2.50
2/26/82 2/26/82 4:06 8 3 <>

<N>VENDOR FEEDBACK--COMMENTS ON OUR MKTING FOLKS/ENG.STAFF/GB3.S2.20
2/16/82 5/12/82 11:27 5 8 <>

<N>VENDOR: RIXON INTERFACE W/DEC SENT TO BERNIE/BERNIE/GB3.S1.24
10/10/81 5/12/82 17:09 4 7
<>

<N>VENUS, GORDON'S VISIT TO MARLBORO/11/8/81/GB3.S2.33
2/19/82 2/26/82 4:00 8 4 <>

<N>VLSI THE GREAT SEMINAR, NOW WHAT PEG?/GB3.S3.15
3/10/82 3/23/82 15:31 12 3 <>

<N>VS11, SUDS AVAILABILITY/11/21/81/GB3.S2.42
2/26/82 2/26/82 4:03 4 3 <>

<N>VT100 LOW COST BEST WAY TO GET IT,A COUNTERPROPOSAL/KO/GB3.S3.09
3/10/82 5/12/82 11:04 17 3 <>

<N>VT102 REPLACEMENT PACKAGING/OLSEN/GB3.S1.16
10/7/81 10/13/81 17:34 9 13

<>

<N>VT200, WHY ISN'T OPAL THE VT200?/CHAMPINE/GB3.S4.08
5/3/82 5/18/82 14:15 4 7 <>

<N>VT278, CONGRATULATIONS/GB3.S2.22
2/16/82 3/1/82 3:59 2 3 <>

<N>WORLD COMPUTER CENTER--RECOMMENDATION OF EQUIPMENT/OC/GB3.S4.27
5/17/82 5/17/82 8:53 23 2 <>

<N>WPS8-DILEMA OF INTRODUCING 3 P.C.'S/AVERY ET AL/ GB3.S2.11
4/8/82 6/1/82 16:53 7 6 <>

```
+---------------------------+
|   |   |   |   |   |   |   |
| d | i | g | i | t | a | l |   i n t e r o f f i c e   m e m o r
a n d u m
|   |   |   |   |   |   |   |
+---------------------------+
```

IV. Subject: **Creating Distribution Lists Using the WPS**

To: Distribution

Date: 24 OCT 78
From: Louise

Principe

Dept: OOD
Loc.: ML12-1/A51

Ext.: 2237

Following is a list of step-by-step instructions to help guide you through the generation of a memo and its distribution list.

Creation

1. Create your memo using the abbreviation file (file {2) to call in your memo header, i.e: Depress gold key and then depress the abbreviation key and mh (for memo header). The

following is a sample for you to type in {2:

```
<<mh>>+---------------------------+
|   |   |   |   |   |   |   |   |
| d | i | g | i | t | a | l |   i n t e r o f f i c e   m e m o r
a n d u m
|   |   |   |   |   |   |   |   |
+---------------------------+
```

Ruler settings:
L-------------------------------------T--------------------------------R

Subject: <>

To: <>

Date: <>
From: <>
Dept: <>
Loc.: <> Ext.: <>

At this point you go to the top of the file, then advance to each <>, rub word out, and fill in the appropriate information.

2. Type the body of your memo and file it.

3. Now you are ready to list process to compile your distribution list for the memo (see appendix).

4. At this point you should decide which group (or groups), see appendix, will make up your distribution list (see appendix). Prepare your spec accordingly. For example, if it is to go only to OOD members then your spec should read as follows:

If <group> =<*>OOD<*>
then process record

If your distribution will include OOD and Marketing Committee (MKT), then your spec would read:

If <group> =<*>OOD<*>
or =<*>MKT<*>
then process record

If you want to exclude your bosses name (for example, Gordon Bell) from the distribution list the spec should read:

If <group>=<*>OOD<*>
but not if <name>=Gordon Bell
then process record

5. The form below is set up for distribution lists for memos. It is not necessary to put a page mark in your file since it is already in the form -- however, when list processing it will ask you if you want to add to the bottom or top of the memo -- always say "a" to add to the bottom of the memo as the form indicates.

V. **Example of a Form to be used for memo distribution**:

-------------------------------NEW PAGE--

D I G I T A L INTEROFFICE MEMORANDUM

```
0        10        20        30        40        50        60
70      79
L........0..T.....0.........0..T.....0.....T...0.........0....T.
...0........R
DIST:<!s><dist>
                <name>               <ms><>      <name>
                <ms><!e>
```

Example of a Form to run labels

<name>
<ms>

List Processing

6. Depress lp and carriage return. The screen will display as follows:

-- LIST PROCESSING MENU --

P = Merge list with a form and print the result

D = Merge list with a form and put result into a document

T = Test a selection specification for errors

Type the letter and then press RETURN

OR Press Gold MENU to recall the Main Menu.

7. Each of the three selections will lead you through the list processing process.

8. Now you have merged your files and have your memo with the distribution list attached at the end on a new page. Be sure to put in a new "print command" if your memo is more than one page long so that you don't get the header on the distribution list page. It should be put on the last page of the memo -- just before the distribution page.

9. Occasionally you will have a distribution list that is random names, not any particular groups. To do this easily, create the memo as before and type in the body; however, when you are finished typing the memo, hit a carriage return and "GOLD GET "your form file" (shown in #5). Then delete

the <name>, etc. and type in your names and mail stops.

Some Helpful Hints:

1. For memos always generated by your boss (for example, Gordon Bell) you can adjust your memo header in the abbreviation and give a different code, thus creating another memo header for memos only generated by your boss. For example: "GOLD Abbreviation mb" gets us the following memo header. Where as "mh" is a regular memo header without any name or mail stop, etc. filled in.

```
<<gb>>+---------------------------+                    ID#<>
|   |   |   |   |   |   |   |   |
| d | i | g | i | t | a | l |   i n t e r o f f i c e   m e m o r
a n d u m
|   |   |   |   |   |   |   |   |
+---------------------------+

Subject:  <>

To: <>                                     Date:  <>
                                           From:  Gordon Bell
                                           Dept:  OOD
                                           Loc.:  ML12-1/A51
Ext.: 223-2236

                                           follow up <>
```

2. You can also set up specs to be kept permanently in files for lists you use often (for example OOD spec, MKT spec).

3. The Library file (file {3) is for commonly used paragraphs or lists that are not used as often as others. For example, in the Library file, I have Engineering Committee and other Groups not always used for distribution.

4. Be sure NOT to keep a list of OOD or MKT or any of the other groups in your "list" in a separate file. This way, you only update

one file and always have an up-to-date list.

5. After creation of a file by name, it is quicker thereafter to access often-used files by number instead of name, especially when list processing. As you create your memo file, jot down the file number. In using list processing, the following file numbers would be helpful:

List processing calls for	file #
name of list	?
name of spec	?
name of form	?
put results into	?

If there are any questions or helpful ideas, please contact me.

APPENDIX

A. Sample List

<name>
<ms>
<group>
<>

<name>Gordon Bell
<ms>ML12-1/A51
<group>OOD,OPC,MKT
<>

<name>Bob Puffer
<ms>ML12-2/E38
<group>OOD,OPR
<>

B. <group>Definitions

OOD = Office of Development
OPC = Operations Committee
MKT = Marketing Committee
OPR = Operations Committee Rotating Members

Sample Group Codes to Create a "List"

Name **Code**

Gordon Bell's Staff---------------------------------------OOD

Bob Puffer (Engineering Operations)
Staff-- EOS
Managers--- EOM

Larry Portner (Software Development)
Staff--
SDSTF
Managers--- SDM
Product Managers-----------------------------------
SDPM

Dick Clayton (Systems Development)
Staff-- SYS
Managers--- SDE
Product Managers-----------------------------------
SYPM

Bill Johnson (Technical Director)
Staff-- WJS
Managers--- WJM

John Kevill (Mass Storage)
Staff-- MDS
Managers--- MDM
Product Managers-----------------------------------
MSPM

Bill Demmer (Medium Systems)
Staff-- BDS
Managers--- BDM
Product Managers-----------------------------------
BDPM

Jim Cudmore (Corporate Process Manufacturing)
Staff-- MSM

Ulf Fagerquist (LCG Development & R&D Group)

Staff-- 10S
Product Managers---------------------------------- D10

Jim Bell (R&D) Staff------------------------------ RDS

Corporate Committees

Product/Pricing Committee------------------------ PLM

Operations Committee------------------------------ OPC

Operations Committee Rotating Members------------ OPR

Finance & Administration Committee--------------- F&A

Marketing Committee------------------------------ MKT

CONFIDENTIAL

Digital **Interoffice Memo**

Subject: **Intel 16 Bitter; Questions We Need to Answer**

To: OOD	MC	Date: 1 NOV 76
Bill Demmer	Bruce Delagi	From: Gordon Bell
Howard Fineman	Lorrin Gale	Dept: OOD
John Mackeen	Ralph Platz	Loc.: ML12-1 Ext.: 2236
Steve Teicher	Mike Tomasic	

F/U 11/8

Let's assume the worst. In 16 months Intel will have a reasonable
bit processor on a chip with a 20-bit (e.g., PDP-10) address size.
Their machine will become the industry standard just as the 8080 ha

1. Can we have someone "play Intel
and "play Intel chips buyer" and build some of the competitive

example systems? What are the costs?

2. Can we get the PLAS address extensions solid and put in hardware and then in software (i.e. languages such as FORTRAN and COBOL) so we can see how they compete? Can Fonz 11 take this?

3. Can we implement a much smaller (8-bit or 16-bit) VAX so that we can be competitive at the boar level? What's the cost...at each level of integration? (I.e., where do we/can we compete?)

4. Review Fonz 11 for goodness against 1...especially our bus and peripherals versus current a planned ones from Intel. (I assume the new serial bus is able utilize these peripherals.)

5. Should we just influence them t get an ISP we want, and then use it widely? What if it were th ISP? Suppose our competitors adopt it...clearly a true stateme

September 2, 1980

Mr. Jack Carsten
Intel Corp.
3065 Bowers Avenue
Santa Clara, CA 95051

Dear Jack,

Just a brief note to say thanks for bringing all your engineers here to present the Intel product line and to discuss your process directions. I hope you found it worthwhile, because we were certainly impressed with what we heard. Also, I feel that there is already a better rapport between the two groups.

I hope we can continue to be a customer and a supplier.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

CC: Andy Grove, Intel
Dick Clayton, Digital
Andy Knowles, Digital

GB1.S6.27

Digital **Interoffice Memo**

Subject: **Intel Visit: Now + Parts; Future 8-, and 16-bit Machine (8086); and Fonz 11**

To: Distribution

Date: 3 NOV 76
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

F/U 11/10

I visited with Gordon Moore, President, and Bill Davidow, head of their Microcomputer Division.

We're doing an extremely poor job of understanding what they're doing and where they're going. In interface chips, there's no competition--their thinking is 2 years ahead of us and increasing. They've not learned the software from us, but by themselves--they're behind, but next go around will be forced to improve. They have lots of programmers but don't know about SW engineering...though they will.

Bill and I made the current competitive chart:

	8080	**LSI-11**

Speed	1	2-(3)->50(for arithmetic)
Memory Size	2K(4K)65K(rom) 4K(16K)56K(RAM)	
Level-of-Integration Sold	<u>chips</u>, boards	boards, <u>chassis</u>, <u>systems</u>
Bus Power (drive)	70ma?(18")	70ma(>)
Software	Assembly;PL/M	Op.Sys. + high level language
Use	terminals control for standalone things, hobbyist	high performance processing: control, comm., arithmetic, languages.
Price of computer part (including mem.& interfaces)	100-500	500-15,000

Note, with the current bunch of competitors of 8- and 16-bit microprocessors we have **<u>NO</u>** competition...next go around things will be different.

Let's get the volume customers now. In one year, it'll be too late!

We do not know the interface chips they're about to introduce. They're not a part of our use, competitive concern in LSI-11, or a source of ideas. Their chips are internally programmable!

It looks like we should be using the keyboard/display/SDLC interface in the LA120 and VT100 for display. [<u>Bob</u> and <u>Ed</u>, what's the story?] [Similarly, <u>Julius</u>, why aren't we using their SDLC chip instead of killing one supplier and making another one unhappy by forcing them to build our unbuildable design?]

[Lorrin, is it reasonable that your charter includes the transfer of knowledge about new chips and the monitoring of marginal DEC designs?]

Future 8- and 16-bit WATCHOUT!

The 8086 is a faster 8-bit 8080--by a factor of 2-4. Hence, there'll be more competition. But we'll be competitive providing we stay to arithmetic based application, and possibly offer microcode.

The 8086 is a code name for a 16-bit microprocessor, which will use 8080 peripheral chips, but will likely be incompatible. Their users don't particularly care, they say, because they are not user programs. In 3 months he'll let me look at it, and delivery is January 78 (I think...but sounds optimistic). Bill, formerly with HP minis, is pushing for a 20-bit address, using a base address scheme. He points out that with 65K RAMS in 1980, the one million bytes only requires 128 chips. Note this is equivalent to the average sized, current PDP-10's!

I find it hard to imagine what the computer market will be like when this basic hardware is available so widely and cheaply. Dick has promised to lead us to this understanding, because it will affect us drastically!

	Fonz 11	**8086**
Memory Size	? 16 bit VA	20 bits
Speed	1 (need FP)	1 (FP?)
Software	11-base	market outside of Intel

Are the resources we have in the low end adequate, given the peripheral chips situation?

How can we solve the virtual address space problem on the few chip 11, assuming they don't do too bad a job with a 20-bit address? PLAS? VAX?

Is it clear that they will set the Instruction-Set Standard for the 80's with this, just as they did with the 8080?

Our 1 Chip 11 - Probably a Significant Bad Idea

It feels like we could, by chasing the 8080 (minimal), lose our traditional business! Now let's assume Intel has a very good 1 chip, 16-bit processor. A 1 chip, minimal (slow) processor without a reasonable address space is a clear loser. Our competitors of small systems will use the 8080 for the very low end, fixed program. We won't have the peripheral support chips, hence at the systems level, (e.g., VT100, or LA120 with floppy or fancy comm.) with memory there'll be a loss!

The situation for performance classes could be:

VAX
.
.
.
White Dwarf
.
.
.
8086 if they don't screw up
Fonz-11
.
.
.
LSI-11 (look, we win)
8085, TI 16-bitter
.
.
.
8080
.
.
.
4004

GB:ljp

<u>Distribution</u>

OOD Marketing Committee

Jim Bell	John Clarke
Ed Corell	Bill Demmer
Bruce Delagi	Howard Fineman
Lorrin Gale	Bill Green
John Mackeen	Roy Moffa
Ken Olsen	Stan Pearson
Steve Teicher	Mike Tomasic

October 27, 1983

Surya Panditi
INTEL CORPORATION
3065 Bowers Avenue
Santa Clara, California 95051

Dear Mr. Panditi:

Thanks for the hospitality extended to me at Intel. It was great to hear about the aggressive plans, and I look forward to receiving more information in regard to the Multibus II as well as other items.

Sincerely yours,

Gordon Bell
Chief Technical Officer

cc: David House
Andy Grove

GB7.IN

Surya Panditi
INTEL CORPORATION
3065 Bowers Avenue
Santa Clara,
California 95051

00 BURT DECGRAM ACCEPTED S 13068 O 31 28-JUN-80 23:11:01

****
* d i g i t a l *
****

TO: DICK CLAYTON DATE: SAT 28 JUN 1980
11:09 PM EDT
BILL DEMMER FROM: GORDON BELL
cc: see "CC" DISTRIBUTION DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: INTEL, A PATH TO A FAST, CHEAP AND GOOD NI. WHY NOT?

I am concerned about what seems to me to be stupid behavior in
regard to acquiring Ethernet chips from Intel. Our current plans
call for parts in March 83, followed by volume in June 84, with
luck. Based on the unluckiness and inexperience of Tewksbury in
this regard, I believe we will not get a product using such a
chip until 5 years from now at the earliest. Furthermore, I
don't believe the Tewksbury mob has any need for such a chip
because it is irrelevant to interconnecting computer systems due
to our expensive bus interfaces and the fact that the interface
cost is totally irrelevant to the total cost, especially
considering the obsolete, SSI/MSI systems they design.

Meanwhile, I believe Intel will define and supply first pass
chips in June 82 at the latest, and some of their aggressive

buyers and (system definers)will offer and deliver a product in March 83 fully 2-1/4 years before we do! We will have no input to them because we don't talk to them for some reason.

By whatever cloudy thinking process we are using, and I want explained, we will not interact with Intel to define a spec that we can use, we will not have as good a chip, we will have it a factor of 2 later, and we will blow our precious resources who could be designing something in spending all our time interfacing to something like NINE, count-em, vendors.

The side-effect is that the small systems group, seeing the unavailability of these chips will go off and create an off the wall, and temporary (cause ultimately the market will force us to the standard) alternative in order to put their systems together.
Similarly, they will not interface to Intel because they know that Intel is smarter than they are and won't know what's going on so as to use the Intel chip that is available. They too will require chips which they will start to design, and will come up with the chip such that they will get to the market sometime in 85, given a 1 year wait, a 2 year chips schedule that will take 3 years and a 1 year time to get it in the product.

The net bottom line is that we will have 2, inferior Ethernets fully 2-1/4 years behind our competitiors. Furthermore, I expect these networks to be different than and incapable of speaking

to
each other or to the real Ethernet. This of course will create
another implementation to the real one for a grand total of 3,
with much resources and kludginess.

Dick, would you please get with Bill Demmer to transfer money and
some smart engineering, implementing person(s) from TW with the
explicit goals of:
.Influencing and buying the Intel Chip;
.Designing the small NI into your terminals hopefully, and small
systems for sure so that we will have products that are
competitive with the people who will be using the Intel part; and
.Simultaneously putting an NI on Qbus using standard parts for
interconnecting to NI based systems?

"CC" DISTRIBUTION:

HENRY CROUSE	BRIAN CROXON	JIM CUDMORE
ULF FAGERQUIST	SAM FULLER	DON METZGER
ROY MOFFA	GEORGE PLOWMAN	LARRY PORTNER
DAVE RODGERS	HERB SHANZER	BILL STRECKER
STEVE TEICHER	JOE ZEH	

GB1.S5.33
00 BURT DECGRAM ACCEPTED S 30388 O 02 20-JUL-80 21:41:56

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION   DATE: SUN 20 JUL 1980 9:32 PM EDT

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: INTEL: GROVE MEETINGS AND GETTING A POLICY

The purpose of the meeting was to prepare for the Intel meeting and to understand our relationship with Intel at this time. Various people exchanged their own levels of frustration. Currently, it appears, the latest information is coming to me. Little, signicant new product or process infromation comes via the established channels.

For starters, I would like purchasing to develop a single contact point to administer our relationship. It would escalate issues versus holding them in a file.

GROVE MEETING
Dick was calling Grove to change the nature of what we thought was the visit agenda (microprocessor peripherals, general relationship with respect to process transfer).

Our agenda would deal with some shorter term issues: the relationship, problems we have on working on the NI, the poor working relationship on the HMOS I transfer. It would propose an escalation procedure. We would like to be treated like a good customer, versus what we get now by reading about designs in Electronics when they are becoming available. This would include infomation about new peripherals and micros (like te 432). We would like to know about their process direction, especially
2

micron and double metal. Roy is interested in getting information on start-up, as well as various schedules of products. We would like to get a commitment as to what we see as
their bus strategy. Also, we might ask how they'd view chip sales.

The meeting attendees will include: Clayton, Moffa, Zeh, Bell,
Tranos and Fetterman.

INTEL INTERFACE POLICY
Dick volunteered to update what we want our policy to be with respect to Intel. It will include:
.Micros competitive aspects (note their board business now appears to be somewhat larger than ours and is growing rapidly).
.What do we expect from them as a supplier and who is responisble
for managing the various parts of it (getting proces and product
information).
.Do we want to exchance process information?
.How do we think they are doing vis a vis VAX? is there a possible area of co-opertation?
.Other CAD co-operation?
.What is our position about using their peripherals?
.What is our position about using their 22-bit architectures (ie
the 8086 and the 432)?
This would be put together in conjunction with the MOS strategy.

This policy is second on Dick's list, after the main strategy,
although the two are somewhat related. It also deals with some of the issues I had outlined in my 7/28/80 memo on the Intel visit. Specifically, I asked:

.How much do we believe they are a competitor, supplier?

.Can we make competitive products without them? (The sense

of
the meeting was yes, but we could get information from them but it's a hassle. Certainly not worth continuing if the future is going to be like the past.)

.Do you see our need to work with them in the same way I do? (Very muddy sense from the meeting.)

.When will we give up the 11 and user their ISP's and software?
(We won't do it consciously because there isn't a very good interface to even see what they are doing. Note IBM is using the 8086 in their wps, and I am not opposed to using it in ours or in our VT/LA where there will be a large amount of fixed functionality and we will be hitting the 11 address space problem in these terminals over their lifetime.)

All, in all, I feel updating our policy so as to answer these and other questions is pretty important and I was very glad to have Dick volunteer to do it.

"TO" DISTRIBUTION:

DICK CLAYTON   HENRY CROUSE   DICK
SPENCER VIA ZEH
ARTHUR W. FISHER   MARY JANE FORBES   SAM FULLER
GEORGE TRANOS VIA FORBES MITCH FEDERMAN VIA FORBESROY MOFFA
DAVE RODGERS   STEVE TEICHER   MIKE
TOMASIC
JOE ZEH

"CC" DISTRIBUTION:

BRUCE DELAGI   BILL DEMMER   DON METZGER
LARRY PORTNER   WAYNE ROSING

GB1.S5.58
00 BURT DECGRAM ACCEPTED S 13066 O 29 28-JUN-80 23:05:41

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION DATE: SAT 28 JUN 1980
10:54 PM EDT

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION DEPT: OOD

EXT: 223-2236

LOC/MAIL STOP: ML12-
1/A51

SUBJECT: IMPRESSIONS ON VISITING INTEL: YOUR MOVE (FAST PLEASE)

I met with Noyce, Gelbach, Carston, Davidow, Kaufman and also received technical presentations on future products and processes, including Ken Fine, who is doing well and is much appreciated.

I want to accept their invitation to meet with various managers
here. We are a 20M$ buyer and have leverage. Dick, I would like
to work with you to get them here and to frame some of these questions:

.How much do we believe they are a competitor? supplier?

.Do you think we are going to be able to make competitive products without them?

.Do you see our need to work with them in the same way I do?

.When will we give up the 11 and use their ISP's and software?

.How are you going to plan in what is a difference of opinion between me and what your current, de facto direction is? (Maybe
I should go to work for Intel or market for the Japanese or back
to the university or argue for a DEC early retirement plan... and

you can suggest this too.)

Their Strategy
I have a set of memos which are available showing my evolution of thinking on Intel and our relationship since 1972-75. A recent Dataquest memo states that there is a major shift into a value-added component, away from semiconductor manufacturing and into design, software, and systems integration. There's a shift since 77 to all forms of systems level products from memories. Microprocessors have increased from only 13 to 26%, microcomputer systems 18 to 22%, and they have a 50M end user channel.

My view of Intel has evolved, but hasn't fundamentally changed from the point of viewing them as the leading edge supplier who is also a potentially significant competitor. Fundamentally, I believe their strategy is to have the best MOS Process technology and to use this firts in memories and then in micropcrocessors to create leading edge products that will command premium prices. They see software and ISP as the lockin/lockout. Furthermore, they see increasing the level of integration as getting more revenue, but detracting from their technology and only to be used to get the high growth and profit they need. They will forward integrate, as needed to get growth. (We tend to backward integrate to get supply and roi.)

If they hadn't existed, we would probably be in a different product position today, as they may have pushed us, or alternatively we may have been pulled into a higher level of integration.

Some, possibly new, but summary observations about them and us:

.Overall, their top level management has worked together a long
time and is extremely bright. Noyce invented the IC, Moore is
one of the brightest persons I've met, and Vadez wrote the
classic on processing. I have had substantive discussions with
them on software. Basically the requirement for an officer is a
PhD... with a few minor exceptions of people that sell the product.

.They seem to work harder than we do. This seems to be a direct
result of having to manufacture and not sell at higher levels of
integration, where one is dealing with inherently unquantifiable
metrics. (Apparently they have a fettish about measuring
everything, which is a result of training and need in the semi
process area.)

.They have assimilated the art of architecture and language
design faster than any group I have ever seen. Furthermore it is
pretty well understood throughout the hierarchy, especially the
top! In the 8 years I have been visiting Intel, I have seen them
converge to, and in a couple of specifics (eg. Floating Point)
surpass our practice and understanding. For example, in 74 the
8080 (a 16-bit address space), evolved to a 20 bit address space

(the 8086) in 78, and in 80 they made a strategically correct decision to make it a 32 bit VA, and multiuser. I feel this basic architecture of the 8086 with its enhancement is adequate
to compete with VAX in most environments and where it has some
problems in the large scientific and engineering domain, the problems can be solved by simply having superior technology (speed) and doing the softare right. Our first enhancement of
the 16 bit VA on the 11 wasn't good enough, necessitating VAX.
In addition they are experimenting with a higher end machine (the
432 which is supposedly a 148 power machine) that is potentially
better than VAX.

.They really do understand the right things about software. Their goal is to develop "a full complement of compatible higher
level languages across all machines". They are in the midst of
providing the standard languages of Cobol, Ada, Fortran, Pascal
and PL/M on ALL of their microprocessors! Remember we said we
market tools (BASIC, Cobol, Fortran)? Here, I have a very serious reservation about our survival now with our software base, based on recent experiences in the government and in WPS8
where we have a 100KW program that can not be enhanced or even
kept working. Our massive machine language investments are neither worth much against this, but foreover turn out to be millstones to carry that we can't afford to either maintain or
enhance. (Mitch, I'd like to believe you have some really bright
MBA type that can push symbols rather than count beans that could
help me do the analysis of this.) They have, flat out,

outlawed
assembly language programming. Furthermore, their compiled code
is all runnable in the same environment and mixable. They have a
single backend compiler. We have too many who like to work at
too low a level to be a threat to them. In contrast, this means
that they can, with far fewer dollars produce spectacularly
better results.

.They are working the operating system and this environment too.
The raw context switching times are quite impressive. Their high
level slides are worrying about the right things like
abstraction, decomposition, consistency. They use our words
intalking about architecture (eg orthogonality and
completeness).
They adopted the IEEE standard for floating point which I am
convinced represents a significant step forward for numerical
computation using floating point.

.They have really gotten their product architecture at the BUS
level together. In the same timescale, we have diverged and
gotten substantially worse. The tragedy at DEC is that we must
support these evolving half-done busses and are kept away from
using their stuff because our bus (eg. Tiny) isn't the 8086 bus
which it was designed to be compatible with. Thus we get a
double whammy- an inferior product that has to be evolved and the
inability to use the industry standard parts (which necessitates
building inferior parts with a slower techology, to go on our
evolving bus, or using expensive MSI).

.On the process side, they are evolving at an incredibly fast

rate. Note, that they are changing processes about every 2 years, going from 4 micron in 78 (HMOS I), to about 2 micron HMOS
II with double poly now, and projected HMOS III in 81-82. They
are assimilating software and new software techniques, we are going off to develop a proprietary process technology that is guaranteed to put us further behind. Here, our historical instincts and policies are not right because the evolutionary time scale is substantially faster than our decision making! This has turned out to be a classic blunder in planning high technology whether you apply it to governments, industries or to
firms. (Note, I have a paper on planning / policy making in high
technology, based on a case study in Brazil.)

.Their product array is both together and good, as you can all
read in their book, MICROSYSTEM 80 ADVANCE INFORMATION, but you
probably have to talk with them to get a copy. It shows how things are integrated together. There are a large number of chips and plans that we should have influenced and been aware of,
but had nothing to do with. We are afraid to talk with them because they are bright and intimadating. By keeping our heads
in the sand they probably won't notice us. In contrast, we have
built a bus evolution at the chip level that doesn't allow us to
use their work, even if we knew what it is. Their microcontrollers for floppies, and com and crt are pretty impressive. Althoug we might not have used them all, we clearly
wouldn't have made the chips we did in this way. I find that they care about architecture now at the chip level and this is
substantially more advanced than our laissez faire development.

.They are developing an Ethernet chip and we are ignoring them.
There's a seperate memo on this if you haven't bee a party to what looks like cloudy thinking. But the bottom line is that I
have shown that by the way we interact with them,we: spend significantly more money, get two poorer products, get them a factor of 2 or 2-1/4 years later, and as a side-effect set up a
bunch of competitors. The two marginal products then have to be
onverged back to the mainstream.

.They have built a packet bus for their 432, which on the surface
looks incredible in its ability to absorb memory cycles and provide performance. The 432 is supposedly 148 speed, with the
ability to mix multiple numbers of processors to gain more performance. It uses HMOS II. The architecture is more advanced
than VAX, but the big question (HOPE) in our mind is does it work? From the superficial discussions, I think it may be just
conservative enough to work. We can not count on it failing. Thus an interesting side question is what would one do with a one chip processor that is equivalent to Comet? (Clearly no market now, except to those crazy universities and a few of the
engineers that are all looking for a personal computer which has
1 Mbyte of Memory, a high resolution tube, etc.) Of course the
packet bus looks better, on the surface than our BI, but then in
4 years when we get the real BI, we could be better.

Overall, I was quite impressed that they had progressed rapidly
in the last 2 years since my last visit. We clearly have our heads in the sand and don't have the foggiest view of them, because afterall, we don't benchmark against them. They have

the
power to put systems together from the boards they supply to put
Mid range systems together that dominate us in every dimension of
cost, performance, reliability, architecture, and higher level
languages. The best historical analogy I can think of is Friden
with its mechanical calculators versus the LSI-based hand
calculators. But since they are so nice, they wouldn't dare
given the 20M$ (2.5%) we buy from them. Also, it is sort of
painful to talk with them because they are bright and it is
embarrasing.

Dick, Jim, and Bill do you folks ever worry about the things I
do? Is there any way to get you to look at what's going on
outside? Do you or will you hold me reasponsible for your fate
and ability to compete on a post facto basis?

I have a number of slides which they gave me outlining
everything from process to high level languages. Is there some
way I could present them to you or your interested delegees?

I am trying to get some help here, but then again, I do hold you
all responsible for our product fate in 82-84 by what we are
doing now. The fact that we have orders now and maybe in 81 is
totally irrelevant, it only means that you did the right thing in
75-79. With a little,... make that a lot, of work we can make
it, but we aren't going to unless we change our ways. Remember
how tough it was to put the structure together to see a few rays
of hope in the disk area?

"TO" DISTRIBUTION:

DICK CLAYTON JIM CUDMORE BILL DEMMER

"CC" DISTRIBUTION:

HENRY CROUSE BRIAN CROXON DON METZGER
ROY MOFFA CRAIG MUDGE OOD:
PAT BUFFET VIA METZGER DAVE RODGERS WAYNE
ROSING
STEVE TEICHER JOE ZEH

GB1.S5.30

ID#0267

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a n d u m
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Subject: **Interaction with Teradyne on Our Needs and Their Products**

To: Bob Armstrong, Jim Cudmore,
Bill Johnson

CC: Leo Bennett, Bert Bruce,
Bob Kusik, Si Lyle,
Rick Oliver

Date: 13 SEPT 78
From: Gordon Bell
Dept: OOD
Loc.: ML12-1
Ext.: 2236

follow up 9/27/78

Joe Lassiter (482-2700, X2734), head of Teradyne's card test division and head of the group they just purchased from DIGITEST, is buying VAX's and 11's for the pattern generation function (versus their special processor).

Can you call him and get our groups together?

<u>Hidden Agendas</u>

I don't want to continue all these simulators! Buy from them! Let's get the products we need from them.

The discussion should include a broad range of our needs and our directions. Also, would they market any of our simulators? Let's start a dialog.

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST: Bob Armstrong TW/D06 Leo Bennett ML4-
4/E99
Bert Bruce ML1-1/E24 Jim Cudmore ML1-
5/E30
Bill Johnson ML21-3/E87 Bob Kusik WZ2
Si Lyle MR1-1/M42 Rick Oliver WA

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION DATE: FRI 22 FEB 1980
11:09 AM EST

FROM: GORDON BELL
cc: BILL DEMMER DEPT: OOD
SI LYLE EXT: 223-2236
LOC/MAIL STOP: ML12-1
A51

SUBJECT: INTERCONNECT MEETING

FROM: GORDON BELL & BILL DEMMER

Last Tuesday, 2/12/80, OOD met and on Thursday, 2/14/80, PMC met to
review the data that is being prepared for dissemination to the
product groups and EBOD. These reviews highlighted a number of cross
product issues that need considerably further investigation. OOD has
requested that Bill Demmer structure a process for converging these

issues associated with the Interconnect Strategy.

Since these affect almost all future hardware and software products,
it is absolutely essential we determine a set of scenarios which are
sufficient (although not finalized) to be used by the five (5)
development areas plus HYDRA for the base plan.

Please do everything possible to clear your calendars for a one day
meeting to address this situation. This meeting is scheduled for
Tuesday, March 4th, in the Site Management Conference Room in
Tewksbury at 8:30am.

Prior to the meeting, a summary of the basic Strategy Statement and
the anticipated system and subsystem evolution that is implied by the
strategy will be distributed. These will be the basis of discussion
at the meeting.

GB:swh
GB1.S2.15

"TO" DISTRIBUTION:

PER HJERPPE	BERNIE LACROUTE	BILL STRECKER
DAVE RODGERS	MIKE GUTMAN	JACK MILESKI
STAN PEARSON	JOHN ADAMS	MICKEY SMITH
AVRAM MILLER	JESSE LIPCON @MR16	

EMS 20-DEC-78
23:06:54 070 1

To: Sam Fuller
CC: Bill Johnson
From: Gordon Bell
Date: WED 20-DEC-78 23:06:54 EDT
Subject: more on the interconnect

My off the wall reaction to Wayne's proposal for a new bus was generally one
of disgust. This may be somewhat unfair, but I'll resist anything like this
until you get the act together.   I see it as another local packet switched
(ie within a backplane) bus that is incompatible with the HSC50 backplane and
is new and that there is othing out there fore. Also it only goes on comet
and nebula? and Hydra comm system. I suggested just using a unibus or q bus
for this.   Alternatively, you might figuer that we need a range of packet
wswitched backplane busses, just as we have a range of inter cabinet busses
such as iccs, ethernet an 50Kbaaud multidrop. for other interconnect.
Somehow, we have to get this morass settled down aso we can have some
longevity.   Is it possible that you could make a range of these
busses/modules that could interconnect on a backplane and have them
communicate eventhough they are at different speeds in much the same way we
talkied of a variable speed bus this morining? We just have to be able to
have some way to preserve investment, etc. Does anyone worry about the delays,
ques, races etc with all this packet switching?

Command:

09:13:53 020 1
To: Bill Demmer, Bill Johnson
CC: Sam Fuller, George Plowman, William Strecker
From: Gordon Bell
Date: FRI 12-JAN-79 09:13:53 EDT
Subject: COMMITMENT TO WORK AT AND SOLVE THE INTERCONNECT PROBLEM

CC: SAM FULLER, TONY LAUCK, GEORGE PLOWMAN, WAYNE ROSING, BOB SAVELL, AND
BILL STRECKER

GIVEN THAT BOB METCALFE HAS JOINED US AS A CONSULTANT IN THIS AREA, I THINK
YOU HAVE THE BEST SET OF RESOURCES AND MOST KNOWLEDGE IN THE INDUSTRY TO SET
FORTH AND GET US AN INTERCONNECT STRUCTURE FOR THE DISTRIBUTED PROCESSING
PHYSICAL STRUCTURE...AND CORRESPONDING SOFTWARE ARCHITECTURE.

FURTHERMORE, WE ARE ABOUT TO EMBARK ON PRODUCTS THAT REQUIRE THIS
DIRECTION...WE MUST GET A PRODUCT (TO AT LEAST ANNOUNCE) SOON TO HEAD OFF THE
IBM 8100!

I THINK IT WOULD BE WISE TO GET A COMMITMENT FROM THE KEY CONTRIBUTORS WHO
CAN SET THIS DIRECTION. THIS MIGHT ALSO ENTAIL GETTING THESE CONTRIBUTORS
FREED FROM THEIR REGULAR LINE RESPONSIBILITIES SO WE GET THE JOB DONE
(E.G., WHY IS WAYNE NEEDED IN THE NEBULA PRODUCT, WHEN THIS PROBLEM HAS MOVED
SUCH A SHORT DISTANCE TOWARD SOLUTION?)

PLEASE GET A PLAN HERE.

Command:
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* d i g i t a l *

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TO: *GORDON BELL
10:23 AM EDT

DATE: TUE 16 SEP 1980

FROM: GEORGE PLOWMAN

cc: SAM FULLER
DAVE RODGERS
BILL STRECKER

DEPT: DISTRIBUTED
SYSTEMS

EXT: 223-3329

LOC/MAIL STOP: ML5-
5/E97

SUBJECT: INTERCONNECT PROGRAM REVIEW ATTENDANCE

The problem referred to is quite simple, it goes like this:

1. Sam owns the responsibility for ensuring that we have a viable Interconnect architecture. He has delegated this responsibility to Bill Strecker.

2. Bill feels that he cannot get the job done, particularly in the area of Systems Communications architecture because he cannot get the support of the VMS group.

3. Because Bill feels he cannot succeed, he refuses to be tagged as the person responsible and stand up at the Interconnect Reviews and report "no progress".

4. We in the Interconnect Program want Sam to resolve this issue and get the architecture phase moving. Actually, Interconnect Architecture is just an example of a bigger problem, and that is defining how Sam wants to carry out his architecture responsibilities and get support from the line organizations to

make it happen.

This is not the first occasion of this problem. We have been working
patiently with Sam and Bill for several months to get things moving.
It's not happening and we are at the critical juncture for results. I
believe Sam needs some help to break the impass we seem to beat.
Maybe you can provide some guidance. This cannot remain unsolved any
longer because while we speak products are being cast in concrete.

GB1.S6.58

GB0001/36

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Subject: Interconnect, the Backbone of the Strategy

To: Paul Bauer, ML3-3/B91
Mike Gutman, ML3-6/E94
Per Hjerppe, MR1-2/E78
Bernie Lacroute, TW/A08
Jack Mileski, TW/C10
Stan Pearson, ML12-2/E38
Mike Tomasic, ML12-2/E71

Date: 3/6/79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

follow up 3/23/79

Given that we are going to take the time to do the planning right this Redbook schedule versus meet an immediate, crisis schedule I'd suggest that the issue of building the homogeneous, distributed computing environment be addressed. The strategy, is given in Part IV of the EBOD Handbook (front matter of the Redbook.)

It seems like the components which are being interconnected are going well, but alas, the interconnection links (busses), their interfaces, and the software to support the structure need significant, overall definition, planning, and a schedule.

These parts include these hardware and software parts:

1. ICCS for high speed interconnection at a single site
2. Intercomputer switching among the distributed machines
3. Terminal interconnection constrained by various current and foreign protocols. This includes all host, terminal, peripheral etc.
4. Hardware interfaces for the above 3 plus unit record interfaces so that the whole net is complete at some future time (when?)
5. Any functional components necessary for a complete system, such as a concentrator, or data base computer
6. Gateways to other networks

Don't we need a seperate section of the Redbook just on this aspect together with who's doing what and when?

What's not being done?

Who'll take responsibility for the section?

BJ, will you get the people together to scope the problem so it can be handled both in the Redbook and then implemented?

GB:ljp

CC: OOD
Sam Fuller, TW/A08
Bill Keating, ML12-3/A62

George Plowman, ML5-5/E97
Chuck Stein, ML5-5/E97
Pete vanRoekens, TW/B10

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Paul Bauer	ML3-3/B91	Mike Gutman	ML3-6/E94
Per Hjerppe	MR1-2/E78	Bernie Lacroute	TW/A08
Jack Mileski	TW/C10	Stan Pearson	ML12-2/E38
Mike Tomasic	ML12-2/E71		
Dick Clayton	ML12-2/E71	Jim Cudmore	ML1-5/E30
Bill Demmer	TW/D19	Ulf Fagerquist	MR1-2/E78
Sam Fuller	TW/A08	Bill Johnson	ML3-5/H33
Bill Keating	ML12-3/A62	John Kevill	ML3-6/E94
John Meyer	ML12-1/A11	George Plowman	ML5-5/E97
Larry Portner	ML12-3/A62	Bob Puffer	ML12-2/E38
Wayne Rosing	TW/A03	Chuck Stein	ML5-5/E97
Pete vanRoekens	TW/B10		

00 BURT DECGRAM ACCEPTED S 1511 O 06 04-JAN-80 09:40:23
FROM: GORDON BELL DATE: FRI 4 JAN 1980 9:09 AM EST
DEPT: OOD
EXT: 223-2236
TO: JOE ZEH @CLEM
cc: LARRY PORTNER
DICK CLAYTON
ROY MOFFA

JIM CUDMORE @CLEM

SUBJECT: THE INTERFACE CHIP THAT JUST GOT APPROVED

I'm delighted that you got the funding for the Tiny interface chip, but
I have many major concerns that it signalled.
1. Tiny sounds wrong--I thought it was 8086 bus compatible, hence why
do you need any interface chips?
2. Tiny seems to have more and more warts, vis a vis its ability to use
dynamic rams, and do dma, etc.
3. It's another chip for the interim process, not the Hmos one.
4. It's another handcrafted job...and they are always late.
5. It takes resources away from getting a methodology for doing what
I thought you were going to develop as fast turn around using either
standard cells or gate arrays.

Can we look at the whole tiny program? I have a feeling it is an abyss.
(Maybe just you and roy and I and dick).

Command >

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+---------------------------+                                  GB0004/51
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Subject: **Interface to Stanford on Their VLSI + TEX Work**

To: Dick Eckhouse, ML3-2/E41	Date: 9/13/79 Thu
Sam Fuller, ML3-5/H33	From: Gordon Bell
Bob Kusik, ML3-5/H33	Dept: OOD

Wayne Rosing, TW/C03   Loc: ML12-1/A51 Ext: 223-2236
Bill Zimmer, ML3-2/E41

CC: George Berry, MK1-2/E09   follow up: 9/28/79
Joe Ford, MK1-2/B11
Len Halio, ML1-2/H26
Nat Parke, TW/B02
Bill Page, TW/C10
Bill Segal, ML3-5/E82

Would whoever(?) has the responsibility for bringing in TEX, please send them to Pascal Spec. The VAX contract should make sure that TEX also run on VAX using the current VAX Pascal?

Also, Forrest Baskett is building a TEX editing terminal. Could we get him a high resolution scope and 11/23 so that it be built on 11's?

GB:swh

EMS   3-APR-79
19:05:50 170 1
To: Larry Portner
To: Larry Portner
CC: Jim Bell, Bernie Lacroute, Bill Keating
From: Gordon Bell
Date: TUE 3-APR-79 19:05:50 EDT
Subject: Interface to VMS Software Developers (especially universities)

Please send to both Hastings and P Conklin too.

Larry, I just got back from visting MIT who is doing a LISP for us... in
return for some discount. The program looks pretty good, but in order to have
it be most effective it has to be managed (interfaced to) in a reasonable
fashion. Conklin and Poonan were going to do this, but alas they aren't.
Why not???

They have questions, but more importantly they must have a system that fits in
with theVMS runtime system so that other langages interface to LIsp, like it
a standard.

Somewhere in the software oraganization we need a management structure to
handle interfaces to groups doing development of systems which we ultimately
want or are depending on for VAX. Some of these include Pascal (U f of
Wash.), the 2 DBMS type programs (total and 10-22), and ther are no doubt many
others including UNIX which I fervently hope has to run under VMSM instead of
being the root of another operating system. This ca can not be a part time
effort.

LCG (ULF) has had the experience on the 10/20 and they have done it well.
Should it reside there?

Please help.

Command:

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+---------------------------+                         GB0002/59
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Subject: **List of Significant Interfaces Under Design**

To: Dick Clayton, ML12-2/E71	Date: 5/11/79 Fri
Bill Demmer, TW/D19	From: Gordon Bell
Sam Fuller, TW/A08	Dept: OOD
Bill Johnson, ML12-1/T32	Loc: ML12-1/A51 Ext: 223-2236

John McNamara, TW/E07
Dave Rodgers, TW/C04
Wayne Rosing, TW/C03
Pete Van Roekens, TW/E07

follow up 5/28

Let's watch these critically now! Cost in hardware, we're stuck for >10 years.

I make it:

CI
NI
BI (Bill, Bill, and Dick please get together on this.) Interface to Comm. options of Mercury (I feel very lousy on this and its important).
DI - how many? When will we get a list?

Internal terminal (LA's, VT's, PDT's?)

Is this the list?

GB:swh

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Dick Clayton	ML12-2/E71	Bill Demmer	TW/D19
Sam Fuller	TW/A08	Bill Johnson	ML12-1/T32
John McNamara	TW/E07	Dave Rodgers	TW/C04
Wayne Rosing	TW/C03	Pete Van Roekens	TW/E07

2 November 1982

Mr. Harvey Cragon
11423 Royal Shire
Dallas, TX 75230

Dear Harvey:

It was delightful to get your letter and encouragement to write an article on interrupts (or lack thereof). Unfortunately, I'm flat out now and don't see how I can. In writing it, I'd have to get into the issues of what's the alternative in cases where they have been used successfully, and how to operate without them in all cases. When there's a fixed program, they can always be eliminated, I believe. The real time programming for the IMP was done totally without interrupts too. SAGE also had an interrupt that could be enabled and used, and like ASC, they used it for power down, too.

I wrote some thoughts on interrupts as they relate to whether a machine has I/O Processors in Computer Engineering, but a fuller article is really needed. Why don't you write the article?

As another matter, I'm incredibly disturbed about the lack of high speed circuitry from U. S. Semiconductor manaufacturers. I noted that TI does get ARPA funding for GaAs, but there was little interest in supplying these circuits to the commercial world.

I believe both the U. S. Military and Computer Industry requires high speed circuits, and the only viable solution is to have a company or company infrastructure that serves both buyers. A single military supplier will be unreliable, expensive and late. A Computer Industry only supplier may not be viable, hence the U. S. computer industry will have to go to Japan for more of its semiconductors.

Is it possible that TI could be that supplier? Would you join with us to supply these circuits? WE NEED HIGH SPEED CIRCUITS!

Sincerely,

Gordon Bell
Vice President of Engineering

GB3.S8.32

WPS USERS - Leave HP mode and type <CR>

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a n d u m
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Subject: **Using IDEA on the 2020**

```
To: Bert Bruce           ML1-1/E24     Date:  10 OCT 78
    Al Crawford          PK3-2/F34     From:  Gordon Bell
    Ulf Fagerquist       MR1-2/E78     Dept:  OOD
    Bob Kusik            WZ-2          Loc:  ML12-1/A51  Ext: 223-
2236
    Bob Puffer           ML12-2/E38

CC: Larry Portner        ML12-3/A62
    Grant Saviers        CZ
```

follow up 10/24/78

I was appalled, and frustrated to find that we still are far away from the above. Thus we defer getting the understanding whether this is really the way of computing!

I thought we had decided to use the 2020. LSI groups the simulators to do work on TOPS 20. When will we get IDEA?

This issue is doubly painful because, as I tried to "reason" initially, we can not afford to make special operating system modifications! Now, I say, get the special interface out of the operating system so we don't have a repeat of this! (This should be a rule in all other internal user groups too.)

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST:	Bert Bruce	ML1-1/E24	Al Crawford	PK3-2/F34
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INTERVIEW - PART I

What was the first computer that you programmed?

The IBM 650 and MIT's Whirlwind, while taking courses at MIT. Both used assembly language. As a graduate student in 1957 I also took a course on programming the IBM 704.

When you left MIT, why did you go on a Fullbright to Australia?

I always thought I wanted to be an engineer, but when I started working as an engineer on MIT's VI A co-operative plan at a power company and for a very large company, I became disillusioned because of their bureaucracies, slow pace and relatively dull work. So this made me question what I wanted to do. After graduation, I received a Fulbright to defer the question as to what I really wanted to do.

Didn't Gordon Brown at MIT talk you into going to Australia?

Yes, I got to Australia because the head of the Electrical Engineering Department, Gordon Brown was an Australian and said that his friend, Rex Vowels, was just starting a new unmiversity and department and they had a new computer. He asked, why didn't I go and help them start up, teach, and do some programming? - Just consider it a year off from study.

But, you really didn't take it as a year off, you seem to have worked awfully hard during that year. Did you consider yourself, in light of today's software engineers, were you doing software engineering and how much did you accomplish in that year?

A friend, Bob Brigham, was also in the same situation and we both worked very hard at the University of New South

Wales under Ron Smart, who headed the center. I'll say in the position of software engineers we put in a good 60 or 70 hour week and then together we organized and taught a graduate course on the side.

What programs did you develop?

There were three programs. There was a basic program that we started with at the beginning which was just to learn the computer - it took about a week to write the program and then we went right into a big assembly language which we called SODA - Symbolic Opum Duce Assembler . Duce was a machine that Turing had worked on and the machine was probably the most difficult machine that I've ever seen to program. It was built to make it easy on hardware and very tough for the programmer and the machine had a two level store delay lines and a magnetic drum and what we did was to convert it into a single level storage. It was one of the first single level storage systems but the main thing we were trying to do was to convert everything from symbolic programming - it had this awful binary code that you had to use which was both time consuming and difficult.

Your third program?

There was another program that I got involved with which is GEORGE which was a program to convert the Duce into a Polish Prefix Machine. It was written by George Hamlin, a philosopher at the University of New South Wales and he used part of my operating system on his interpreter. Anyway, GEORGE was later built into hardware in a thing called the KDF9 as a stack machine so GEORGE I worked on was probably one of the first stack machines also so from an introduction to computing standpoint, I really worked on two very early concepts many years before they were really embodied well in hardware. In fact, in the program called GEORGE, I really got used to the idea of stacks and when it came time to build the PDP-6 really considered making that a full stack machine as in a machine like the BURROUGHS B5000 that was just coming out at that time but just couldn't figure out how to make it work with small mount hardware and work efficiently and therefore made the compromise that's become traditional in Digital's computers starting with the PDP-6 and then going on to the PDP-11 and the most support for this is in the VAX.

When you came back to the U.S. in late '58 and you looked around at job opportunities, how did you appraise what the opportunities were for someone now with your unique experience?

This was just at the beginning of computers and I guess what I decided to do was to do something that had a very high computing content as opposed to more of a circuits and logic design orientation so what happened was my thesis adviser, Ken Stevens, who ran the Acoustics and Speech Research Lab at MIT convinced me to come back and work there because they had just got a new computer, the TX-O from Lincoln Laboratory, and they were starting to do speech research on that computer so it looked like it was probably one of the most interesting jobs around as I surveyd other alternatives including going to Philco actually to help design their computers. That was a fortunate decision, however, because Philco was later purchased by Ford and Ford ultimately drove them out of the computer business.

You then got acquainted with Digital while you were at MIT with the TX-O, isn't that right?

Right, because the TX-0 didn't have any secondary memory and so initially my job was to write programs for speech recognition which I probably should comment more on because I keep saying the same recurring theme about engineers who try to do speech recognition. But my job was to interface speech equipment to the machine and then do recognition programs and what we needed was good secondary storage so I proceeded to buy a Potter tape deck for the TX-0 and to interface it and in that way I discovered Digital in '59 because they were just starting to sell their system modules and the system modules were compatible with the TX-0, of course, because the TX-0 was really the breadboard for the

Lincoln Laboratory circuits that ultimately became the breadboard for Digital circuits.

Well then wasn't it part of Digital's tradition that they hired their customers and you no longer became a customer but an employee?

Alright, that's happened a number of times. That's how we get users (people who know how to use machines) to help design the next one. Certainly a number of people have done that. I think Dave Cutler who did significant process control work at Dupont before he went on to build the RSX and VMS.

So we can say that you've been building programs or computers your entire career and do you want to say something about the myth about the people who do all of their good work before they're 30?

I think basically overall people do their best work before they're 30 but I think it's possible for people who are over 30 to do very good work too but the main thing you don't want to do is break a tradition of working. Certainly someone like Seymour Cray who is certainly over 30 and has built a number of machines has built them at a constant rate - sort of one every few years - and Hurley Daisy <?> has cranked one out a year but when it was easier to build machines but I think it's important for engineers to continue to stay engineers and to be involved in building all the time - that is, don't break the pace.

Mike Riggle at Digital is one of these, isn't he?

Oh yes, Mike is maybe a year or two older than I am but he is probably the one I envy the most because of the detailed contributions that he makes to all kinds of storage devices, everything from how heads fly to how databases are searched. He covers a tremendously dynamic wide range of topics and he's passed by many opportunities to serve on larger and larger groups but he feels, and I guess I feel too, that he makes the greatest contributions as an individual contributor running a group of about 30 plus all the influence he has with it throughout the rest of the company when he acts in a senior consulting role.

When you came to Digital in 1960, what was the engineering group like?

As I recall, I was the second computer engineer. There were Ben Gurley, who was head of Computer Engineering in the Engienering Group hired me and Dick Best was Chief Engineer and there were a number of people involved in designing circuits or modules but I was sort of the second one to do computer logic and computer programming so I was doing both programming and in some sense doing architecture work and also doing a lot of logic design.

When did you start hiring software engineers?

Tom Hastings claims to be the first software engineer that I hired and he was hired for a summer job - I believe it was the summer of '60 or '61 - to really work on getting the PDP-1 program library into shape and to verify and get IRO routines so that they could work with one another correctly.

Isn't it true that you had trouble getting decent software in the early period and couldn't figure out how you could afford it so some of you went to a restaurant and what did you invent there?

We had seen the power of the user base that I.B.M. had in the share group so we invented DECUS and DECUS was invented solely for the purpose of developing and sharing programs as we had a number of critical programs that we were trying to get written, I think including the <?> arithmetic at that point and time and we all got the users together in order to do that.

Who was at this first users' meeting?

I know Ed Fredkin was there from BPN and Roland Silver. BPN was the most active group and I think we had people from AFCR but there weren't that many because when we first started to do it there were only half a dozen users.

How many PDP-1's did you turn out in the first year?

In the first year, I don't remember - I haven't the foggiest idea.

There were 50 total. When did you stop making them?

We stopped making the 1 somewhere in 1964-65. One of the luckiest things that happened to us was that a machine that we made based on the 1, which is really a PDP-1 but made for message switching, which is the ITTADX 7300 which is a torn tape message switch which could handle up to 256 telegraph lines and switch them to other telegraph lines that was to do the work of a torn tape center that ITT had run overseas so that this could be done automatically. It was then that I invented a thing called the UART (Universal Asynchronis Receiver Transmitter) which was a serial line encoder decoder for telegraph lines but we were very lucky in getting the ITT order because of half of the PDP-1s that were made for message switching and that was a standard product and if that hadn't happened, I don't think we would have survived in the computer business because it turned out every order the PDP-1 had said IO for it and every piece of IO that the 1 offered somebody bought and one of our earliest customers, Livermore, bought virtually every thing we had for sale and we only made one, including a 5 inch precision <?> scope a 4096 x 4096.plotting <?>scope that's still almost unrivaled today in its precision but the PDP-1 was used there to be a converter from 7090 to STRATCH to LARK so it had UNIVAC tapes on it, I.B.M. tapes on it and I think it even had a UNIVAC card reader, an I.B.M. card reader and a CARTER card punch and a funny CRT and we had to make all of that work which was no trivial task. Then we only sold one of each of those so we were lucky to not have many orders like that, although LRL has remained a great customer of ours and we like them because they are so demanding.

I understand that Digital's goal from the very outset was to build a whole scale of computers - from small to large - and I don't remember what ever happened to the 2 and 3 but the next ones were the 4 and the 5 - what ever happened to the large end?

The PDP-2 was a mythical machine that was reserved in case we wanted a 24-bit computer - it was never defined on paper but the number was just held. The PDP-3 was actually defined on paper and one of our customers actually built one out of DEC modules. We were just about to get an order for a PDP-3 from the Air Force and Holland Anderson, who was the Vice President at that time, and I -- These were in the days when you offered everything for sale that was on paper and then you did market surveys by seeing what people bought and then you went and designed it if they bought one so because we were just starting out, we had offered the PDP-3 for sale that was specified and about this time orders for the PDP-1 started coming in like crazy and luckily we went over to the Cambridge and said instead of a 36-bit machine, would you mind taking two 18-bit machines and we were able to convince them that that made a lot more sense and again, that was at a time when DEC was saved from itself by our customers not buying something that we had for sale.

The PDP-4 started you in a new line of business from the PDP-1.

We didn't understand it at the time but the PDP-4 started down trying to introduce lower and lower cost computers and we thought there would be some kind of an elastic demand but really didn't understand what that was like. But the main thing the 4 was designed for was process control so it was easy to interface we designed it for a couple of customers - Foxboro - Foxboro had several process control applications and so it had a lot of IO interface standards so that it could be used in process control and it turned out that the 4 actually then created the 5 because one of the first few customers that bought the 4 was the Canadian Atomic Energy Commission at Chock River and the first thing they wanted was a process control - they wanted a control nuclear reactor and so there was a lot of front end work for nuclear power reactor monitoring and in going up there, in fact I went up there with Ed DiCastro to look at the monitoring requirement which we were thinking of as a special system - and in looking at it and thinking about how you would build a special system to do the separate monitoring independent of the control, we came upon the idea of the PDP-5. The PDP-5 is really a computer that was designed to do process monitoring and recording and work with the 4 so that is how the 5 came about because it was in an era that I think everybody who builds specialized Digital systems discovers, and that is that the best Digital controller is a computer so no matter what we start out with, we always end up building a computer as a controller.

You also claim that the 5 was the first mini?

I think the 5 was the first minicomputer because it really was built to be used and imbedded in a system and although the 5 didn't have quite the characteristics that I think the later 5's successful PDP-8 had, it did have the right attributes. It was half the price of the PDP-4, it was a lot easier to interface to and it was something you could imbed anything you thought about. The 8 went on to be even faster and smaller and because of the way we manufactured it, it was clearly something that you imbedded in another control device because it took less than half of a 19" rack and so the computer was now clearly a component so the whole notion of what I think of as mini, which I like that to stand for minimal computer - that is the smallest computer you can make at a given time for the lowest price and it's something you use to substitute for other Digital control systems.

Let's go back, I've also heard you say in some ways that the

LINK is the first personal computer, but in many ways the PDP-1 for the people using it had many of the attributes of a personal computer and hasn't the personal computer philosophy been sort of whipped back in with your engineering from the very beginning?

The whole notion of a personal computer or personal computing is something that Digital pioneered but we've got to be fair that it really was in a tradition that we all learned about in working with the various MIT computers. In the case of Ken or Win and in my case, the TX-0 where we had insisted on interactive use, that included the cathatray tube and the typewriter - whatever other means so that one had interactive use. It turned out that other computers had typewriters on them and you could interact with them but they didn't have a CRT and usually they didn't have a good file system. That's why I think that the first personal computer was actually the LINK which was designed with DEC modules and had its own file system which
was called LINKTAPE and when Digital took the ideas over from Lincoln Laboratory in the form of the carrier being Tom Stockeybrand that the LINKTAPE became the DECTAPE and thereby one was able to have a personal filing system and be able to write programs directly on the CRT, edit them, compile and then execute them without any human interaction and no other system was offering that at that point and time until we started doing the timesharing systems where we had the large drums and people were able to keep their files on the drums or on disks over a long period of time. Personal computing to me means having a CRT, having a very good interaction and having a filing system so that the machine takes care of the bookkeeping of your large programs.

Certainly the small machines are one brand of personal computing but the other form of personal computing that we went after was timesharing and it should be noted that I viewed the personal computing timesharing as the first really significant personal computing because the goal of timesharing was by one of the inventors of the concept, John McCarthy, was to provide a large computer and thereby give each user what appeared to be his own computer by simply timeslicing that computer up among a number of users and, in fact, that concept was implemented in about three places at the same time. It was done at BBN using the PDP-1 because BBN had ordered two typewriters with their initial PDP-1 and did some of the first work on that - then there was work at MIT by putting several typewriters on a 7090 and then there was work at Systems Development Corporation but that was a little bit later. It was out of those ideas that we created the PDP-6 which was a machine built from scratch to be timeshared so that everybody could have their own computer for personal computing.

When you decided to go to MIT you more or less said that that's where the action seemed to be at the time. Was it a similar choice when you left Digital and went to Carnegie?

In retrospect that turned out to be really perfect timing because what happened was that at the time I left the third generation was just beginning with integrated circuits and at least it wasn't clear to me that integrated circuits were going to take on the proportion that they did today where they went on to become large scale integrated circuits and now on a very large scale integrated circuits. But in '66 the issue was that we were switching from circuits that Digital built to circuits that _____________<sounds like semielectric> companies built and aside from being a little bit smaller, there certainly wasn't much of a difference and that transition really carried on for about six years during the time I was at Carnegie so the main reason that I went to Carnegie was to really give me some time to think about computers and I didn't realize that it was going to be such an uninteresting time during what I really call the third generation where we just made integrated circuits. However, the reason I came back was severalfold: One was that we were entering the fourth generation with large scale integrated circuits and the notion of a processor on a chip was just beginning to appear - in fact I did a lot of work at Carnegie when it became clear that was the way things were going just to make sure to get some of the ideas ready for when processors were going to be very very cheap. All the multi-processor and multi-computer work at Carnegie was really started and predicated on that set of principles and so I

came back really to get DEC interested in going in LSI and get projects going there. The other reason I came back was to what amounted to VAX because at the time, even though I worked on the PDP-11 and the 11 wasn't big enough when we designed it, it wasn't extended to be big enough so it was clear we had to do something else so I was interested in that something else.
Really the third reason was that Ken made me a really good offer that I couldn't refuse and then I guess probably the other one was that I had spent a lot of time trying to understand computing from a sort of computer scientist standpoint and I really consider myself an engineer and got tired and wanted to build something.

From the time you were in Australia you did a lot of writing of what you did, what's your attitude towards keeping records, reports and getting publications out?

I think the main thing is that people do interesting things. It's hard to say that everybody should write up what they do but I think if you're doing work that's primarily ideal work where you want those ideas to influence others, it's essential that those ideas be readily available in some form and writing probably gets the greatest distribution. The important thing is the work, however, because a lot of people who write things - the work isn't worth much.

Why did you write computer structures and why did you put together computer engineering?

Computer structures started when I was really trying to build a kind of a compendium of how to design Digital computers and I started into that work with Alan Newell trying to understand computers and write a text. The more we got into it the clearer it was was that the best way to do it was to show a lot of examples and to make a comparative study and, I don't know at what point, whether Alan got the idea or what, but he certainly influenced me in thinking that some sort of taxonomy was the right way to do it and we built a large multi-dimensional space to map these computers into and

I got interested in numerical taxonomy. The goal started out simply to be able to let people understand computers really clearly and in the process we invented two notational ways of describing computers - VMS and ISP. ISP has been enormously influential in being able to describe computers at all levels and, in fact, was influential in various people's use of simulators. In fact, the program we use here called TUMS which is based on the ISP notation is used for transfer simulation.

What I'm sorry about PMS is that I think PMS is grossly underrated. I think PMS is enormously powerful for everybody to understand the whole domain of information processing because it separates every component or every facet of information processing into component parts that I think everybody, including the layman, can understand and by breaking it apart that way, I think systems just become a lot clearer.

You're talking in a secret language. Nobody knows PMS - PMS doesn't mean anything to anybody and then you say that it helps the layman understand. Why does he have to understand? Why?

I don't know whether he has to understand it or not, I just think it would be useful if people knew more about computers. PMS is a way of letting you dissect a complex information processing system such as a computer into smaller components and each one of these components are primitive information processing pieces. P stands for processor, M is for memory, S is for switches, T is all forms of transduction.

PMS doesn't mean anything. How can it help me buy a personal computer?

I think if people had used it, it would let you see personal computers in a much more clear comparative way just like you can see what the different kinds of animals are by walking through the American Museum of American History - they're all categorized that way - so if PMS were used more, it would let everybody see what those things were, including personal computers, calculators and even teletypes and things that are not strictly computers.

Yes, but I'm into personal computers and you want me to understand all of this about teletypes and everything else, why do I have to do that?

I don't know why you have to do that.

Gordon, I just don't think you've got that argument now.

In all fairness, PMS is used a lot inside of Digital by a number of engineers because what we do is we use it to communicate computing structures to each other and it's simply a shorthand way of describing components and how they interact and what they are and it allows you to decompose those components in simpler and simpler components all the way down to as far as you want to go.

You said, and I know one thing you've got a collection of, is the <----?> handbooks and you thought that they were sort of a neat thing. If these are good at documenting, why were you instrumental in starting Digital Press? What is that all about?

What's Digital Press all about? I wanted machines and programming languages and programming systems to be really clear and available to anybody and everybody who wants them and that's been the philosophy of Digital all along - to make what appear to be really elegant simple handbooks that describe the machine. If you look at the first one, the PDP-

1, it's very thin and extremely elegant and I think one of the things I'm the proudest of is I wrote the first reference manual for describing how you connect IO equipment into a PDP-1 and then some of the ways in which it was done because I wanted to make it clear how you made a system out of a computer and I guess I've sort of been interested in that all along. That probably influenced the desire to write the Computer Engineering book with McNamara and Mudge because it turned out that the 25th anniversary was coming upon us and I had the good sense of not wanting to couple the book to the 25th anniversary primarily because there was too much that was going to happen.

We decided to write the book to really give our view of why Digital's computers are built - what they are and why they are built the way they are. All the chapters and articles are written by various engineers, including a lot myself, just when somebody didn't write about them, but the notion was to be able to hold a sort of engineering philosophy constant in the walk around and look at all the machines built by a single company in a single engineering philosophy.

In a sense, maybe it all started when I and Sam Fuller and Dan Swiorek were editing Communications EACM and we got the notion that we should describe the historical description of a number of machines and I tried to get somebody to describe the PDP-6,10 family and found out that people just weren't up to that so ultimately I wrote the article and got a lot of contributions from the DEC people but there was a certain style of trying to understand machines that I think we understood and we wanted to go on and describe all the machines in that way starting from a basic - What were the goals that the machine had - and then we went on to describe how the machines turned out based on the goals - and then to look after the fact whether the machine achieved what we wanted to after the fact. That's the kind of style that we used throughout the Computer Engineering. We wanted to set really good examples for people who built things to get in the habit of describing them so that people understood them and then we felt that would influence the way they went about their basic design from a goals and a constraints and really a thoughtful design standpoint.

Do you think new engineers at Digital should read or have a copy of Computer Engineering?

I wish that everyone at Digital would read Computer Engineering as much as I think our competitors read it. We sell lots and lots of copies to competitive companies and it's taught in a lot of other company training classes and I think it's because we do a good job of describing all these different views of how one can look at a computer in the first part and then we go on and describe the whole notion of how design is done in subsequent parts. I just think it's excellent training and I wish that we would formally give the course within Digital.

I know your own sabbatical got a little bit out of hand, that is you were six years at Carnegie, but during that time didn't you get the idea to start the concept of sabbaticals for other engineers?

We have a program within Engineering that I think needs to be drastically expanded and that is the ability to have somebody go away for a year and go to a university to take courses or to teach or to participate in a research program of some kind and I think that we just need to do enormously more of that because anybody who's been working at Digital and trying to build state-of-the-art products for about ten years really just needs to get out of the environment and look at it from another perspective and I think a university is a good place to do that because students are just very demanding in terms of the way they like to know about things.

Do you have these programs with a number of universities now?

Yes. We used to have a program with Carnegie but no one has been there for about five years. There's a program with Caltech and we have a resident there every year at the Silicon Structures Project learning VLSI Design. We have one or two residents at Stanford working on their Silicon Structures. We've had people teach at Berkeley. Alan Kotok, for example, went away a few years ago and taught at Berkeley for a year and I know he found that enormously stimulating. Of course, we have programmed with MIT where our people either go to teach there or certainly go and take courses. Joe Zeh just finished a year there last year and he enjoyed it.

When Digital started, I know, everybody was planning on staying there. I know you're a long way from retirement and there's a long time between ten years, what other ideas do you have to keep the engineers being fresh?

The problem of continuing education is a massive problem as we can see our engineering population getting older unless we have enormously high growth, which is unlikely and so we have to look at every possible continuing education program. MIT is pushing to make a really significant continuing education program and I hope we can really go on and participate with them to do that. That's a very extensive program and we should get involved in it. Until that time comes, I think every engineer's got to take a tremendous amount of responsibility on themselves to deal with the problem of his own continuing education. To mean that means we've all got to do what amounts to, I think, at least one course a year of our own education and that can be any kind of form. It can be teaching a course somewhere so that one solidifies a bunch of concepts, it could be really writing a significant paper which gives you the kind of rigor that you need and that a formal course does, it could be giving a set of lectures at a university, it could be attending a whole seminar series that we have here. Right now I think we're beginning to have a really good set of seminars at some of the sites. Hudson sort of pioneered the whole notion of a seminar series in the semi-conductor engineering group and that's also now where Corporate

Research brings in people. Marlboro has copies that format and they have a series concerned with building large systems - both the technology and the organization of large computers . Those are really good programs and I think that if one attended what amounts to a whole series of those and read a book, you could think of that as a course in say the Organization of Super-computers.

Of course, we've got a tremendous number of regular courses taught by various local universities including the tutored-video instruction that Univ. of Mass. has on Computer Architecture and Programming Languages and things like that.

You really seam to be a proponent from learning from history and you ask your engineers to go to the history lectures at the museum. They'll need this generalization of learning from history - what do you have in mind?

The main reason for studying history is so that you don't have to repeat it. If I look back at all of the four generations where work has been done first at universities then the large corporations and then by us and the whole main computer industry and now most recently by the semi-computer companies, we've all had to re-learn a whole set of lessons that were invented earlier. So the main reason for studying history is simply to learn from those in the past.

For example, recently I was reminded as one of our last lecturers had a number of good examples of being able to tell when something was obsolete. As we get too close to the products, one of the hardest things that we've got to learn is when is euthanasia in a product. I think history provides a lot of good lessons in knowing when products get over the hill and can't be extended.

Several years ago I gave a set of lectures, which I hopefully will become a book, on the evolution of computing in which I went back and looked at what one could learn at just looking at the experience Babbage had in building some of his machines. One of the recurring themes is that people tend to make the same kinds of mistakes over and over again and there's a particular nice set of lessons about the whole notion of generalization - of building elegant products, extending them to be more general, and then finally making them so general that they were incredibly tricky. On the other scale of elegance, there are sometimes some extreme ideas that are incredibly simple that when done properly they can be elegant but very often they just turn out to be naive because the ideas aren't really good enough.

We also see from history that certain ideas go in cycles and waves and we need to be aware of when this is happening. Currently we are going through a whole bunch of new waves of machines which I've been told one time called the "wheel of re-incarnation" which I describe in the Computer Engineering book. Now it's being applied to databases, it's being applied to communications processors, it's being applied to central processors, we're doing certain kinds of arithmetic, etc. What you have to do is stand back when somebody starts around this wheel and see that it's the right thing to do because I think, in general, it isn't.

Why you don't describe it.

The "Wheel of Re-incarnation" is simply that when you start to do a function such as displaying information, that you put some special hardware with the processor to do that function. Gradually you start adding more and more hardware so that the function can be done better and without any help by the main processor. Ultimately what you end up with is a totally generally purpose device which does the display function plus you've now totally unloaded your other processor so you end up with two computers, both of which are probably not doing very much and you've spent twice as much as you need to on the whole project.

What do you think Silicon Mountain has done for Digital?

I think the by-products of Silicon Mountain are really good because it really requires very demanding engineering and aside from bringing in a vital technology, which I think we're going to need in the ensuing years for designing our own special circuits because I think within ten years we'll find that a large number of the systems are going to be built on a single chip and we must have access to that technology, it has taught us a great deal about managing complexity and that's something that every engineering group must know how to handle. The VLSI Group leads in that domain but every group must master it. Complexity management is the orderly interconnection of a large number of parts. What is done is it has also provided a technology challenge to a number of our engineers so that they continue to grow with the technology and that's something that we have to do to keep ourself alive and growing.

How do you best see the U.S. can fight the commercial battle with the Japanese?

I see that there's only one way and that is just to be incredibly strong and innovative. The Japanese are superb engineers, they are very bright and they work extremely hard and they are very adept at not only capitalizing on ideas that are in the research environment, but they are also adept at doing innovative work on their own. I say that there's only one way and that is to be incredibly good from an engineering and innovation point of view, including going back and having very strong mastery of the fundamental materials from which parts are made. This is not going to be easy because the Japanese culture is basically a culture of technocracy where engineering is rewarded virtually more than any other profession.

Do you see this as the same kind of challenge in the 60's with Sputnik that led science education to change? Do we need a similar revolution for engineering education?

I think that the Japanese competition could be an impetus for change in the same way that Sputnik was a signal to change the scientific basic education. On the other hand, I don't think that that was as effective as it could have been. It may have gotten a few more people into science but basically the space race was really more of an engineering problem than it was a scientific problem. I don't think we do a very good job of educating people as to why engineering is a worthwhile profession but we've got to do a better job of that too.

PART II

Mary Jane is a very special person but since you've really started experimenting with Office Automation for a long time, you had one of the world's first word processors. How does that work?

When I came back in from Carnegie I had just finished writing a book in which we had the whole machine on line and we were able to publish the book directly. One morning we decided that we were finished writing and about two days later we had a complete printout of the book with camera running paper - so I must say parenthetically we have not yet achieved that same level of automation in book publishing here at Digital over 10 1/2 years later, but when I came back I wanted to get to a level where everybody lived and worked on the machine so I started by convincing Mary Jane that that's what we ultimately wanted to do. She started out using the timesharing 10 initially to do editing. I did some program writing but I'd say we're about half there in terms of what I think we wanted to do. On the other hand, Mary Jane has gone much further than I expected - than I guess I had hopes we had gone - she really has driven the whole business of Office Automation in Digital and the book she has written will probably be a significant influence in other corporations as well. Our ultimate goal is to really use the machine as virtually all forms of information processing and to get rid of paper, not necessarily that paper is bad, but it's just that it really is redundant most of the time if you've got a really good computer system.

The other goal is to be able to get a computer to do a significant number of the office information processing tasks beyond where we are now - like dealing with calendars, meeting schedules, electronic mail, word processing, paper publishing, teleconferencing with the other people on various subjects.

The way you really did this is almost subversively. You didn't set out to direct a project that had a budget but you just did it and by doing it, hoped that it would catch on and be successful. Now, isn't that a kind of way that you've fostered a number of things? Didn't the original mail system sort of happen and didn't the Ethernet go in without any program or budget for the Ethernet going in? How do you let creative good things like this boil up? What kind of environment does that take?

I think getting anything done takes access to free resources of some sort so first off you've got to have the computer resources to have things like that. In the case of electronic mail, that one really started when <Onulate??> had its origin back with the Arpanet but then our first version was really something that some of us cooked up with Computer Corporation of America where we provided them a computer and they proceeded to write the Electronic Mail Program and we became a test site for it. So I guess its based on the fundamentally good idea that you invest somehow and then you see where it leads.

That's the whole notion behind Ethernet because its something that is basically a good idea, doesn't cost very much, and it's something that everybody can use and by having the interconnection and coming together the way I expect systems to come together, we will be provided with a computing environment that we never dreamed of before. Probably the best example of that was the whole business behind the Engineering Network which is, I think, probably the world's largest computer network with over 300 computer nodes and has the ability for all the engineers to communicate with one another. But that network happened totally in an unplanned bottom up demand way. It came in initially through the software organization based on the need to transmit files and to communicate specs and things like that along the users and then it sort of grew as people could see that it had a lot to offer. In this case the idea behind it was a really superb network architecture name of the whole business of DECmail and all of the protocols surrounding that and the need was there and when that happens people do the right thing. The trick is to try to provide all those ingredients so that people are going to behave in the most creative way.

Let's go back to the Office of the Future or Office Automation. I know that you're a computer user and type and write your own things and it's not going to automate you. How do you see the secretary in the office and the engineer of the future sort of in terms of these aids?

This is another question. You talked about education, the importance of education, but a lot of the people in your organization, whether they started as secretaries or whether they're male or female have developed according to their merits and neither because of the kinds of education that they've had or because of their sex. Again, how do you let the Mary Janes, the Carol Peters, the Joe Zehs - what kind of organization have you tried to create? What are your ideas that are behind this organization?

It has always been the goal of people here to provide a maximum sort of opportunities for everybody so that we're not restricting what somebody can do either by their title or by their formal education, in fact, a really good example of that is the program I call DEC-U which is really almost an engineering granting degree program i.e. for the purposes of Digital we provide a method whereby technicians can become engineers with sort of proper courses. The goal is to let people have that kind of opportunity. Similarly, anybody who wants to do any form of engineering has an opportunity to do that using all kinds of tests and all kinds of courses and things like that. I don't think that's necessarily me but certainly has my support and I encourage everybody to go right up to the limit of their capability.

Why don't you tell us how the word VAX came into being?

VAX was a name that I coined which was the start of the project on April 1, 1975 which was the virtual address extension to the 11, in fact we call it VAX-11. By calling it that, it was the intent to make it something which we finally called culturally compatible with the 11. If you knew about the 11 you would understand the VAX. It's one of those strange things where the name actually stuck throughout the life of the project and ultimately the press got wind of it and we got free PR with it so when it finally came time to name the machine, we called it VAX-11 and now subsequently we've let it become known as just VAX.

In the last four or five years, you really have sponsored distributed engineering on the West Coast, in Colorado, in Japan. Why have you done this?

There are a whole bunch of reasons but certainly a big one is that certain people have a preference for location is one but I guess the threebig ones are I really believe that small groups perform a lot better than large groups, I think that we just got soaked too much in New England and when you have a lot of engineers in one place they tend to spend a lot of time at committees and the things that should be architectural interface specifications and could/should be done that way - we often end up just spending sort of callous hours in large groups trying to get all these details worked out. Sort of the best example of that originally is one of the most complex interfaces we've got is the mass storage control protocol that links mass storage devices with VAX systems. That was worked out totally between Colorado and VAX and VMS Engineering in a quiet clean way - probably the simplest interface work we had and then strangely enough when we plugged it together it all worked. So group size is the other reason - group size effectiveness in making clean interface boundaries .

The other big reason is that there's a significant talent that lives outside of New England and there I refer to the group both on the West Coast and in Japan where we've built the groups from scratch out of natives from those areas. Particularly in the case of those two places, we also have a goal of being able to interface to all the technology that's available in those locations and there's considerable technology both in the South Valley and Palo Alto around Stanford and then of course I have the highest regards for engineering that's done in Japan because that's where all the advanced VLSI work is done and where a lot of magnetic recording and printing technology is the best at this point and time. Of course, the Japanese excel in their electronics that we have to learn about so we're there to couple and learn from these other locations as well as get people who are there and want to live there.

The Seattle location is really the other kind - Dave Cutler's site. That's a transplanted East Coast site where the desire was to have a small really effective tight-knit group and the same way with Colorado and both of those have turned out to be really excellent. In terms of dollars shipped per year at engineer I think Colorado is at this point and time beats every other engineering group in sight.

There is a tiny engineering effort going on in places like Australia and another one in France and isn't there some local kind of differences that help or didn't you make that observation in Australia?

I guess that's something that we've been able to do very effectively at all and those are computer special systems sites. We at Central Engineering have not been able to couple into the engineering that's available on a worldwide basis. I think that's something that I'd like to be able to do in the next five years, e.g. I just returned from Australia where a small group of engineers in the Special Systems Group built a statistical communications multiplexor that we're shipping in the range of about 1,000 units/year. That's a respectable small company in U.S. terms and if we had better marketing of that product, we'd ship even more. That was done for only about a quarter million dollars and right now with engineering the size it is, we can't even write a business plan for a quarter million dollars which really speaks to the big reason why I want small engineering groups because I think they're just much more dedicated and much more effective. Of course, when you do that there are other negatives too which presents an incredible management problem to sort out all the interfaces and to sort out all of the duplicate of products. If you had several hundred engineering groups, probably half of them would be going for the same products all the time.

A lot of the engineers survived through STRATTON 5 and there hasn't been another STRATTON since STRATTON 5. Were the Stratton Mountain meetings appropriate for a certain level of growth of the size of engineering and now do you have to think of something else? What did they do? Why did you start them?

The Stratton meetings which culminated in this grand finale which was teleconferenced to a large number of the engineering sites was started at a time when we were starting to locate engineering in different geographical areas - when we first moved to New Hampshire and Marlboro and outside of Maynard. It was formed as a means of communicating among all the engineering groups. At this point a single meeting doesn't seem to make any sense because engineering at this point is so big that a Stratton wouldn't be able to handle it.

I think what we need at this point is several things that amount to Stratton-like meetings for communicating what's going on and allowing people to present their work and to get feedback from their peers who they don't see. The thing that Stratton accomplished was that it let everybody sort of calibrate where they were with respect to their peers and what I see now with the very large engineering group is that there is even more of a larger gap in terms of capabilities across the various groups and I think people need that kind of calibration and they also need to know what's going on in the various places, e.g. VMS people would certainly influence the way printers are done but there's no way at this point that the printer people who are located in the Mill ever talk to the people in New Hampshire and we desperately need that kind of interchange for some of the product definitions. We probably have much better ability to define products for use because we have so many users within engineering than by going out to the external environment which I'll say is much much less demanding than our own internal users. I think our systems programmers have a much better idea of what should be the personal computer than say the personal computer market as the personal computer market is defined.

When you came back to Digital, you thought of yourself as a computer architect and now I think that you're an urban designer - i.e. you're somebody who really thinks of the Faneuil Hall Marketplace - that whole center - now you had a city planner who deals with millions of people and hundreds of square miles -

No, at this point I don't think of myself as a computer architect working on an individual building.

But your an urban designer?

No, I believe I'm a city planner.

But a city planner talks about and deals with two million people with all of Boston and that is when you can really put all kinds of Ethernets together.

Yes, and that's the kind of thing I worry about.

But the Ethernet is really only at the scale of the urban designer or even an architect.

But you have to link all the Ethernets together and then the Ethernet has to fit with all the other forms of communications.

Now explain about how you're a city planner.

O.K. I'm a city planner because what I'm really involved in is really putting a network system in place whereby all kinds of individual architects can build all their information processing systems at an individual level.

That's an urban designer.

G.B. - An urban designer is what?

Anyway, now I think of myself as a city planner and not a computer architect because a computer architect worries about the individual nodes; I really tend to worry about how the nodes are connected and how information flows betweeen them and what kind of a system one can build from a collected set of nodes. Systems like this include the local area networks, how you connect local area networks together across geographies forming the wide area networks, how technology such as Cable TV are used to interconnect the various computing nodes because as we're finding out as we distributed computing, the need for communication among the nodes just rises expinancially. Also, as we need to form more reliable systems and larger systems, it turns out that the best way to do that is by interconnecting the SPAR system rather than to continue to build larger and larger systems which are difficult from an engineering standpoint. So that's why I think of myself as a city planner.

You started at Digital as a Computer Engineer before Computer Engineering was taught in any schools and while Digital's major business was in modules - then you went off to Carnegie and you came back as a Computer Architect before Computer Architecture was really thought of as a discipline and while the company was really making machines you thought of a new architecture in VAX that changed the way for machines. Now you call yourself a city planner. What does that mean for the new level of products and any kind of new approach to computers and computing?

I think all that's happening is that we're just working with higher and higher or more and more complex things. I started out doing logic design on computers and then designing whole computers and then the architecture of whole computers and now I work with how computers are tied together and how applications are done on those and what the environment is like. It turns out that this is just more of my own interest, not the fact that we've done away with any of these layers over time. What we've got right now is if you look at the whole range of what I call levels of integration, we have a lot more levels of integration now than we did when I started to do computing. When I came as the second computer engineer we didn't have the notion of architecture, we defined something and ended it was in one person's head, it was architecture, and we went about at most one engineer designed some circuits and somebody else designed the logic to do that and then we had a very sketchy handler or a way of using that particular piece of hardware in a single program. Then a user linked together various subroutines whenever he wanted to do anything. Every application was a linking of a particular set of subroutines.

Now today if you go back, we've gone to sort of a maximum set of layering because with integrated circuits we are back down to where not only there is more creativity for the circuit engineer, but there is the whole physical problem of laying out those circuits on chips. The whole notion of architecture is grossly refined where we define a machine and that machine has a meaning over several implementations as we've done in both the VAX and the 11 family in a very elegant way and then you lay on top of that a very complex set of software and languages that to the user are really the architecture of the machine, and that's one use of a particular machine. What you really find is that as I recently did in Australia, is they had built a total homogeneous VAX computing environment where they had their large VAX's in Sydney running sort of central computation centers and they had distributed 730's out into the various regional offices. Then they had control computers in there doing real time applications and all these were completely networked together. That whole system really ran a single computing environment so my interest has sort of followed a lot of that over time, being interested in individual machines and probably still. I'm most fascinated by building a single computer and I get involved in all of those but now with the things that we're doing with networks where its possible to run a single problem on a large number of machines within a network made possible by high speed Ethernet, that's a whole new domain of architecture that I think is really more exciting than anything we've had in the past.

Of course, when you do that on a global scale like we do in Engienering Network, we have 300 computers that are all linked together physically as a single system, that's a really fascinating kind of architecture that I like to see us provide.

When you came to Digital, where there any computers in the company to use in designing computers?

We didn't start using computers in the design of computers or to assist in the building of computers until sort of mid-60's. What we did is have them take care of the bookkeeping of wireless and then when we got a Gardner Denver machine then they told the Gardner Denver machine how to wirewrap the various runs but those were really computer aided manufacturing more than computer aided design whereas now what we use computers for alot is to actually lay out circuits and to check whether circuits are going to operate correctly and to simulate them. The use of computers in computer design really didn't start until the start of the '70's - now we can't do without them.

What's going to be the impact of the personal computer on larger scale machines on the network?

There are a number of people who think that with personal computers and powerful personal computers which we are beginning to see based on very fast microprocessors that it's completely possible to displace any kind of central computing facility. I personally don't think that's really the case nor will it happen. It turns out that alot of what is maintained centrally is databases and it's still the case that databases are cheaper to keep in large disks and so while you can have a personal computer in principle controlling each disk in a central facility, it turns out the cost is all in the disks anyway so you end up with what amounts to the things that look like today's mainframe computers. That's really traditional computing. I strongly believe that all new computing will take on this very highly flattened form simply because personal computers are becoming so very powerful and that the ability to have your own under your own control will far outweigh the benefits of a highly centralized facility so we'll see a very flat kind of system where all the personal computers are with individuals and then anything that's needed on a community basis will be maintained somehow by the community or by some centralized facility. Things that are worth maintaining centrally for a group are orders, or communication links to other systems or filing which we just described. These systems we call personal computer clusters and it turns out with an Ethernet chip that's just being delivered right now in the next 18 months, we will see an onslaught of personal computer clusters being marketed by every manufacturer and they will make claims that they can do exactly what mainframes do and what our distributed minis do and we do what we provide in those kinds of systems, of course.

Can you see the onset of this kind of personal computer system in Japan as well as the U.S.?

For example, one company, NEC, has made a statement by its chairman that every employee should have and operate a personal computer and I believe they are doing that so that they can understand what computers are good for. I think Japan has a special set of problems that relate to inputting Japanese characters and that may slow them down until they get voice, but on the other hand, that just makes the Japanese work harder so that they get good voice input fast so it means that they have very good output because they have to have high quality output in order to get the Japanese <Congi??> output.

<The really big database problem seems to be one that still is with us - the library problem, data processing - that kind of thing that really big computers up til now have been used for a number of crunchers. Do you think the company should now up the personal computer in the new big systems will change that and there will be new big database systems to serve the personal computer?>

It's hard to tell.

I've heard you say that one personal computer isn't enough per person.

I think that already if you look at the number of terminals we have within engineering, there's I think probably more than one terminal per person within engineering. In a lot of our groups and our projects every person has two terminals - one at home and one in their own office. To me, that's kind of the minimum number for people who are actively doing engineering and communicating within the engineering environment. I expect everybody to basically have two terminals or two personal computers and, by the way, I exactly equate personal computers and terminals to be the same thing because Digital's goal has been to do personal computing since the beginning of timesharing in the mid-60's and I could care less whether I have my own computer and its own files and programs that I have to deal with or whether that's a facility that's maintained here in our office like we have for Word Processing or whether it's a central system that's maintained in a group. Right now I'm excited about my first personal computer which is a VAX 730 which turns out to have two users on it - Mary Jane and I - and it's important that we both have the same personal computer because we both share the same set of programs and files and work on and that's accessible from home or from a terminal in my office. I believe that's a reasonably nice personal computer.

You've been involved with research at universities and at Digital. What do you think is the role of research within a company and in particular what's your model for the research group at Digital?

In 1972 when you returned there was no such thing as Central Engineering. Now there is and what is its value and how does it work today?

There's always been a central core of engineering people, it just turned out that they were distributed in various groups called Product Lines which had both the marketing and the engineering function combined together and operated in more of a total profit and loss framework. Today engineering is much more aligned with manufacturing and still retains a lot of the marketing functions for the basic products that we build. In a sense engineering is more of a complete group that its ever been - it has more responsibility that it has ever had. The group that engineering is part of is more of an overall responsibility than it ever had except that we don't put so much emphasis on the measurement of profit and loss of the various products. I think this is not necessarily healthy. You've got to get back to a real measurement of product profitability.

You want us to look at the rest of the company too. If anything, I think that we're returning to a whole emphasis on products. The various groups we call product lines are really doing application products, i.e. products that are predominantly software and they're on top of the basic central engineering organization. We're now trying to strengthen the engineering within the various product lines, in fact, they really are concentrating on products for particular market segments such as Word Processing and the factory - things that were our traditions - but also new areas such as the small business computing.

The difference I see between industrial research and academic research is that in the industrial research that we really have to be much more applied and must be driven by problems that the corporation needs solving versus in the academic world where the problems are totally directed by the whims of the individual professors and to a large extent the graduate students and the problems that the graduate students are interested in solving. I guess mainly there's a focus on the applied and less on basic research. I regard that the universities are doing an excellent job in computer science basic research and that we should really be trying to apply what they have pioneered to particular products. As I see virtually all of the things that we end up doing in our research group, I think that we can find a model that the university has done them to a certain degree somewhat earlier but perhaps not suitable for productization.

I know you use your own personal computer and answer your own mail to some extent, what value has that for an executive to do? Do you think that all Vice Presidents of Corporations , or at least of Digital, should do that?

I think it's essential that all of us use our products. I think that it's the only way that we can have any feeling as to what the problems are in building products for others to use. I use a computer for two reasons - one is that it is faster and because I can type rapidly, also can type and author rapidly using a computer - but there's this other reason which is to really understand how the products work and how easy they are to use and how well engineered they are and how reliable and all of the things that one does by using a product. My only regret is that I can't use every product but we do have something that we call the Mary Jane Test which has been reported on by Fletcher. Anyway, the Mary Jane Test is like my own test only Mary Jane is more effective at getting the engineers to change something that really bothers her in terms of being difficult to use or not having a certain capability. That's why we try out all of the terminals and all of the personal computers and all the mail systems and things like that before we make them public.

The new computers aren't like a new kind of toothpaste, i.e. you can't take a market survey and will peppermint do better than something else? You're really offering totally new ways of living. How do you know what to do if you don't have a trusty market survey like a toothpaste manufacturer?

There's a branch of engineering called human engineering that deals with letting you try out a lot of things, namely, we have a way by which people are formally subjected to new products and then go about testing those product ideas to see how easy they are to use. Even though things appear to be quite subjective, it turns out that when you measure the performance of a system with a person too, that is probably an indicator of how good the system is. Things are not subjective at all in the way that certain kinds of taste is. You can really tell a difference when you look at the amount of time it takes to do a job.

I think it's important that when we design computers that we design them so that they are fun for us to use and that our friends like them too and want to buy them. In particular, I happen to like designing computers for the friends I have in the academic and scientific world because I think they are quite demanding and will give us feedback, both good and bad, about how well they like the products. I have a couple of examples. One was in the case of VAX. As we were about half-way through the design, we subjected the design to Ken Thompson of the Labs who was one of the authors of UNIX and asked him how well UNIX would run on VAX. The second case is a very old one where when we were designing the PDP-6, the pre-cursor to the PDP-10, we asked John McCarthy to consult and help us make a machine that could execute lists very rapidly and cleanly. In fact, the reason that the 10 continues to be the benchmark machine virtually 20 years later is that we really paid a lot of attention to lists when designing the PDP-6 originally.

I think it's important to have a number of close relationships with very demanding companies. In our networking we spend a great deal of time interfacing with some large companies, in particular Dupont, because they have such incredibly large-scale networking and distributive processing demands by which we can test our ideas. We can also, of course, use our own. Digital is an excellent place for trying out ideas for new products. This is how electronic mail was done and this is how the Engineering Network got formed but it's important to do other things as well. I think we ought to be using our products more, particularly in manufacturing and in a lot of our administrative work.

DIGITAL COMPUTER MUSEUM CATALOG

INTRODUCTION

The second duchess of Portland, born in 1714, was an insatiable shell collector. She never found a satisfactory artistic arrangement for the specimens until she hired a student of Linnaeus (1707-1778), the father of botanical classification systems. Then the collection was rearranged according to a taxonomy illustrating evolution and relationships between family members.

The collection of the Digital Computer Museum, relating to the whole family tree of computers from their earliest origins, also needs a disciplined classification scheme. Those who have tried to understand computer evolution have

intuitively considered a tree structure -- the basis of taxonomies -- but none have been fully developed for the purpose (Bell and Newell, 1971; Bell, McNamara and Mudge, 1978; Rogers, 1980; Science Museum, 1975, Sieworek, Bell and Newell, forthcoming). The National Science Foundation tree of early computers shows roots and connections but does not name branches. A number of partial systems and some generally agreed
upon terms exist for defining a classification system. The classification system in Computing Reviews works very well for the extraordinarily broad range of materials including "mathematics, engineering, the natural and social sciences, the humanities, and other fields with critical information about all current publications in any area of the computing sciences" (Sammet, 1980). The work of the AFIPS Taxonomy Committee, Taxonomy of Computer Science and Engineering, provides a convuluted semi-lattice covering all possible issues (AFIPS Taxonomy Committee 1980). Other trees look at only a part of computing (Weizer 1981, Sammet 1969). The evolutionary model has also resulted in the identification of generations (Rosen, 1969).

Generations are the primary organizing element for the collection and the catalog. The first four sections present the pre-computer generations. The fifth section is devoted to the pioneer computers that spanned the revolutionary bridge. The remainder of the catalog and collection is open ended; inclusive of all historic generations, i.e., at least one generation removed from the present technological generation.

THE GENERATIONS

Within the broadly accepted idea of technological generations, clear criteria can be identified to mark each one. These are listed below with examples shown in Table 1.

* A new base technology;
* A new machine structure;
* Satisfaction of a newly perceived need;
* Resulting in significantly different use of computing devices.

TABLE 1. THE GENERATIONS

PRE-COMPUTER GENERATIONS

TECHNOLOGY	MANUAL	CRAFT	MECHANICAL	ELECTRO-MECHANICAL
		1620	1810	1900
MACHINE	Abacus	Tables Gunter's Rule	Planimeter Jacquard loom	Hollerith census machine, Friden calculator
NEED	Taxes	Trade Exploration	Industrial Land Division	Census Business
USE	Counting	Arithmetic Navigation	Surveying Weaving	Sorting Accounting

COMPUTER GENERATIONS

TECHNOLOGY	ELECTRONIC	TRANSISTOR
	1950	1960
MACHINES	Whirlwind UNIVAC 1 ERA 1101	CDC 160, IBM 7090, IBM 1401 PDP-1
NEED	Defense Weather prediction	Space Science
USE	Firing Tables Weather Forecasting Management	Simulation Training programmers Accounting

Generational change is modelled by a series of distinct steps with a new base technology at a significantly different level. The technology base never meets the aspirations and dreams of mankind because perceived needs are continually rising. A new base technology only creates a higher takeoff plane. (Maslow, 1943) With each new invention, one or two prominent people often note that it will fulfill all future computational needs; but each time the demand for more computational power only grows.

A number of ideas and machines are designed and even built out-of-phase with a technology. Ideas that occur before their time often lie dormant in an inventor's notebook until the technology evolves to match the idea. Later historians illuminate these early concepts, showing the contemporary entrepreneurs that they are not originators but only implementers of ancient ideas. In the mid-twentieth century, some letters of Wilhelm Schickard dated 1624 were unearthed. These contained the drawings for the first known digital machine to perform calculations. (Cohen 1980) It is doubtful that these ideas transmitted from Schichard to his friend Kepler influenced any of the mechanical calculators that were subsequently developed. Blaise Pascal, whose single-register, mechanical calculator of 1645 was widely known, appears to have invented this machine totally on his own, as a young man intrigued with a mechanical solution to the problems of accounting, with which his father occupied himself. The inventors who actually develop a baseline machine for a technology are often tinkerers, not scholars searching the literature for ideas.

Increasingly, computing devices are not the sole result of one invention but the convergence of many. As a set of benchmark ideas coalesce into a new machine relating to a new technological generation, then additional, incremental inventions result that also become part of the technological base. A new generation is marked after the project has proven itself, shown not to be a fluke, and has added a new layer to the technological base. The Computer Revolution and beginning of the electronic generation saw the use of vacuum tubes in the ENIAC on a scale of magnitude never before experienced and the invention of magnetic core memory on

Whirlwind. Since a generation is a convergence of inventions, its emergence cannot be marked by a single event. A clustering of events, including patents, publications, and start-up dates are used to somewhat arbitrarily select a particular year.

Three pre-computer generations and three computer generations are clearly distinguished. Although calculating activities started with early civilization, it was not until the seventeenth century that a variety of calculating devices were invented and used. The collections begin in 1620 with the beginning of the "Craft Generation". Prior to that computation was carried out manually, in much the same manner for all of history. Defining computing power as the product of processing rate and memory size, a 20 order of magnitude increase can be measured from the time when people used stone-based, single register devices to the 1980s. The most significant increase -- a revolutionary change -- occurred with the beginning of the computer era. Before then, memory size was essentially constant at one. Afterwards, computing power began to increase at roughly twice the exponential rate of all past generations.

A generation is named for its predominant technology. The starting date of a generation is set not by the idea leading to a project that triggers the generation, but by the incorporation of a technology into a new product, concurrent with significant use. In most cases devices from a previous generation continue to be designed, manufactured, and used, often supplying a base on which the new generation is built. The electronic computer generation is marked at 1950. By that time the ideas of ENIAC had been replicated and the first commercial machine, the ERA 1101, was announced to the market. In the Computer Age, the naming conventions given by industry have been used, and they seem to accurately fit the model.

Table 1 lists representative needs, uses and inventions for each of the generations. During the pre-computer generations, evolution was exponential -- each period being about half as long as the one preceding it. The rapid change is similar to manufacturing learning curves, whereby a particular unit cost declines by 10-20% each time the cumulative number of units of a given type built doubles.

THE TAXONOMY

A taxonomy has been developed in parallel with the collection and the exhibits at the Digital Computer Museum. The taxonomy's basic framework is the PMS classification that describes the structure of computers (Siewiorek, Bell and Newell forthcoming). PMS allows any computing or software structure to be described hierarchically in terms of eight basic information processing primitives, but it does not deal with functional behavior, such as program interrupts that are not implied by a structure. The PMS system is generally used to provide a structural representation of the components of digital computer systems. In contrast, the Museum taxonomy classifies only whole computing systems and their antecedents. The following compares the two breakdowns:

TABLE 2. COMPARISON OF MUSEUM TAXONOMY AND PMS

MUSEUM TAXONOMY CLASS - CODE	CODE - PMS
Memories - M	M - Memories
Controls - K	K - Controls
Transducers - T	T - Transducers
Links & Switches - S	S - Switches
	L - Links
Calcula - D	D - Data Operation
	P - Processor
Digital Computer - C	C - Computer
Robotics - R	

The criterion defining the tree is the structure of the computing device, not the organization that made it or the purpose that it was meant to fulfill. To make an analogy with the animal kingdom, if the bone structure of a horse is that of a fine race horse then it would be classified as such; it would not matter if it were bred by the government and used to pick up garbage. In computing, the EDSAC, built at Cambridge University, is classified as neither an English nor a university computer, but as an EDVAC-related machine in the same family as the Maniac and ILLIAC. Thus, differentiation by manufacturers, countries, or intended users is not part of the taxonomy.

The classical scientific taxonomy system with its seven levels has been adopted to organize and classify all species of related inventions. The two top levels, kingdom and phylum, are technology and information, respectively. The Museum collection displays seven classes within the phylum of information. Each of these seven classes is broken down into order, family, and genus, and then identified by species. Table 3 lists the criteria used for the breakdown of the classes. Specific descriptions for each of the classes are found throughout the catalog.

Table 3. (in process)

Criteria used in differentiating orders, families, and genus.

CLASS	ORDER (Technology)	FAMILY	GENUS
Memory	Machine interface	Storage material	Structure of access movement
Controls	*	Degree of complexity	*
Transducers	*	Phenomena/material	*
Links & Switches	*	Degree of complexity	*
Calcula	Analog or Digital	Degree of complexity	Structure
Digital Computers	*	*	*
Robotics	*	*	*

* - To be determined.

Memory is probably the oldest class, starting with early markings on caves and continuing as a significant part of both computers and automata, and also as all kinds of human-readable aids to the brain. See Table 4 for more complete explanations.

Controls are rooted in early analog devices, such as the Greek water clocks, and have been significant in the mechanization process. At the beginning of the nineteenth century, card controlled looms introduced sophisticated pattern control to the industrial process through the use of a larger scale memory data-set than hitherto used. Card control ended with a great flourish in the early nineteen sixties with the tabulating machines. Again, with the advent of the computer on a chip, earlier technologies of control devices are rapidly becoming obsolete, being replaced by the "on-board" micro-processor.

Transducers take information in one form and put it into another. They are often associated with memory systems, allowing their replication; for example, printing use type (a transducer) to duplicate the information in books (a memory device). Transducers began with the movable type and include the teleprinter, tape transport, telephone, and television. These machines are becoming more and more sophisticated and less and less distinguishable from computers.

Calculators, other than the manual bead devices, did not develop until the 19th century and have been virtually displaced by computers. In the PMS notation, these are the data operators carrying out arithmetic operations. Either calculators have become embedded in computers or miniaturized computers have been embedded in what have traditionally been considered calculators. The taxonomy of Class Calcula is explained in the text. (See Table 5.

Links and switches evolved out of the needs of a large number of subscribers all desiring the use of a single system. The first telegraph was a simple device transferring information from one place to another. But the growth of telegraphy and telephony systems in the late nineteenth century created a need to establish elaborate networks linked together with a switching system. Computers still depend on linking and switching for cross communication.

Digital computers emerged in the late nineteen forties from a combination of calculator, control, transducer, links and switches, and memory technologies. The section "Pioneer Computers" shows the combination of elements that was adopted by the first 16 machines, many of which were patched together based on different technologies. Class Digital Computer is certainly more than the sum of these parts, as the parts have converged and been modified and molded into a new phenomenon.

Robotics actually started very early with man's desire to replicate life and took the form of doll-like automata. The experimentation in the sixteenth century however only served as entertainment for kings and in travelling sideshows. The ideas for what automata might do ranged far beyond the technology of the time. It was not until the second half of the twentieth century, that robots have become economically utilitarian. With smaller and more powerful computers, on board machines for sensing as well as calculating and thinking, robots will become more widespread in the future. This class is presently not included in the collection; but will be included in the future.

Each class, like a species, starts within a given generation, flowers, and dies or is incorporated within another class. Each started almost as an independent thread but is beginning to merge into one or two dominant classes: computer and automata. Figure 1 illustrates the potential scope of the collections, indicating the period in which each class emerged and for those, becoming extinct, the time of their gradual demise.

FIGURE 1: THE COLLECTIONS

```
              Period that the exhibit covers:
              Craft  Mechanical Electro-mec  Electronic Transistor IC
               1600    1810        1900        1950       1960    1970
```

MEMORIES
MMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM
MMMMMMMMM
including books and magnetics

CONTROLS KKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKK
K K
including water clocks, and governors

LINKS & SWITCHES
SSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSS
including telephony and telegraphy

TRANSDUCERS TTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTT T T T
including typewriters and printers

CALCULA DDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDD D D
D D
including analog and digital calculators

DIGITAL COMPUTERS
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
including processors

ROBOTICS RR R R R R R R R R R
RRRRRRRRRRRRRRRRRRRRRRR

DMCAT1.6

PEOPLE TO GIVE LECTURES AT THE COMPUTER MUSEUM

CGB (GKB 841118; with CGB strike through *updates 020821*)

COMPUTER SYSTEMS

Historical

R M Block

Bauuw

Manchester Machines: Tom Kilburn, Lavington

Nixdorf and German Computers

Early Computers: Brian Randell

An Wang

Early BTL: Gene Felker

Early IBM: Haddad?

Calculators

Early calculators and slide rules: Delhar or Wheatland

Bomar

HP

Sharpe

TI

PCs

Apple: Jobs, Markula, Wozniak, Rosing,

Atari: Forest Mims

BBC Computer:

Commodore: Jack Trammiel, or Chuck Peddle

IBM PC: ~~Don Estridge~~, Bocca Raton

IMSAI

MITS Altair: Bill Roberts

Osborne

Sinclair (Sir Clive)

Palms

Palm, Handspring, Jerry Kaplan

Philadelphia company…

Workstations

Apollo *Poduska*

SUN (*Joy, Bechtolsheim, and McNealy)*

Viatron- Bennett

Xerox: Lampson, Taylor, Thacker

Lisp Machines: Noftsker, Greenblatt,

The Wang WPS

The first IBM MT/ST

Minis (*Note my list of 100 minis…)*

Digital: Olsen, Strecker

DG: ~~Burkhardt~~, DeCastro

IBM

HP

Prime
SAAB or Datasaab
SDS/XDS Palevsky
Tandem

<u>Mainframes</u>
IBM
Amdahl
Honeywell/GE/Multics/
Univac/Eckert
Burroughs/Barton
NCR/???

<u>Supers</u>
Cray
Thornton
Norris
Thorndike/ETA/Lincoln

NEC: Kobayashi
Hitachi
Fujitsu
Illiac IV: Slotnick, Kuck
TI ASC: Cragon
Burton Smith

<u>Other</u> <u>Computing</u>
Cellular Automata: Fredkin
Cellular Automata: Steve Wolfram
Macro Modules: Clark and Molnar (we want to get a collection)

FPS: Norm Winginstaad

<u>Robotics</u>
SRI Charlie Rosen; *Rosensheim, etc.*

SEMICONDUCTORS/LOGIC
The transisor: schockley, bardeen, brattain
The ic: Noyce, hoerni, Jack Kilby
Mead and Conway
Silicon Compilers: Doerr, Mead, Dave Johannsen
New ECAD including Prabhu Goel et al for Verilog

Fairchild: Les Hogan, Gene Kleiner
IBM Erich Bloch
Intel/Hoff and ? of Japan
Motorola/68K

Mostek/rams
MOS Technology: 6502 and Chuck Peddle
Parametron: Goto (also Lisp machine)

OTHER COMPONENTS (EG. DISKS, CRT'S)
<u>A/D</u>
Analogic: Bernard Gordon
Analog Devices: Ray Stata

<u>Disks</u>
Al Hoagland
Floppies, Winis Al Shughart

<u>Memories</u>
RCA: Rajman
Early designs: Wang, Forrester, IBM book author Pughe, IBM core inventor

<u>Printing</u>
Irwin Tomash

<u>Other</u> <u>Peripherals</u>
L C Hobbs

<u>Communications</u>
Modems- the Carterfone case
Packet Switching / DARPA Net: Kahn, Roberts, Kleinrock, Frank Heart
Packet Switching British PO: Donald Davies
LANs: Bob Metcalfe

LANGUAGES, DATABASES, EDITIORS, OPERATING SYSTEM

Algol

Dijkstra

Perlis

ADA: Icbidah

APL: Iverson

Basic: Kemmeny and Kurtz, Bill Gates, Microsoft First Micros Basic

C: Ritchie

C++:Grady Booch

C#

Java

Scripting languages:

Cobol: Hopper, Sammet

Fortran: John Backus

LISP: McCarthy

LOGO: Papert

Smalltalk, *Parcplace, Squeak*: Adele Goldberg, *Kay*

Wirth: PL/360, Algol W, Pascal, Modula

Visicalc: Dan Bricklin, Software Arts

Excel:

Word etc.

Lotus 1-2-3: Mitch Kapor

EMACS: Stahlman

Gnu tools: Stahlman

Operating Systems

Timesharing: Corbato, McCarthy, Fredkin, Beranek, Boillen (CTSS, Multics)

UNIX: Richie, Thompson

GNU/LINUX: Stahlman and Linus Torvald

OS 360: Brooks

Tops 10/20, TENEX: Pete Hurley

OS/8 & RT11 as predecessors to CP/M and MDOS

Gary Kildall, CP/M and PL/M

MAC OS's

Xerox stuff, inc

Real Time Operating Systems: VMS, RSX, Dave Cutler

Windows

NT: Cutler

Dynabook: Alan Kay

Network (CODASYL) Database: Bachman
Relational Databases: Ted Codd; *Gray*
Informix
DB2
Tandem
Oracle

<u>THE INTERNET</u>
Arpanet, etc.
HTML
MOSAIC & Apache
Etc.

ALGORITHMS
Bentley
FFT: Cooley and Tukey
R W Hamming
Knuth
Traub
Wilkinson

APPLICATIONS, Etc.
<u>AI</u>
Feigenbaum
McDermott
Dendral: Lederberg
Macsyma: Moses, Wolfram
Newell
Simon
McCarthy
Minsky: LISP
Roger Shank

<u>Business</u>
Banking: B of A, and ERMA at SRI
Banking: Citicorp John Reed ATM

<u>CAD/CAM</u>
Doug Ross: APT
Applicon: Fontaine Richardson
ComputerVision:

<u>Games</u>
Pong: Noland Bushnell
Spacewar Russell, Graetz, Kotok, Sampson
Rocky's Boots

….

<u>Graphics:</u>
Bill Atkinson: MacPaint
James Blinn: JPL; Microsoft
Jim Clark, Silicon Graphics
Pixar: Ed Catmul, Alvey Ray Smith
Evans and Sutherland
Dean Winkler and John Sanborn
Alvey Ray Smith, Lucas
Don Lynn ?
Mandelbrot
Martin Newell
Graphics keeper: Steve Levy's Film and Photo Collection (we need!)
Graphic Wonder: Negroponte
NYIT Alexander Shure (historical)
Steve Benton ?

<u>Laboratory</u>
Wes Clark

<u>Music</u>
Chowning, Mathews, Vercoe, UC/SD ?, Pierce

<u>Real time</u>
Sage Forrester, Everett, Crago
Sabre   Max Hopper

<u>Space</u>
Dave Scott, Astronaut
Space Shuttle Person

<u>Speech and Pattern Recognition</u>
Kurzweil Reading Machine
Ken Stevens
Raj Reddy
K S Fu
Rosenfeld

<u>Scientific Computing</u>
Ken Wilson, Cornell
Richard Fineman, Cal Tech

<u>Testing</u>
Alex D'Arbeloff

<u>Typography</u>

Knuth
Mike Parker, Bit Stream
Interleaf
Warnock & Geschke

<u>Weapons</u> <u>Design</u>
Edward Teller

PROFESSIONAL ORGANIZATIONS

PUBLICATIONS
Auerbach
Datamation
Computerworld: McGovern
Byte: Carl Helmers
UNIX: Yates and testing services

BOOKS
Hackers: Steve Levy
Dreams: Waldrop
Fire In the Valley
Turing: Hodges
First Fortran Books: McCracken
Edmund Berkely
Wilkes, Wheeler and Gill

FUNDING
AR&D: Doriot
Kleiner, Perkins, etc.
West coast firms

<u>Government</u>
ARPA/DARPA
DOE
NSF

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION
4:13 PM EST

cc: see "CC" DISTRIBUTION

DATE: SAT 10 APR 1982

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-

1/A51

SUBJECT: UNDERSTANDING COMPLEXITY FOR GUIDING ENG. INVESTMENT

I'd like to work with someone who would dig into understanding
complexity with me. The goal would be to be able to give a simple, but deep presentation of various systems we have because
it's at the heart of deciding the base for our future work. Thus, it is a major engineering cost, time and hence business strategy question.

Recently, I've advised several engineers to use the 68,000 (BUT
ONLY IN C... UNTIL Bliss) because I believe the task they are undertaking is substantially easier if done without program or
data overlays. For example, we spend several hundred dollars to
lay down an instruction in WPS or in some of our operating systems; there's a high cost to maintain them too.

The basic premise is that the overall complexity of a final user
machine such as a language, a word processor or cad system is the
product of 3 factors:
1. The basic architecture on which the target task is built.
2. The structure chosen to implement the target.
3. The target task. eg. PL/1, BASIC, WPS

Diagramatically,

```
3.  The target task_____x_____x____.......x_____________
                        .     .          . .
                       . .    .         .   .
2.  The structure     .   .   .        . .  .
                     .     .  .       .   . .
                    . .   . . .      .     ..
                    . .   .  ..     . .     .
                    . .   .   ....... .     .
```

```
                  . .   .   .       .     .
1.  Base machine____x_x___x___x_______x_____x___________
```

This falls directly out of the fact that we build by layers and layers of finite state machines as in the ISO 7-layer protocol. Conventional machines have microcode, macrocode, O/S, and Languages as their levels we present. The office architecture has: the Individual Machine, the Organization Machine, the Professional Machine, the Generic Office Machine (GOM), the Office Base Machine (OBM), the conventional base machine such as VMS or CTAB, and finally the Hardware machine.

HARDWARE COMPLEXITY STUDY (a good PhD topic)
In Venus, VAX is the task. Venus is the structure, and the MCA and 10K family is our base. Venus is complex, and I don't even know how to measure this. Ulf uses gates, including ram's as a measure. There are lots of measures in software, including lines of code. A trivial, but better measure for hardware might be the number of D-size prints. For Venus, the 4 coupled micromachines, amount of microcode, the timing constraints and other parallelism all increase complexity in some way I know not how to even express or think about. I'd like to get a PhD student to go over our designs historically and see if they can arrive at some complexity measures. There measures would be the basis of correlating design time, errors, cost, etc. Any ideas how or who?

HELP NOW ON LOOKING AT OUR BASE SYSTEMS (To project the Future)
I want help to look at the base structure of say 3 or 4

systems
(eg. Tops 20, PDP-8, VMS and RSX) to examine how they influence
some of the systems that are built on them. I think it can be
shown that this is a major cause of complexity in the systems
built on them. I simply want to show the resultant complexity
of the primitives when exressing trivial tasks like accessing
various kinds of variables either directly or in a procedure.
For example, the expression A = B (12 bit integers) can require
up to 4 instructions and 2 x 5 pieces of data which the
programmer usually has to keep track of. This can become
horrendous if you want variable length data or there's a
procedure.

The outcome of this simple study is going to be the understanding
of how much we think our systems can be enhanced over time.
Right now, I think there are cases where we are committing
suicide. The groups are just big enough to add errors and
maintain them, but not large enough to provide winning products.
The approach will be to look at the new functionality that has
been added the last few years and get incremental costs for this
together with the investment required to maintain what has been
added. In many cases, I think we've gone over the brink! BJ,
what about someone in the quality organization that could help
here? (Again, to do what I really want over time, would be a
good PhD thesis based on looking at our software systems and
software engineering in detail.)

"TO" DISTRIBUTION:

BILL DEMMER	ULF FAGERQUIST	SAM FULLER
BILL JOHNSON	BILL STRECKER	

"CC" DISTRIBUTION:

BILL AVERY MIKE GUTMAN DICK
LOVELAND
JACK SMITH

GB3.S4.35

FROM: GORDON BELL DATE: THU 10 JAN 1980 10:01
PM EST
DEPT: OOD
EXT: 223-2236
TO: JACK GILMORE
cc: STAN OLSEN
LARRY PORTNER

SUBJECT: INVITATION T

We would like to invite you to become a part of Engineering. This is along
the lines of various discussions you have had with Larry and Stan. The
way we believe the organization would work is:

1. You become a member of Si Lyle's staff as Program or Product Area manager
for the OFIS Products.

2. Bob Travis would report to Bruce Stewart (who reports to Bob Daley in
MK) as the chief architect for WPS and OFIS Products.

3. The programming group would report to Bruce.

4. The hardware group would report to Brian Fitzgerald.

Although the WPS work would be your main responsibility, especially getting
orders for the WPS 78, 278 and 200 from the P/L's, for the

short term, the
efforts to get us to full OFIS capability would be your longer term work.
This includes:
1. any R and D in this area, and setting the needs there
2. getting Mail and the Post Office
3. Compatibility with EDT and KED, and perhaps using EDT in the short
term so that we have a WPS compatible editor ASAP across VAX, RSTS and RSX.
4. workding on the compatibility of FMS (forms) and what you have promised in
release 6
5. defining how we are going to get intelligence for editin moved into the
immediate and successor terminals
6. stabilizing future 200's so that we meet our commitments and are
able to get a high growth of products in the next 2 years, followed by use
of 11's as main line, with ability of 200's to front end mainline VAX, 11 and
10/20 standard products in a clear way, transparent to user.
7. solving technical problem of ease of converting to arbitrary language
8. compatibility such that typesetting can be done from a WPS terminal
9. essential compatibility of files so that our programs on the various
systems can read and write wps files with no extra programming

We are committed to become the dominant supplier of WPS systems in the next
three years by:
1. building on and fixing the systems we have now
2. introducing the 278 in the near term
3. moving all the wps software to vax, rsts, and m (and possibly 10/20) so
that we dominate this on the basis of the number of installed terminals

Please join us and continue the fine work you have started as

a Product Line.
Regards,
Gordon

Command >
November 20, 1981

Robert Moreton
Butler Cox & Partners Limited
Morley House
26-30 Holborn Viaduct
London ECIA 2BP

Dear Mr. Moreton:

Thanks for the honor of inviting me. I'm sorry I am overcommitted with project work and cannot attend.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:mal
ID#GB3.S1.44
November 4, 1981

Professor Daniel J. Pease
Syracuse University
Department of Electrical and Computer Engineering
Syracuse, NY 13210

Dear Professor Pease:

It was good to get your letter on the VAX/780 for the Syracuse computing laboratory. I quite agree that the addition of this computer would be of great benefit to your community.

Unfortunately, the Museum runs under a tight budget and simply does not have the funds to support this grant. However, once Syracuse University decides to redo the laboratory and remove the equipment, we believe we might be able to provide a home for the installation. In doing this, we would want to photograph and carefully dismantle the machines so the laboratory can be recreated to a certain degree. We do have copies of all the machines you have in a warehouse, but it would be nice to have the collection as a single exhibit on "PDP-8's in a university environment", provided we can allocate the space to it. Since we are taking a very long term view at the Museum, I know we can all visualize the impact such a laboratory exhibit would make for visitors in say 50 to 100 years... provided we can store, retrieve and then display them effectively.

Since we cannot help you at this time with funds, I am forwarding your letter to the Corporate Contributions Committee in hopes that they might be able to provide some funds to assist. We are sorry we cannot help directly, but we strongly support both efforts to get a VAX there and to be able to archive your machines here at the Museum for future exhibits.

Sincerely yours,

Gordon Bell
Vice President, Engineering
Keeper, Digital Computer Museum
Professor, on leave, Carnegie-Mellon University

CC: Gwen Bell, Director, Digital Computer Museum
George Chamberlain, Treasurer and Head of Corporate

Contributions
Nance Dube, Secretary, Corporate Contributions
Joe Meany, Product Line Manager, Education Group
Charles G. Blanchard, Senior Sales Representative, Syracuse Office

GB:mal
ID#GB3.S1.35

December 8, 1981

Iann M. Barron
Executive Director
Inmos Corporation
P.O. Box 16000
Colorado Springs, Colorado 80935

Dear Mr. Barron:

I thank you for your letter regarding the offer to hear about the INMOS microprocessor architecture. Unfortunately, I must decline your offer.

It seems that you were correct in your assessment that there would be a conflict of interest if I received information pertaining to the INMOS architecture,. My receipt of such information would violate Digital's Business Ethics Policy.

I am pleased that you considered me as one of the people you desired to critique the INMOS architecture.

Sorry I can't hear about it, but let's get together when you visit us anyway.

Look forward to seeing you.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:mal
ID#GB3.S1.64

cc Del Thorndike

June 2, 1982

Mr. J. Russell Nelson, President
Arizona State University
Tempe, AZ

Dear Mr. Nelson:

Thanks for the invitation I received today. I'm sorry I can't come.

Thanks for thinking of me.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:mal
GB3.S5.9

+---------------------------+   GB0002/7

| d | i | g | i | t | a | l | **i n t e r o f f i c e   m e m o r a n d u m**

+---------------------------+

Subject: **Iowa State Testimonial Ad**

To: Rose Ann Giordano, MR1-1/A65
Doug Towle, MR1-1/M55

Date: 4/5/79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

CC: Dave Cuttler, TW/D08
Bernie Lacroute, TW/A08
John Leng, MR1-1/A65
Jerry Witmore, PK3-1/M40

follow up 4/13/79

I heard they are using VMS as open shop, GP timesharing. They supposedly have >60 users.

Can we get them in the ad series?

GB:swh

D I G I T A L INTEROFFICE MEMORANDUM

DIST: Rose Ann Giordano MR1-1/A65 Doug Towle MR1-1/M55

Dave Cuttler TW/D08 Bernie Lacroute TW/A08
John Leng MR1-1/A65 Jerry Witmore PK3-1/M40

5/7/79

John M. Chowning
IRCAM
31 rue Saint-Merri
F-75004 Paris

Dear John:

I'll call you from France. I have no plans for Paris, but my wife and I will be traveling in the Loire area on May 19 - 28.

Sincerely,

Gordon Bell
Vice President,

Engineering

GB:swh
GB0002/49

May 19, 1979

Brigette Marger
IRCAM
31 rue Saint-Merri
F-75004 Paris
FRANCE

Dear Brigette:

Thanks for the wonderful dinner with you and the IRCAM staff last Sunday at Train Bleu. Gwen and I really enjoyed the food and ambiance, but mostly we liked the discussion about computers and music.

I'm sending you a book by three of us at DEC about engineering of our computers that I hope may be interesting and useful to IRCAM. Again, thanks for the hospitality.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:swh
GB0003/35
Enclosure - CE

CC: John Chowning - IRCAM
Jean Claude Risseltt - IRCAM

00 CORE DECGRAM ACCEPTED S 004177 O 663 18-AUG-82 18:57:10

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION   DATE: WED 18 AUG 1982
2:30 PM EDT

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5172940949

SUBJECT: ISI, ENVIRONMENT (TALK WITH BOB BALZER)

Bob'll send information on computing environment they're trying to
build. They're switching to Ethernet, having played with old Ethernet
and Chaosnet. It seems like everyone's wanting to go to personal
machines - mainly because of the long history of machine service
overload. He sees: super terminals or workstations ala SUN, HP, or?
where graphics, editing and possibly small LISPS are run. This
environment has to be compatible with big machine environment where
bigger problems are run. He wants 750's for this. He's not enamoured
with the 730 for this due to CPU. I think he may be wrong - or at
least I hope he is. HP's putting (has) LISP on a 68,000 at Utah.

The LISP conference will be a place to get much info as everyone's

trying to get their machines benchmarked. (3 x 780's = KL = scheme
chip = 4 x 68,000) The 2060's the benchmark - thus, we could have a
really nice LISP-server when we can get the 2080 built! The fact is:
the community is out of cycles and needs a very high performance
machine for attacking new problems.

Neal Goldman will be in Boston next week. He mentioned their software
for multichip projects. IBM's sending someone there to visit.

"TO" DISTRIBUTION:

GEORGE CHAMPINE	SAM FULLER	ROSE ANN GIORDANO
DICK HUSTVEDT	DIETER HUTTENBERGER	BILL JOHNSON
BILL STRECKER	DEL THORNDIKE	

WPS USERS - Leave HP mode and type <CR>

ITINERARY - LASL - OCTOBER 5 & 6/1982

October 4 - Monday

2:10P L PK3 Chopper
2:30P A Logan
3:05P L Boston AA 509
5:50P A Dallas
6:40P L Dallas AA 489
7:23P A Albq
Stocky and Huttner will meet plane and transport to ROSS Air.

8:15P L Albq Ross ZD20
8:45P A LASL

Government taxis have been arranged to meet this flight and transport to Hill Top House, Trinity & Central St.
505-662-2441

October 5 - Tuesday

Meeting at LASL

October 6 - Wednesday

AM Meeting at LASL

1:00P L LASL Ross ZD 13
1:30P A Albq
2:00P L Albq CO 326
2:59P A Denver
4:05P L Denver CO 442
9:40P A Boston

Gwen will pick you up.

ITINERARY - MCC - AUSTIN, TEXAS **CANCELLED** GB7.11

August 3 - Wednesday

1:35P L Boston EA 647
Snack
5:47P L Atlanta Delta 401
Dinner

6:51P A Austin

Courtesy Van will pick you up

Drive to Lakeway Resort - about 25 miles away

(Tel:512-261-6600)

August 4 - Thursday

MCC

August 5 - Friday

8:00A L AustinEA 148

2S Brkf/Dinner

2:15P A Boston

ITINERARY - November 7 thru 13 - San Francisco/Portland

<u>November 7 - Sunday</u>

6:30P L BostonTWA 845

Dinner

9:37P A San Francisco

Gannon has a car

Rickey's Hyatt Palo Alto (415-493-8000)

<u>November 8 - Monday</u>

7:30A Breakfast (Rickey's): Lee Ehrman H:415-961-1316

W:415-327-6600

9:00-5:00 Stanford

<u>November 9 - Tuesday</u>

9:00-5:00 SRI, Frank Kuo

San Francisco Hyatt Regency

Downtown SF: 415-

788-1234

<u>November 10 - Wednesday</u>

9:00-5:00 LBL, Jim Baker

<u>November 11 - Thursday</u>

9:00-5:00 LLL

4:30P L SFUnited 1278
Snack
6:02P A Portland

Lynn Berg, DEC Sales, will pick you up at airport. No meeting with FPS til Friday morning. W:503-245-1341

Greenwood Inn
(503) 643-7444

Meeting with representatives of Oregon Grad Center while waiting for Pete Smith to arrive.

<u>November 12 - Friday</u>

9:00A Floating Point Systems

Lloyd Turner, President (W:503-641-3151)

Bob Schumann, VP Marketing

1:20P L Portland
United 148 Lunch
11:18P A Boston

Peter Smith will drive you home.

<u>MEETING POTENTIALS:</u>

Tom McWilliams
Charlie Smith H:415-854-8439

Citibank
National, John Payne
Per's friends

ITINERARY - MINNEAPOLIS - NOVEMBER 21 - 23

November 21 - Sunday

4:30-5:00 Gannon will pick you up at home.

Gannon's tel-- H:869-6433

6:30P L Boston NW 43
dinner
8:20P A Minneapolis

Sheraton Inn (at airport) 612-854-1771

November 22 - Monday

8:00A Cedar Conference Room, Sheraton Inn

November 23 - Tuesday

8:00A Cedar Conference Room

5:25P L Minneapolis
NW 154 snack
9:44P A Boston

Gwen will pick you up (Gannon returning Wed.)

DEC. 11 - SATURDAY AIRLINE STOPS

5:00P L Boston TWA 811
7:58P A LA
8:45P L LA PAN AM 811

DEC 13 - MONDAY

12:20P A Sydney
Take cab to hotel
Hotel: Regent Hotel in Circular Quay, downtown Sydney (location of symposium)

DEC 14 - TUESDAY

DEC 15 - WEDNESDAY

9:00A TALK: ETHERNET AND THE 5TH GENERATION

DEC 16 - THURSDAY

DEVOTE MORNING TO CONFERENCE

DEVOTE PM TO BUSINESS (Max B.)

4:00P Gwen talk to staff about museum

DEC 17 - FRIDAY

DEVOTE DAY TO BUSINESS (Max B.)

Evening DEC-office party at Hilton (600+ attendees)
Will be asked to say a few words.

DEC 18 - SATURDAY

0840A L Sydney AN 250 0
1005A A Adelaide

Weekend with Mudge's

DEC 20 - MONDAY

7:00A L Adelaide Trans-Australia 21
9:10A A Sydney
10:30A L Sydney Qantas 93
3:20P A Nandi
5:30P L Nandi Air Pacific 116
5:55P A Suva

See flight plan for return.

ITINERARY - AUGUST 8 THRU 11,1982

Sunday - August 8

9:30A L Boston UA 91
12:25P A LA

Monday - August 9

7:00A L LA PSA 161
802A A San Jose

Jeff Kalb will pick you up outside.

9 to 1:30Intel - includes lunch

3 to 5 LSI Logic dinner included

Tuesday - August 10

9 to 12 National
1 to 5 Fairchild (Milpitas Facility)

Wednesday - August 11

8:30-11:30A Baskett

1:40P L San Francisco UA 94
9:55P A Boston

ITINERARY - JAPAN/TAIWAN - JUNE/JULY 1982
UPDATED: 6/11/82 Fri 13:00

Flight Stops

JUNE 19 - SATURDAY

8:55A L BOSTON TWA 7 0
10:01A A NY - Kennedy
12:00noon L NY (1st Class) PAN AM 801 0

JUNE 20 - SUNDAY

2:35P A TOKYOTom K. will meet you.
HOTEL: OKURA (Olivetti electric typewriter in room)
2-10-4 Toranomon, Minato-ku, Tokyo TEL:582-0111

<u>JUNE 21 - MONDAY</u> - 10 working days

<u>JUNE 22 - TUESDAY</u>

<u>JUNE 23 - WEDNESDAY</u>

AM Hitachi Central Research
PM Hitachi Musashi

<u>JUNE 24 - THURSDAY</u>

AM Asahi Shimbun (Kanji System)
PM KEIO University (lecture)

<u>JUNE 25 - FRIDAY</u>

ALL FUJITSU Kawasaki

<u>JUNE 26 - SATURDAY</u>

<u>JUNE 27 - SUNDAY</u>

<u>JUNE 28 - MONDAY</u>

AM ETL-ELECTRO TECHNICAL LABS (5G and super computer)

<u>JUNE 29 - TUESDAY</u>

AM NEC show room
PM NEC Central Research

<u>JUNE 30 - WEDNESDAY</u>

AM U of Tokyo (lecture)
PM Institute of New Gen C. Tech

<u>JULY 1 - THURSDAY</u>

AM SONY Headquarters
PM SONY, Atsugi

<u>JULY 2 - FRIDAY</u>

<u>JULY 3 - SATURDAY</u> - 5,6,7, = 3 working days

9:30A L TOKYO
Singapore 7 0
11:40A A TAIPEI, Taiwan
HOTEL: Taipei Regency, 116, SEC 4, Zen-eye Road
TEL: 02-7059161 - TYPEWRITER OR A WPS IN YOUR ROOM
Yen will meet you: home: 011-862-781-4468; w:886-2731-0155
Taiwan is 13 hours ahead of us.

JULY 5 - MONDAY

AM TA Plant Tour and presentation

1:30-5:00P Visit Chiao-Tung University in Hsinchu

JULY 6 - TUESDAY

8:30-12:00AVisit Taiwan University in Taipe

PM Open (discussion with D Yen)

JULY 7 - WEDNESDAY

8:30-12:00PSpeech at NTIT in Taipei
Topic: Ethernet, Distributed Processing and the 5th Gen.

1:30-5:00P Visit NTIT

JULY 8 - THURSDAY

9:10A	L	TAIPEI (1st Class)	NW4
2	16 hrs		
1:10P	A	CHICAGO	
2:40P	L	CHICAGO	NW288
0	2 hrs 5 mins		
5:45P	A	BOSTON	

Japan Trip Diary Index - 1978

PLACE WHO DESCRIPTION
DEC: Tokyo Yu Hata Host + dinner with his wife, Don Frost at Yu Hata's son's apartment
DEC: Osaka their end-of-the-year party.

ETL (Electro Technical Lab) -run by MITI (Ministry of Trade/Industry
Dr. Nishino
Dr. Mori Gave a talk on the VAX design

FUJITSU, Kawosaki Central lab
Mr. Kurosaki
Mr. Sato
FUJITSU, Numazau

HITACHI: Yamamota, ?
Kazuo Kimbara Head Semis
Makimoto Eng. Mgr, Musashi Works
Mr. Asano In charge of SEMI-ELECTRIC TUBE DIV, expressed interest in meeting you but didn't last December.
KEIO U Professor Toroko
Professor Nori Doi Showed us around . The main professor wasn't there.

NEC, Kyushu Mr. Iwao Chief Engineer, took us around
NEC, Tokyo Their people from Central Research.
Dr. Yashiteru Ishii
Mr. Kitamura
NEC, Maynard 11/11/81
Dr. Kani,Corporate Engineering Mgr. Microcomputers
Mr. Matsue, Corporate Mgr. Memory Products
Dr. Sasaki, Assistant General

Manager IC Division

<u>SONY</u>, Tokyo Central Research Lab
Plus went to Sony's Atsugi plant
Mr. KAZUO Iwama President and technical person

<u>Kyoto U</u> Gave talk
<u>Osaka U</u> Gave talk
<u>Kyoto Sanyo U</u> Dr. Yugo Araki Gave talk + dinner

<u>U of Tokyo</u> Gave lecture on minicomputer architecture
Prof. Ashida
Prof. Hiroshi Inose
Professor Tohru Moto-oka

<u>Sightseeing</u> at Kyoto Palace of the Emperor Shugakuin outside
Gen Narui of Kyoto, Arashi-Tei, a restaurant
Miss Tomioka overlooked the Hozu River. Visit the Nijo-Jo castle in the center of Kyoto.
Tawaraya Inn

Sightseeing at Nara Todaiji Temple, Taishi Shrine
Old inn called Tonochaya
Toshodaiji Temple & Yakushaji Temple.

ITINERARY - MCC MEETING IN DENVER

<u>August 19 - Thursday</u>

7:15AM Meet Shel at his house
4:30PM L MK Chopper
4:50PM A Logan

5:30PM L Boston CO 25 0 - 1st class
7:48PM A DenverSEATS: 2A,B, &E (only ones left. Grant and Mike Poe know--first one there try to get a better arrangement)

Barry Rubinson will see you at the hotel. H:303-598-0966

Cab to Stapleton Plaza Hotel--TEL:303-321-3500

<u>August 20 - Friday</u>

8:00AM Meet Arneson in hotel coffee shop for breakfast.

9:30AM Task Force Meetings
1:00PM Directors Meeting

Cab/limo to airport
4:40PM L Denver UA 368 0
10:20PM A Boston

PS: if you get out earlier, there is the following Continental which you can get 1st class if you identify yourself as DEC:

4:05PM L Denver CO 24
8:15PM A Boston

IINERARY: OCT 27 THRU OCT 30, 1982

<u>October 27 - Wednesday</u>

Lauri will bring you in to Mill
12:30P Chopper from PK3 to Logan
1:55P L Boston NW209
4:59P A Minneapolis

Airport van to hotel
Holiday International
Airport - 612-854-9000

Call Gannon's room when you arrive at hotel. He will meet you, dinner, then meeting.

<u>October 28 - Thursday</u>

8:30 AO meeting

5:35P L MinneapolisRepublic 341
7:15P A San Fransisco

AVIS CAR - Route Us101 to University Avenue. West on University Ave which will run into El Camino. Hotel is on El Camino.

Palo Alto Holiday Inn, 415-328-2800

<u>October 29 - Friday</u>

8:45A Forest Baskett will pick you up at hotel
W: 415-949-0777 H: 415-493-7407

During dayCall Mr. Barry Plotkin to confirm time and place of dinner, and if you should still go straight to Tecknowledge at 5:00--Tel:415-327-6600

5:00P Meet at Tecknowledge
Start Up dinner

<u>October 30 - Saturday</u>

8:30A Tecknowledge - meeting
12:00N LEAVE for airport
1:35P L SF UA 94
9:50P A Logan
Gwen will pick you up.

August 24 - Tuesday - CG & GK
1:00PM L MR (Gwen)Chopper
1:10PM L PK (Gordon)Chopper
1:20PM A Logan
2:00PM L Logan Eastern Shuttle
2:45PM A NY
9:00PM L JFK TWA 806 Coach

August 25 - Wednesday
10:05AM A Paris

September 5 - Sunday
HOTEL: CG & GK
Claridge Bellman, 37 Rue Francoise, Paris
Tel: 01-723-54-42
Same hotel 9/6 but for Gwen only.

7:30P Dinner with Paris office: DODIN BOUFFANT, Tel:1-325-25-14
25/27. rue Frederic Sauton, 75005 Paris
Sournac--Tel Work:33-6-0778292, Home:6-428-69-79

September 6 - Monday - CG only
10:00AM World Computer Center, 22. Avenue Matignon, 75008 Paris
Ask for: Madame Gaillard Tel: 1-268-11-00
7:30PM L Paris BA 315
7:30PM A London
Dick Davies (Home:Workingham, 0734-784206) will meet you at airport, at arrival door outside terminal. Drive to Cambridge, 1-1/2 hours)
Hotel: University Arms, Tel# 51241

Davies--Tel work:44-734-868711

September 7 - Tuesday

GWEN: 1:45P L Paris TWA 811
3:05P A Boston

GORDON:
8:30-2:00 Cambridge University. Dr. Andrew Hopper will host the visit (arranged by Prof. Roger Needham who will be away. Needham's phone W:44-223-35-2435).
Davies will drive you to Coventry from Cambridge.

Hotel De Vere, Cathedral Square, Coventry,
Tel#:0203 51851.

September 8 - Wednesday

9:00 DECUS talk - ETHERNET AND THE 5TH GENERATION
University of Warwick, Main Hall of the University, Arts Center Theatre

PM Travel back to Reading with Davies for early engineering review. Pick up Delehar package from Davie's office.

Hotel: Copper Inn, Church Road, Pangbourne
(TEL:07357 2244)

September 9 - Thursday

11:30A L LondonTWA 753
1:35P A Boston

ITINERARY - SAN FRANCISCO, MCC MEETING
GB3.S6.18

7/25 - Sunday
6:30P L BostonTWA 847 DINNER
9:31P A San Francisco
(Bruce will be flying out with you but stay a few days longer. If you want to drive to the airport with him, his home phone is: 448-6548. Bruce has a car and you are both at the same hotel.)

Hote: Claremont, Berkeley Tel:415-843-3000

7/26 - Monday
9:30A Meeting at LBL, Room 4205-Building 50B
4:30P Meeting ends

7/27 - Tuesday
9:15A L San Francisco TWA 754 LUNCH
5:32P A Boston

00 CORE DECGRAM ACCEPTED S 005724 O 471 09-MAY-83 17:31:41

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! d ! i ! g ! i ! t ! a ! l !
!___!___!___!___!___!___!___!
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I n t e r o f f i c e M e m o

TO: KEN OLSEN
DATE: MON 9 MAY 1983 3:05 PM DST

FROM: GORDON BELL
cc: JACK SMITH
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5199370805

SUBJECT: VISIT TO STANFORD, COLORADO, AND HOPEFULLY DAVE CUTLER

GB5.41

While I was in the hospital, Ed Feigenbaum (and Bruce Delagi) invited me to recuperate at Stanford. At the time, it sounded like a great idea, because I sure didn't feel like getting back into details then.

The 3 products I worried about in the hospital: 10/20 (Viet Nam), MicroVAX PC, and the Parallel Processor (read the notes on it as a hot product). All are moving, but I'll be in close contact.

THE MICROVAX PC
Since January, I've been trying to get a CRT controllers for a MicroVAX PC. Now that THE CONTROLLER SPEC IS QUITE CLOSE, I'm reluctant to leave it, but fortunately I have promises as to what it is, and when we're going to get it, plus the right people working on it. Also, we should just about have the critical experimental data about how our current system's are working. Jim Cudmore, Sam Fuller, Dick Hustvedt, Bob Huettner and Bill Avery are all working on this now. The problem is more difficult than I thought, when you consider the software problem.

WHAT I INTEND TO DO

Frankly, everytime I leave Maynard, I get a different perspective. For example:

Colorado Hospital- clarity that we're in Viet Nam on 10/20, and how to get the parallel processing done and in the market

California last summer with Jeff- understood that CMOS and ECL are it on gate arrays, and TI's going to lose. Nautilus made the choice to use ECL. Unfortunately, I should have stopped Scorpio too.

I have an office in the Computer Science Department, and want to:

. see what the problems they are working on, and how they work (ie what it's like in their powerful PC network) especially with good resolution and good printing and their Ethernets

. look at and help on two machines they're talking about--
Bruce Delagi is doing one in representing Knowledge
The CS Dept wants a copy of our Parallel Processor... and I want to get them one too, provided they're going to work on the problems of parallelism and help us develop it.

. help sell the Stanford Campus on our computing environment of VAXen, 10/20 interfaces, Ethernet, etc. evolving to clusters.
This involves the CSD, Computation Center, Business School, EE department. Sam is coming out for this, and I want to understand and help it.

. visit the Center for Integrated Systems headed by Jim Meindl, where they are having their groundbreaking. Scientific American had an article on some of the work they do

with
accleration, temperature and pressure sensors.

. visit Berkeley, and possibly Cal Tech. I have offers to visit
the Livermore and Berekely labs.

. see the Western Research Lab and understand their machine, and
how we make it into a several billion dollar product
. look at and use LISA and the SUN workstations; we've scheduled
a day meeting on these and how our architecture and
implementations compare. This is vital to the MicroVAX PC.
. visit Gene and Carl Amdahl at Trilogy. Hope we can sign up
with them as a technology supplier. Wonder what best machine
to implement will be.

. go with the CX and MK database groups to National to look at
their database work and chips; much of this came out of the
Alpha Omega definition. Want to work toward a product within a
year based on MicroVAX, and want to understand how close this
is and if we have to wait on their chips.
. visit LSI Logic, VALID (CAD supplier to us) and see where they
are and where they are going to be.
. visit Les Hogan and Tom Longo at the Fairchild research labs,
and follow up their invitation to look at their LSI and A/D.

. Gwen's going to be there for a week and wants me to sell the
museum.
. other possiblities include Apple... Intel... Zilog.

VISIT TO SEATTLE
Dave wants me to stop by and I hope I can.

THEN ON TO COLORADO
It's been quite a while since I've been there. They are running out
of work since the last time I spent with them on the HSC, and working
on the database machines.

All in all, it looks interesting, and hardly as relaxing as I had
hoped, yet stimulating.

September 8, 1978

Mr. Kazuo Iwama
Sony Corporation
P.O. Box 10
Tokyo A.P.
Tokyo, 149 JAPAN

Dear Mr. Iwama:

Thanks for the fast response to my request for material. I just returned to the U.S. and find we're proceeding reasonably well with the evaluation of the Betamax that's been modified for holding digital information. The important part for us now is to determine how it can be used, i.e., the market.

In order to get a product, we'll have to somehow develop a more trusting relationship because the design alternatives will have to be more fully explored. I hope we can do this.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:ljp
ID#0259

CC: John Kevill
    Mike Riggle
    Michael P. Schulof
00 BURT DECGRAM ACCEPTED S 646 O 33 17-JAN-81 12:24:47

****
* d i g i t a l *
****

TO: SI LYLE   DATE: SAT 17 JAN 1981
12:19 PM EST
                                               FROM: GORDON BELL
cc: see "CC" DISTRIBUTION   DEPT: OOD
                                               EXT: 223-2236
                                               LOC/MAIL STOP: ML12-
1/A51

SUBJECT: J-11: AT BOARD, BOX AND SYSTEM LEVEL

J STATUS
Bob Supnick presented the current status. I'm impressed with the design team, their aggressive schedule, and believe in the necessity of the Floating Point Accelerator chip both as a product, and to learn about VLSI design ahead of VAX-11. Let's not spend too much time with the tin cup.

J AS AN AGGRESSIVE BOARD PRODUCT

The most exciting thing about the chip is that it really lets us
go head to head with the chip folks in the high performance market. Intel and Motorola appear to not be getting the performance. Here, it is simply experience, so it feels like we do have good market potential to go head to head with the 68000 and 8086 ... if we deal from performance and software strengths. (UNIX is, however, coming on strong as a way of the semicomputer companies getting software.)

SELLING THE 11 AS A 16-BITTER

As a computer scientist/engineer, I'm really worried about the
addressing problem. In my advanced age, the one metric I use to measure architectures is simply address bits. Thus, what have been called 8-bitters, I would classify as 16 bits, and the 16-bit ones (eg. 68000 and 8086) I'd classify as 22 bits. For building interactive terminal systems, it is awfully nice
to have 20+ bits, cause we've seen that the 10/20 address space
of 20 bits is really quite adequate and only just now breaking
for large programs. The VAX address space lets a whole range of
problems be solved however that we'd never see done on a 24-bit
machine like the 370... also, it will change the nature of programming. The trick then is twofold: make it clear to the
market that we feel that the 11 address size of 17 bits (I and D
space) x number of independent processes is just fine, especially
when we have all the ways to do overlays; AND learn about and develop programs that require 32-bit addresses so that this will
be demanded for large, personal systems of the mid-80s when we
get VAX in a personal computer.

THE 11 SYSTEMS AND THE BUS TACTICS

Therefore, we should plan to use J to go aggressively after
the Qbus board level business. At the system level, for
those
who needn't or won't switch to VAX, we should build the
11/24J
to give us the 11/70 performance at 11/24 price. This gets
us a system that is still below the Nebula in price... to
distinguish the two products (even though the performance is
at Comet level for certain cases). Given our limited
offering
of Q bus system options (comm options, big disks), then it
would seem to make sense to NOT INTRODUCE the Qbus (quad
version)
a system. This also makes sense since all the VAXes use the
Unibus. In this way we could go into a bus holding pattern
until we see how much of the systems will migrate to the NI.
Also, there's a question of what the right sizes are for
building
the various nodes that connect to the NI, where we have these
alternatives:

.All tie directly to the NI with NO modularity of backplane
 (take an R80/81), remove the SI, and put a computer and NI
 there as the Fileserver)

.Build the nodes out of Qbus parts ... like our OEMS do.
Here,
 we should move to have just one Qbus (duals) versus duals &
quads.

.Unibus ... until the NI takes over

.BI (for VAX) to interconnect the various computer components

.Continued use fo system unique backplanes

.Personal computer components oriented to industry std parts.
 (Here, the II bus is being defined.)

What do you think? Is this the right direction?

"CC" DISTRIBUTION:

JIM CUDMORE   BILL DEMMER   BERNIE
LACROUTE
JACK MACKEEN   MARKETING COMM: JOHN
MCNAMARA
ROY MOFFA   STAN PEARSON   DAVE

RODGERS
HERB SHANZER STEVE TEICHER

GB2.S4.14
September 25, 1981

James Martin
c/o Judy Maurer
2395 Huron Parkway
Ann Arbor, Michigan 48104

Dear James Martin:

I enjoyed your stimulating seminar. Thanks.

Enclosed is a paper by one of our people discussing this issue of how one defines the word maintainance. Let me also recommend the taxonomy by Babb & Tripp appearing in SIG SOFT SW Engineering Notes, No. 1. 4 # 4, October 79.

Also enclosed is a Museum brochure.

Hope to see you again.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:mal
ID#GB2.S8.16

<subj>NATIONAL RESEARHC COUNCIL
<from>BLACKBURN, JACK F.

<to>BELL, GORDON
<date>80/1/29
<date rec>1/31/80
<log#>1-48
<dispo/date>
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<roll>
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<subj>PENNSYLVANIA INSTITUTE OF TECHNOLOGY
<from>STRAYER, JOHN C.
<to>BELL, GORDON
<date>80/1/28
<date rec>1/31/80
<log#>1-47
<dispo/date>TED JOHNSON - 1/31/80
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<subj>ROBOT INSTITUTE OF AMERICA
<from>SALLOT, BERNARD M.
<to>BELL, GORDON
<date>80/1/31
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<log#>1-46
<dispo/date>BOB GLORIOSO - 2/1/80
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<roll>
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<subj>TRANSACTION SECURITY, INC.
<from>SERNET, PIERRE
<to>BELL, GORDON
<date>80/1/28
<date rec>1/30/80
<log#>1-45
<dispo/date>JOHN HOLMAN - 2/4/80
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<f/u>
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<roll>
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<subj>ROBERT M. GORDON
<from>GORDON, ROBERT M.
<to>BELL, GORDON
<date>80/1/27
<date rec>1/30/80
<log#>1-44
<dispo/date>FILE #12 - 3/11/80
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<subj>INFOTECH
<from>MULLER, BOB
<to>BELL, GORDON
<date>80/1/24
<date rec>1/30/80
<log#>1-43

<dispo/date>TO LETTERBOOK (GB1.S2.14) - 2/22/80
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<subj>CARNEGIE-MELLON UNIVERSITY
<from>BARBACCI, MARIO R.
<to>BELL, GORDON
<date>80/1/28
<date rec>1/30/80
<log#>1-42
<dispo/date>CIRCULATION - (DICKMAN, FULLER, WILL SHERWOOD, GORDON) - 2/5/80
<message>COMMENT? FYI AND RETURN.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>EFM ASSOCIATES - RESUME' (ALBERT P. BELLE ISLE)
<from>MORRIS, E.F.
<to>BELL, GORDON
<date>80/1/25
<date rec>1/29/80
<log#>1-41
<dispo/date>ARMAND LA VALLE - 1/30/80 (CC: CUDMORE, CLAYTON, DEMMER, MEYER)
<message>PLEASE HANDLE. ANY INTEREST? EXPLORATORY INTERN?? LOOKS CAPABLE!
<answer>
<f/u>
<filed>
<ret-gb>
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<subj>BELL LABORATORIES
<from>DEPP, WILLIAM A.
<to>OLSEN, KENNETH H.
<date>79/12/19
<date rec>1/28/80
<log#>1-40
<dispo/date>ORIGINAL RETURNED - (CC: JOHN MEYER, LARRY) - 1/30/80
<message>LET'S GET HIM INTO TALK WITH US.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>RESUME' - JOESEPH ZICCARDI
<from>ZICCARDI, JOSEPH
<to>BELL, GORDON
<date>80/1/24
<date rec>1/28/80
<log#>1-39
<dispo/date>ARMAND LA VALLE - 1/30/80
<message>PLEASE HANDLE.
<answer>
<f/u>
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<roll>
<>

<subj>COOPER, PAUL J. (I.D. 460990)
<from>COOPER, PAUL J.
<to>BELL, GORDON
<date>80/1/22
<date rec>1/25/80
<log#>1-38

<dispo/date>JIM BELL - 1/30/80
<message>THERE IS SOME HISTORY TO BE ATTAHCED. ART FISHER, LEGAL HAS IT. ART SYAS WORKER MUST SIGN A WAIVER BEFORE/IF HE COMES. GORDON WOULD APPRECIATE IT IF YOU WOULD WRITE OR CALL COOPER.
<answer>SPOKE TO COOPER; HE IS SENDING A PROPOSAL TO DICK ECKHOUSE. - 2/5/80
<f/u>
<filed>
<ret-gb>YES - 2/5/80
<roll>
<>

<subj>STANFORD UNIVERSITY
<from>LISCOM, JILL
<to>BELL, GORDON
<date>80/1/21
<date rec>1/25/80
<log#>1-37
<dispo/date>ROBERT ASHENHURST, ACM EDITOR, UNIVERSITY OF CHICAGO, CHICAGO, ILL 60637 (CC: AL CRAWFORD)
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>B.P.A.
<from>ATKINS, WILL E.
<to>BELL, GORDON
<date>80/1/5
<date rec>1/24/80
<log#>1-36
<dispo/date>JOHN MEYER - 1/28/80
<message>JUST GO ON.
<answer>
<f/u>
<filed>

<ret-gb>
<roll>
<>

<subj>SRI
<from>SIGISMUND, CHARLES DR.
<to>BELL, GORDON
<date>80/1/21
<date rec>1/24/80
<log#>1-35
<dispo/date>JIM BELL - 1/30/80
<message>DO YOU WORK ON THIS PROBLEM?
<answer>I'D LIKE TO HEAR WHAT THEY COULD OFFER US. (WANT TO REFER HIS CALL TO ME?) - 2/5/80
<dispo/date>JIM BELL - 2/8/80
<message>YES
<f/u>2/8/80
<filed>
<ret-gb>
<roll>
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<subj>UMIST
<from>ASPINALL, PROFESSOR D. (JANID)
<to>BELL, GORDON
<date>80/1/17
<date rec>1/23/80
<log#>1-34
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>RESUME' - EXCEL PERSONNEL (MED-1205)
<from>KELSEY, RICHARD
<to>BELL, GORDON
<date>80/1/10

<date rec>1/22/80
<log#>1-33
<dispo/date>ARMAND LA VALLE - 1/23/80
<message>PLEASE HANDLE.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>HISTORICAL TECHNOLOGY, INC.
<from>MOSKOWITZ, SAUL
<to>BELL, GORDON
<date>80/1/11
<date rec>1/22/80
<log#>1-32
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>DIEBOLD GROUP, INC.
<from>MILLER, N. RICHARD
<to>BELL, GORDON
<date>80/1/17
<date rec>1/22/80
<log#>1-31
<dispo/date>MAILED REPLY CARD - 1/25/80
<message>I CANNOT ATTEND EITHER EVENT, BUT WOULD BE INTERESTED IN A SUMMARY OF THE PROCEEDINGS.
<answer>
<f/u>
<filed>FILE #13 - 1/25/80
<ret-gb>
<roll>
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<subj>UNIVERSITY OF NEW SOUTH WALES
<from>VOWELS, REX
<to>BELL, GORDON
<date>80/1/10
<date rec>1/21/80
<log#>1-30
<dispo/date>JERRY WITMORE - 1/25/80
<message>FYI.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>WATERMAN, ALAN T. (AWARD COMMITTEE)
<from>HAMATY, LOIS J.
<to>BELL, GORDON
<date>80/1/15
<date rec>1/21/80
<log#>1-29
<dispo/date>LOIS HAMATY - 1/29/80
<message>FORM RETURNED TO HAMATY BLANK AS HE HAD ALREADY NOMINATED SAM FULLER.
<answer>
<f/u>
<filed>#13
<ret-gb>
<roll>
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<subj>UNIVERSIDADE FEDERAL DO RIO DE JANEIRO
<from>MARINHO DE ARAOJO, JOSE FABIO
<to>BELL, GORDON
<date>80/1/10
<date rec>1/21/80
<log#>1-28
<dispo/date>MANUALS SENT TO JOSE - 2/13/80
<message>
<answer>
<f/u>
<filed>BRAZIL - 2/13/80

<ret-gb>
<roll>
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<subj>CALIFORNIA INSTITUTE OF TECHNOLOGY
<from>SUTHERLAND, IVAN
<to>BELL, GORDON
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<date rec>1/18/80
<log#>1-27
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<filed>
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<subj>NATIONAL ACADEMY OF ENGINEERING
<from>BOLEY, BRUNO A.
<to>MEMBERS
<date>80/1/10
<date rec>1/18/80
<log#>1-26
<dispo/date>TO LETTERBOOK (GB1.S1.35) - 1/25/80
<message>
<answer>
<f/u>
<filed>
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<roll>
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<subj>NATIONAL ACADEMY OF ENGINEERING
<from>PERKINS, COURTLAND D.
<to>MEMBERS
<date>80/1/11
<date rec>1/18/80
<log#>1-25
<dispo/date>
<message>

<answer>
<f/u>
<filed>
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<roll>
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<subj>RESUME' - DICK SITES
<from>JOHNSON, BILL (ML1-2/E65)
<to>BELL, GORDON
<date>80/1/16
<date rec>1/18/80
<log#>1-24
<dispo/date>
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<answer>
<f/u>
<filed>
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<subj>UNIVERSITY OF CAMBRIDGE
<from>WILKES, MAURICE V.
<to>BELL, GORDON
<date>80/1/4/80
<date rec>1/18/80
<log#>1-23
<dispo/date>
<message>
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<f/u>
<filed>
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<roll>
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<subj>CHARLES BABBAGE INSTITUTE
<from>ARMER, PAUL
<to>BELL, GORDON
<date>80/1/7
<date rec>1/17/80

<log#>1-22
<dispo/date>TO LETTERBOOK (GB1.S1.33) - 1/30/80
<message>
<answer>
<f/u>
<filed>
<ret-gb>
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<subj>IEEE
<from>WEINSCHEL, BRUNO O.
<to>BELL, GORDON
<date>80/1/11
<date rec>1/16/80
<log#>1-21
<dispo/date>TO LETTERBOOK (GB1.S1.39) - 1/25/80
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<f/u>
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<subj>CHAPLIN, CASNER & EDWARDS
<from>CHAPLIN, ANSEL B.
<to>BELL, GORDON
<date>80/1.15
<date rec>1/16/80
<log#>1-20
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
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<subj>ROSETTA STONE ASSOCIATES, INC.
<from>FUREY, JOHN F.

<to>BELL, GORDON
<date>80/1/14
<date rec>1/16/80
<log#>1-19
<dispo/date>MARCY KENAH - 1/18/80
<message>NOTE.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>TECHNICAL RESEARCH INC.
<from>MILLER, COLE
<to>BELL, GORDON
<date>80/1/?
<date rec>1/15/80
<log#>1-18
<dispo/date>
<message>
<answer>
<f/u>
<filed>
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<roll>
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<subj>RESUME' - JEFFREY MARK SISKIND
<from>SISKIND, JEFFREY MARK
<to>BELL, GORDON
<date>80/1/10
<date rec>1/15/80
<log#>1-17
<dispo/date>ARMAND LA VALLE - 1/16/80
<message>ARMAND, PLEAS CALL - GORDON OUT OF TOWN...
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>CASE WESTERN RESERVE UNIVERSITY
<from>ROSE, CHARLES, W.
<to>BELL, GORDON
<date>80/1/10
<date rec>1/15/80
<log#>1-16
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>SOFTWARE ENGINEERING - BOOK 1
<from>SHELDON, LIZ
<to>BELL, GORDON
<date>80/1/?
<date rec>1/11/80
<log#>1-15
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>PERKIN-ELMER CORPORATION
<from>SORENSEN, ROBERT H.
<to>BELL, GORDON
<date>80/1/9
<date rec>1/11/80
<log#>1-14
<dispo/date>
<message>
<answer>
<f/u>
<filed>

<ret-gb>
<roll>
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<subj>RESUME' - JOHN A. HILL
<from>HILL, JOHN A.
<to>BELL, GORDON
<date>80/1/2
<date rec>1/11/80
<log#>1-13
<dispo/date>ARMAND LA VALLE (CC:SI) - 1/14/80
<message>PLEASE ANSWER.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>NANODATA CORPORATION
<from>SENFT, MICHAEL C.
<to>BELL, GORDON
<date>80/1/8
<date rec>1/11/80
<log#>1-12
<dispo/date>SAM FULLER - 1/14/80
<message>DO YOU SEE ANY REASON WHY WE'D NEED ONE?
<answer>1) I AM SURE DEC SHOULD NOT GET A QM-1 BECAUSE: A. VERY OLD TECHNOLOGY B. DIVERT ATTENTION FROM BETTER PROJECTS. 2) IT WOULD BE WORTHWILE TO SEND ON OF OUR MICROPROCESSOR DESIGNERS TO THE USER GROUP MEETING TO SEE HOW "THE OTHER 1/2 OF THE INDUSTRY" DESIGNS MICROPROCESSORS (E.G. SIMON STEELY? STEVE ROTHMAN? DAVE CANE? IT WOULD BE FUN TO GET AUNIVERSITY WITH A QM-1 TO EMULATE THE VAX & SEE HOW IT STACKS UP AGAINST OUR VAXES! - 1/29/80
<f/u>1/25/80
<filed>
<ret-gb>
<roll>
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<subj>GARNER-BORDEN COMPANY, THE

<from>BORDEN, ROBERT P.
<to>BELL, GORDON
<date>79/12/28
<date rec>1/9/80
<log#>1-11
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>UNITED TECHNOLOGIES RESEARCH CENTER
<from>DEMARIA A.J.
<to>BELL, GORDON
<date>80/1/7
<date rec>1/9/80
<log#>1-10
<dispo/date>
<message>
<answer>
<f/u>
<filed>NAE - MEMBERSHIP CO. - 1/14/80
<ret-gb>
<roll>
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<subj>MORGANSTERN, MICHAEL
<from>MORGANSTERN, MICHAEL
<to>BELL, GORDON
<date>80/1/?
<date rec>1/9/80
<log#>1-9
<dispo/date>JOHN MEYER - 1/11/80
<message>WHAT'S THE ISSUE?
<answer>
<f/u>1/18/80
<filed>
<ret-gb>
<roll>

<>

<subj>INVESTORS REALTY
<from>MAUREY, JERRY
<to>BELL, GORDON
<date>79/12/18
<date rec>1/8/80
<log#>1-8
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>CAHNERS PUBLISHING COMPANY
<from>WYNKOOP, ROBERT C.
<to>BELL, GORDON
<date>80/1/4
<date rec>1/7/80
<log#>1-7
<dispo/date>
<message>
<answer>
<f/u>
<filed>NO (FILE #13) - 1/9/80
<ret-gb>
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<subj>UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN
<from>VAN VALKENBURG, M.E.
<to>COLLEAGUE
<date>80/1/4
<date rec>1/7/80
<log#>1-6
<dispo/date>KEN OLSEN - 1/9/80
<message>PLEASE SIGN + RETURN TO ME.
<answer>
<f/u>

<filed>
<ret-gb>
<roll>
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<subj>PARTNERS FOR LIVABLE PLACES
<from>MCNULTY, ROBERT H.
<to>BELL, GORDON
<date>79/12/27
<date rec>1/7/80
<log#>1-5
<dispo/date>GEORGE CHAMBERLAIN - 1/8/80
<message>YOURS.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>BOSTON RESEARCH DIRECTORS' CLUB
<from>LUNDSTROM, JERRY E.
<to>MEMBERS OF THE BOARD
<date>80/1/?
<date rec>1/4/80
<log#>1-4
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>UNIVERSITY OF CALIFORNIA, LOS ANGELES
<from>KENNER, PATRICIA
<to>OLSEN, KENNETH
<date>12/17/79
<date rec>1/2/80
<log#>1-3
<dispo/date>KEN OLSEN - 1/4/80 CC:CRAWFORD, VLACH, MARCUS,

CADY, DEMMER, RODGERS, CLAYTON, PICOTT, TRAVIS, GILMORE, ME
<message>I SAY NO! AL CRAWFORD COULD FILL IT OUT IF YOU THINK IT'S WORTHWHILE.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>BOSTON UNIVERSITY
<from>O'DETTE, DEBORAH A.
<to>BELL, GORDON
<date>12/21/79
<date rec>1/2/80
<log#>1-2
<dispo/date>JOHN MEYER - 1/2/80
<message>PLEASE HANDLE.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>PROPOSAL TO THE NATIONAL SCIENCE FOUNDATION
<from>NSF
<to>BELL, GORDON
<date>11/1/79
<date rec>1/2/80
<log#>1-1
<dispo/date>CIRCULATE - 1/2/80 (ZIMMER, GLORIOSO)
<message>ANY USE?
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>NRC--NATIONAL RESEARCH COUNCIL QUESTIONNAIRE

<from>BLACKBURN, JACK
<to>BELL, GORDON
<date>79/12/31
<date rec>1/3/80
<log#>1-1
<dispo/date>CC:JIM BELL,SAM,ULF - 1/4/80
<message>SHOULD WE FILL THIS OUT? WILL IT JEPORDIZE OUR COMPETITIVE POSTURE? JIM, HOW MUCH TROUBLE? I'D LIKE US TO FILL IT OUT.
<answer>
<f/u>1/11/80
<filed>
<ret-gb>ORIGNAL - 1/4/80
<roll>
<>
Prompted by a recent presentation on this at MCE, here's my cut:

INDIVIDUALS..

IQ's are higher by 10 points (Fortune 5/82). Higher literacy
Lower wages, but increasing.
They work harder. Net equals more thoughts and actions per yen
Less individualistic and willing to accept other ideas (anti-NIH)

SOCIETY..

More engineers available to fuel a high technology technocracy
Less lawyers and legal documents to waste time
Few MBA's, thus focus on content versus process of technology
Understands meaning of productivity and quality. They apply them
Understands timeliness, the parametric variable of ROI
Clear goal set of production domination with demonstrated success
Coded language which we don't understand. One way flow of ideas

COMPANIES..

Low operating margins are acceptable
Availability of cheap capital

Better professional demographics because marketing is done by US
Technical training programs
Permanent workforce with 1/2 workers in sweatshops structure
Good management and more stable technical workforce
Less venture capital firms to compete in getting critical mass
Protected market resulting from many factors
Better balance and experience in automation
Ability to manage flow of US research into Corporate products
INDUSTRY INFRASTRUCTURE...
Have the basics including materials versus US trends to systems
Collaborative intercompany behavior for research
Ability to segment mkts. to reduce expense of covering all bases
No "Eastern Electric", hence manufacturing is via companies
Successful acquisition and are beyond US technology in semis, magnetics, displays, optics, etc.
Dominance of consumer electronics for manufacturing understanding
GOVERMENT..
No military creating no productivity for a large expenditure
Less of it to support
Supportive versus conflictive
Directs and funds goals to dominate various industries
OTHER..
Have a single, working view of the 5th Computer Generation
Incredible PR and self and US belief that "Japan Number One"
OUR EDGE...
Individualists. Creativity. Much CAD/CAM is US based. Software engineering. Better higher education, even though it's used for foreigners. Science and research base (funded by DOD). Entrepreneurial belief and structures to exploit ideas.

INNOVATION IN JAPAN--A LESSON FOR US?

The Japanese, are innovating in the right way. How can Japan be the model if their new ideas come from other places? Especially because many ideas probably come from the US, a lot can be learned about their processes of innovation that lead to success. This process takes ideas from research through manufacturing and into the market. In dealing with making prototypes and then developing production capabilities, the Japanese are solving the problems that will lead to more innovations. In the meantime, US industry has been transformed into warehouses, managed by purchasing agents, and I haven't noticed how many ideas come from them. Selling ideas to Japan and then buying back the products that incorporate the ideas will lead only to fewer innovations and to industrial decay in the US.

JAPAN'S STRATEGY AND TACTICS

With 100,000,000 people and virtually no natural resources, Japan has progressed from manufacturing low technology commodities such as textiles to complex machinery, such as the micro-miniature area employing precision optics and precision mechanics in video tape recorders and television. High skill, low cost level technology work is being concentrated in Japan while low skill work such as assembly of things like television sets are done in appropriate off-shore low skill areas such as San Diego.

The overall approach to market domination comes in a four phase attack starting from the development of a domestic industry, often using borrowed technology but controlling imports until it is established. Their second phase is to establish the export base with a reputation for quality and reasonable prices. The third step, major market penetration, depends on cooperation among Japanese companies with respect to their models and using marketing muscle, mass volume, and low prices to rapidly gain market share and knock-out the competition. When there is sufficient market penetration they finally move into market exploitation and totally dominate, for example, in precision cameras.

In Japan, government and business work together in a team sense unlike the highly adversary relationship existing in the US.

The group called MITI, (Ministry of International Trade and Industry) with almost an autocratic power, helps amalgamate strategies commonly referred to as Japan Inc. Digital Equipment Company has had experience in terms of exporting a particular product called MUMPS, a data-base operating system for interactive data-base problems. After six sales of MUMPS in Japan, interpreted by MITI as lost sales, the development of a Japanese mini-computer version was funded. In mid-1978 a Japanese researcher at Carnegie Mellon University asked me for the internal structure of DEC's implementation of MUMPS from a so-called computer science viewpoint. This particular episode shows me how they really have integrated academic research with industrial goals. The US certainly does not have the equivalent of MITI, protecting and aiding major corporations as national resources. In particular the US Government seems to be determined to break up corporations such as IBM, capable of undertaking innovative projects.

The Japanese strategy to win domination is hidden. Their behavior is open: they combine and in computers, different companies position the machines to provide a full line from Japan. They have won the advantage of providing a range of machines so the software runs across that system and avoiding redundant, costly development. Also, this work is based on IBM emulation. Such industrial collusion is not acceptable in the US: when people meet in a hotel room, talking about prices or positioning, they often end up in jail. Yet neither the US Commerce Department or the Labor Department appear to have a plan or personnel to maintain dominance in high technological fields that is important to economy and security. More important, both these departments behave as adversaries to each other and to industry.

Japanese industrial tactics focus is on the centrality of work and loyalty to the company. The work ethic at work is an incredible thing to see. A highly stable work force promotes a certain amount of risk-taking because there is little fear of job termination. In the US, with threats of unemployment, risk-taking keeps declining, and with it innovation. In some groups in US companies, it is difficult to find out who can take a risk. For example, a very nice memory component was developed in a large corporate lab, under DOD sponsorship and

I tried to buy it but found that the Defense Department was bidding against me. All this little lab really wanted to sell was about one a year to the Defense Department to keep their research group going. I wanted 10,000 a year. We just couldn't find anyone within the structure of the large organization who wanted to manufacture the product. It was really tragic, a very good product that could be useful to society and the economy. But I really couldn't even find out who it was who made the decision. Why is research funded in the first place if the goal is not to product a useful device? The group is still doing research in the same area, and the Defense Department is still buying prototypes and there is absolutely no way that the device can ever get out of that laboratory through the divisional bureaucracies and into industry. This really points out the poor coupling between the development of ideas and the mechanisms for exploiting them. Our present government/industrial bureaucracy might well have throttled Edison to one light bulb had he lived one hundred years later.

Quality control has been delegated to the worker as opposed to being managed. This participation provides a key to the devotion to the workplace and a sense of achievement within the fabric of societal goals. Incompetent workers become wards of the organization and not wards of the state, such as teh 300,000 retired, handicapped federal workers. This provides much, local pressure to not be a ward. In the US, the freedom of the individual not to contribute to national goals has undermined the the work ethic.

USING ACCULTURATED DESIGNS

If you look in the sixteenth century, it only took the Japanese 18 months to acquire the manufacture of guns and gunpowder from the Portguese. For any product, they consider quality first, then volume for growth and flexibility to allow for the fast turn around needed to maintain full-production capacity in shifting markets.

They do a superb job of being able to orient their production line with quality and flexibility. The whole issue of semi-conductor quality necessary for building computers seemed to come from the fact that the telephone company buys from other sources, acting as a quality filter. Once you've got volume it is not so easy to get quality. The fact that the Japanese have this separate organization buying and selling really has helped their semi-conductor industry. If you contrast this with our situation, the telephone industry is its own captive supplier. They have quality, of course, but they don't have the technology incentive or cost goals because of the long amortization period.

All the Japanese computer manufacturers have acquired their technology within the past ten years by dealing with US manufacturers, either as a joint venture or under license, including: Fujitsu (Amdahl/Siemens) and Hitachi (RCA); NEC (Honeywell, GE, Varian) and Toshiba (Honeywell, GE, Interdata); Mitsubishi (Xerox) and Oki (with Univac joint venture); Yokogawa (HP); and Nippon Minicomputer (DG). In all cases, the Japanese have improved the technology in terms of perceived quality, performance and manufacturability.

In addition, Japanese computer manufacturers have a complete line of peripherals and test and manufacturing equipment, much of which is based on counter-parts invented in the US. The designs range from "reverse engineered", to look-alike copies, to radically improved products based on Japanese inventions. With "reverse engineering" a product is dissected with micrometers, special gauges, etc, and made compatible in nearly every respect. The Japanese make only products for export to the US market that do violate patents. Tektronix look-alike scopes and reverse engineered IBM disks are common. In 15 months, Nippon Peripherals Limited produced a disk that was mechanically identical to the IBM 3340. From comparing the two drives, one might evern conclude that they were made from the same drawings.

LONG-TERM THINKING

Product design based on need, quality, and long-term projections can lead to innovation. But product design derived from the very thick marketing survey only extrapolates straight line trends in a self-perpetuating fashion. US industry has gotten into the habit of short-term thinking, epitomized by these
surveys whose currency drops off rapidly in weeks after

publication. Japanese companies, with long-term goals and commitments, have little need for marketing surveys and the energy and money they waste, partially because U.S. buyers do their market work for them.

NEC, Fujitsu and Hitachi, unlike Xerox, GE, Westinghouse, and RCA, have all persisted with computer manufacturing and after years of investment have established successful products. Their long-range thinking from the outset allowed them to invest in long lasting quality. NEC was no different in terms of corporate structure than the large U.S. companies that went out of the computer business. But the notion that success follows if one sticks to a fundamental idea has been lost in U.S. corporate thinking.

Isn't it amazing that Japan has been able to focus on quality, sophistication, rather than throw-away products: Seiko vs. Timex watches and Nikons vs. Polaroids. In fact, given their approach to man/machine interaction, it is probably impossible for a Japanese designer to come up with a one-step camera. However, it may be that the overall concern for quality also comes into play.

When considering innovation it is important to distinguish items with a lasting value from just another piece of injection molded plastic, something that will soon be thrown away. The life cycle of industrial products is something that we do not pay enough attention to. We are not trained to think about investment evaluation for any long period of time, and that leads to worrying about the wrong characteristics and the wrong problems. Each new product should be evaluated in terms of maximizing its life, minimizing the cost to use, and maximizing productivity. For example, in Japan, all line printers had paper cutters and paper sorts on them.

UNDERSTANDING COMPLETE PROCESSES

The successful production of competitive performance products in high technology industries depends on understanding a complete process that includes basic research, going through applied research and advanced development, to product development. In addition, a parallel and equally complex process is required to design and build the process that manufactures such products. After a new product is introduced, it may then be necessary to modify and enhance it to adapt it to the real or changing market, and finally to eliminate it when it is no longer effective.

The Japanese need invest little in basic and applied research because they are effectively coupling the U.S. laboratories into their advanced development. In contrast, aside from the direct hiring of students and researchers, there is very little flow of ideas from our public laboratories into our own industry. As Carver Mead of Cal Tech points out, "I like the Japanese. They listen. Also unlike American industry, they're willing to build from our ideas." The university laboratories at Stanford, MIT, Carnegie Mellon, the University of Illinois, receiving significant ($20-30 million per year) Advanced Research Projects Agency (ARPA) funding for Computer Science, have post-doctoral Japanese visitors. The university and industrial laboratories of Japan are headed and staffed by researchers who've spent their research years in key American laboratories such as MIT Multics. The flow of ideas from these centers to the Japanese is better than from these centers into American computing companies. Many of our companies don't even know these centers exist or that money is being poured into them.

Most recently, Japan has offered to spend one billion dollars in the U.S. for research, predominately for energy conversion. By accepting these funds, the Japanese can be even more effectively coupled to U.S. research and can "learn" to research, just as they've learned manufacturing, design and advanced development.

MITI, in contrast to the U.S. government, has few laboratories. They do research by funding and promotion of technical interchange. The Japanese have a good set of techniques for managing the flow of ideas back and forth across boundaries based on industrial need.

The Japanese orientation is clearly based on engineering and design for manufacturing rather than on science. In contrast, manufacturing technology in the U.S. has gone out of the engineering school and into the business school. But there is more to manufacturing than the machine shop scheduling problem. Quality control is often not taught! The invention that can come out of a manufacturing operation (often equalling the amount in the product design itself) is being ignored. Manufacturing engineering is segmented in U.S. colleges and in business. In contrast, in Japan people are rotated among the various processes and disciplines, making it equally desirable to carry out any function. But more significantly, this reinforces the understanding of innovation feeding backward and forward in affecting total processes.

The Japanese have shown that they are willing to give up profit for growth. For example, RCA is now a rug maker (or distributor), car renter, publisher, television component distributor; it hardly resembles the electronics company that pioneered televisions. RCA's role is that of a banker and such a conglomerate is no match for a serious manufacturer. Whereas there is extreme pressure on our business for profit and return on investment, these factors are less important to the Japanese companies. In computing, NEC or Hitachi computer divisions took a long time to become profitable. Japanese companies are buying market share. Given the growth phase, these companies would not compete for capital in the U.S. stock market where return-on-investment is the key criterion.

A gradual erosion of carrying out whole processes in the U.S. through a series of incremental decisions has lead to the erosion of U.S. industry as a whole. Not only has control and market share been lost, but also the whole process that lead to coming up with good ideas. The people who really have the vision to come up with the good ideas are those actually carrying out the totality of the manufacturing process and deal with issues of quality day in and day out. Today, these are the Japanese. We are fools if we think that U.S. industry will be healthy only playing the role of a distributor.

TECHNOLOGY AND THE FUTURE

An overriding element of time and patience is the key to the long term success of the Japanese. They have been willing to wait for a whole variety of material goods, but they really work at obtaining up-to-date information relative to developing innovations. They are impatient with trivial nuisances, inventing and using automatic taxi door openers for example, but have been patient in achieving quality performance prior to going into a field.

The Japanese, as I do, believe computers are fundamental for the long term and they are prepared to invest in them and wait. Not only are machines used in all products they build for export, but they save labor too. Labor is both precious and expensive in Japan: There are only about one hundred million people with two percent unemployment. They must have computers to raise productivity; computers are vital to their continued domination of manufacturing. As a separate research area robots are an important component of manufacturing domination. While much of the pioneering work was done in the U.S., the continued work to make robotics practical takes places in Japan.

In the U.S., in contrast, the role of the computer and robot is still debated, while our disgruntled workforce grows impatient carrying out meaningless work on throw-away items. We must return to valuing the understanding of our technology so that we stop being the slaves of Japanese enterprise.

Acknowledgment

The author is especially indebted to his wife, Gwen Bell, who took the transcribed talk, notes and ideas for the talk, and

converted them into the current paper.

Pat McGuire, Mary Jane Forbes, and Sue Hunt typed and edited the final document.

Prompted by a recent presentation on this at MCE, here's my cut:

INDIVIDUALS

IQ's are higher by 10 points (Fortune 5/82). Higher literacy
Lower wages, but increasing.
They work harder. Net equals more thoughts and actions per yen
Less individualistic and willing to accept other ideas (anti-NIH)

SOCIETY

More engineers available to fuel a high technology technocracy
Less lawyers and legal documents to waste time
Few MBA's, thus focus on content versus process of technology
Understands meaning of productivity and quality. They apply them
Understands timeliness, the parametric variable of ROI
Clear goal set of production domination with demonstrated success
Coded language which we don't understand. One way flow of ideas

COMPANIES

Low operating margins are acceptable
Availability of cheap capital
Better professional demographics because marketing is done by US
Technical training programs
Permanent workforce with 1/2 workers in sweatshops structure
Good management and more stable technical workforce
Less venture capital firms to compete in getting critical mass
Protected market resulting from many factors
Better balance and experience in automation
Ability to manage flow of US research into Corporate products

INDUSTRY INFRASTRUCTURE

Have the basics including materials versus US trends to systems
Collaborative intercompany behavior for research

Ability to segment mkts. to reduce expense of covering all bases
No "Eastern Electric", hence manufacturing is via companies
Successful acquisition and are beyond US technology in semis, magnetics, displays, optics, etc.
Dominance of consumer electronics for manufacturing understanding

GOVERMENT

No military creating no productivity for a large expenditure
Less of it to support
Supportive versus conflictive
Directs and funds goals to dominate various industries

OTHER

Have a single, working view of the 5th Computer Generation
Incredible PR and self and US belief that "Japan Number One"

OUR EDGE

Individualists. Creativity. Much CAD/CAM is US based. Software engineering. Better higher education, even though it's used for foreigners. Science and research base (funded by DOD). Entrepreneurial belief and structures to exploit ideas.

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PRODUCT/COMPANY      |FU HI  NE  MI  TO  OK  MA  SH  |SO SA  SE
                     CA  CN  SD  JV  PI  |CI BR  TE  JU  |TC YE
                     TD  AL  KY  |FX RK  |DE
      POWER SUPPLY   |P  P   P   P   P   P   S   P   |P  P   P   P
      P              P   P   P   |P  P   P   P   |   P   P   M   P
      |P             P   |P
      PASSIVE COMP   |S  S   S   S   S   -   S   -   |-  -   -   -
      -              -   -   -   |-  -   -   -   |-  -   S   S   M
      |-             -   |-
      PHYS. INT. CON |P  P   P   S   P   -   S   -   |-  -   -   -
      -              -   -   -   |-  -   -   -   |-  -   S   -   M
      |-             -   |P
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SEMI  |                                      |
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      VLSI           |S  S   S   S   S   S   S   S   |P      P
      P                      |               |
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      |                 |P
      CMOS GA       |S  S   P   P   S   S   P   P   |P  -   -   -
      -             -           |               |
      |                 |-
      BIP GA        |S  S   S   P   P   P   P   P   |P
                                |               |
      |                 |P
      ECL/CML GA    |S  P   P   P   P   -   -       |R
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      |                 |-
      H/S (JJ,GaAs) |R  R   R   R   R       R   R   |R
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DISPLAY             |                               |
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      |                 |
      ELD,LCD,PLASMA|S  S           S           S   |       S
                                |               |
      |                 |-
      CRT           |-  S   S   S   S       S       |S
                                |D              |
      |                 |I
      TV            |   S   S   S   S       S   S   |S  S
                        S       |               |
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PRINTER             |                               |
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      |                 |
      KEYBOARD      |S  P   P   P   P       S   P   |P  -   P   -
      -             -           |   S           |           S
      |                 |P
      DOT MATRIX    |S  P   -   -   -   S   -   P   |-  -   S   -
      P             -           |D  S   S   S   |           S
      |                 |P
      FAX           |S  S   S   S   S   S   S   S   |
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       |S              S   |
       DAISY           |-      S           S           |-
                                   |M  S   S       |
       |                   |-
       COPIER          |-              S           S   |
       S                           |               |
       |S              S   |-
       THERMAL         |-  -   -   -   -   S   -   -   |-  -   S   -
       P               -           |S  S   S       |           S
       |                   |R
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       ROBETICS        |S  S   S   S   S       P   P   |P
                                   |               |
       |                   |
       IMAGE PROC      |                               |
                                   |               |
       |                   |
       VOICE I/O       |R  R   S   S   S   R   R   S   |R      S   S
                                   |               |
       |                   |R
       AUDIO           |   S   S   S   S       S   S   |S  S
                           S   S   |               |
       |                   |
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MEMORY |                                           |
                               |               |                   |
                       |
       FLOPPY          |   S   S   S   S       S       |
       S                           |       S       |S  S       S
       |                   |P
       MINI WINI       |S  S   S   S   S               |
                                   |               |S
       |                   |-
       LG WINI         |S  S   S   S   S               |
                                   |               |
       |                   |P
       TAPE            |S  S   S                       |
                                   |               |S
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      |                |P
      VTR             |   S   S   S   S       S   S   |S  S
                         S   S   |               |
      |                |R
      VIDEO DISK      |R  S           S       S   S   |S  S
                         S   S   |               |
      |                |-
      LG MASS STOR    |S  S   S                       |
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L/S   |                                          |
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      FIBER OPTICS    |S  S   S       S           P   |R
                                 |               |
      |                |-
      RADIO LINK      |S  S   S       S   S           |
                                 |               |
      |                |
      PABX            |S  S   S       S   S           |
                                 |               |
      |                |
      LAN'S           |S  S   S                       |
                                 |               |
      |                |S
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CALC, PC, C'S         |                               |
                                 |               |
      |                |
      < 250           |               S       S   S   |       S   S
      S                          |   S               |
      |                |
      250 - 1K        |               S       S   S   |       S   S
      S                          |   S               |
      |                |
      1K - 4K         |S  S   S   S   S   S   S   S   |S  S   S   S
      S               S          |       S       |S          S
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       |S            S   |S
       4K - 16K     |S  S   S   S   S   S   S   S   |S  S   S   S
       S            S          |       S       |
       |S            S   |S
       16K - 64K    |S  S   S   S   S   S   S       |
                               |              |
       |                 |S
       64K - 256K   |S  S   S   S   S           |
                               |              |
       |                 |S
       256K - 1M    |S  S   S   S               |
                               |              |
       |                 |S
       > 1M         |S  S   S   S               |
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FU - FUJITSU          HI - HITACHI   NE - NEC      MI -
MITSUBISHI            TO - TOSHIBA   OK - OKI      MA -
MATSUSHITA
SH - SHARP            SO - SONY      SA - SANYO    SE -
SEIKO                 CA - CASIO     CN - CANON    SD -
SORD
JV - JVC              PI - PIONEER   CI - C. ITOH  BR -
BROTHER               TE - TEC       JU - JUKI     TC -
TEAC
YE - YE DATA          TD - TDK       AL - ALPS     KY -
KYOCERA               FX - FUJI XEROXRK - RICOH    DE -
DEC
S = SELL (USE AND MAKE)              R = RESEARCH  M =
MAKE + SELL           P = PROPRIETARY (MAKE + USE)
D = DISTRIBUTOR FOR SOMEONE ELSE     - = BUY & USES
                                     BLANK = DON'T KNOW
OR UNINVOLVED         GB:3.S6.4
July 20, 1982
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Fisher Lee
General Manager
China Computer Corporation

Room A, 5th Fl., 126 Nanking E. Rd.
Sec. 4, Taipei, Taiwan, R.O.C.

Dear Fisher:

Let me drop you this brief note to thank you for the wonderful hospitality that was extended to me on my recent visit to Taiwan.
Most importantly, I was impressed with the large number of VAX's I saw at the universities. It was also very nice to see the fine co-operation between your company and Digital Service. Also, the rapid growth of your company has been outstanding. I hope this growth can continue at the current rate. In a separate letter to Mathew (and you) I urge you to look at installing Ethernets as a way to get much more out of the computing environments at the universities.

Sincerely,

Gordon Bell
Vice President, Engineering
Curator, The Digital Computer Museum

CC: Bob Chen, Digital, Hong Kong
Jerry Witmore
Dick Yen

July 20, 1982

Mr. Mathew Miao, President
China Computer Corporation
Room A, 5th Fl., 126 Nanking E. Rd.
Sec. 4, Taipei, Taiwan, R.O.C.

Dear Mathew:

I was delighted to meet and visit you in Taiwan during July 5-7. T growth and competence in your country is really impressive. Everything looked good to me: drive, young leadership, the universities and the overall industrial climate.

Most important of all to me personally was seeing the large array o VAX's at the various universites. I believe you have a great chanc to do really first rate research there by by encouraging the universities to have Ethernets to connect their individual machines a campus together. I would also then like to see all the nets lin together to form a complete network of all the machines. This woul give a very strong project focus to getting going to build distribu processing via networks.

It was a pleasure to discuss the Computer Museum with you and prese the vision of continuing to build an international, industry-wide museum for this most significant invention--the "computer." The wo "Digital" is being dropped from it's name to avoid confusion. Enclosed is the first report and a museum layout which includes an invitation to become a member.

I would like to invite you to become either an institutional or personal founder to make this a significant international museum. will note that the list of founders includes pioneers such as Gene Amdahl and Bob Noyce.

The museum also invites you to supply important artifacts for thei historical preservation. Your Chinese typewriters and terminals wo qualify. The current list is included in the report and grows rapidly.

I'd welcome being able to show you the growing museum whenever you visit this area.

Most of all I hope you can visit me so I can try to repay the fine Chinese banquets and hospitality you extended to me in Taipei.

Sincerely,

Gordon Bell
Vice President, Engineering
Curator, The Computer Museum

CC: Dr. Gwen Bell, Director, The Computer Museum
Robert Chen, Digital Hong Kong
Fisher Lee, General Manager, China Computer Corporation
Jerry Witmore, Digital Equipment Corporation
Dick Yen, Digital Equipment Corporation

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|   |   |   |   |   |   |   |                 m e m o r a n d u m
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SUBJ: JAPANESE ELECTRONICS INDUSTRY

TO: Operations Committee
PEG
Tom Kobayashi
Henry Crouse
Dick Clayton

Date: JULY 19, 1982
From: Gordon Bell
Dept: Eng. Staff
MS: ML12-1/A51 Ext: 223-
2236
EMS: @CORE

Tom and I started this, In addition, a table of these supplier/competitors is needed in terms of size, # people, R & D.

The basis is whether a company is some combination of
a maker (design & mfg.)
buyer
user
seller

Note that all the audio suppliers are going to Digital (eg. TEAC) and with some saturation are becoming Digital suppliers. Also consumer electronics includes calculators, etc.

ATTACHMENT: GB3.S6.4

Japan Trip Diary Index - 1978

PLACE WHO DESCRIPTION

DEC: Tokyo Yu Hata Host + dinner with his wife, Don Frost at Yu Hata's son's apartment

DEC: Osaka their end-of-the-year party.

ETL (Electro Technical Lab) -run by MITI (Ministry of Trade/Industry

Dr. Nishino

Dr. Mori Gave a talk on the VAX design

FUJITSU, Kawosaki Central lab

Mr. Kurosaki

Mr. Sato

FUJITSU, Numazau

HITACHI: Yamamota, head of semis Getting info from Hamel

KEIO U Professor Toroko

Professor Nori Doi Showed us around . The main professor wasn't there.

NEC, Kyushu Mr. Iwao Chief Engineer, took us around

NEC, Tokyo Their people from Central Research.

Dr. Yashiteru Ishii

Mr. Kitamura

NEC, Maynard 11/11/81

Dr. Kani,Corporate Engineering Mgr. Microcomputers

Mr. Matsue, Corporate Mgr. Memory Products

Dr. Sasaki, Assistant General Manager IC Division

SONY, Tokyo Central Research Lab

Plus went to Sony's Atsugi plant

Mr. KAZUO Iwama President and technical person

Kyoto U Gave talk

Osaka U Gave talk

Kyoto Sanyo U Dr. Yugo Araki Gave talk + dinner

U of Tokyo   Gave lecture on minicomputer architecture
     Prof. Ashida
     Prof. Hiroshi Inose
     Professor Tohru Moto-oka

Sightseeing at Kyoto   Palace of the Emperor Shugakuin outside
     Gen Narui of Kyoto,   Arashi-Tei, a restaurant
     Miss Tomioka   overlooked the Hozu River. Visit the Nijo-Jo castle in the center of Kyoto. Tawaraya Inn

Sightseeing at Nara Todaiji Temple, Taishi Shrine
          Old inn called Tonochaya
          Toshodaiji Temple & Yakushaji Temple.

00 CORE DECGRAM ACCEPTED S 003516 O 436 20-JUL-82 17:49:26

****
* d i g i t a l *
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TO: TOM KOBAYASHI   DATE: TUE 20 JUL 1982 3:03 PM EDT
    GRANT SAVIERS   FROM: GORDON BELL
cc: OPERATIONS COMMITTEE: DEPT: ENG STAFF
    PEG: EXT: 223-2236
                                     LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5170097356

SUBJECT: CONTINUING TO BUILD SOME JAPANESE CORPORATE PROFILES

I was surprised to find the large number of engineers (10,000) at
Kawaski, given that Fujitsu is smaller than we are. The one page
matrix of 28 companies by 50 technologies gives a very general overview of the makeup of a company.

Can we continue and make the rest of the grid which gives:
size, growth rate, some financial measures, sites, research and

development attitudes, key technologies they own (with effort)?

For example it's helpful to know the makeup of how much Sharp is
into computing... since it's a 5B company. I'd also list some US
companies like Univac, Intel, Burroughs, AMD, etc for a comparison. My gut says that there's about as much information processing equipment (semis and calculators and typewriters included) coming out of Japan now as the US.

If we had such a profile and dossier and kept it in our market data center library it would sure make visiting companies a lot easier.

Was surprised to find that as we toured Hitachi Central Research the guide carried a 1/2" thick dossier on me/DEC that included various papers including the Fortune article and various visits with Hitachi people.

This feels very important to do.

WPS USERS - Leave HP mode and type <CR>

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+---------------------------+                          GB3.S6.22
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| d | i | g | i | t | a | l |                 i n t e r o f f i c e
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SUBJ: ENGINEERING IN JAPAN: LET'S MOVE!

TO: OPERATIONS COMMITTEE
PEG
GRANT SAVIERS
JERRY WITMORE

Date: JULY 21, 1982
From: Gordon Bell
Dept: Eng. Staff
MS: ML12-1/A51 Ext: 223-2236
EMS: @CORE

1. The engineering is superb in scope (see 2), cost, quality and timeliness.

The supply of all types is plentiful, including support for quick turn-around of prototypes for boards, mechanisms and plastics. Purchasing and manufacturing people also have engineering degrees. The GO playing, high IQ and literacy shows. The cost per engineer is about 0.7 x US, but not a reason per se. The strong work ethic, focus and understanding of quality both in engineering and manufacturing will result in a factor of two in overall productivity, I believe. We have much to learn here.

2. Many consumer and computer technologies are now indigenous, especially since the saturation of audio/video market. These are now the basis of computing, including:

optics and fiber optics - innovation is rampant in switching
matrix printing - Kanji demands high resolution
xerographic - all sorts of opportunities, eg FUJI-XEROX
fax - for Kanji
Daisywheel -
liquid crystal, electro - lumenescent panels, small crts
keyboards - all new typewriters are electronic (watch out!)
tape, floppies, and small Winis (eg. TEAC)
voice i/o - Sharpe to show proto of 2K word voice typewriter
crt's and videotechnology including disks and tapes
semiconductors - see 3

From a customer perspective, we must be here to buy and understand the possibilities.

3. Semiconductors are very good and getting better. NTT may have a breakthrough in terms of their Hierarchial Design Language (based on Conlan and ISP... I'm obviously biassed) which is oriented to specifying the design rather than trying to tweak it into existence at the tube. Their large CPU chip done in 2 months used it. NTT described the language 1 year ago, inside Japan. They are going to use it as a quick turn-around for small firms supposedly. The big users have similar systems in Research and in some development. Saw a system very much like the Si Compiler.

Saturday morning I was handed two Hitachi CMOS static rams for test and evaluation using 2 micron CMOS with 2 poly. They're running 2 metal now also. In 2 years it's one micron. Saw .8 micron at the research center from a Class 1 clean room (with 0 particles and 16 people in it). One megabit is on target for ship in '85. I make this a 3 year lead.

Several companies are interested to design and build a one chip VAX, which they admire.

4. Tokyo has the urgency of technocracy of Si Valley, without the movement of people. Ideas do move in a very competitive way. "Known" technology like low cost and/or high quality print heads, recording heads, etc. are plentiful everywhere. kanji is a good focus for excellence in printing. We were going to buy heads here, move them to the US for designing and then build them somewhere in the Far East. This makes no sense due to availability of whole mechanisms and the need for close interfacing and no real technology to build on in ML. JEC is promising a factor of 2 better in every dimension (time, cost to design and cost to build), so we do have to give them the chance. DEC Japan-CSS just introduced a Kanji VT80 and LA80 with a 9 month gestation time, based on VT100 case and PS.

Designing and building complete products here will eliminate a whole series of content-free, boondoggling, process-oriented buyers, sellers and negotiators which only add time and overhead.

5. Engineering-Manufacturing organizations do the work and are responsible with little or no marketing organizations. Engineers take responsibility for product definition.

Four years ago when I first put forth the thesis that lawyers and MBAs had ruined US industry, it was little more than a conjecture. Now that everyone has picked the theme up it must be right. It clearly seems right based on talking to my counterparts here.

By having no marketing outside of sales and engineering, delays and costs are reduced, noise is non-existent, and only two groups are responsible instead of three. Product responsibility is clear.

6. Saturday morning I visited a small, but very innovative company doing all sorts of fiber optical devices. These companies are not visible outside Japan, but they provide much of the infra structure for innovative products by the large companies.

7. There are also research results such as the Fifth Computer Generation Project we can couple to. Fujitsu, 3/4 our size has two times the engineers in ISP and lots of technology. IBM has a large, 1000 person facility and just sent a very senior researcher to establish a VLSI research center.

8. There is really no choice: either we make products competitively here under the DEC name, or we buy them on a purely random basis when the suppliers and needs arise as a crisis (eg. LA50). In both cases we need more presence (including being a competitive Japanese company which includes more than sales). This is not to say that we make, not buy everything, but that we need to have the alternative.

We must not become like our former neighbor, HH Scott in learning too late that Japan had much to offer in design and manufacture.

I look forward to PEG, OC and BOD support to establish and then accelerate our Japan Engineering Center.

R>

00 CORE DECGRAM ACCEPTED S 001091 O 440 27-JUN-82
23:34:12

****
* d i g i t a l *
****

TO: GRANT SAVIERS DATE: SUN 27 JUN
1982 11:11 PM EDT

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION DEPT: ENG STAFF

EXT: 223-2236

LOC/MAIL STOP: ML12-
1/A51

MESSAGE ID:
5167764623

SUBJECT: ENGINEERING IN JAPAN ; LET'S MOVE

I'M EVEN MORE POSITIVE ABOUT OUR JAPANESE ENGINEERING
BECAUSE;

1. THE ENGINEERING IS SUPERB IN SCOPE (SEE 2), COST, QUALITY
AND TIMELINESS.

THE SUPPLY OF ALL TYPES IS PLENTIFUL, INCLUDING SUPPORT
FOR QUICK~
TURN-AROUND OF PROTOTYPES FOR BOARDS, MECHANISMS AND
PLASTICS.
PURCHASING AND MANUFACTURING PEOPLE ALSO HAVE ENGINEERING
DEGREES. THE GO PLAYING, HIGH IQ AND LITERACY SHOWS.
THE COST
PER ENGINEER IS ABOUT 0.7 X US, BUT NOT A REASON PER SE.
THE STRONG WORK ETHIC, FOCUS AND UNDERSTANDING OF QUALITY
BOTH IN
ENGINEERING AND MANUFACTURING WILL RESULT IN A FACTOR OF
TWO IN
OVERALL PRODUCTIVITY, I BELIEVE. WE HAVE MUCH TO LEARN

HERE.

2. MANY CONSUMER AND COMPUTER TECHNOLOGIES ARE NOW INDIGENOUS,
   ESPECIALLY SINCE THE SATURATION OF AUDIO/VIDEO MARKET. THESE ARE
   NOW THE BASIS OF COMPUTING, INCLUDING;
OPTICS AND FIER OPTICS- INNOVATION IS RAMPANT IN SWITCHING MATRIX
     PRINTING-KANJI DEMANDS HIGH RESOLUTION
     XEROGRAPHIC- ALL SORTS OF OPORTUNITIES, EG FUJI-XEROX
     FAX- FOR KANJI
     DAISYWHEEL-\par   LIQUID CRYSTAL, ELECTRO-LUMENESCENT PANELS, SMALL CRTS
     KEYBOARDS- FROM ALL NEW ELECTRONIC TYPEWRITERS (WATCH OUT!)
5
     TAPE, FLOPPIES, AND SMALL WINIS (EG. TEAC)
     VOICE I/O- SHARPE TO SHOWPROTO OF 2K WORD VOICE TYPEWRITER
     CRT'S AND VIDEOTECHNOLOGY INCLUDING DISKS AND TAPES
     SEMICONDUCTORS- SEE 3

  FROM A CUSTOMER PERSPECTIVE, WE MUST BE HERE TO BUY AND UNDERSTAND THE
  POSSIBLITIES.

3. SEMICONDUCTORS ARE VERY GOOD AND GETTING BETTER. NTT MAY
   HAVE A BREAKTHROUGH IN TERMS OF THEIR HIERARCHIAL DESIGN
   LANGUAGE(BASED ON CONLAN AND ISP... I'M OBVIOUSLY BIASSED)
WHICH IS ORIENTED TO SPECIFIYING THE DESIGN RATHER THAN TRYING TO ~
   TWEAK IT INTO EXISTENCE AT THE TUBE. THEIR LARGE CPU CHIP DONE
   IN 2 MONTHS USED IT. NTT DESCRIBED THE LANGUAGE 1 YEAR AGO, INSIDE
   JAPAN. THEY ARE GOING TO USE IT AS A QUICK TURN-AROUND FOR SMALL

FIRMS SUPPOSEDLY. THEBIG USERS HAVE SIMILAR SYSTEMS IN
RESEARCH AND IN SOME DEVELOPMENT. SAW A SYSTEM VERY
MUCH LIKE THE SI COMPILER. THEY BELIEVE LITTLE RESEARCH
ISNEEDED
IN VLSI CAD!

SATURDAY MORNNG I WAS HANDED TWO HITACHI CMOS STATIC
RAMSFOR
TEST AND EVALUATION USING 2 MICRON CMOS WITH 2 POLY.
THEY'RE
RUNNING 2 METAL NOW ALSO. IN 2 YEARS IT'S ONE
MICRON.
SAW .8 MICRON AT THE RESEARCH CENTE FROM A CLASS 1 CLEAN
ROOM (WITH 0PARTICLES AND 16 PEOPLE IN IT). ONE MEGABIT
IS ON
TARGT FOR SHIP N '85. I MAKE THIS A 3 YEAR LEAD.

SEVERAL COMPANIES ARE INTERESTED TO DESIGN AND BUILD A
ONE
CHIP VAX, WHICH THEY ADMIRE.

4. TOKYO HAS THE URGENCY OF TECHNOCRACY OF SI VALLEY,
WITHOUT THE
MOVEMENT OF PEOPLE. IDEAS DO MOVE IN A VERY COMPETITIVE
WAY.
"KNOWN" TECHNOLOGY LIKE LOW COST AND/OR HIGH QUALITY PRINT
HEADS,
RECORDING HEADS, ETC. ARE PLENTIFUL EVERYWHERE. KANJI IS
A
GOOD FOCUS FOR EXCELLENCE IN PRINTING. WE WERE GOING TO
BUY
HEADS HERE, MOVE THEM TO THE US FOR DESIGN INS AND THEN
BUILD
THEM SOMEWHERE IN THE FAR EAST. THIS KES NO SENSE
DUE TO AVAILABILITY OF WHOLE MECHANISMS AND THE NEED FOR

CLOSE
INTERFACING AND NO REAL TECHNOLOGY TO BUILD ON IN ML. JEC IS
PROMISING A FACTOR OF 2 BETTER IN EVERY DIMENSION (TIME, COST
TO DESIGN AND COST TO BUILD)~, SO WE DO HAVE TO GIVE THEM THE
CHANCE. DEC JAPAN-CSS JUST INTRODUCED A KANJI VT80 AND LA80 WITH A
9 MONTH GESTATION TIME, BASED ON VT100 CASE AND PS.

DESINING AND BUILDING COMPLETE PRODUCTS HERE WILL ELIMINATE
A WHOLE SERIES OF BOONDOGGLING, CONTENT-FREE, PROCESS-ORIENTED
BUYERS, SELLERS AND NEGOTIATORS WHICH ONLY ADD TIME
AND OVERHEAD.

5. ENGINEERING-MANUFACTURING ORGANIZATIONS DO THE WORK AND
ARE RESPONSIBLE WITH LITTLE OR NO MARKETING ORGANIZATIONS.
ENGINEERS TAKE RESPONSIBILITY FOR PRODUCT DEFINITION.

FOUR YEARS AGO WHEN I FIRST PUT FORTH THE THESIS THAT LAWYERS
AND MBAS HAD RUINED US INDUSTRY IT WAS LITTLE MORE THAN A CONJECTURE.
NOW THAT EVERYNE HAS PICKED THE THEM UP IT MUST BE RIGHT. IT
CLEARLY SEEMS RIGHT BASED ON TALKING TO MY COUNTERPARTS HERE.

BY HAVING NO MARKETING OUTSIDE OF SALES AND ENGINEERING, DELAYS
AND COSTS ARE REDUCED, NOISE IS NON-EXISTENT, AND ONLY TWO GROUPS
ARE RESPONSIBLE INSTEAD OF THREE. CLEAR PRODUCT RESPONSIBILITY.

6. SATURDAY MORNING I VISITED A VERY SMALL INNOVATIVE COMPANY
BUILDING ALL SORTS OF FIBER OPTICAL DEVICES. THESE

COMPANIES
ARE NOT VISIBLE OUTSIDE JAPAN, BUT THEY PROVIDE MUGH OF THE INFRA
STRUCTURE FOR INNOVATIVE PRODUCTS BY THE LARGECOMPANIES.

7. THERE ARE ALSO RESEARCH RESULTS SUCH AS THE FIFTH COMPUTER
GENERATION PROJECT WE CAN COUPLE TO. FUJITSU, 3/4 OUR SIZE HAS
TWICE ~THE ENGINEERS IN A SINGLE FACILITY AND TECHNOLOGY AND

ENGINEERING MASTERY. IBM HAS A LARGE, 1000 PERSON FACILITY AND
AND HAS JUST SENT A VERY SENIOR RESEARCHER TO ESTABLISH A VLSI
RESEARCH CENTER.

8. INNOVATIVENESS FOR EXAMPLE, FOR YEARS I'VETRIED TO GET A
CALUCULATOR BUILT INTO OUR LA AND VT TERMINALS, NOW,
BROTHER IS SHIPPING A $200 PORTABLE TYPEWRITE WITH BUILT IN
PRINTING CALUCULATOR. W
WE CAN EXPECT THIS KIND OF IMPROVEMENT.

9. THERE IS REALLY NO CHOICE: EITHER WE MAKE PRODUCTS
COMPETITIVELY HERE UNDER THE DEC NAME, OR WE BUY THEM ON
A PURELY RANDOM BASIS WHEN THE SUPPLIERS AND NEEDS ARISE AS A
CRISIS (EG. LA50)s~ IN BOTH CASES WE NEED MORE PRESENCE
(INCLUDING BEING A STRONG JAPANESE COMPANY WHICHINCLUDES
MORE THAN SALES). WE NEEDN'T ALWAYS MAKE THINGS, BUT WE NEED TO HAVE
THE ALTERNATIVE.

WE MUST NOT BECOME LIKE OUR FORMER NEIGHBOR, HH SCOTT IN LEARNING TOO LATE THAT JAPAN HAD MUCH TO OFFER IN DESIGN AND MANUFACTURE.

I LOOK FORWARD TO PEG, OC AND BOD SUPPORT TO ESTABLISH AND THEN ACCELERATE OUR JAPAN ENGINEERING CENTER.

"CC" DISTRIBUTION:

TOM KOBAYASHI OPERATIONS COMMITTEE: PEG:
JERRY WITMORE

March 20, 1979

Dr. Tribus
Room 9-215
77 Massachusetts Avenue
Cambridge, MA 02139

Dear Dr. Tribus:

Thanks for the encouragement on the Japanese paper. I'm delighted to have you share it with people at M.I.T., and would be happy for more feedback on it. It's in the state of trying to be published. If you get the chance, and know the editor of Technology Review, could I ask you to see if they would be interested in it? I've sent it to Fortune Magazine because I know the Editor-In-Chief and thought that their readership was the one I wanted to reach. I would also like to sound out the IEEE, so Weinschel would be a good sounding board for Spectrum, even though I think much of the IEEE regards itself as a bunch of "scientists and citizens of the world", and hence the message is against what they want to project.

I would like to incorporate your two additional examples in the article. If possible, I would love to get permission from the "coach" who suggests doing advanced development for the Japanese to publish his advice on a named basis. Is there a chance that you could somehow get him to write a note to me so that I could get this point of view in the article as typical of how the current liberal, intellectual American regards the situation? Carver Mead's quote on why he likes the Japanese as being ego gratification is typical, and another example would be really nice.

It is becoming increasingly clear to me that we are either going to have to get around to new measures as a society that are not productivity related, or that we should work on the productivity problem. I believe that an economist ought to be able to show rather easily that our decrease in productivity is solely related to our becoming a consumer society where the Japanese produce the goods and we merely do the advanced development, the market research and distribution (all of which only employ a few bright people...as opposed to the many who have previously been happy in producing the goods). Perhaps we should all be happy as Americans who only engage in the intellectual disciplines and consume what the rest of the world supplies us. This certainly makes me worry about whether the bulk of the people who used to build things will be happy, and whether our suppliers will be happy supplying us, given that we don't bring anything to the party?

On your paper, it seems like it is powerful enough already, and mixing Ken in at this point will probably not strenthen it. It might be worth trying to get Ken to work with you on another, but that would certainly be up to him.

Sincerely,

Gordon Bell
Vice President, Engineering
Professor, Computer Science and
Electrical Engineering
Carnegie-Mellon University, on
leave

GB:ljp
GB0001/48

CC: Ken Olsen

March 29, 1979

Professor Mattill
Massachusetts Institute of Technology
Room 10-140
545 Technology Square
Cambridge, MA 02139

Dear Professor Mattill:

Per our telephone conversation, enclosed is my Japan essay.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:ljp
GB0001/54

February 20, 1979

Dr. Myron Tribus, Director
Center for Advanced Engineering Study
Massachusetts Institute of Technology
Cambridge, Massachusetts 02139

Dear Dr. Tribus:

I enjoyed the article you are preparing on risk-taking and the use of roi as a sole measure of business ventureness. I am enclosing an article on Japan that is along these lines too, but from a totally different perspective. You may get some ideas there too and at any rate, I would like to get your comments on the article. Some of the ideas in it will be presented at the meeting at Dartmouth, which you are also attending.

Overall, I believe the paper is good although I felt it might have self-served CDC a bit too much. Also, it seems a bit disjoint. For example, it would be good in the example to give the measures by which the projects were judged worthwhile beyond the roi and what kind of pressures there were on them to stop. A chronology of Plato would be good. What was it traded-off against? Was anyone opposed, given that Norris was for it? What led to the inner city projects? Labor supply? Any government help or hinderance? Why is it a big deal? For example, we've had plants in places which are out of the conventional places (that your average MBA would go to).

Some comments (also see them hidden in the paper) which are relevant:

1. There may be an oversupply of business schools and graduates which are driving American business to the focus on the single measure, roi. The MBA is being worshipped to the exclusion of advanced professional degrees, and though useful, it doesn't do a hell of a lot for us in designing, building, selling and servicing computers. Over time, it seems that the business degreed people take over an industry, and the industry becomes obsolete (e.g., shoes, textiles, lumber, steel) because the graduates are only roi focussed. There is no concept of change or innovation. The biggest innovation here has been LIFO accounting (or FIFO...I never can remember), but this slight of hand doesn't make for better design, new applications, and lower cost manufacturing in any of these industries.

2. There can be similar statements for the legal professions, especially in industries that are heavily regulated. We have 20 times the lawyers on a per capita basis than Japan.

3. There is the essential notion of growth and fast upward mobility that allow the roi to be such a single, clear measure. Graduates love it because the message is clear...versus ones an engineer might give, like all products must add a significant dimension for the user. Or, products must be field enhanceable and compatible with others, whereas a single point product might do better roi-wise.

4. Researchers are far from clean. Laboratories are a way to ease the corporate conscience, despite the fact that nothing useful has come out or been transferred into the product domain. Where do the Japanese get their product ideas anyway?

5. The main point of the paper which I have enclosed is that the Japanese make out because we have become roi focussed, and the best way to get high roi is to not manufacture. Engineering and Manufacturing is a real pain! Marketing (identifying what to warehouse, and what to sell) is quite inexpensive and can be done experimentally...and only takes an MBA degree. If you win, it's fame, mobility, and write up in Fortune Magazine. Thus, it satisfies all the neat criteria of roi, low risk, done by relatively unskilled labor (as an MBA has little or no content except case studies and some definitions), and it doesn't require the complexity of managing and making large investments.

6. The point you make is the simple measure of roi is bad. I try to show this more vividly in the ultimate use of roi to eliminate manufacturing within the U. S. and give it to the Japanese. The result is the three island formulation, in which not investing means that we have to be owned...because there isn't any source of funds left except the Japanese to even do the simple task of

marketing (need identification) and distributing.

7. I think there are a bunch of evils associated with worshipping the market research surveys that are now in vogue. This is an outlet to employee MBAs, but the results only extrapolate the past in a linear fashion.

8. Conglomerates really bug me. These make many industries average, drive out manufacturing (e.g., RCA), focus on banking and dilute any knowledge that quality of the product or service matter.

There was a similar case within DEC where we hung in for about six years having been the first company to introduce a computer for timesharing. The initial roi measures were clearly bad, especially in relation to the small computers, but by staying with it, we ultimately put more machines of this class in the field than GE, Honeywell, RCA, Xerox, Burroughs, NCR and CDC. IBM did not recognize the interactive style and only recently (about 10 years later) endorsed it. The important thing was that we knew it was the right way to supply computing, and this wasn't reinforced by market research which only supports the existing. Note that three of these companies are not now in the computing business, both because of their attitudes on roi and their over estimating of their ability as general managers (something you get with an MBA) as opposed to high (or specific industry) technology managers.

Anyway, you have struck a sympathetic bone in me and hopefully the comments will be useful to the paper. I don't see a need to get together until after you see whether these comments are of any use to you. Also, I'd like comments on the paper.

Sincerely,

Gordon Bell
Vice President, Engineering
Professor, Computer Science
and
Electrical Engineering
Carnegie-Mellon University,
on leave

GB:ljp
GB0001/23

CC: Ken Olsen

Enclosure

April 18, 1979

George R. White
Xerox Corporation
Rochester, New York 14644

Dear George:

Enclosed is a copy of my essay on Japan.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:swh
GB0002/27

February 20, 1979

Mr. Hedley Donovan
Editor in Chief
Fortune Magazine
Time and Life Building
Rockefeller Center
New York, New York 10020

Dear Mr. Donovan,

I would like to take advantage of the fact that we met on one of the Doxiadis Delos cruises and, I believe, regarded each other as reasonable sorts. Thus, I hope you will acknowledge this request.

As a non subscriber, non-reader of Fortune, I read the article by Uttal on computers and Japan. Although the article prompted me to want to write a letter to the editor, I didn't because there was too much to say. The enclosed article, by me, is written from the perspective of a computer technologist and business person, hence I think it has the substance that is needed to address this really important issue.

The article was the result of a visit to Japan last summer and I would hope that it could get wide scale circulation in Fortune. It has been circulated within the computer and engineering community and the readers believe there are worthwhile and novel insights. For example, Bob Noyce, Chairman of the Board of Intel, would be happy to write a foreword for it. Also, I have been invited to give it at Harvard's Asian Studies Institute.

Last week when Bro Uttal was here interviewing officers of Digital for a story, I gave him the article for comment. Now, I would like to proceed to get it published in Fortune.

Please help me.

Sincerely,

Gordon Bell
Vice President, Engineering
Professor, Computer Science
and
Electrical Engineering
Carnegie-Mellon University,
on leave

GB:ljp
GB0001/24

CC: Bro Uttal

Enclosure

IMPRESSIONS ON HOW THE JAPANESE HAVE CONVERTED WORLD INDUSTRY INTO DISTRIBUTORSHIPS -- CONCERN NOW FOR SEMICONDUCTORS AND COMPUTERS

Gordon Bell
Vice President of Engineering,
Digital Equipment Corporation, Maynard, Mass.
Professor of Computer Science and Electrical Engineering (on leave)
Carnegie-Mellon University; Pittsburgh, Pa.

We must be impressed with the intense drive, technical and manufacturing ability of the Japanese. As an island with few natural resources, and only very bright, hard working people they have set about and accomplished the market domination of virtually all manufactured consumer goods including the components and processes to make these goods. Currently the U.S. has a dominant position in computers and semiconductors. However, there's no fundamental reason why the Japanese won't attain what appears to be a basic goal to dominate these industries, given their history in other industries and helped by our governments.

On a first visit to Japanese computer and semiconductor companies, universities, and a government R&D laboratory, I found them relatively open. This was in contrast to my former experience as a computer science researcher with their one-way scientific interchange and being an information sink. Perhaps their openness is because they are so far along with good products, and their position so secure. Their competence, hospitality, and "apparent openness" made me quite fond of them; but I now fear them more than ever.

Based on a simple system of three islands, two supply energy and manufactured goods and one consumes from the other two, the only apparent stability occurs when the two supplier islands "own" the consumer island.

Furthermore, I question whether we (the U.S.) want to be owned in this fashion, and therefore state we may have a problem. It's not the intent to give solutions here.

Forty-odd reasons are given in the form of "feelings" to support this domination conjecture. These reasons vary from a belief that we are comparatively lazy and greedy to the fact that their government and companies get together and systematically plan to dominate an industry.

The reasons for their ability to dominate are formed from my observations, but like the Japanese, taken freely (generally without credit) from other sources with an attempt to make a better, more complete end product for industrial and government users.

BASIC WORK ENVIRONMENT IS STRONGLY COMPETITIVE WITH PLANS (STRATEGY) AND DRIVE (TACTICS) TO DOMINATE AN INDUSTRY

The new recently announced Fujitsu M200 computer appears to be the highest performance, most reliable, plug compatible 360/370 yet announced. The technology originally from the Amdahl Corporation, was improved and made manufacturable in one computer generation of about 6 years.

The Japanese industry and government team is fundamentally more competitive than any other nation. Competition is built into their culture and reinforced by training. For example in mainframe computers they have carried out a plan to build a successful industry, unlike many companies and countries.

We, the computer and semiconductor industries see a clear pattern based on the Japanese performance in textiles, steel, radios, sewing machines, typewriters, quality cameras/optics, small cars, TV, tape recorders, watches, calculators. (Note the progression from low technology/simple commodities to complex manufactured goods.) Their current position in semiconductors and semiconductor-making equipment indicates they are well on plan to dominate semiconductors as a base for electronics, and computers. This will also be the base of products that are electromechanical and will become more electronic intensive.

There is an amalgamation of the Japanese within an industry which creates something that's often referred to as Japan Inc. The Japan Club is a better name, because there's at least a show of competitiveness at the market level. Not only is MITI supportive, they also have relatively autocratic power. More importantly, they interact with industry in a helping way.

They identified and encouraged DEC's early imports in order to build their own industry as described above. For example, one of our important interactive data base systems, MUMPS* was used in six applications. At this point MITI funded the development of MUMPS on a Japanese Mini. In early July a Japanese researcher asked me for the internal architecture of MUMPS, through an academic channel, in order to study its structure from a so-called computer science viewpoint.

While there isn't direct control an connoted by our phrase "Japan Inc.", there is clear collusion and planning among the government, and companies. Not only is collusion among companies illegal in the U.S., but furthermore the role of government is one of discouraging and being an adversary to industry. In the case of IBM, who developed the mainframe computer market, both the U.S. and Japanese governments are determined to destroy the company and set-up the industry for an American distributorship of Japanese products. IBM is a key resource and should be protected as such.

The Japanese government and companies actually plan to win! Such thinking is totally foreign to us. This includes basic strategy setting among the players to segment and go after various markets (e.g., Fujitsu/Hitachi are IBM System 370 plug compatible -- Hitachi is concentrating on the internal Japanese market against IBM Japan and Fujitsu is concentrating on exports). The companies can plan and talk with one another and do, but certainly compete intensively with one another within a limited domain.

With computers, the Japanese strategy has been to couple individual companies to U.S. Companies for technology acculturation and then to pair companies to build the same compatible machines in a quasi planned, competitive fashion. This is a well-known management technique to make technology gains quickly.

Overall, MITI appears to be very strong and competent! The goal of MITI and the Japanese computer companies is a strong, dominant industry! This is in contrast to our standard regulatory 9-5 bureaucrats, who seem to work for either security or power. However they have no real way to make anything happen. Nor is there any measure of their performance. Who believes that our Department of Commerce has anything to do with our position on imports and exports or any understanding position on standards or technology?

Reicshauer hints at the fact that MITI has high quality people, as opposed to our articulate ones. In addition to the right longevity, power, and process, maybe they segment responsibility and measure results with reward based on performance, as for example "winning" in a trade area. In a few samples, I believe it's simple people quality, and the right process enabling them to accomplish something. Being responsible and measured may be the key variable. Here, this suggests we could probably eliminate the Department of Commerce and have no real change except more output, and less government spending on hand-wringing trips to Japan. For starters, a clear change of management and a clear notion of old fashioned responsibility is in order at the Department of Commerce as we see trade deficits increase with no plan in sight and only a trade trip to Japan by Juanita Kreps as a palative.

As the head of our Osaka sales office, who attended graduate school at the University of Kansas, put it: <u>the Japanese live to work versus the American need to work to live</u>. Thus, there is the basic tactical drive to back up any goal to form a dominant market oriented around a company. This is instilled at birth and trained. Work is a central theme.

A company screens its hires carefully since there is a lifetime commitment. In contrast, a recent Intel ad claimed that no interviews were required for hire. Companies only get graduates from certain universities, more extensive than here.

Housing is provided for the workers and they have what amounts to a lifetime contract. This is bad if a person's incompetent, it also means that it's hard to breathe different life into an organization. On the other hand, turn-over is low to non-existent and a team spirit clearly develops as the various members learn to work with one another.

The <u>pressure to work is fed back producing more work output</u> since everyone is working. Unemployment is non-existent and this creates an environment where non-work is unacceptable. Recall how acceptable unemployment is when the U.S. unemployment starts getting high.

<u>Only half the work is done in large companies</u>; <u>small shops buildsub-assemblies</u>. Since large organizations tend to become inefficient and lithargic, they farm out stable sub-assembly production to small shops on a competitive basis. This limits the organization, provides a buffer, and gets the costs down by

a buyer-seller relationship as opposed to operating through a large bureaucratic organization that typifies governments (invariably large and unbounded), large corporations, and large universities.

Their physical condition certainly reflects working, and they have the longest life span in the world now. On one hand there is much smoking, but an anti-smoking campaign is in progress. However, nearly all Japanese are trim versus being basically overweight. Their diet is conducive to trimness and better health, I'd guess. Although alcoholism is supposedly on the rise, the consumption in business I saw was certainly less than in the U.S.

Invention occurs, though they have large, stable companies. Unlike most large U.S. corporations which lose entrepeneurial drive and operate in a stable non-risk taking fashion, the Japanese structure encourages risk because the entrepeneurs can't escape. That is, the large corporation is the only "game in town". The inventors and entrepeneurs of American business escape large organizations in order to start new small businesses. The effect of mixing the two types in their organizations causes continual reform, rejuvination and risk taking.

I believe their manufacturing output is at least equal to the U.S., even though they have half the population. Numerous factors contribute: investment, equipment, less-overhead at the company and by society, work ethic, more output per person over their lifetime and good management attention to personnel details.

PRODUCT DESIGN IS NOT EGO DRIVEN, BUT IS A PLANNED ACCULTURATION PROCESS

There appears to be less individual egos, although there is a strong group ego! Japan has acculturated customs, technology, etc. from everywhere for centuries and knows how to do it. In the 16th century they apparently set up manufacturing of guns/gunpowder in 18 months once the Portuguese brought them in. Any good idea is fair game, subject to very strict legal patent technicalities. Having adopted an idea they fundamentally understand and improve it.

They seem to be less oriented to technology for its own sake versus what it can do for them in the long run in achieving a particular market domination. For example, they moved more rapidly into semiconductor gate arrays for their computers earlier, quite likely under Gene Amdahl's influence. The computer industry has been unable to get the U.S. semiconductor industry interested in this technology until recently, hence we lag in this basic technology. In Japan since the companies are larger, corrective action can be within a company, or if needed, MITI may force and rearrange priorities.

They clearly think both product and process together in what is a long term view. Again, here they're competitive and they orient the processes to: Quality and Volume (for growth), and finally Flexibility for fast turn-around in order to support and tune the volume. As a quirk, the predominate customer for semiconductors has been their telephone company. Unlike the U.S., where ATT has a fundamentally non-competitive, captive high cost semiconductor supplier. The buyer/seller relationship here has forced a concern for quality that would not be met by simpler consumer use (in calculators, radios and TV).

All of the computer manufacturers have acquired their technology over a one or two technology generation history (approximately 10 years) of dealing with U.S. manufacturers either as a joint venture or under license: Fujitsu (Amdahl/Siemens) and Hitachi (RCA); NEC (Honeywell, GE, Varian) and Toshiba (Honeywell, GE, Interdata); Mitsubishi (Xerox) and Oki (with Univac joint venture); Yokogawa (HP); and Nippon Minicomputer (DG). In all cases, the technology has been improved in terms of quality, performance and manufacturability. The case of Honeywell is ironic. The high performance technology selected for the mainframe is now manufactured more effectively at NEC.

The agreement between Fujitsu and Amdahl Corporation appears to be a good example of the classic Japanese computer acculturation process even though only the first two phases have been carried out. My simple understanding is that in the late 1960's Gene Amdahl explored the basic technology for high performance IBM computers as head of IBM's San Jose advanced development laboratory. As an IBM employee he tried, unsuccessfully, to get IBM interested in building high performance machines. He formed Amdahl Corporation and proceeded to develop the technology. For various reasons, more capital was needed and Fujitsu bought in as an owner. As part of the agreement, Fujitsu got the manufacturing rights to and became the manufacturer for the Amdahl line. In return, Fujitsu was able to use the same technology to design and manufacture computers for their Japanese market. At the beginning of 1978, both Amdahl and Fujitsu have announced their latest computers based on the Fujitsu processes and production facilities.

It appears now that Fujitsu has built a higher performance, incremental performance upgrade, and higher reliability machine than either Amdahl or IBM have so far announced. As an IBM computer it is unorthodox because it is a multiprocessor. Not hampered by the IBM thinking process and appealing to a buyer versus rental market, the Fujitsu machine could have a significant edge, because it also gives users new capabilities that they probably need. Care to bet on the position in 1982?

The current computer <u>manufacturers have</u> a complete line of <u>peripherals</u>, <u>and</u> <u>test and manufacturing equipment, taken from copying and improving counter-part U.S. products</u>. In one very quick casual trip through a computer factory I was able to count a dozen "copied and improved" devices.

For products under license, there is always incremental improvements. Product alternatives range from reverse engineered look-alike, through radical improvements based on key ideas or patents (e.g., video tape recording). Occasionally the Japanese buy U.S. manufactured production machines (e.g., the Gardner

Denver Wire-Wrap machine) where the manufacturer won't grant a license. In general, the emphasis is on making products they can export, versus making manufacturing process equipment that can not be exported.

In one case, (DEC) developed a semi-automatic wiring machine and manufactured a few for internal needs and licensed a U.S. manufacturer. Neither DEC nor the licensee had bothered to patent and protect the design. The Japanese version of this machine appeared in several computer factories. There were Tektronix look-alike scopes and the ideas for a laser printer came from IBM, modified by a Honeywell product and teaching. In the case of disks, they use the reverse engineering techniques (also used by Memorex, STC and Telex) to produce disks identical to those of IBM. They have made improvements in disks technology and will export either head and surface components or complete disks. Geographical separation is not a hinderance, it is a benefit because they are excluded from U.S. laws. With the advent of the IBM 3340 disk organization, NPL (Nippon Peripherals Limited) was put in place to make a comparable product. This "engineering process" required 15 months and produced a disk that was "identical" mechanically. In fact, when comparing the two drives, one might conclude that both drives were made from the same drawings!

<u>A Chronology of Systematic Domination</u>*

"Four phases are involved in the Japanese assault on a market. They include the initial development of a domestic industry, an establishment of an export market base, significant market penetration in the foreign market, and ultimate market exploitation.

> I. <u>Development of a domestic Japanese industry</u>. The Japanese industry is developed and grows rapidly. A number of major aspects mark this development. These include:
>
> (a) Market control. Imports limited essentially to zero. Only a few major manufacturers are permitted. Prices remain significantly higher in Japan than in other

competitive markets.

(b) Borrowed technology. The Japanese borrow heavily from foreign technology, including a large number of purchased licenses and patent rights, and wholesale reverse engineering.

(c) Vertical integration. During this phase, the Japanese vertically integrate their manufacture almost totally.

(d) Major investments. This period sees major investments for modern plant, equipment and technology, both for the final product and throughout the vertical chain of manufacturing. Continued heavy research and development and investment expenses keep manufacturing up to date.

II. Establishing an export market base.

(a) The establishment of widespread sales organizations throughout the United States, and, perhaps, elsewhere.

(b) A thorough researching and understanding of the foreign markets and their various facets.

(c) Establishment of a reputation for quality products and reasonable prices.

(d) A limited focus, especially in those markets less attractive to domestic manufacturers.

III. Major market penetration. Major market penetration occurs usually during an economic downturn in Japan. Previous efforts by the industry have set the stage for them to be successful in this endeavor. It is marked by the following considerations:

(a)
Cooperation among the Japanese companies with respect to models, prices, and markets.

(b)
Focus at the mainstream of the foreign market.

(c)
High inventories because of poor markets in Japan, i.e., an export push at any cost is highly expedient to the Japanese manufacturers.

(d)
Extremely low prices to the mass market to gain high percentages of market share rapidly, i.e., a knock-out punch to the domestic manufacturers. Modern plants, reasonable costs, an established export organization, and good reputation set the stage for success.

At this time, marketing muscle is established. Not only was the export market share large, but the domestic market remained closed. It should be pointed out that this major market penetration had been made by a <u>combination</u> of factors, as outlined. The greater marketing muscle allows the Japanese manufacturers to subsequently gain the profits of their long investment.

IV.<u>Market exploitation</u>. This period is marked by higher prices -- often higher than domestic manufactured models. However, the higher prices are often more than offset by perceived higher quality, both real and imagined. There is also continued cooperation on prices and markets, as well as continued limitations on imports to the domestic Japanese market."

JAPANESE DESIGNED PRODUCTS REFLECT A CONCERN FOR QUALITY, PERMANENCY AND NEED

Product design in Japan seems to have a better tradeoff among quality, product cost versus lifecycle and human usability. The lack of structured marketing as we know it provides the opportunity for products to be designed on the basis of user need rather than filling a corporation's revenue gap demanded by its financial growth model.

<u>They're</u> more <u>long versus short term oriented</u>. Their monolithic culture and history reinforces this attitude. They're capable of waiting us out in an area because we're fundamentally impatient and generally "big bang" product/market oriented and because they want long term business domination. NEC, Fujitsu and Hitachi, unlike Xerox, GE, Westinghouse, and RCA, have all persisted with computer manufacturing and now appear to be winning! This timeliness certainly affects their thinking on quality, and lastingness both in markets and products. And they're willing to invest.

Even though they have a concern for long term, <u>they work the short term very hard</u>. This may follow from the competitiveness/growth. They engineer for quick turn around, they have good processes and the engineers at these large companies work very hard. The official work week is 40 hours, but a more accepted pattern is 50-60 hours...particularly to maintain schedule or to win against IBM, Amdahl or Hitachi (if you're at Fujitsu).

<u>They</u> seem to <u>do "bottom-up" product design versus "top-down" market</u> planning as typified by the expensive, heavy, multi-volume market <u>surveys</u> and the classic Edsel. These reports usually report history and extrapolate it in a self-perpetuating fashion gathering data from a variety of sources consisting of discarded product ideas. Using this approach, we continue to build heavy, gas-consuming cars because the market has historically bought them because there is no choice. They look at the needs, and take existing ideas and improve them.

<u>Products are quality/detail oriented versus being</u> the <u>ultra-high volume</u>, <u>low-quality throw-away</u> types. These are characterized by say, Sieko (versus Timex) and anyone of their cameras say, Minolta

(versus Kodak or Polaroid which assume an idiot user with no concern for quality picture, but must have it now).

With Japanese Quality Control, although data is kept by the factory reporting and control structure (i.e. management) the analysis, corrective actions and responsibility for improvement is delegated to the workers! Even enlightening American factories go through elaborate analysis to understand and engineer the change of processes that are easily understood and correctable by the workers themselves, given they have the tools to understand how well they're doing. Thus, there is "delegated QC" versus "centrally managed QC".

The <u>long term, quality products makes them built products that are hard to beat on a life-cycle basis</u>. While it isn't clear they really consider all life-cycle costs, their small cars now get very high ratings. In the case of computers, they have begun to design and build multiprocessors because their customers invariably buy and want upgrades. Since IBM rents computers, the multiprocessor approach hasn't been developed. The multiprocessors they sell also permit better Reliability, Availability and maintainability. They seem to do a better job considering life-cycle costs than we do!

<u>Products are designed for people</u> with attention to detail. The styling happens to be also attractive to others, but their technical, gadget-orientation really biasses them to designing technical looking, knob-intensive products as typified in hi-fi sets, complex watches, and cameras). It's probably impossible to have them design a product like the Polaroid One-Step camera. Color TV scopes are used to help operators control the large computing machines. More importantly, less people are involved in operating the Japanese computer centers, giving lower life-cycle costs.

PRODUCTS RESULT FROM UNDERSTANDING AND MANAGING A COMPLETE PROCESS

The basis of competitive performance products in high technology industries depend on understanding a complete process starting with basic research, going through applied research and advanced development, to product development. In addition, a parallel equally complex process, is required in order to design and build the process that manufactures such products. As a new product is introduced, it may be necessary to evolve and enhance it, to adapt it to the real or changing market and finally it must be eliminated when it does not effectively solve a need. There must be astute marketing including forward pricing in order to get on the necessary cost versus volume learning curves.

<u>The Japanese need invest little in basic and applied research because they are effectively coupling the U.S. laboratories into their advanced development</u>. In contrast, aside from hiring, there is very little flow of ideas from our public laboratories into U.S. industry. The university laboratories which have or are receiving significant Advanced Research Projects Agency (ARPA) funding for Computer Science (i.e., 20-30M/year), have post doctoral Japanese visitors. These laboratories include Stanford, MIT, Carnegie-Mellon, the University of Illinois, etc. One finds that the university and industrial laboratories of Japan are headed and staffed by researchers who've spent their research years in the mainstream American laboratories. For example, the head of a major research effort at one company was trained at the MIT Multics Laboratory.

Of the large companies with research laboratories, the Japanese emphasis is on advanced development where the output is a breadboard of a potential product. The quality of these laboratories seemed substantially ahead of comparable U.S. laboratories which often engage in research to ease the corporate conscience by having a research lab. For example, our corporate research laboratories were significant in the development of television. In later years even though labs at GE, Motorola, RCA, Westinghouse and Zenith grew in size and number, there was ineffective coupling and the U.S. TV industry has disappeared.

<u>MITI funds and manages other laboratories and corporations</u> to

carry out research that's oriented to getting experience that will eventually produce products. Funding, as opposed to having a captive laboratory, not only provides a system of checks and balances, but provides an incentive. This minimizes what I call the "dusty-lab syndrome". Many of our government labs were initially set up for a mission, and once the mission has been completed, the lab continues to exist. Since there's no real need, or mission, or review, negligible new work is output. We can all recall visiting these labs in which the dust is blown off the equipment for visitors and the same demo is run year after year. The same equations are on the board, with the same usually vague, unattainable, immeasurable, non-milestone based goal for the research. A buyer-seller relationship can help check this to a great extent whereby an independent organization such as a university manages the lab and takes responsibility for results in a competitive, seller fashion. Government labs set up to provide results to the government are most generally incestuous and ineffective. Also this brings the groups together and technology transfer is more likely to take place.

For example, NBS is setting up a lab to research computing interface standards, with industry being expected to contribute people to them to carrry out the work. This is ridiculous! People capable of this research are clearly going to be employed in developing interfaces. A government group dedicated to this will ultimately be tired and useless, assuming it does become successful in creating a standard. A more fruitful way to bring about the standards is to subcontract several competitive approaches and have industry prototype and report on them to NBS. In this way the expensive, bureaucratic staff is minimized at NBS. Again, such a staff will become obsolete even if it could be acquired. Quality output can be managed by NBS through a buyer role, provided the contact red tape is minimized.

The Japanese <u>orientation is</u> a strongly <u>engineering for trade versus</u> strongly <u>science-based</u> culture! Since the rest of the world does their research, why should they bother? This comes about because of their need for manufacturing novel products and their total dependence on the export of manufactured goods. Since our basic federal research funding for computing comes through the NSF, ARPA, and armed services, the emphasis is on science and research. Their funding comes through MITI and from various corporations, and hence the orientation is on international trade.

<u>The culture supports a strong emphasis on manufacturing, not just product design</u>. In addition to the product engineering process there is a comparable and equally important process responsible for the development and operation of manufacturing. This discipline has been eliminated from U.S. universities. While it isn't clear that the emphasis in Japan universities is stronger, there is more emphasis in the companies on manufacturing processes. People are rotated among the various processes and disciplines, making it equally desirable to be in all functions and phases.

<u>The whole culture</u> appears to understand basic learning and demand curves and they <u>are volume (and growth) oriented</u>, subject to the quality-first constraint. Knowledge of the learning curves is everywhere even the government research labs and universities. Their needs and goals are manufacturing/trade/industry oriented. This also means that, like Texas Instruments*, they're willing to dump and lose money for the short term in order to gain the market. This practice, when carried to certain extremes, was ruled to be illegal for a U.S. company. Although the Japanese put on a good act that their products won't be competitive when the yen is so strong, having gone from 300/1$ to 100/1$, it's a big ruse because of our dependency as a distributor now in many industries. This dependency will be elaborated on the following section.

As a corollary to learning curves and market domination, it's necessary and t<u>hey</u> are willing to <u>give up profit for growth</u>. For example, RCA is now a rug maker (or distributor), car rentor, publisher, TV distributor etc., instead of an electronics company that pioneered television. Their role is essentially no more than a banker and such a conglomerate is no match for a serious manufacturer. Whereas there is extreme pressure on our business for profit and return on investment, these factors are less in the Japanese companies. Sony is only moderately profitable, Fujitsu does relatively poor financially and I'd bet NEC or Hitachi computer divisions might even lose money. For now, they may still be buying in which is clearly more acceptable than GE, Xerox and RCA could accept. This makes the Japanese doubly hard to beat, since they can lose money on every one and make it up in volume. They can buy the business dumping and why not if there is long term reward?

INDUSTRY DOMINATION BY THE JAPANESE IS SIMPLY PREDICATED ON U.S. NAIVETY, GREED AND VALUES

Whereas as we watched the first few industries of textiles and steel become dominated by the Japanese, we unsympathetically stated that these industries were tired, the workforce was lazy, and the management was incompetent and unagressive about getting capital. Certainly there is no special societal fondness for the automotive and petroleum industries and now it's fitting to import our cars to straighten out the U.S. manufacturers. Now, the domination of all manufacturing is so clear and pervasive that we must look deeper because all society is to blame and is beginning to pay the price.

The domination can only happen with consenting buyers in the U.S. It is these buyers, (nee distributors, including tired old former manufacturers, that are to blame, not the Japanese. Alternatively our values are too short term and too basic as to see and understand the real long term effect.

<u>The (Unstable) Three Island System</u>

Since it's not clear to everyone what the long term, stable situation has to be, let's look at the end point. A system of three inhabited islands, all of which have adequate food, water shelter and land, points out the dilemma:

#1. supplies energy; consumes negligible manufactured goods;

#2.supplies manufactured goods (is supplied raw materials from several small islands it owns, and from discarded goods of island 3); and consumes energy;

#3.consumes energy and manufactured goods; supplies information.

Given that information is generally treated as a waste commodity of zero value there is no stable state for the system <u>until</u> islands 1 and 2 absorb island 3. Or conversely using any monetary system, island 3's paper or tokens will always be worthless. That is, islands 1 and 2 currency values will be out of balance with island 3, until 1 and 2 "own" island 3.

To a first approximation, <u>the Japanese and</u> their counterpart <u>American buyers have systematically transformed American business from inventor-manufacturer-distributor to</u> simply <u>distributorships</u>. This is in complete keeping with the goals of American business as reported and exonerated in business magazines and the teachings of modern business schools. The goal and reward of American industry is clear: return on investment and profit. Secondary measures like market share are occasionally used. Following only the ROI goal, subject to no other constraints, leads U.S. industry directly to being a distributorship for Japanese products. With this strategy, no investment, no planning, and no risk are required . All a company or its potentially enshrined leader has to do to be successful is to buy the right product for resale. Our electronics industry doesn't have to worry where the money comes from to pay the Japanese and Arabs. On the other hand a group who can only run a distributor is probably fairly top heavy and can easily be replaced say, by a hard-working Japanese group.

This merely confirms the classic definition of a capitalist as someone who'll make and sell the rope to hang himself. In this case it's merely reselling someone else's rope as we become too lazy to design and make rope.

The essence of distributorships is competely counter to the principles which made American industry initially great. Now it's simply with no work, no capital, anyone (everyone) can do nothing and succeed. All that's important for us now is to find the right supplier who'll put up the capital, design and manufacture products which we can distribute.

In computing, the trend has already started with Itel buying Japanese manufactured 370-compatible computers. Thus we expect Itel to have high ROI, and a net flow of dollars from the U.S. The solution is obvious:

> No company must be allowed to buy and distribute a foreign product without an offsetting equal export credit which they must arrange! That is, Itel can get agricultural products to sell or it could export its services. This has to be Itel's problem -- not

Carter's, Krep's, or Congress's problem as we now define them.

<u>There's no way a manufacturer can re-enter</u> various <u>lost businesses once he becomes a distributor</u>. The spirit, and capability to catch-up and manufacture are gone. Society and the investment structure are all aimed at continuing a status quo. In the case of TV, radio, hi-fi, and video recorder products all of which were U.S. products and which the first invention or key patents apply, the cause is hopeless.

Again, we can blame the Japanese, but someone in the distributorships acquired by the Japanese had to buy the sets in the first place and had to choose not to design and build competitive products or to insist on bi-lateral flow of goods. In the case of Motorola, the division was purchased by Matsushita and included both manufacturing and distribution. By 1976, the U.S. plant was reduced by 2/3, but the distribution network was left intact.

<u>We (U.S.) have a higher regard to business training versus engineering and technical training</u>. Here the Japanese are in even better shape because they don't yet have many business schools. Therefore instead of getting MBA's their engineering students get engineering master's degrees. In contrast, more engineers, quite erroneously, regard the MBA as necessary or useful to enter industry. This not only makes the Japanese better engineers for the same educational output, but doesn't reinforce the notion that engineering is the route through to the management ladder, or that an MBA is automatically needed if one is to supervise people. The MBA, oriented at every dual-career person being president, and epitomized by the content-free case study methodology, focusses on the quick buck. This is in contrast to the Japanese concern for deep understanding and the long term.

U.S. VALUES ARE CLEARLY DIFFERENT AND AS SUCH WE MAY BE HELPLESS AND SHOULDN'T BOTHER TO MANUFACTURE ANYTHING

At a government/society level they appear to have their act together much more than we do. In societal issues and in their products they seem to have clear, crisp ranking of goals and priorities. For starters, they know them, whereas nearly all our issues that start out simple become entangled as everyone (a new set of referees) enter the fray. These include: human rights vs equal rights; full employment vs inflation and balance of payments; environment vs region vs country; capital vs labor; and consumer protection vs business protection. But worse than a muddy set of design criteria is a muddy set of decision makers and an unclear decision process. The Japanese processes though more complex appear to be clearer. There is less government but it appears to be responsible and accountable!

Because of the need to export, for example there's educational support for engineering and technology, versus lawyers and other semantic accountants. There is a factor of 2 less lawyers per person than in the U.S. while lawyers wouldn't be bad if they only talked to each other. A productive lawyer can consume much productive and creative output of much of society. The Japanese emphasis (priority) is on physical output because they are a manufacturing island with no other visible means of support. With the increased emphasis in legal training, our priorities seem to be on the manufacturing of paper, intergroup contracts, governing and bickering among semantic accountants.

As a simple explanation, more money is available for investment to enable them to manufacture (for their island) because of lower taxes. This clearly affects their ability to invest in industry. They're supposed to be willing to pollute for profit. I didn't observe this. For example, LPG taxis are used instead of gas or diesel. Perhaps they only kill whales outside of Japan and pollute other enivronments. Their environment is just fine, though high density. On the other hand, taxes can be low because their priorities are clearer, more people work and they spend less on government and defense.

Their government spending for military is far less and nearly non-existent. Although there is some fall out of our military spending for a better society, it seems to be small and clearly a by-product. In the case of semiconductors, computers and related research, the benefit is small compared to what it could be compared to more directed goals such as the Japanese have with export domination.

In a similar way the Japanese spend significantly less per capita for health care and medical research. They can capitalize on our research here, but since they have a longer lifespan, its not clear what the extra expenditures we make buy. In effect, the lack of spending in medicine goes to investments which result in full, lifetime employment which is probably the best solution to personal health.

The <u>Japanese don't have the massive federal research over-expenditures, epitomized by NASA and NIH</u>. Here again, in the rare event there are results, the Japanese will capitalize on our research for manufacture and export. These areas seem to have big expenses and contribute little because much of the work has no goal. NASA goals appear to be vague and tenuous now that they've stopped providing the world with exciting space shots and television pictures from the moon, and the immediate needs for this research escapes most of us. National health research is also equally vague. This work only increases health care costs, by a whole series of secondary effects. Here the Japanese have a greater life expectancy with under 1/2 the per capita costs.

<u>They believe computers are fundamental for the long term</u> and they're prepared to invest and wait for return. Machines are used in all products they build for export and they save labor too. Labor is both precious and expensive in Japan as there are only 110M people and 2% unemployment. They're considering raising retirement from 60 to 65 to get the extra productivity. They must have computers to raise productivity! This is vital to their continued domination of manufacturing. As a separate research area, robots are an important component of manufacturing domination. While much of the pioneering work is U.S., the continued work to make robotics practical takes place in Japan! This is the opposite of say the Australian attitude where there is increasing unemployment and a belief that computers must be eliminated. Australia is now almost totally dominated by Japanese products and the small Australian automotive industry of GM- and

Ford-based large cars and is rapidly declining under the stress of small, high volume, quality Japanese cars.

THE JAPANESE SOLUTION TO OUR BALANCE OF PAYMENTS PROBLEM: SELL (IN JAPAN)

This is the answer our industry wants and will willingly, but foolishly looks to. However, the Japanese rhetoric is only for our gullible government and academic communities and the naive business people. For example, trade envoys from Massachusetts and New Hampshire visit Japan with the expectation of selling high technology goods. They'll succeed to sell a few prototypes. The real sales will come in 5-10 years when these products are resold in volume to the U.S!

There has not, nor will there be any serious trading of American products of Japan. The distributor/trading network entirely thwarts such an effort! The results are clear and we must face this.

<u>Japan is a closed society and market</u>. As the most powerful, homogeneous culture in the world there is a long history of being closed. This can be verified by: reading any of the books or articles on Japan; trying to understand the complexity, yet subtly of a formal tea ceremony; looking at any industry manufacturing case; or just visiting and observing.

The <u>language is a code to</u> further <u>segment</u>. It's not clear how difficult the language is to learn, but it's probably relatively useless without the societal understanding. We only teach Japanese minimally on the West Coast of the U.S. On the other hand the technically trained Japanese have several years of English in order to read the literature.

Even though there are major cultural differences among Japan and other far eastern countries (e.g., China, Taiwan, Korea) there is closer proximity among them than with western countries. This closeness is especially advantageous in finding additional sources of especially low cost labor.

The <u>tariffs support the establishment of any industries</u> they target. Now the computer import duty has been reduced to be on a parity with the U.S., but this matters little since their industry is strong enough to withstand imports! As we've seen in other industries, this is a come-on to further strengthen the

Japanese manufacturers for export competition by having them compete in a token way with the few imports and thereby gain ideas to sharpen their exports.

For example, in the early seventies the Japanese encouraged U.S. minicomputer imports. These occurred and now there is a significant Japanese minicomputer industry. For example, the basic structure of Fujitsu's minicomputer is identical to the PDP-11 DEC introduced manuals and brochure before the patent application, making the PDP-11 non-patentable in Japan.

<u>By the society</u> and the <u>emphasis on personal relationships it's hard for foreigners to break into or sell</u>, especially on a one shot basis. "Doing business" together appears to be done over a long time period and is almost ritualistic. This means that it's essentially impossible to have an effective international company as we know them. A foreign manager is clearly tabu and sales are limited to one-shot deals with trading companies. There is no trading except as joint ventures! A foreign owned company with ?% of the equity is illegal in Japan.

LABOR COST, LIMITED POPULATION, FULL EMPLOYMENT AND FEW NATURAL RESOURCES, CREATES IMPORTANT BY-PRODUCTS

Transportation and meetings run on time and at full capacity. This is in contrast to U.S. facilities, especially the meetings scheduling and performance. I accomplished roughly twice as much per day as in another western country in terms of customer and plant visits. The cordial, formal protocols help meetings proceed rapidly. By operating in a highly scheduled fashion more work gets done and there is less anxiety as to performance.

There's measurement of and pressure for efficiency. That is, the work-out/work-in ratio is high. In a taxi, there's an automatic back door opener so that the driver can load/unload faster. Of course, the factories graph everything. It feels like the notion of efficiency is taught to all. Concepts like fuel efficiency versus speed, weight and pollution are impossible concepts for Americans to understand. Worse yet, having only briefly lived in a constrained environment during wartime, most of us have no understanding of living with finite resources.

Given a notion of efficiency, there's real concern for saving of physical resources too. At the computation center, printout isn't automatic; it's queued and must be requested by badge reader. Lights, always florescent due to efficiency, are off when not in use. Of course small cars, taxis, a good train/subway are other indicators. The cars have bells that ring when the car is going over 100 Kmh! None of these exist in the U.S.

Contrary to a previous "feeling" they are working the environment issue. There were U.S. environmental people at a conference at the same time I visited; the Japanese were politely ignoring them while taking their basically boondoggle-oriented conference registration fees paid by the U.S. government research establishment.

There is a range of basically human and personal concerns. The result is a longer life span. While the subways and high density trains jostle people pretty badly, and there's no segmented smoker areas (and many smoke), there's great concern for the feelings, privacy and treatment of individuals. Although I had special treatment on the visit, on arrival and departure at every organization, I was given hot cloths and refreshments of tea, juice or coffee to be really considerate to westerners. It was hot and humid in July, but taxis and all buildings had air-conditioning. The hotels, though the most expensive, were also the best in terms of privacy, food and service. This included a large hotel in Tokyo and a 15 room old style, inn in Kyoto. The goal is privacy, and ambiance, with incredible attention to simplicity, design and detail. For example, there was a cloth cover over the telephone because it didn't fit the room decor.

Of course, the food is the ultimate in personal concern. Food served in many courses varied from raw fish to pickled vegetables (e.g., potatoes) and flowers (lotus blossoms) with lots of seaweed, fish and fish eggs. Tempura, teryaki, and hibachi grilled meat and fish are more easily digested by the westerners. The bread crusts were removed when sandwiches were served to westerners. There was much concern that the colors of the food matched; the physical looks were important.

There are Japanese baths, and these are great too!

<u>They are compulsively clean</u>. In an indirect way, this really helps the manufacturing of small, precise goods (including cameras, semiconductors, high-speed computers and disk memories.

<u>There's</u> orderly <u>queueing</u> at <u>each server</u>. The Japanese appear to be the world's best self-queuers. There's probably some protocol for resolving conflict when two persons arrive to the queue at the same time. In general, a system of this type has higher through-put. I also suspect there is lower general hostility arising from competing for a finite resource.

<u>Inventions are to labor-saving devices</u>. I saw countless gadgets of this form. The printers at computation centers had paper cutters on them with conveyors to bring output back to a single station. There are no computer operators and people to serve the users! This direct use of facilities not only costs less, but provides significantly higher through-put.

EPILOGUE

On arriving at Sydney, I was struck with the contrast to dense, intense, humid and hurried Tokyo. I was ecstatic to get back, after 20 years, to a life style, people and place I feel more comfortable with.

Sydney's beaches are the world's finest; the weather's great; people spend lots of time out-of-doors with sports, strolling and simple gardening versus the subtle and very complex Japanese gardens; work starts late, runs slower and ends promptly with twice as many secretaries to do half the work -- but they do make their bosses feel good; and the continental and western food, beer and wine drastically improved having moved away from the early English influence.

Thinking about the Japanese competing with the Arabs to buy American and Australian mines, property and factories is frightening, but remote in my mind. Besides, does it matter who owns us? Will they interfere with our way of life? Maybe we'll change them and make them lawyers rather than manufacturers. If enough of them come to live or vacation with us very long, we'll be back manufacturing and exporting to them if anybody can learn the language. If things don't go our way, we can make it illegal, set up an agency, and then sue them with our incredible bureacracy and legal technology.

IMPRESSIONS ON HOW WE AND THE JAPANESE ARE CONVERTING U.S. INDUSTRY INTO DISTRIBUTORS

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The island of Japan, with few natural resources and over 100 million people, virtually dominates world production of manufactured goods, including the components and processes to make these goods. Every Japanese knows that exports are vital to survival. Also ingrained is the understanding that savings and living within one's own means support the ability to manufacture and export. In contrast, the notion of balanced budgets, savings and manufacturing have gradually disappeared from U. S. culture.

For example, the United States still holds a dominant position in the production of computers and semiconductors, but the Japanese plan to dominate these industries. Unwittingly, U.S. industry, government and society continue to aid the Japanese. Forty odd reasons are given to support this conjecture, each one providing a lesson.

The Japanese have progressed from domination of low-technology simple commodities to complex manufactured goods. The progression has been from textiles, steel, radios, sewing machines, typewriters, quality cameras/optics, watches, small cars, television sets, tape recorders, video tape recorders, calculators and on to state-of-the-art semiconductors and computers. Their current position in semiconductors and semiconductor-making equipment indicates they are well on their plan to dominate this manufacturing as a base for the continued and future market domination of electronics and computers. High-technology industry is increasingly being concentrated in Japan while the Japanese-owned low skill textile and television factories are being located in the U.S.

Dataquest describes how the Japanese go about systematically to dominate a market. Appendix 1 describes the four, detailed phases: initial development of a domestic industry, establishment of an export base, significant market penetration in foreign markets and final market exploitation.

BASIC STRATEGY, AND TACTICS FOR DOMINATION

Japanese industry and government operate as a team reinforcing strategy and tactics with appropriate levels of competition. Unlike many companies and countries that have tried and failed, they successfully planned and built a mainframe computer industry.

The Ministry of International Trade and Industry (MITI), with autocratic power, helps to amalgamate strategies within industry groups creating an organization commonly referred to as "Japan Inc." Because there is no direct control, I prefer not to use the term "Japan Inc." but to name the phenomena "The Japan Club" since there's a structure for the essential competition at the market level. For example, MITI identified and encouraged early importing of minicomputers, including those from Digital Equipment Corporation, as a competitive "straw horse" to build their own industry. One of DEC's interactive data base systems, MUMPS, was sold in Japan for end-user applications. On seeing several lost sales, MITI funded the development of MUMPS on a Japanese minicomputer. In mid 1978, a Japanese researcher asked me, through an academic channel, for the internal architecture of MUMPS in order to study its structure from a so-called computer science viewpoint. We expect to catch MUMPS from Japan soon.

The U.S. has no equivalent of MITI to protect major corporations as national resources. In contrast, U.S. corporations are looked on as adversaries to the national interest. IBM, already under attack from Japanese competition, is also under the gun from most U.S. government departments. Together they seem intent on destroying IBM, leaving it and others as distributors for Japanese products.

The strategy of MITI and the Japanese companies to win dominance of the computer industry is clearly evidenced, but it is not understood by U.S. government and industry. In keeping with the priority, MITI is both very strong and attracts competent people. The Japanese companies, while maintaining competition in limited domains, both plan and talk with one another. For example, Fujitsu and Hitachi have developed IBM plug-compatible machines. Coupling individual, competing companies for technological acculturation in this fashion is an important management technique to assimilate technology quickly.

The U.S. Department of Commerce and the U.S. Labor Department, in contrast to MITI, have neither a plan nor the personnel to help maintain U.S. dominance in high-technology fields important to the future of the country's economy and security. Furthermore, these two adversary departments are adversary to U.S. business. Trade trips to Japan by Secretary Kreps only emphasize our lack of understanding of the Japanese capability to use trade to introduce technology into their society. Our trade deficits cannot be turned around by hand-shaking missions, but demand a strategic and tactical plan based on understanding. Our political system is devoid of planning and accountability of government departments; even if the Secretary of Commerce could plan, her short tenure is inadequate to solve this problem. Once a new administration appears, any policies, plans and commitments are reset to zero!

Japanese tactics focus on the centrality of work and loyality to a company. A company screens each new employee carefully because when it hires an individual it takes on a lifetime commitment. The security promotes risk-taking, a phenomena generally unknown in large U.S. corporations. The team spirit is engendered as the various members learn how to get along with each other.

Quality control is in the hands of the workers. Although data is kept centrally, the analysis, corrective action and responsibility for manufacturing and quality rests with the employees concerned. Quality control is generally centralized and the organization of work often does not lead to self-esteem in the U.S. organization. Such participative management provides a key to the devotion to the workplace and sense of value achieved through work. The incompetent workers become the wards of the organization rather than wards of the state. Pride, family tradition, and because everyone is working, nonwork is socially unacceptable, embedding the importance of work into the fabric of society. A similar effect is observed in the U.S. during periods of high unemployment. At this time non-work is approved since others are unemployed.

In the U.S., the freedom of the individual has superseded work as a goal. The employee mobility is high and as a result companies screen very little as the short tenure is assumed. One recent semiconductor company ad claimed that no interviews were required at all. Turn-over and unemployment here are high with levels of consumption also rising so that some Japanese observers have concluded that the Japanese live to work and the Americans need to work to live. The measurable results are simply that the relative per capita productivity in manufacturing industries of Japan is now almost twice that of the U.S! Also, the sales per employee of a Japanese electronics corporation is about $100K, versus $45K for the U.S.

The Japanese government has been able to nurture both large and small companies while the U.S. government agencies seem to alienate the large and aren't effective at supporting the small ones. Much work in Japan is done in small subassembly operations. Competitive small shops keep the cost down by removing it from the large, hard to manage hierarchical organizations.

USING ACCULTURATED DESIGN AS THE BASIS TO DOMINATE

For centuries Japan has acculturated customs, but mostly it adopts and adapts technology. In the 16th century, for example they began manufacturing gunpowder a scant 18 months after the Portuguese brought it to Japan. Shortly thereafter they were banned. Any idea or product has always been fair game for adoption and improvement. Product and process evolution are merged in a long term view of achieving market domination. They orient the processes competitively considering quality, volume for growth, and flexibility to allow for the fast turn-around needed to maintain full-production capacity in a shifting market.

All the Japanese computer manufactuers have acquired their technology within the past ten years by dealing with U.S. manufacturers either as a joint venture or under license, including: Fujitsu (Amdahl/Siemens) and Hitachi (RCA); NEC (Honeywell, GE, Varian) and Toshiba (Honeywell, GE, Interdata); Mitsubishi (Xerox) and Oki (with Univac joint venture); Yokogawa (HP); and Nippon Minicomputer (DG). In all cases, the Japanese have improved the technology in terms of perceived quality, performance and manufacturability.

The agreement between Fujitsu and Amdahl Corporation, though still at an early stage, provides a good example of the classic Japanese computer acculturation process. In the late 1960's, Gene Amdahl, then head of IBM's San Jose Advanced System Development Laboratory, explored the basic technology for high-performance IBM computers. When he failed to interest IBM in building high performance machines, he formed Amdahl Corporation to develop the technology. When he needed more capital Fujitsu bought an interest and acquired the manufacturing rights to, and became the manufacturer for the Amdahl line. Fujitsu was also able to use the same technology to design and manufacture computers for the Japanese market. In only one computer generation, at the beginning of 1978, both Amdahl and Fujitsu announced their latest computers based on the Fujitsu-Amdahl circuits and packaging. Now, Fujitsu appears to have a machine with higher performance and reliability (the M200) than either Amdahl or IBM have so far announced. Fujitsu has produced a machine based on multiprocessing which provides users with new capabilities; furthermore they can buy more processors rather than trade-in when increased computation is needed.

In addition, Japanese computer manufacturers have a complete line of peripherals and test and manufacturing equipment that is based on counterparts invented in the U.S. The designs range from "reverse engineered", to look-alike copies, to radically improved products based on Japanese inventions. With "reverse engineering" a product is dissected with micrometers, special gauges, etc. and made compatible in nearly every respect. The Japanese make only products for export to the U.S. market that do not violate patents. Tektronix look-alike scopes and reverse engineered IBM disks are common. In 15 months, Nippon Peripherals Limited produced a disk that was mechanically identical to the IBM 3340. From comparing the two drives, one might conclude that they were made from the same drawings.

PRODUCT DESIGN BASED ON NEED, QUALITY AND THE LONG-TERM

Traditional top-down marketing is characterized by expensive, thick market surveys that extrapolate history in a self-perpetuating fashion. Here, the goal is to fill various revenue gaps that develop. Using a market survey approach the U.S. continues to build heavy, gas-consuming cars, because the marketing managers can only think in terms of what has sold in the past. Freed from this approach, the Japanese have been able to look at the real needs, and they have appropriately adapted existing ideas. High-level corporate marketing does not design the products; engineers design according to needs using a bottom-up approach and based on technology.

Japanese companies, with long-term goals and commitments, similarly are not forced to depend on a short-term marketing approach. NEC, Fujitsu and Hitachi, unlike Xerox, GE, Westinghouse, and RCA, have all persisted with computer manufacturing and after years of investment have established successful products. Their long-range thinking from the outset allowed them to invest in long lasting quality.

Japanese companies focus on highly sophisticated quality products rather than ultra-high quantity, low-quality throw-away merchandise. The differences are characterized by comparing Seiko versus Timex watches and comparing Minolta or Nikon versus Kodak or Polaroid cameras. Japanese styling is often technical and gadget oriented, typified by multi-knob hi-fi sets and complex watches. It may be impossible for them to design a product like the Polaroid One-Step Camera because of the differences in picture quality. The emphasis is on an educated consumer who will value his purchase.

Concern for quality and long-term values leads the Japanese to build products that have a long lifecycle. Even their auto industry constrained by Detroit's yearly new model concept is now getting very high ratings for durability and serviceability. Accounting models lead to emphasizing production of long lived versus throw-away goods.

PRODUCTS RESULT FROM UNDERSTANDING AND MANAGING A COMPLETE PROCESS

The successful production of competitive performance products in high technology industries depends on understanding a complete process that includes basic research, going through applied research and advanced development, to product development. In addition, a parallel and equally complex process is required to design and build the process that manufactures such products. After a new product is introduced, it may then be necessary to modify and enhance it to adapt it to the real or changing market, and finally to eliminate it when it is no longer effective.

The Japanese need invest little in basic and applied research because they are effectively coupling the U.S. laboratories into their advanced development. In contrast, aside from the direct hiring of students and researchers, there is very little flow of ideas from our public laboratories into our own industry. As Carver Mead of Cal Tech points out, "I like the Japanese. They listen. Also unlike American industry, they're willing to build from our ideas." The university laboratories at Stanford, MIT, Carnegie-Mellon, the University of Illinois, receiving significant ($20-30M/year) Advanced Research Projects Agency (ARPA) funding for Computer Science, have post-doctoral Japanese visitors. The university and industrial laboratories of Japan are headed and staffed by researchers who've spent their research years in key American laboratories (e.g., MIT Multics). In contrast there is no Japanese training of U.S. engineers and scientists; furthermore, the flow of ideas is minimal.

Most recently, Japan has offered to spend one billion dollars in the U.S. for research, predominately for energy conversion. By accepting these funds, the Japanese can be even more effectively coupled to U.S. research and can "learn" to research, just as they've learned manufacturing, design and advanced development. The scientific community is anxious for more funds, independent of where they come from or what the consequences are. Of the large companies with research laboratories, the Japanese emphasis is on advanced development where the output is a testable prototype, often of a potential product. In contrast, U.S. corporate laboratories hide behind the veil of science where the output is vague and untestable. The quality of these laboratories is high versus many comparable large U.S. companies where research is to ease the corporate conscience instead of providing new development. Although such corporate research laboratories (e.g., GE, Motorola, RCA, Westinghouse and Zenith) were significant in the early development of television, the U.S. television industry has declined with few recent local advances.

MITI funds and manages other laboratories and corporations to carry out research that is oriented toward getting experience that will eventually produce products. Funding specific, as opposed to having a captive laboratory, not only provides a system of checks and balances, but also provides an incentive. Many of our government laboratories were initially set up for specific missions, and although the missions were completed, the laboratories continue to exist. Since they no longer have a real goal, or mission, negligible new work is done. The dust is blown off the equipment for visitors and the same demonstration is run year after year. A buyer-seller relationship, in which an independent organization, such as a university, manages the lab and takes responsibility for results can minimize this "dusty lab" syndrome. Moreover, funding for specific projects can bring together diverse groups and promote technical interchange.

The Japanese orientation is toward engineering for trade rather than being strongly science-based. Since the rest of the world provides research, why should they bother? This comes about because of their need to manufacture products and their total dependence on the export of manufactured goods. Since our basic federal research funding for computing comes through the NSF, ARPA, and the armed services, the emphasis is on science and research. Their funding comes through MITI and from various corporations, and hence the orientation is on international trade.

The trade drive causes a strong emphasis on manufacturing, not just product design. In addition to the product engineering process there is a comparable and equally important process responsible for the development and operation of manufacturing. This discipline has been nearly eliminated from U.S. universities as it has moved from the engineering to the management school. There is a decided emphasis on manufacturing processes in Japan as people are rotated among the various processes and disciplines, making it equally desirable to be in all functions.

Everyone associated with science, engineering and manufacturing understands basic learning and demand curves and they are quantity (and growth) oriented, subject to the quality-first constraint. Knowledge of the learning curves (i.e., increases in the combined number of units produced cause a reduction in manufacturing cost) is everywhere. Fred Bucy comments on Japanese competition in TI's 1978 Annual Report: "...the big difference is that TI is the first major non-Japanese company they have run into that understands and uses the learning curve". The Japanese are willing to sell outside Japan at a lower exported price (dump) and lose money often by selling below cost for the short term (see also Appendix 1) in order to buy market share. This practice is illegal for both U.S. and Japanese companies. Although the Japanese pretend that their products are not competitive because the yen is so strong, they are consciously ignoring our dependency as a distributor now in many industries.

As a corollary to learning curves and market domination, it's necessary and they are willing to give up profit for growth. For example, RCA is now a rug maker (or distributor), car rentor, publisher, television component distributor; it hardly resembles the electronics company that pioneered television. It's difficult to put the whole blame on RCA management because they are constrained by the economic and business temperament of the U.S. environment. Whereas there is extreme pressure on our business for profit and return on investment, these factors are less important to the Japanese companies. Sony is only moderately profitable, Fujitsu does relatively poorly financially and NEC or Hitachi computer divisions may even lose money. None of these companies would compete for capital in the U.S. stock market where return-on-investment is the key criterion. Japanese companies are buying market share and this is clearly more acceptable to the U.S. investors than for GE, Xerox and RCA who left the computer business. They can buy the business through "dumping" and why not if there is long term reward?

JAPANESE DOMINATION IS PREDICATED ON OUR GREED AND VALUES`

As we watched the first few industries of textiles and steel become dominated by the Japanese, we unsympathetically stated that these industries were tired, the workforce was lazy, and the management was incompetent, unimaginative and unaggressive about getting capital. Certainly, there is no fondness for the automotive and petroleum industries and it seems fitting to import our cars as a lesson to our own U.S. manufacturers. Now, however, the domination of <u>all</u> manufacturing is becoming so clear that we must look deeper at the causes.

The domination can only happen with consenting buyers in the U.S. It is these buyers, called distributors, including tired, old, former manufacturers that are to blame, not the Japanese. Our values appear to be too short term and too basic. We really must understand that the following, simple, long-term consequence is <u>complete</u> economic domination.

<u>The (Unstable) Three Island System - Or How and Why We Will Be Dominated</u>

Since it's not clear that continued consumption, with no corresponding export means, let's look at what is the ultimate, singularly stable point simply. A system of three inhabited islands, all of which have adequate food, water, shelter and land, points out the dilemma:

#1. supplies energy; consumes negligible manufactured goods;

#2. supplies manufactured goods (is supplied raw materials from several small islands it owns, and from discarded goods of island 3); and consumes energy;

#3. consumes energy and manufactured goods; supplies information.

Given that information is generally treated as a waste commodity of zero value, there is no stable state for the system <u>until</u> islands 1 and 2 absorb island 3. Or conversely using any monetary system, island 3's paper or tokens will always be worthless. That is, islands 1 and 2 currency values will be out of balance with island 3, until 1 and 2 "own" island 3.

Through greed and short-term values, <u>the Japanese and</u> their counterpart <u>American</u> <u>buyers have systematically transformed American business from inventor-manufacturer-distributor to</u> simply <u>distributorships</u>. This transformation is in complete keeping with the goals of American business as reported in business magazines and the teachings of modern business schools. The goal and reward of American industry are clear: return on investment and profit. Secondary measures, such as market share, are occasionally used. Only a few corporations consider no lay-offs and full-employment to be important; as such, a clear, adversely separation has formed between management and labor. Following only the profit-based goals, subject to no other constraints, leads U.S. industry directly to distributorships for Japanese products. This strategy requires no investment, no planning, and no risk. All a company has to do to be successful is to buy the right product from Japan and then resell it.

This merely confirms the classic definition of a capitalist as someone who'll make and sell the rope to hang himself. However, in this case the capitalist is reselling someone else's rope because he is too lazy to design and make his own rope.

The essence of distributorships is completely counter to the principles that made American industry initially great. The new principle is simply that with no work and no capital, anyone (everyone) can do nothing and succeed. All that's important is to find a supplier who'll put up the capital, design, and manufacture products that we can distribute. In computing, the trend has also started: Itel is buying Japanese-manufactured IBM 370-compatible computers. Thus we expect Itel to have good financial metrics and be a good investment. It will also cause a high net flow of dollars from the U.S. as it becomes more successful.

American business, of course, is only slightly at fault because <u>the U.S. non-business communities</u> (politicians in government, consumers, and academics) <u>have introduced and strongly support heavy borrowing, beyond income</u>. These thwart an environment conducive to manufacturing. Both the per capita rate and amount of savings for both individuals and corporations in Japan is twice that of their U. S. counterparts! For example, the retirement system in Japan is actuarially sound. Of course, the Japanese government operates a balanced budget and taxation supports savings. Furthermore, as a society, they understand themselves simply as an island that must have a favorable balance of trade.

<u>There's no way a manufacturer can re-enter</u> a <u>lost business once he has becomes a distributor</u>. The spirit, and capability to catch-up and manufacture are gone. Society and the investment structure are all aimed at continuing a status quo. Radio, television, hi-fi, and video recorder products are all built using key U.S. developed ideas and patents, yet are no longer built by U.S. manufacturers. Again, we can blame the Japanese, but someone in the distributors had to choose to buy the products rather than design and build competitive products. In the case of Motorola, the television division was purchased by Matsushita in 1974 and included both manufacturing and distribution. By 1976, the U.S. plant was reduced by 2/3, but the distribution network was left intact.

<u>We (U.S.) have a higher regard for business training versus engineering and technical training</u>. In the U.S. many engineers regard the MBA degree as necessary for a career in industry. The Japanese do not yet have many business schools; therefore, instead of MBAs, engineering master's degrees are sought. This makes the Japanese better engineers for the same educational investment. Also, the management of manufacturing organizations are the better equipped to understand technology and products.

By having more people just concerned with distribution, we are becoming a nation of shopkeepers. The emphasis is simply to keep stores open longer and to find new ways to distribute Japanese manufactured goods. Not only does this further stimulate consumption, but it takes people from the primary production work force and makes us merely an island of consumers with no material means of support.

THE JAPANESE HAVE PRIORITIES AND SUPPORT FOR TRADE

At a government/society level the Japanese appear to have their act together. The Japanese seem to have a clear, crisp ranking of goals and priorities. For starters, the Japanese know their goals and priorities, whereas nearly all our goals that begin simple become entangled as special interest groups enter the fray. Some issues that compete for priority include: human rights versus equal rights; full employment versus inflation and balance of payments; environment versus region versus country; capital versus labor; and consumer protection versus business protection.

Because of the need to manufacture and export, the Japanese educational system supports engineering and technology, while we support lawyers and other semantic accountants. There are fewer lawyers per person by a factor of two than in the U.S. The Japanese emphasis (priority) is on physical output. The increasingly large number of U.S. lawyers: consumes productive and creative output of workers; creates a self-perpetuating, non-productive body; detracts from persons who would otherwise enter productive occupations; and tends to build an even larger governing body. With an increased emphasis on legal training, our output is measured by intergroup contracts, policies, laws, rules, regulations and other forms of bickering among semantic accountants.

As a simple explanation, more money is available in Japan for investment to enable them to manufacture (for their island) because of lower taxes. This clearly affects their ability to invest in industry.

Their government spending for military is nearly nonexistent. Although there are prototypes from our military spending, they seem small and are by-products. In the case of research for semiconductors and computers the benefit though impressive might have been as great, given a different goal (e.g., energy self-sufficiency).

The Japanese don't have the federal research over-expenditures, epitomized by NASA and NIH. In the event of results, the Japanese will capitalize on our research for their manufacture and export. The NASA goals, for example, appear to be vague now that they've stopped providing the world with exciting space shots and television pictures from the moon, and the immediate needs for this research is unclear to most of us.

National health research seems equally vague. This research appears to increase health care costs, through a number of secondary effects. By contrast the Japanese spend one-half of what we do per capita for health care and medical research. They can capitalize on our research, but since they have a longer lifespan, it is not clear what we gain with the extra expenditures. In effect, Japan's lack of spending in medicine goes to investments which result in full, lifetime employment which is probably the best solution to personal health.

The Japanese believe computers are fundamental for the long term and they are prepared to invest in them and wait for return. Non only are machines used in all products they build for export, but they save labor too. Labor is both precious and expensive in Japan: there are only about one hundred million people and two percent unemployment. They're considering raising retirement from 60 to 65 to get the extra productivity. They must have computers to raise productivity; computers are vital to their continued domination of manufacturing. As a separate research area, robots are an important component of manufacturing domination. While much of the pioneering work was done in the U.S., the continued work to make robotics practical takes place in Japan. By contrast, in Australia where there is increasing unemployment, there's a belief that computers must be eliminated. Australia buys nearly all Japanese products, produces less and less, and the small Australian automotive industry of GM- and Ford-based large cars is rapidly declining under the stress of small, mass-produced Japanese cars.

THE JAPANESE SOLUTION TO OUR BALANCE OF PAYMENTS PROBLEM: SELL (IN JAPAN)

Can we solve our balance of payments problem by selling to Japan? Selling to Japan is the answer our government and industry want and willingly, but foolishly, look to. However, the Japanese rhetoric is only for our gullible government and academic communities and the naive business people. Furthermore the trade missions are only stocked with powerless, non-responsible, short-lived politicians whose main purposes include visiting Japan and being able to say something to the folks back home. For example, when state trade envoys visit Japan with the expectation of selling high technology goods, they succeed in selling only a few prototypes. The real sales will come in 5-10 years when these products are resold in volume to the U.S!

There has not been, nor will there be any serious trading of American products with Japan. The distributor/trading network entirely thwarts such an effort! The results are clear and we must face them.

Japan is a closed society and market. As the most powerful, homogeneous culture in the world it has a long history of being closed. There is no counter-evidence that an open market exists. The language is a code to further segment. Although business people do learn the language in crash courses, the language is relatively useless without the societal understanding. We only teach Japanese minimally on the West Coast of the U.S. On the other hand the technically trained Japanese have several years of English language training.

Even though there are major cultural differences among Japan and other far eastern countries (e.g., China, Taiwan, Korea) there is closer proximity among them than with western countries. This closeness is especially advantageous in finding additional sources of especially low cost labor.

The tariffs support the establishment of any industries they target. Although the semiconductor and computer import duties have been "advertised" to be on a parity with the U.S. they aren't there yet, but this matters little since their industry is strong enough to withstand imports. Still prices of U.S. produced computing machines are cheaper. In semiconductors the rationale for high tariffs has been protection of infant industries, yet outside of Texas Instruments and Western Electric, Japanese companies have been manufacturing longer than all other U. S. corporations. As evidenced in other industries, this is a come-on to further strengthen the Japanese manufacturers for export competition by having them compete in a token way with the few imports and thereby gain ideas to sharpen their exports.

For example, in the early seventies the Japanese encouraged U.S. minicomputer imports, although there were high tariffs. These occurred and now there is a significant Japanese minicomputer industry. For example, the basic structure of Fujitsu's minicomputer is quite similar to the DEC PDP-11.

Because of the closed nature of society and the emphasis on personal relationships, it is difficult, perhaps impossible to have significant Japanese sales. There are no significant examples to the contrary. "Doing business" together appears to be done over a long time period and is almost ritualistic. This means that it's essentially impossible to have an effective international company as we know it. A foreign manager is clearly tabu and sales are limited to one-shot deals with trading companies. There is no trading except as joint ventures. A foreign-owned company with controlling equity is so rare that it is an effective unwritten law.

JAPANESE HIGH LABOR COST, LIMITED POPULATION, FULL EMPLOYMENT AND FEW NATURAL RESOURCES, CREATES IMPORTANT BY-PRODUCTS TO FURTHER HELP TRADE

Japanese transportation and meetings run on time and at full capacity. Roughly twice as much as in the U.S. can be accomplished per day in Japan, especially those requiring meetings. The cordial, formal protocols help meetings proceed rapidly.

There's measurement of and pressure for efficiency. That is, the work-out/work-in ratio is high. For example, taxis have a driver-operated back door opener so that passengers can load/unload faster. The notion of efficiency seems to be taught to all and factories measure, graph and display key results. Concepts like fuel efficiency versus speed, weight and pollution are difficult concepts for Americans to understand, yet the Japanese "feel" them.

Given a notion of efficiency, there's real concern for saving physical resources too. At the computation center, printing isn't automatic; it's queued and must be requested separately. Lights, always florescent for high efficiency, are off when not in use. Of course small cars, taxis, a good train/subway are other indicators. The cars have mandatory bells that ring when the car is going over 100 Kmh! None of these artifacts for efficiency exist in the U.S.

Contrary to our "feelings", they are working the environment issue by less consumption, for example. This will indirectly make more money and resources available for production at lower costs. For example, cars don't pollute. U.S. environmental people at conferences in Japan are politely ignored while taking their basically boondoggle-oriented conference registration fees paid for by the U.S. government research establishment.

There is a range of basically human and personal concerns which encourage and support productivity. The result is a longer life span in the face of stress on productivity. While the subways and high density trains jostle people pretty badly, and there's no segmented smoker areas (and many smoke), there's great concern for the feelings, privacy and treatment of individuals. On arrival and departure at every organization, one is given moist cloths and refreshments. Taxis and buildings are air-conditioned. The hotels, though very expensive, provide privacy, ambiance and excellent food and service. For example, one expects a cloth cover over the telephone to enable it to fit the room decor. There are Japanese baths, and these are great too!

They are compulsively clean. In an indirect way, this really helps the manufacturing of small, precise goods including cameras, semiconductors, high-speed computers and disk memories.

There's orderly queueing at each server. The Japanese appear to be the world's best self-queuers. Queued systems of this type have higher through-put and make the best use of resources. One might suspect there is lower general hostility arising from competing for a finite resource when queueing.

Inventions are to labor-saving devices. There are countless gadgets to save scarce labor. Computation center line printers have paper cutters and conveyors in order to bring printing back to a single station. There are no computer operators and people to serve the users! This direct use of facilities not only costs less, but provides better service and through-put.

Conclusions

We must be impressed with the intense drive coupled with the technical, manufacturing and marketing acumen of the Japanese. This drive and ability, coupled with many factors of our society, has enabled the Japanese to systematically plan and dominate every U.S. market that they've attempted. Although there's been a "feeling" that the market domination is limited to low technology, there is evidence that nothing is immune.

However, despite a desire to blame the Japanese for dominating our manufacturing, it comes about because there are U.S. buyers and distributors for their goods. Distributors come about because of the intense emphasis we have on profit and return-on-investment. By only distributing and not designing and manufacturing the investment is negligible, giving a high return-on-investment.

The intent of the paper is to describe variously "how" this market/product domination is carried out. Like any good Japanese product, the ideas within the paper have been taken liberally from many sources -- mostly without credit. It should be self evident that, we (the U.S.) have a problem. Each of us, whether we be part of industry, government, or academia, can now address the issues we're responsible for. There's no real need for another fact-finding trip to Japan to further define the problem. Japan is clearly not a place to search for the solution.

Many solutions are required. Freezing the current level of government size spending and non-productive people (e.g., lawyers) would be fine first starts. Living within our collective energy budget is also needed. Rather than engaging in a trade war the following mechanism could simply address the trade deficit:

> No company can import and distribute a foreign product without arranging an equal export credit. That is, a company; such as Itel who buys and resells Japanese computers can get agricultural products to sell or it could export its own services in an equal amount. The trade balance has to be the distributor's problem -- not that of the President, or the Secretary of Commerce or Congress.

Appendix 1. A Chronology of Systematic Domination*

I. "Development of a domestic Japanese industry. The Japanese industry is developed and grows rapidly. The major aspects that mark this development include:

(a) Market control. Imports limited essentially to zero. Only a few major manufacturers are permitted. Prices remain significantly higher in Japan than in other competitive markets.

(b) Borrowed technology. The Japanese borrow heavily from foreign technology, including a large number of purchased licenses and patent rights, and wholesale reverse engineering.

(c) Vertical integration of most manufacturing.

(d) Major investments. Major investments are made in modern plant, equipment and technology, both for the final product and throughout the vertical chain of manufacturing. Continued research, development and plant investment expenses are made.

II. Establishing an export market base.

(a) The establishment of world-wide sales organizations.

(b) Researching and understanding of the foreign markets.

(c) Establishment of a reputation for quality and reasonable prices.

(d) A limited focus, especially in those markets less attractive to domestic manufacturers.

III. Major market penetration. Major market penetration occurs usually during an economic downturn in Japan. Previous efforts by the industry have set the stage for them to be successful in this endeavor. It is marked by the following considerations:

(a) Cooperation among the Japanese companies with respect to models, prices, and markets.

(b) Focus at the mainstream of the foreign market.

(c) High inventories because of poor markets in Japan, i.e., an export push at any cost is necessary and expedient.

(d) Extremely low prices to the mass market to gain market share rapidly, i.e., a knock-out punch to the domestic manufacturers. Modern plants, reasonable costs, an established export organization, and good reputation set the stage for success.

At this time, marketing muscle is established. Not only was the export market share large, but the domestic market remained closed. It should be pointed out that this major market penetration had been made by a combination of factors, as outlined. The greater marketing muscle allows the Japanese manufacturers to profit from their long investment.

IV. Market exploitation. This period is marked by higher prices -- often higher than domestic manufactured models. However, the higher prices are often more than offset by perceived higher quality, both real and imagined. There is also continued cooperation on prices and markets, as well as continued limitations on imports to the Japanese market."

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JULY 21, 1982

Dr. Kazuhiro Fuchi
Institute for New Generation Computer Technology
21F Mita Kokusai Building
1-4-28 Mita
Minato-Ku, Tokyo, Japan

Dear Dr. Fuchi:

It was a pleasure to meet with your and your staff on June 30 and discuss the direction for the Fifth Generation Research Program. I was extremely impressed with the program in terms of aggressive goals to build the Relational Database and Prolog machines. Also, I was delighted to hear that you made the excellent choice to use the DEC 20 as the LISP and Prolog machine for starting your applications work.

It was a pleasure to discuss the Computer Museum with you and present the vision of continuing to build an international, industry-wide museum for this most significant invention--the "computer." The word "Digital" is being dropped from it's name to avoid confusion. Enclosed is the first report and a museum layout which includes an invitation to become a member.

I would like to invite you to become either an institutional or personal founder to make this a significant international museum. You will note that the list of founders includes pioneers such as Gene Amdahl and Bob Noyce.

The Museum invites you to supply important artifacts for their historical preservation. The current list is included in the report and grows rapidly.

I'd welcome being able to show you the growing museum whenever you visit this area and discussing the Fifth Generation with you.

Sincerely,

Gordon Bell
Vice President, Engineering
Curator, The Computer Museum

CC: Dr. Gwen Bell, Director, The Computer Museum
    Dr. Sam Fuller
    Dr. Tom Kobayashi
    Grant Saviers, Vice President for Mass Storage Engineering

July 20, 1982

Mr. Osamu Seki, Director
Electronics Policy Division
Machinery & Information
Industries Bureau
Ministry of International
Trade and Industry (MITI)
Tokyo

Dear. Mr. Seki:

It was a pleasure to meet with you on 30 June on behalf of Digital Equipment Corporation.

At that time I mentioned that Digital would like to become a member of the Fifth Generation Research Program.

Sincerely,

Gordon Bell
Vice President, Engineering

CC: Dr. Tom Kobayashi

July 20, 1982

Mr. Shigeru Sato
Fujitsu Limited
1015, Kamikodanaka Nakahara-Ku
Kawasaki-Shi, Kanagawa-Ken 211,
Japan

Dear Mr. Sato:

It was nice to meet you again at the talk I gave on Ethernet at Tokyo University.

I'm grateful to you for supplying the early Fujitsu parts to the Computer Museum four years ago.

Sincerely,

Gordon Bell
Vice President, Engineering
Curator, The Computer Museum

CC: Dr. Gwen Bell, Director, The Computer Museum

August 2, 1982

Dr. M. Yasufuku
Executive Director
Fujitsu Limited
1015, Kamikodanaka Nakahara-KU
Kawasaki-Shi, Kanagawa-Ken 211, Japan

RE: Visit to Fujitsu Limited

Dear Dr. Yasufuku:

Thank you for your warm hospitality during my visit to Fujitsu. I was very much impressed by your company and its personnel as I wrote earlier.

Upon my return, I reviewed the material you gave me during my visit. For the first time, I noticed that several of the pages were marked with the legend "FUJITSU LIMITED - Proprietary and Confidential". Since you made no reference to any need to maintain your information in confidence during my visit, I assume that I can delete the legend and treat it as non-confidential like the other material you gave me. However, I will not distribute this material outside of Digital. If this is not the case, please let me know as soon as possible.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:pef
GB3.S6.52

JAPAN IMPRESSIONS (Part I)

Reaffirmed to be #1 in Sales and Technology (see slide on IBM hi-end)

Now claim to be #1 in supercomputers

Technologies that are dominated:

- Base materials and production (esp. Quality)
- CRT, LCD, EL
- Printing, fax, thermal, xerography
- Magnetic recording and video disk
- Video, video b/w compression and image processing
- Voice i/o
- Communications (installing systems)
- Fiber optics (installed LANs)
- Packaging and PWB's
- Semis and Semi CAD
- ECL, Bipolar, MOS, CMOS

. Research in J^2, (GaAs and HEMT in factory?)
. Robotics?

The Japanese Computer Industry

. (MITI and Fujitsu, Hitachi, NEC, Mitsubishi, Toshiba, Matshusta, Oki)

. have and are implementing a vision of 5G computing based on AI and high performance processing.

Program includes:

. Supercomputer technology, 1981 + 8 years (VLSI, J^2, GaSa, HEMT)
- new architecture and technology

. Dist. Proc. and LAN's ($40M over 3 years)
. ICOT (the main push)
. Next generation (farther out)
.NTT Si Compiler - a real compiler that's so far produced a 13k t chip in 2 months without using a CRT. Totally language driven with separate backends for CMOs, HMOs, bipolar or ECL. 2,000 people are working on VLSI and this will be used for smaller companies. Also, several new architectures, including 2 data flow.

ICOT - INSTITUTE OF NEXT GENERATION COMPUTERS

. Headed by Dr. Fuchi
. Coupled into universities - 5 people + 5 x 7 company research
. Use a 2060 for Prolog and LISP
. Two machines are to be built by companies (in 2 years)
- RDMS
- Prolog processor
(Data flow for Resolution desired)

. Prof. H. Goto, TU, believes Prolog is wrong and has Mitsui building a 10 mips LISP machine for him.
. Government funded, Company's fund space,...
. They are driven.

. Three Groups: Architecture, Application, Human Interface

<u>JAPAN IMPRESSIONS</u> (Part I)

Reaffirmed to be #1 in Sales and Technology (see slide on IBM hi-end)

Now claim to be #1 in supercomputers

Technologies that are dominated:

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- Communications (installing systems)
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- Semis and Semi CAD
- ECL, Bipolar, MOS, CMOS
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- Robotics?

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- <u>have</u> <u>and</u> <u>are implementing</u> a vision of 5G computing based on AI and high performance processing.

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- Supercomputer technology, 1981 + 8 years (VLSI, J^2, GaSa, HEMT)
  - new architecture and technology
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- ICOT (the main push)
- Next generation (farther out)
- NTT Si Compiler - a real compiler that's so far produced a 13k t chip in 2 months <u>without</u> using a CRT. Totally language driven with separate backends for CMOs, HMOs, bipolar or ECL. 2,000 people are working on VLSI and this will be used for smaller companies. Also, several new architectures, including 2 data flow.

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. Two machines are to be built by companies (in 2 years)
- RDMS
- Prolog processor
(Data flow for Resolution desired)

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. Government funded, Company's fund space,...
. They are driven.
. Three Groups: Architecture, Application, Human Interface

00 CORE DECGRAM ACCEPTED S 003411 O 389 20-JUL-82 17:36:59

****
* d i g i t a l *
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TO: TOM KOBAYASHI DATE: TUE 20 JUL 1982 2:29 PM EDT
OPERATIONS COMMITTEE: FROM: GORDON BELL
PEG: DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5170097172

SUBJECT: MISCELLANEOUS MESSAGES FROM JAPAN

Engineering Away From Maynard
Have never been more enthusiastic about doing engineering in both

Japan and Taiwan. There's a plentiful supply of dedicated, high
quality engineers and for the products where we have clear interface specs (eg VT100, or a printer) it's ideal. I saw a Taiwan design terminal that went out alternatively in boxes bound
for the US or sold internally at $600 to compete with the VT100.

A major reason why the Japanese and Chinese can be so effective is based on the notion of engineering learning curves. They really understand this implicitly. We should look at the case where upward or sideward or external mobility of engineers interfere with doing it again and taking advantage of the 20% better preformance the second time around. It's essential to keep the team together and do it several times, thereby taking advantage of great learning. We've not managed this well at all.

Software looks like a good thing to look at doing in Taiwan... especially applications such as engineering because the universities are so strong analytically.

In Taiwan one is supposedly able to check out the PDP 10/20 prints because all products are reproduced and go to all plants. This can be fixed simply. One plant is the designated plant to
support a product. Prints are released and kept there. If other
plants need them, they get released. The flexibility in the system makes for high productivity in the print room, but it requires much manpower to file all the stuff. Why?

Power Supplies continue to be a major problem in Japan. I think
we need a concerted effort to understand why. Clearly an engineering problem.

Computer Engineering was highly sought because it has so many papers that go into the philosophy of why something is designed a
particular way. The VAX, 11, and 10/20 papers were taken to be

excellent examples. This may be the best reason to have a DEC Engineering Journal... namely because that it will need pages. Right now people crave information on VMS, DECnet, Ethernet, LAN's, etc of this form. This sounds like something we need to
do within engineering.

Manufacturing

We must be careful not to bank too much on low, far east labor rates as the answer to costs. The Hitachi automatic lead bonder negates low labor costs and reduces inventory. The US semiconductor industry got trapped on this one. I think the work
on simple assembly robots will have a similar effect on producing commodity things. Seiko is very good here and others are investing much too. It's the old story of brawn vs brain (lots of very good electromechanical engineers).

Am really concerned about lurking competitors such as Brother who
are really building great smart typewriters. The step to a programmable computer is a very small one. They are getting the
profit from the commodities to make this happen.

I saw an excellent IBM captive plant in Taiwan making heads for the IBM 1403 printer, which was just cut back by a factor of 2.
IBM set up the whole thing, and bought much of the equipment, but
it's run by another company. This looks like a much better way to go if we want cost. (It'll cream a plant like Boston or Springfield or Albaquerque.)

Quality continues to be so much of a concern that the Japanese are and have installed a complete burn-in facility in Japan. I
don't see how we can continue our strong position by having to do
this. Spares are a great concern too. Much servicing is done by
carrying two.

Marketing
NEC had a great showroom for all it's products in downtown Tokyo.
Ken has been pushing this and based on the one I saw, the idea surely has merit.

The issue of having no separate marketing organization per se really struck me. NEC has half of the marketing in the sales organization (say here in New England and on the West Coast) and
the other part in the engineering organization. The two get together quarterly for a week to exchange demands. In this way the engineers really hear it from the sales/marketplace. Some form of this exchange looks vital for us.

WPS USERS - Leave HP mode and type <CR>

July 20, 1982

Dr. Hirohiko Aya
Mitsui Engineering &
Shipbuilding Co., Ltd.
6-4 Tsukiji 5-Chome
Chuo-Ku, Tokyo 104, Japan

Dear Dr. Aya:

It was a great pleasure to have dinner with you and Dr. Goto on June 30 and to discuss computing. I'm quite impressed with the work you've done in the large scale control of using computers. You are also to be congratulated for the support of Dr. Goto's LISP machine effort.

It was a pleasure to discuss the Computer Museum with you and present the vision of continuing to build an international, industry-wide museum for this most significant invention--the "computer." The word "Digital" is being dropped from it's name to avoid confusion. Enclosed is the first report and a museum layout which includes an invitation to become a member.

I would like to invite you to become either an institutional or personal founder to make this a significant international museum. You will note that the list of founders includes pioneers such as Gene Amdahl and Bob Noyce.

The Museum also invites you to supply important artifacts for their historical preservation. The current list is included in the report and grows rapidly.

I'd welcome being able to show you the growing museum whenever you visit this area.

Again, it was nice to meet you and I hope we meet again.

Sincerely,

Gordon Bell
Vice President of Engineering
Curator, The Computer Museum

CC: Dr. Gwen Bell, Director, The Computer Museum
Dr. Tom Kobayashi
Ed Reilly

July 20, 1982

Mr. Masahiko Morizono
Sony Corporation
Atsugi Plant
14-1 Asahicho-4
Atsugi-Shi Kanagawa-Ken
Japan

Dear Dr. Morizona:

Please let me thank you for the visit to your plant on 1 July.

I was extremely impressed with the video products, the Personal Computer and the Micro floppy development. Mr. Hori and Mr. Tanaka both gave impressive demonstrations of their Personal Computer and Micro floppy products. I came back very enthusiastic about the floppy and hope there's some way we can use it in our products.

Sincerely,

Gordon Bell
Vice President of Engineer, Digital Equipment Corporation

CC: Dr. Tom Kobayashi
Grant Savier, Vice President for Mass Storage Engineering

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+--------------------------+

SUBJ: ENCLOSED NOTES OF VISIT TO VARIOUS JAPANESE COMPANIES AND RESEARCH ORGANIZATIONS

TO: OPERATIONS COMMITTEE
PEG:
Dick Clayton
Jim Cudmore

Date: 7/21/82 Wed
From: Gordon Bell
Dept: Eng. Staff
MS: ML12-1/A51 Ext: 223-2236
EMS: @CORE

JUNE 21

. Japan Engineering Center Meeting

. Visit Mr. Yanase, TEAC President re our lack of buying drives

. Dinner with Drs. Kanai and Sasaki (head of Semis), NEC

JUNE 22

. Presentation and Demonstration on Kanji at CSS Hakusan by JTC and CSS personnel

. Ethernet lecture at KEIO University (Hiyoshi Campus)

. Dinner with Dr. Aiso and Prof. Tokoro

JUNE 23

. Visit Hitachi Central Research

They want a VAX. Looked at color CRT design.

. Visit Hitachi Musashi Semiconductor plant (see attached) and dinner (Dr. Makimoto)

JUNE 24

. Visit Asahi-shinbun Newspaper on IBM Kanji system

. Press Conference at Hilton Hotel

. Dinner with Sharp Dr. Saski (R&D,VP--now President) at American Club

<u>JUNE 25</u>

. Visit Fujitsu Kawasaki (Dr. Yasufuku, Semiconductor group head--General Manager Semis)--See M382, fiber optics, semis--see attached.

. Visit Mr. Yamamoto, President, at Fujitsu Headquarters re becoming a member of Fifth Generation Research Group.

. Dinner with Yasufuku, Hiraguri

<u>JUNE 26</u>

. Visit Machida (fiber optics) Industry - "one man" company

<u>JUNE 27</u>

. Rikei

<u>JUNE 28</u>

. Visit Electrotechnical Laboratories (ETL) in Tsukuba - Dr. Tojo

(see attached)

JUNE 29

. Visit NEC O.A. Show Room

. Visit NEC Central Research
Dedicated to be Number 1 in C&C (Computers and Communications)

. Engineers do marketing

. Sales and marketing are in 1 group

. There are quarterly, 1 week meetings on Product Planning with 50-100 people. Design engineers must attend (in Tokyo).

Chairman Kobayashi says:

1. All engineers must learn/know English
2. All employees must use Personal Computers

JUNE 30

. Lecture at Tokyo University (Moto-oka and Hiroya Fijisaki. Saw Dataflow Computers (8-control, 16-processor) FOR:1

Have built:

1. Old mP=4P

2. Prolog MC = 16 processor computers, 8 control computers, Z80 message passing, each P communicates 4 control computers. The companies build these gratis.

. Visit NTT Headquarters (sales)

. ICOT (5G) Research Lab, Dr. Fuchi

. Dinner with Mitsui, Zosen staff (sales) Prof. H. Goto (LISP machine)

JULY 1

. Visit SONY Headquarters (See MAVICA, audio disk)

. Visit SONY Atsugi, Mr. Morizono, VP

(see attached)

JULY 2

. Visit NTT Tsu-shin Kenkyu-sho

Electro Communications Lab

. Building T^2L LISP machine

. Building 2 Dataflow machines

. Building "Array" (1 bit machine)

. Address to sales and MC, dinner with MC

JULY 3

. Arrive Taipei - rest, write, swim, dinner with Yen

JULY 4-7

. Visit DEC Taiwan, 3 universities, China Computer Corporation (our rep.)

July 20, 1982

Mr. Haruo Yamaguchi
Nippon Telegraph and Telephone
Public Corporation
1-1-6 Uchisaiwai-Cho
Chiyoda-Ku, Tokyo
Japan

Dear Mr. Yamaguchi:

It was a pleasure to meet with you and your staff on June 30. Since NTT is such an important customer, it is necessary that we understand your requirements and I hope this meeting will lead to a better understanding. It has come to my attention that Fujitsu, NEC and Hitachi are going to provide Minicomputers to you based on VLSI. Is it possible that we might also discuss supplying computers under this arrangement?

Digital Japan wants to be very responsive to the needs of NTT and Digital is a major supplier of computers for communications on a world-wide and multi-applications basis.

If there is anything that any of us at Digital can do to be a more helpful or responsive supplier, please let us know.

Sincerely,

Gordon Bell
Vice President of Engineering, Digital Equipment Coporation

CC: Dr. Tom Kobayashi
Ed Reilly, Head of Digital, Japan
Jerry Witmore, Vice President

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! d ! i ! g ! i ! t ! a ! l !      I n t e r o f f i c e
M e m o
!___!___!___!___!___!___!___!
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TO: SAM FULLER DATE: WED 1 JUN 1983
1:12 PM DST
TOM KOBAYASHI FROM: GORDON BELL
JULIUS MARCUS DEPT: ENG STAFF
MAHENDRA PATEL EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

MESSAGE ID: 5201608801

SUBJECT: NTT/ECL'S AI PROJECT

GB5.47

I met Dr. Nobuyoshi Terashima
Mgr. Knowledge Base Research Dept.
NTT/ECL
Yokosuka-Shi, L38-03
(0468) 59 2680

at Stanford when he came to visit Ed Feigenbaum.

They have quite an impressive project where they're learning how to
build expert systems by putting together an advanced office automation
system. The tasks include scheduling of resources and people, filling
out forms, etc.

All of them might be done by conventional techniques, but the key is
to get people to program in a different style.

It would be good to visit them.

WPS USERS - Leave HP mode and type <CR>

July 20, 1982

Dr. M. Mizushima
Sony Corporation
7-35 Kitashinagawa 6-Chome
Shinagawa-Ku, Tokyo, 141 Japan

Dear Dr. Mizushima:

Please accept my sincerest thanks for the hospitality you and Dr. Kihara extended to me at Sony Headquarters on 1 July. I would also like to convey my thanks to Mr. Kishimoto who escorted us to the Atsugi Plant. It was impressive to see the Mavica and the Compact Audio Disk at the headquarters. The Video, Personal Computer and Microfloppy were equally good.

It was a pleasure to discuss the Computer Museum with you and present the vision of continuing to build an international, industry-wide museum for this most significant invention--the "computer." The word "Digital" is being dropped from it's name to avoid confusion. Enclosed is the first report and a museum layout which includes an invitation to become a member.

I would like to invite you to become either an institutional or personal founder to make this a significant international museum. You will note that the list of founders includes pioneers such as Gene Amdahl and Bob Noyce.

The Museum also invites you to supply important artifacts for their historical preservation. The current list is included in the report and grows rapidly.

I'd welcome being able to show you the growing museum whenever you visit this area. In the future, the museum intends to request that Sony assist in archiving important computer pioneer talks that have been given.

Again, thank you for the hospitality.

Sincerely,

Gordon Bell
Vice President of Engineering

CC: Dr. Gwen Bell, Director, The Computer Museum
    Dr. Tom Kobayashi

July 20, 1982

Dr. Nobutoshi Kihara
Sony Corporation
7-35 Kitashinagawa 6-Chome
Shinagawa-Ku, Tokyo, 141 Japan

Dear Dr. Kihara:

Although we only met briefly, please let me thank you for the hospitality extended to me at Sony by Dr. Hizushima and the staff at the Atsugi plant. I was very impressed by all the products and technology I saw there.

Sincerely,

Gordon Bell
Vice President of Engineering

CC: Dr. Tom Kobayashi

INDUSTRY, GOV'T, ACADEMIA,...SOCIETY CONSPIRE TO AID THE JAPANESE.

THEY HAVE <u>SYSTEMATICALL</u>Y DOMINATED TRADE BY:

1. DEVELOPMENT OF DOMESTIC INDUSTRY
2. ESTIMATED EXPORT BASE
3. MARKET PENETRATION

4. MARKET EXPLOITATION

STRATEGY & TACTICS OF THE JAPANESE

. INDUSTRY, GOV'T, ACADEMIA OPERATE AS TEAM.

. MITI IS AUTOCRATIC - CREATES JAPAN CLUB.

. WE HAVE NO MITI TO PROTECT AND BUILD TRADE RESOURCES.

. THE INTENT IS TO DOMINATE SEMIS + COMPUTERS.

. U.S. DEPT'S OF LABOR & COMMERCE AREN'T SKILLED & AREN'T TOGETHER.

THE JAPANESE "LIVE TO WORK VS. WORK TO LIVE"

. FOCUS IS ON WORK + LOYALTY.

. RISK TAKING IS POSSIBLE (WITH SECURITY).

. QUALITY CONTROL IS AT WORKER LEVEL.

. KNOW-HOW FOR TEAM (INTER-DISCIPLINARY) WORK.

. WORK IS THE GOALS VS. FREEDOM (NON-WORK).

J - "KNOW HOW" FOR DESIGN/TECH. ACCULTURATION

. PROCESSES ARE ORIENTED FOR COMPETITION, QUALITY, GROWTH, FLEXIBILITY.

. ACQUIRED COMPUTER TECH. FROM WORLD, (U.S.) - BUT IMPROVED ON IT.

. DESIGN INCLUDE: LOOK-ALIKE, LICENSE, REVERSE - ENGINEERING.

ENGINEER/DESIGN FOR LONG-TERM/NEEDS.

. DON'T DO MARKETING.

. GO FOR QUALITY VS. THROW-AWAY
LONG-LIFE CYCLE

J - UNDERSTAND AND MANAGE A COMPLETE PROCESS

- INVEST LITTLE IN RESEARCH - THE U.S. DOES IT FOR 'EM. COUPLING TO ARPA

- MITI HAS FEW LABS, BUT FUNDS (CONTROLS) WORK.

- ENGINEERING VS. SCIENCE

- UNDERSTAND GROWTH, VOLUME, DEMAND, ETC.

- THEY GIVE UP PROFIT FOR GROWTH (IN SHORT TERM)

BAD? PICTURE 3 ISLANDS:

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             ________          _______________      _______
             _______
        !        !          !               !     !       !
!       !
        ! ENERGY ! ---->    !   CONSUMER    !<--- ! MFG.  !<-
->! RAW   !
        !        !          !               !     ! GOODS !
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                                               !INFORMATION
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J AND AMERICAN BUYERS HAVE CHANGED FROM INVENTOR - MFG. - DISTRIBUTOR

TO DISTRIBUTOR

NO WAY FOR US TO RE-ENTER LOST BUSINESS.

(TEXTILES, STEEL, RADIOS, SEWING MACHINES, TYPEWRITERS, CAMERA/OPTICS, SMALL CARS, TV, TAPE RECORDERS, WATCHES, CALCULATORS, VIDEOTAPE, SEMICONDUCTORS, COMPUTERS.)

AMERICAN REGARD (WORSHIP) OF MBA.

AMERICAN BUSINESS FOCUS ON

AT A SOCIETY LEVEL THEY'RE TOGETHER

ENGINEERING & SCIENCE VS. LAW AND BUSINESS TRAINING

LOWER TAXES.

LESS MILITARY, NIH, NASA EXPENSES.

COMPUTING IS SUPPORTED.

April 17, 1979

Vern Alden, Chairman
Massachusetts Business Development Council
27th Floor
600 Atlantic Avenue
Boston, MA 02106

Dear Vern:

Thanks for setting things up and attending the meeting at Harvard last month. It was really stimulating. I look forward to our continued interaction on the subject over the years.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:swh
GB0002/25
GB3.S6.2

Mr. Koichiro Tanaka
Rikei Corporation
Shinjuku Nomura Building
1-26-2 Mosjo-Shinjuku,
Shinjuku-Ku, Tokyo 160 Japan

Dr. Michiyuki Uenohara
Nippon Electric Co., Ltd.
1-1, Miyazaki, Yonchome,
Miyamae-Ku, Kawasaki-City
Kanagawa Prefecture 213, Japan

Dr. Sukehiro Ito
Nippon Electric Co., Ltd.
1-1, Miyazaki, Yonchome,
Miyamae-Ku, Kawasaki-City
Kanagawa Prefecture 213, Japan

Mr. Hisashi Hosaka
Nippon Electric Co., Ltd.
33-1, Shiba Gochome
Minato-Ku, Tokyo 108, Japan

Professor Moto-oka
University of Tokyo
7-3-1 Hongo, Bunya-Ku
Tokyo 113, Japan

Professor Hiroya Fujisaki
Electrical Engineering Department
University of Tokyo
7-3-1 Hongo, Bunya-Ku
Tokyo 113, Japan

July 19, 1982

Mr. Koichiro Tanaka
Rikei Corporation
Shinjuku Nomura Building
1-26-2 Mosjo-Shinjuku,
Shinjuku-Ku, Tokyo 160 Japan

Dear Mr. Tanaka:

Please let me give you my strongest thanks for visiting Rikei and viewing the Perq computer on Sunday the 27th. I certainly appreciate the extraordinary effort it was to open Rikei on Sunday and let me see your facilities. Please also give my regards to the people responsible for programming the Perq who demonstrated the machines to me. I'm glad we have such a dedicated representative such as Rikei selling computers in Japan.

It was a pleasure to discuss the Computer Museum with you and present the vision of continuing to build an international, industry-wide museum for this most significant invention--the "computer." The word "Digital" is being dropped from it's name to avoid confusion. Enclosed is the first report and a museum layout which includes an invitation to become a member.

I would like to invite you to become either an institutional or personal founder to make this a significant international museum. You will note that the list of founders includes pioneers such as Gene Amdahl and Bob Noyce.

The Museum also invites you to supply important artifacts for their historical preservation. The current list is included in the report and grows rapidly.

I'd welcome being able to show you the growing museum whenever you visit this area.

Again thank you for your hospitality.

Sincerely,

Gordon Bell
Vice President, Engineering
Curator, Computer Museum

Enclosure
cc: Tom Kobayashi, DEC
    Gwen Bell, Computer Museum

July 19, 1982

Dr. Michiyuki Uenohara
Nippon Electric Co., Ltd.
1-1, Miyazaki, Yonchome,
Miyamae-Ku, Kawasaki-City
Kanagawa Prefecture 213, Japan

Dear. Dr. Uenohara and Dr. Ito:

Please accept my sincerest thank you for the hospitality at your research facility. Dr. Ito did an excellent job of hosting my visit at NEC Laboratory. Although we only met briefly I am greatly impressed by the work there. In particular I enjoyed seeing the computer aided design, learning about research in multiprocessors and in high speed circuitry, in particular Josephson Junction circuitry and the COBOL machine.

In regard to the COBOL machine I have requested we run your benchmark on VAX because I think we should be curious in comparing how well our VAX encodes and executes COBOL as compared with your specialized COBOL machine. I enjoyed seeing the Netec-X1 TV Codec, and think we are a potential customer for such a codec as we are using teleconferencing.

It was a pleasure to discuss the Computer Museum with you and present the vision of continuing to build an international, industry-wide museum for this most significant invention--the "computer." The word "Digital" is being dropped from it's name to avoid confusion. Enclosed is the first report and a museum layout which includes an invitation to become a member.

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I'd welcome being able to show you the growing museum whenever you visit this area. Again, thanks for the hospitality.

Sincerely,

Gordon Bell
Vice President, Engineering
Curator, Computer Museum

Enclosure
cc: Dr. Sukihiro Ito, NEC
    Tom Kobayashi, DEC
    Gwen Bell, Computer Museum

July 19, 1982

Dr. Sukehiro Ito
Nippon Electric Co., Ltd.
1-1, Miyazaki, Yonchome,
Miyamae-Ku, Kawasaki-City
Kanagawa Prefecture 213, Japan

Dear. Dr. Uenohara and Dr. Ito:

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Sincerely,

Gordon Bell
Vice President, Engineering
Curator, Computer Museum

Enclosure
cc: Dr. Michiyuki Uenohara, NEC
    Tom Kobayashi, DEC
    Gwen Bell, Computer Museum

July 19, 1982

Mr. Hisashi Hosaka
Nippon Electric Co., Ltd.
33-1, Shiba Gochome
Minato-Ku, Tokyo 108, Japan

Dear Mr. Hosaka:

Please accept my thanks for guiding us around the NEC show room on the morning of June 29th and for lunch, and then being with us at the NEC research laboratory.

It was a pleasure to meet you and I hope when you are in the Boston area you can visit our computer museum.

Sincerely,

Gordon Bell
Vice President, Engineering
Curator, Computer Museum

Enclosure
cc: Tom Kobayashi, DEC
Gwen Bell, Computer Museum

July 19, 1982

Professor Moto-oka
University of Tokyo
7-3-1 Hongo, Bunya-Ku
Tokyo 113, Japan

Dear Professor Moto-oka:

It was a great pleasure to see you again at the University of Tokyo. It was really my pleasure to lecture to your students and colleagues on June 30th.

I was quite impressed with your multiprocessor that is used for the execution of the prolog. I believe that this is a very impressive achievement.

I was delighted that earlier this year you were able to present a talk on the fifth generation at the computer museum. Also, I'd like to thank you for the introduction to Mr. Seki of MITI.

It was a pleasure to discuss the Computer Museum with you and present the vision of continuing to build an international, industry-wide museum for this most significant invention--the "computer." The word "Digital" is being dropped from it's name to avoid confusion. Enclosed is the first report and a museum layout which includes an invitation to become a member.

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The Museum also invites you to supply important artifacts for their historical preservation. The current list is included in the report and grows rapidly.

Again, thank you for the hospitalility.

Sincerely,

Gordon Bell
Vice President, Engineering
Curator, Computer Museum

Enclosure
cc: Tom Kobayashi, DEC
Gwen Bell, Computer Museum

July 19, 1982

Professor Hiroya Fujisaki
Electrical Engineering Department
University of Tokyo
7-3-1 Hongo, Bunya-Ku
Tokyo 113, Japan

Dear Professor Fujisaki:

It was great to see you again at the University of Tokyo after 23 years. I am sorry that we did not have more time to visit and to be together socially. In the future Gwen will come to Tokyo and she would like to visit you too. So both of us, I hope, will see you there.

On the other hand I know that you probably travel to the U.S. more than I travel to Japan. Let me urge you to visit us. You are welcome to stay at our house when you come to Boston.

It was a pleasure to discuss the Computer Museum with you and present the vision of continuing to build an international, industry-wide museum for this most significant invention--the "computer." The word "Digital" is being dropped from it's name to avoid confusion. Enclosed is the first report and a museum layout which includes an invitation to become a member.

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Sincerely,

Gordon Bell
Vice President, Engineering
Curator, Computer Museum

Enclosure
cc: Tom Kobayashi, DEC
Gwen Bell, Computer Museum
GB3.S6.3

Dr. Hisao Kanai
Nippon Electric Company, Ltd.
10, 1-Chome, Nisshin-Cho
Fuchu City, Tokyo, 183 Japan

Dr. Hajime Sasaki
General Manager,
VLSI Development Division
Nippon Electric Company, Ltd.
1753, Shimonumabe, Nakahara-ku,
Kawasaki City, Kanagawa, 211 Japan

Mr. Noboru Yanase
President
Teac Corporation
3-7-3, Naka-Cho
Musashino, Tokyo, Japan

Professor Hideo Aiso
Keio University
3-14-1, Hiyoshi
Kohoku-Ku, Yokohama 223, Japan

Dr. Tsuneyo Chiba
Hitachi Central Research
Kokubunji, Tokyo 185, Japan

Dr. Makimoto
Hitachi. Ltd.
Nippon Building
No. 6-2, 2-Chome, Ohtemachi
Chiyoda-Ku Tokyo 100, Japan

Dr. Tadashi Sasaki
Sharp Corporation
2613-1, Ichinomoto-Cho
Tenri-City, Nara 632, Japan

Dr. Takuma Yamamoto, President
Fujitsu
Furukawa Sogo Building
6-1, Marunouchi 2-Chome
Chiyoda-Ku, Tokyo 100, Japan

Dr. Yasufuku
Fujitsu Ltd.
1015, Kamikodanaka Nakahara-KU
Kawasaki-Shi, Kanagawa-Ken 211, Japan

Mr. Toshio Hiraguri
Fujitsu Ltd.
1015, Kamikodanaka Nakahara-KU
Kawasaki-Shi, Kanagawa-Ken 211, Japan

Mr. Haruhiko Machida
Machida Endoscope Co., Ltd.
13-8, Honkomogome 6-Chome,
Bunkyo-Ku, Tokyo, Japan

Dr. Akio Tojo
ETL, Tsukuba
1-1-4 Umezono
Tsukuba Science City
Ibaraki, Japan 305

July 19, 1982

Dr. Hisao Kanai
Nippon Electric Company, Ltd.
10, 1-Chome, Nisshin-Cho
Fuchu City, Tokyo, 183 Japan

Dear Dr. Kanai:

It was a great pleasure to see you again in Tokyo on Monday the 21st of June and to have dinner with you and Dr. Sasaki. Our engineers in Marlboro still refer to your excellent lecture several months ago when you visited the United States.

On the 29th of June, I visited the NEC Research Laboratory and met Dr. Uenohara and reviewed some of the excellent semiconductor and computer system's research. I also visited the NEC showroom to look at your fine products. My impression is that NEC is a very fine company dedicated to producing state-of-the-art products. It also appears to be a company that is a pleasure to work in because of such competent people.

It was a pleasure to discuss the Computer Museum with you and present the vision of continuing to build an international, industry-wide museum for this most significant invention--the "computer." The word "Digital" is being dropped from it's name to avoid confusion. Enclosed is the first report and a museum layout which includes an invitation to become a member.

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The Museum also invites you to supply important artifacts for their historical preservation. The current list is included in the report and grows rapidly.

I'd welcome being able to show you the growing museum whenever you visit this area.

Please give my regards to your colleagues and my congratulations to your Chairman, Dr. Kobayashi. Thank you for the fine hospitality.

Sincerely,

Gordon Bell
Vice President, Engineering
Curator, Computer Museum

Enclosure
cc: Tom Kobayashi, DEC
Gwen Bell, COMPUTER MUSEUM

July 19, 1982

Dr. Hajime Sasaki
General Manager,
VLSI Development Division
Nippon Electric Company, Ltd.
1753, Shimonumabe, Nakahara-ku,
Kawasaki City, Kanagawa, 211 Japan

Dear Dr. Sasaki:

Thank you for taking the time from your busy schedule at NEC to have dinner with me and Dr. Kobayashi, and Dr. Kanai. It was a pleasure to see you again in Tokyo and I look forward to your continued visits in Maynard and continuing to buy various computer components from you.

I visited the NEC Central Research on the 29th and there learned of your advanced semiconductor research work, especially those in Josephson Junctions. I hope on your next visit here you might present some of the future directions for high speed semiconductors. We have an interest in high speed gate arrays, too.

It was a pleasure to discuss the Computer Museum with you and present the vision of continuing to build an international, industry-wide museum for this most significant invention--the "computer." The word "Digital" is being dropped from it's name to avoid confusion. Enclosed is the first report and a museum layout which includes an invitation to become a member.

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Again, thank you for your fine hospitality.

Sincerely,

Gordon Bell
Vice President, Engineering
Curator, Computer Museum

Enclosure
cc: Tom Kobayashi, DEC
Gwen Bell, COMPUTER MUSEUM

July 19, 1982

Mr. Noboru Yanase
President
Teac Corporation
3-7-3, Naka-Cho
Musashino, Tokyo, Japan

Dear Mr. Yanase:

It was a great pleasure to meet you and Mr. Jitsukawa on June 21st and to discuss our problems with the order from your company. I am sorry for the inconvenience but I have been assured that our factory responsible for the manufacture of the product is going to remedy the situation. Also, our President, Ken Olsen is looking into the situation.

It was a pleasure to discuss the Computer Museum with you and present the vision of continuing to build an international, industry-wide museum for this most significant invention--the "computer." The word "Digital" is being dropped from it's name to avoid confusion. Enclosed is the first report and a museum layout which includes an invitation to become a member.

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Again, thank you for your patience. I can assure you that this is not normal, Digital business practice.

Sincerely,

Gordon Bell
Vice President, Engineering
Curator, Computer Museum

Enclosure
cc: Gwen Bell, COMPUTER MUSEUM
Ken Olsen, DEC
Tom Kobayashi, DEC

July 19, 1982

Professor Hideo Aiso
Keio University
3-14-1, Hiyoshi
Kohoku-Ku, Yokohama 223, Japan

Dear Professor Aiso:

It was great to meet you at Keio University on June 22nd and it was my pleasure to present the lecture on Ethernet.

I certainly appreciate the 45,000 yen honorarium and I have transferred this money to the Digital Computer Museum in the name of the Computer Science Department of Keio University. It qualifies you for founding membership in the Computer Museum.

It was a pleasure to discuss the Computer Museum with you and present the vision of continuing to build an international, industry-wide museum for this most significant invention--the "computer." The word "Digital" is being dropped from it's name to avoid confusion. Enclosed is the first report and a museum layout which includes an invitation to become a member.

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I'd welcome being able to show you the growing museum whenever you visit this area.

Again, thank you for hosting me at Keio. I enjoyed the dinner with you and Prof. Tokoro and Dr. Uchida of ICOT.

Sincerely,

Gordon Bell
Vice President, Engineering
Curator, Computer Museum

Enclosure
cc: Gwen Bell, Computer Museum
Tom Kobayashi, DEC

July 19, 1982

Dr. Tsuneyo Chiba
Hitachi Central Research
Kokubunji, Tokyo 185, Japan

Dear Dr. Chiba:

Thank you for hosting me at the Hitachi Central Research on June 23rd and for lunch with you and your colleagues, Dr. Masaki and Dr. Kamiuchi. Please give my regards to Dr. Kayama who acted as my host at your laboratory.

It was a pleasure to get an understanding of your research in computer aided design, data transmission and semiconductors. As a customer we are especially interested in your semiconductors.

It was a pleasure to discuss the Computer Museum with you and present the vision of continuing to build an international, industry-wide museum for this most significant invention--the "computer." The word "Digital" is being dropped from it's name to avoid confusion. Enclosed is the first report and a museum layout which includes an invitation to become a member.

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Sincerely,

Gordon Bell
Vice President, Engineering
Curator, Computer Museum

Enclosure
cc: Gwen Bell, Computer Museum
Tom Kobayashi, DEC

July 19, 1982

Dr. Makimoto
Hitachi. Ltd.
Nippon Building
No. 6-2, 2-Chome, Ohtemachi
Chiyoda-Ku Tokyo 100, Japan

Dear Dr. Makimoto:

I enjoyed having dinner with you and your colleagues, and I look forward to a continued close working relationship between Digital and Hitachi.

Thank you for hosting me at the Hitachi semiconductor works on June 23rd. It was indeed a pleasure to visit Hitachi and learn of your developments in all kinds of semiconductors and in particular the status of CAD work. I was especially happy with the 64K static CMOS RAM you gave me and our people are looking at the technology of this RAM at this time and I hope we can use it.

It was a pleasure to discuss the Computer Museum with you and present the vision of continuing to build an international, industry-wide museum for this most significant invention--the "computer." The word "Digital" is being dropped from it's name to avoid confusion. Enclosed is the first report and a museum layout which includes an invitation to become a member.

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It was nice to see you again after your first visit to the Museum.

Sincerely,

Gordon Bell
Vice President, Engineering
Curator, Computer Museum

Enclosure
cc: Gwen Bell, Computer Museum
Tom Kobayashi, DEC

July 19, 1982

Dr. Tadashi Sasaki
Sharp Corporation
2613-1, Ichinomoto-Cho
Tenri-City, Nara 632, Japan

Dear Dr. Sasaki:

It was a great pleasure to meet you for dinner on June 24th and learn of your activities at Sharp. I congratulate you on becoming the new President of Sharp and I hope that in the future we may become closer.

It was especially interesting to learn that you are writing a history of calculators from the abacus through the mini and including the office machines. We have quite an extensive calculator collection at the Museum, including a Napier Bones, as well as various calculating tables.

It was a pleasure to discuss the Computer Museum with you and present the vision of continuing to build an international, industry-wide museum for this most significant invention--the "computer." The word "Digital" is being dropped from it's name to avoid confusion. Enclosed is the first report and a museum layout which includes an invitation to become a member.

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The Museum also invites you to supply important artifacts for their historical preservation. The current list is included in the report and grows rapidly.

Again, I enjoyed our interaction and I hope you can visit us here in Digital and especially the Computer Museum.

Sincerely,

Gordon Bell
Vice President, Engineering
Curator, Computer Museum

Enclosure
cc: Gwen Bell, Computer Museum
Tom Kobayashi, DEC
Ken Olsen, DEC

July 19, 1982

Dr. Takuma Yamamoto, President
Fujitsu
Furukawa Sogo Building
6-1, Marunouchi 2-Chome
Chiyoda-Ku, Tokyo 100, Japan

Dear Dr. Yamamoto:

Thank you for meeting with me on June 25th and discussing how we might become part of the fifth generation research program. On the following days I visited ICOT and Professor Moto-oka and introduced myself to Mr. Seki of MITI. The research program that is going on at ICOT looks very good and everyone is enthusiastic and dedicated to its success. I think there will be very interesting results from this work. I would also be interested in joining this effort.

It was a pleasure to visit your semiconductor work under the direction of Dr. Yasafuku. As a customer of Fujitsu's, we are very impressed with the quality and technology of your products.

It was also a pleasure to discuss the Computer Museum with you and present the vision of continuing to build an international, industry-wide museum for this most significant invention--the "computer." The word "Digital" is being dropped from it's name to avoid confusion. Enclosed is the first report and a museum layout which includes an invitation to become a member.

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The Museum also invites you to supply important artifacts for their historical preservation. The current list is included in the report and grows rapidly. I met Dr. Sato on June 30th and he and Dr. Kurosaki had presented us with earlier Fujitsu artifacts for the museum.

I'd welcome being able to show you the growing museum whenever you visit this area.

Sincerely,

Gordon Bell
Vice President, Engineering
Curator, Computer Museum

Enclosure
cc: Gwen Bell, Computer Museum
Tom Kobayashi, DEC
Ken Olsen, DEC

July 19, 1982

Dr. Yasufuku
Fujitsu Ltd.
1015, Kamikodanaka Nakahara-KU
Kawasaki-Shi, Kanagawa-Ken 211, Japan

Dear Dr. Yasufuku:

Thank you very much for hosting me at your Kawasaki Research Facility. I enjoyed the openness of your semiconductor presentation and I was certainly impressed with the technology and engineering capability of Fujitsu. I enjoyed looking at the fiber optics and the M382 in your plant. Your work is indeed impressive and its no wonder that you're a key supplier for our semiconductor components. I look forward to our continued interaction in the future. I hope that Jeff Kalb, who heads our semiconductor work, can visit you soon to view your impressive facilities.

Sincerely,

Gordon Bell
Vice President, Engineering
Curator, Computer Museum

cc: Tom Kobayashi,DEC
Jeff Kalb,DEC

July 19, 1982

Mr. Toshio Hiraguri
Fujitsu Ltd.
1015, Kamikodanaka Nakahara-KU
Kawasaki-Shi, Kanagawa-Ken 211, Japan

Dear Mr. Hiraguri:

I enjoyed meeting you for dinner with Dr. Yasafuku on June 25th and I am certainly impressed with your design capabilities for mainframes. You are to be highly congratulated on the successful design of the M382. It is a very spectacular engineering achievement.

If you are in the U.S., please feel free to visit me.

Sincerely,

Gordon Bell
Vice President, Engineering
Curator, Computer Museum

cc: Tom Kobayashi, DEC

July 19, 1982

Mr. Haruhiko Machida
Machida Endoscope Co., Ltd.
13-8, Honkomogome 6-Chome,
Bunkyo-Ku, Tokyo, Japan

Dear Mr. Machida:

I enjoyed visiting your company on Saturday, June 26th. Thank you for taking Saturday morning and presenting the work on your vast array of optical and fiber optics work. It was great to see the laboratory of an incredibly innovative company like yours. I am certainly impressed with all the products and I hope that we can cooperate to supply computers for your fiber optic tomograph and I hope that, in turn, we can purchase fiber optic devices from you for some of our products. We need this innovation for our products.

It was a pleasure to discuss the Computer Museum with you and present the vision of continuing to build an international, industry-wide museum for this most significant invention--the "computer." The word "Digital" is being dropped from it's name to avoid confusion. Enclosed is the first report and a museum layout which includes an invitation to become a member.

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Again, thank you.

Sincerely,

Gordon Bell
Vice President, Engineering
Curator, Computer Museum

Enclosure
cc: Tom Kobayashi
Gwen Bell, Computer Museum

July 19, 1982

Dr. Akio Tojo
ETL, Tsukuba
1-1-4 Umezono
Tsukuba Science City
Ibaraki, Japan 305

Dear Dr. Tojo:

Please let me take this opportunity to thank you and your colleagues for hosting me on the afternoon of June 28th at ETL. I enjoyed interacting with Drs. Nakajima, Shirai, Yuba and Shimada and learning of your work in picture processing, speech, vision of the LISP machine and your recent work on data flow architectures. I have admired the work of ETL for many years and I'm happy that we can supply computers to you in Tsukuba Science City. I look forward to our continued close relationship.

I'm happy that Dr. Kobayashi is setting up a research and development laboratory in Tokyo and look forward to our being able to interact with your laboratories there for the design of creative products.

It was a pleasure to discuss the Computer Museum with you and present the vision of continuing to build an international, industry-wide museum for this most significant invention--the "computer." The word "Digital" is being dropped from it's name to avoid confusion. Enclosed is the first report and a museum layout which includes an invitation to become a member.

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The Museum also invites you to supply important artifacts for their historical preservation. The current list is included in the report and grows rapidly. I think the LISP machine would be a worthwhile artifact for the museum. I saw the earliest ETL machine in the Tokyo Science Museum. Is there any chance that we could secure some plug-in units, from each of the ETL machines that were in the museum.

I'd welcome being able to show you the growing museum whenever you visit this area.

Sincerely,

Gordon Bell
Vice President, Engineering
Curator, Computer Museum

Enclosure
cc: Tom Kobayashi, DEC
Gwen Bell, Computer Museum

July 19, 1982 GB3.S5.73

Mr. T. Kuroki
DEC Japan, Marketing Dept.

Dear Mr. Kuroki:

Please let me express my gratitude for the prompt, careful, courteous and pleasant driving while in Japan. It was nice to work with such a competent and pleasant fellow Digital employee.

Sincerely,

G. Bell

cc: Tom Kobayashi
Ed Reilly

GB/pef

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION DATE: WED 14 JUL 1982
1:36 PM EDT

FROM: GORDON BELL
cc: RAD: DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

MESSAGE ID:
5169488093

SUBJECT: WHY WE MUST BUILD A GREAT PORTABLE TERMINAL/PERSONAL COMPUTER

TRIP TO JAPAN, STIMULATE THESE MANY THOUGHTS:

MOTIVATION

0. Japanese consumer electronics makers are entering the computer
market both with components (eg. TEAC is 1/2 digital with floppies
and Wini's) and systems (eg. Sony).

1. Lots of small, portable, relatively useful products are now on the
market including:
    a. Computing calculators with narrow paper, and mass storage
    b. Sony typecorder
    c. Brother $200 thermal ribbon typewriter and calculator
    d. Viewman
    e. Purse-sized computer terminal
    f. Low cost Timex computer
    g. Grid systems using Sharp EL panels

2. Emerging Components:
   a. EL and LCD panels
   b. 64K CMOS rams and many other CMOS parts;
   c. 256K rams & large roms
   d. Sony micro diskette
   e. Modem chips, codecs, telephone interfaces
   f. Voice synthesizers and analyzers
   g. A plethora of 2K-8K gate CMOS gate arrays.
   h. Videoprocessors

3. Personal need of a product like Dynabook that does the functions that are emerging in today's personal computers.

4. The size would help drive the cost, styling and the market. We need a more aggressive cost and functional target to push us.

5. Our manufacturing technology is not good enough to build low cost terminals. If we get some reasonable distribution channels going, then we could do a joint venture with high volume supplier such as Brother, Sharp, Sony or some other supplier who is good at low cost, high volume units. They'd teach us.

6. This product is inevitable and I think possibly more desirable than current, bulky PC's. We must work on it before we find that we're behind and that someone else is taking the market.

7. Within a few (say <5 years) a unit such as this will provide the
    functionality of today's large PC's. This is more than many users
    can handle anyway.

SOFTWARE FUNCTIONS - What it does

- Standard, correcting typewriter mode
- Good word processor
- Visicalc
- Scientific calculator (possibly compatible with TI and/or HP programmables)
- Business calculator
- Virtual Terminal (for all common terminals)
- Terminal compatibility with new very small terminal system
- File transfer to/from DEC system
- Standard Basic?
- Games (optional)
- Very fancy alarm clock
- Calendar keeper ala WPS
- Forms entry/WPS math for expense account data, order entry, etc.
- Datatrieve (eg. for names, addresses, comments, fields)
- Voice would ideally be the interface. Failing this, we could use handwritten input and keyboard. Voice annotation and dictation are a must.
- Telephone message interface

HARDWARE REQUIREMENTS

	IDEAL	GOOD	ACCEPTABLE
Display**	24-66 lines;1Kx1K	8 lines	1 line or 8 lines
Print* qual.	"LA100"		"LA12" none?
Graphics	yes	video text	none
TV i/o	yes		none

Keyboard	Brother "std"	--	Brother "portable"
Handwriting	yes (notes)	--	none
Voice	recognition	"Pro 350"	none
Modem	"LA12"		300 b acoustic
Fax	full	no scan	none
File	Sony Micro flopy		Micro cassette
Pc	VAX	don't care	
Mp	256K		65K
Power	solar	6-12hr. batt.	AC
Size	"Typecorder & Sony floppy"		Briefcase/2
Weight	2#		5#
Clock	yes		yes

*   Need not see printing if display is good.

** (Ability to browse & deal with multiple, overlapping windows)<-too wild?

COMPUTER AND CALCULATOR SIZES AND PRICE RANGES

Wrist watch watches	25 - 160	Casio
Purse/shirt pocket calculator	10 - 62.50	thin
Hand held/coat pocket	10 - 62.50	HP35
(Programmable)	62.50 - 160	
Paper stack sized	160 - 1000	Typecorder
Portable typewriter	160 - 400	
Typewriter	400 - 1000	?
CRT-based PC	1000 - 6250	VT182

DISPLAY - I met the head of engineering who has subsequently become head of Sharp. They have various solid state displays and will soon have an 83X8 line LCD. He commented on the Grid System portable computer. Sharp also has Maxwell's Equations in concrete at their R & D center.

Having tried to edit on the Sony (40 characters) and Brother typewriters (16 characters), I think we should not make people suffer, but pay the extra price (say $500 selling price) for something that can be used.

The 8 line display be totally program transparent to a standard 24 line CRT by having two characters define the bottom of the window. On entry it would start at 8, go to 24, and stay there,

scrolling off the
top. At anytime the window bottom could be moved back, independent of
the cursor. Any action on the cursor would snap the window back to
24, displaying the bottom part of the "CRT".

KEYBOARD - I'd like a regular typewriter keyboard although the $200
Brother is acceptable. It should be quiet.

PRINTER - I now believe a printer of some sort is nearly always
required for the foreseeable future. Here, it would be nice to print
high quality so that personal notes and letters could be sent. It
would be possible to have this printer modular, but given the small
Brother portable, the typewriter doesn't seem to add much size or
cost.

The printer would be used to supplement editing, for personal
correspondence, forms, order confirmation, calculator, etc. I typed
on the big, office, Daisy Wheel Brother which had a 16 character
display and did most of the important functions of our WPS. It was
very impressive and especially nice to have no carriage motion until
the line was ready to be printed.

The $200 little, thermal, sub-portable Brother was most impressive!
It too had a 16 character display and includes a calculator mode.
It's the size of a Sony Typecorder, so it occupies about 1/4 briefcase
and is 1 1/2" - 2" x 8 1/2" x 11" - or "paper stack" size" or 1/2 the

size of a portable.

MASS STORAGE - Although it's too late to redo our decision, the Sony 31/2" Micro floppy looks to be ideal and could obviate the need for the 5 1/4". The project engineer gave one of the best presentations I've ever seen on why it will become the dominant drive. He started with goals and constraints and went into detail of all kinds. He believes they've got a technology base that can live for 10 years in terms of form factor and cartridge.

For this computer, it could be acceptable to limit response time to small tapes since they would only store files that would mostly be in memory.

APPROACHES

I don't think we can achieve the "ideal" within two years. Rather than waiting, we can take two, two-step approaches:

1. Build the right sized unit now and put in whatever is possible, giving up some level of functionality. Don't worry cost, but put in the most functions we can for the "Typecorder" size. The next incarnation would have more capability and approach the ideal.

2. Large size first with right functionality, then cost (and size) reduce.

I strongly prefer the first approach targetting small size to get our thinking down. The Nebula with VS100 and good copier

output
is what I want. Therefore, it's important to constrain size, not
function in our design! Such a product could be easily spec'd and
built either here or with one of the major Japanese vendors.

"TO" DISTRIBUTION:

BILL AVERY	PAUL BAUER	ART CAMPBELL
DICK ESTEN	BARRY JAMES FOLSOM	SAM FULLER
JOHN KIRK	TOM KOBAYASHI	AVRAM MILLER
KEN OLSEN	GRANT SAVIERS	JACK SMITH
DON WILSON		

WPS USERS - Leave HP mode and type <CR>

TRIP TO JAPAN, STIMULATE THESE MANY THOUGHTS:

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b. Sony typecorder

c. Brother $200 thermal ribbon typewriter and calculator

d. Viewman

e. Purse-sized computer terminal

f. Low cost Timex computer

g. Grid systems using Sharp EL panels

2. Emerging Components:

a. EL and LCD panels

b. 64K CMOS rams and many other CMOS parts;

c. 256K rams & large roms

d. Sony micro diskette

e. Modem chips, codecs, telephone interfaces

f. Voice synthesizers and analyzers

g. A plethora of 2K-8K gate CMOS gate arrays.

h. Videoprocessors

3. Personal need of a product like Dynabook that does the functions that are emerging in today's personal computers.

4. The size would help drive the cost, styling and the market. We need a more aggressive cost and functional target to push us.

5. Our manufacturing technology is not good enough to build low cost terminals. If we get some reasonable distribution channels going, then we could do a joint venture with high volume supplier such as Brother, Sharp, Sony or some other supplier who is good at low cost, high volume units. They'd teach us.

6. This product is inevitable and I think possibly more desirable than current, bulky PC's. We must work on it before we find that we're behind and that someone else is taking the market.

7. Within a few (say <5 years) a unit such as this will provide the functionality of today's large PC's. This is more than many users can handle anyway.

SOFTWARE FUNCTIONS - What it does

Standard, correcting typewriter mode
Good word processor
Visicalc
Scientific calculator (possibly compatible with TI and/or HP programmables)
Business calculator
Virtual Terminal (for all common terminals)
Terminal compatibility with new very small terminal system
File transfer to/from DEC system
Standard Basic?
Games (optional)
Very fancy alarm clock
Calendar keeper ala WPS
Forms entry/WPS math for expense account data, order entry, etc.
Datatrieve (eg. for names, addresses, comments, fields)
Voice would ideally be the interface. Failing this, we could use handwritten input and keyboard. Voice annotation and dictation are a must.
Telephone message interface

HARDWARE REQUIREMENTS

	IDEAL	GOOD	ACCEPTABLE
Display**	24-66 lines;1Kx1K	8 lines	1 line or 8 lines
Print* qual.	"LA100"		"LA12" none?
Graphics	yes	video text	none
TV i/o	yes		none
Keyboard	Brother "std"	--	Brother "portable"
Handwriting	yes (notes)	--	none

Voice	recognition	"Pro 350"	none
Modem	"LA12"		300 b acoustic
Fax	full	no scan	none
File	Sony Micro flopy		Micro cassette
Pc	VAX	don't care	
Mp	256K		65K
Power	solar	6-12hr. batt.	AC
Size	"Typecorder & Sony floppy"		Briefcase/2
Weight	2#		5#
Clock	yes		yes

*   Need not see printing if display is good.

** (Ability to browse & deal with multiple, overlapping windows)<-too   wild?

COMPUTER AND CALCULATOR SIZES AND PRICE RANGES

Wrist watch	25 - 160	Casio watches
Purse/shirt pocket calculator	10 - 62.50	thin
Hand held/coat pocket	10 - 62.50 62.50 - 160 (Programmable)	HP35
Paper stack sized	160 - 1000	Typecorder
Portable typewriter	160 - 400	
Typewriter	400 - 1000	?
CRT-based PC	1000 - 6250	VT182

DISPLAY - I met the head of engineering who has subsequently become head of Sharp. They have various solid state displays and will soon have an 83X8 line LCD. He commented on the Grid System portable computer. Sharp also has Maxwell's Equations in concrete at their R & D center.

Having tried to edit on the Sony (40 characters) and Brother typewriters (16 characters), I think we should not make people suffer, but pay the extra price (say $500 selling price) for something that can be used.

The 8 line display be totally program transparent to a standard 24 line CRT by having two characters define the bottom of the window. On entry it would start at 8, go to 24, and stay there, scrolling off the top. At anytime the window bottom could be moved back, independent of the cursor. Any action on the cursor would snap the window back to 24, displaying the bottom part of the "CRT".

KEYBOARD - I'd like a regular typewriter keyboard although the $200 Brother is acceptable. It should be quiet.

PRINTER - I now believe a printer of some sort is nearly always required for the foreseeable future. Here, it would be nice to print high quality so that personal notes and letters could be sent. It would be possible to have this printer modular, but given the small Brother portable, the typewriter doesn't seem to add much size or cost.

The printer would be used to supplement editing, for personal correspondence, forms, order confirmation, calculator, etc. I typed on the big, office, Daisy Wheel Brother which had a 16 character display and did most of the important functions of our WPS. It was very impressive and especially nice to have no carriage motion until the line was ready to be printed.

The $200 little, thermal, sub-portable Brother was most impressive! It too had a 16 character display and includes a calculator mode. It's the size of a Sony Typecorder, so it occupies about 1/4 briefcase and is 1 1/2" - 2" x 8 1/2" x 11" - or "paper stack" size" or 1/2 the size of a portable.

MASS STORAGE - Although it's too late to redo our decision, the Sony 31/2" Micro floppy looks to be ideal and could obviate the need for the 5 1/4". The project engineer gave one of the best presentations I've ever seen on why it will become the dominant drive. He started with goals and constraints and went into detail of all kinds. He believes they've got a technology base that can live for 10 years in terms of form factor and cartridge.

For this computer, it could be acceptable to limit response time to small tapes since they would only store files that would mostly be in memory.

APPROACHES

I don't think we can achieve the "ideal" within two years. Rather than waiting, we can take two, two-step approaches:

1. Build the right sized unit now and put in whatever is possible, giving up some level of functionality. Don't worry cost, but put in the most functions we can for the "Typecorder" size. The next incarnation would have more capability and approach the ideal.

2. Large size first with right functionality, then cost (and size) reduce.

I strongly prefer the first approach targetting small size to get our thinking down. The Nebula with VS100 and good copier output is what I want. Therefore, it's important to constrain size, not function in our design! Such a product could be easily spec'd and built either here or with one of the major Japanese vendors.

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|   |   |   |   |   |   |   |                 m e m o r a n d u m
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SUBJ: TOKYO PRESS CONFERENCE 6/24/82--INCLUDING HISTORICAL PERSPECTIVES ON DEC

TO: Operations Committee Date: 7/19/82 Mon
Dick Berube From: Gordon Bell
Bob Lane Dept: Eng. Staff
Ed Reilly MS: ML12-1/A51 Ext: 223-2236
Tom Kobayashi EMS: @CORE

(You might find this version of the philosophy of our products useful.)

Thank you for coming. I understand there is competition to have press conferences today. (The Hitachi/Mitsubishi Press Conference)

I'm delighted to be here today and meet you as the Vice President of Engineering of Digital Equipment Corporation. I am also the curator of the Computer Museum, and as such would like to suggest you visit the museum in Marlboro Massachusetts to view the origins of computing. It is now an official, public institution independent of Digital and it is the largest. We archive and display artifacts from the abacus and soroban to the first supercomputers.

My purpose in being here today is threefold:
first, to tell you about our corporation, Digital;
second, to present the history and philosophy of our products, and;
third, to describe the Engineering Center under Dr. Kobayashi, we have in Tokyo.

This year, Digital is celebrating its 25th Anniversary. For the last 14 years we have a Japanese branch.

Our business growth has become a legend in the business world and this growth has been recorded in a recent article, entitled the Astonishing Growth of DEC in Fortune Magazine. This year we became the second largest US computer company according to the recent Datamation Survey, surpassing the companies of the group called BUNCH. We're 137th in the Fortune 500 companies and our growth over this last decade has averaged 36% per year.

We have over 40% of the world minicomputer market. Digital Japan has grown 41% annually over the last 5 years. I hope we can continue to find ways to provide more computing in the important Japanese market, because I believe we have unique capabilities

that are important for your future. These include:
1. computing for the technical and OEM marketplace;
2. better capabilities for engineering micro and personal computers of all types,
3. a means of interconnecting and supporting all types of computers, including personal computers in a distributed fashion in a users environment, and
4. distributed office data processing of all types based on local area networks.

Just as we have engaged in distributed processing, I believe we have also originated and engaged in distributed partnerships. Now, to fully utilize these unique and important products and capabilities, we need to look for new forms of distributed partnerships.

Now, I'd like to turn to the philosophy, and history of our products...
While Digital started in 1957 to build modules, we introduced one of the earliest transistorized computers, the PDP-1, in 1960. Our computers are built on one basic theme: they must completely integrate with their environment and couple to the user and his application in the best way. They must also be friendly and approachable.

The PDP-1 was approachable in two ways: it was the first computer to have an interactive, CRT display for the user; and a user could connect his own equipment to form a total system. All our computers follow in this tradition. These two characteristics made the computer ideal for use in scientific and real time computing. The program, Spacewar, was first written for the PDP-1 and its CRT. It was the first video game and you can see it in operation in the Computer Museum today.

In 1963, we introduced the LINC, which I believe is the world's first Personal Computer. This was based on a MIT Lincoln Laboratory design. A Personal Computer provides direct access by a single user in an interactive fashion so that the user can define and operate programs automatically from the keyboard and LINC had a small, personal tape file system with 1/4 megabyte. A PC must have a filing system for keeping its programs. LINC also had input/output channels for interconnecting experimental equipment. It was used by scientists for many years and several are still in use. We made two follow-on compatible versions.

In 1964, we introduced an alternative form of Personal Computing, which we called timesharing, as the first commercial, mainframe timesharing system. That was the PDP-6 which later became the PDP-10. Today we call it the DECsystem 10 and 20 series and we hope it will be used in the 5th Generation Research Program.

Timesharing and personal computing are essentially the same because they both provide on line, interactive computing. Whereas in personal computers only one user has access to a machine, with timesharing, many users share the machine in order to get the economy of sharing. Only recently, were we able to provide high quality personal computers with the same capablity of our timesharing machines. For example, the CP/M personal computer system is similar to our first timesharing system.

In 1965 we introduced the first minicomputer, the PDP-8. It was important for two reasons: we could mass produce them and the result was a cost of only $18,000 which was the lowest cost by at least a factor of 3 in those days; and the computer was rack mounted and could be used personally or it could be interconnected with other equipment for control of power plants, experimental equipment, and process control. The result of low cost and interconnectability was a large market.

With the first minicomputer, our computers became less visible because they were part of a larger system that was designed by someone else . This is one reason Digital may not be familiar to you here in Japan. I'd like to call this Original Equipment Manufacturing relationship a Distributed Partnership. That is why we have many close business relationships in Japan today of this distributed partnersthip form.

The PDP-11 was introduced in 1970 and became the standard of excellence for minicomputing because it was approachable and could be easily and flexibly integrated into other equipment. The Unibus was the interconnect medium for physically coupling computer hardware components together in a flexible, unbounded fashion. Several minicomputers and all microcomputers use the Unibus-type structure.

In 1972 timesharing was added to the PDP-11 minicomputer, providing very low cost computing to many more users. In this way, the computer started to live with its actual users in a highly dispersed fashion. Also, people started using the resource time sharing system RS03 for many other types of computing, including word and data processing. Because so many computers were dispersed, we had to find a way of interconnecting these machines, DECnet, was developed in 1975 as a set of communications links and protocols to provide what is known to day as Distributed Processing!

Also in 1975, several of us started to work on the VAX computer which we introduced in 1978. The goals of VAX was to provide a computing environment that had none of the limits on program size or program interconnectablity that we knew. In essence, we applied to programming, what we had been applying to hardware interconnectability we pioneered on the PDP-11 using the Unibus. Since then, we introduced other members of the VAX family that could be used in both a mainframe and distributed processing fashion.

This year we introduced three very important distributed computer processing products:
1. a much smaller model of the VAX, the 11/730 which is so small that it lives with and can be used by only a small group of only 4 to 8 users. In fact, I am using one with my secretary for my own personal computing. It has an integrated disk of 140 Megabytes, providing the space of what is equivalent to about four, 4-drawer filing cabinets in what is the space of a single cabinet.

2. a set of three personal computers, including the Professional series, based on PDP-11. Now, a user can have the facility we had traditionally supplied on our timeshared, minicomputers, but on a personal basis in a fully compatible fashion. Thus, applications written on the Personal Computer can grow and then be moved to a VAX group-level, or VAX departmental-level, or VAX central-level mainframe.

3. Ethernet, to allow a user to interconnect all of our products together to form a fully distributed computing environment. In this way, the actual network becomes the computing environment.

In fact, I like to call Ethernet the Unibus of the fifth generation.

By having all these interconnected products, a user can choose to compute in one of five ways:
1. on a personal computer, or,
2. interconnect the personal computers to form a distributed system, or,

3. interconnect terminals or personal computers to the small group level machines, or
4. interconnect terminals or personal computers to departmental level machines owned by a department, or
5. interconnected to a central facility whose computers are also interconnected.

While the methods of computing just described are structural, two sets of applications we introduced this year for VAX are even more important:

A distributed data base system with both relational and CODASYL network-type data base was introduced. This complete system has many components including a common dictionary, forms i/o and other facilities. It is known as VIA for Vax Information Architecture. Not only is it impressive by itself, but it is the only distributed database system I know of.

The complete office system, including word processing, electronic mail, typesetting, and various office procedures such as calendar keeping, meeting scheduling, and forms processing. This is not a promise, but a system that has been in use within our company providing office processing to over 5,000 users for four years. I hope that this system can be made available here in Japan.

I've described Digital and its past and present products. The emphasis has been on quality and innovation. For the last ten years a Digital Engineering group has modified our worldwide products for use in Japan. This year we are starting another engineering group under Dr. Kobayashi to build products for worldwide use. We would like to have this product development center actively developing high technology products and it would grow from about a dozen now to over a hundred employees in 3 to 5 years.

I am delighted to be here and provide this information. If you have questions, I will try to answer them.

ID#0265

d i g i t a l   i n t e r o f f i c e   m e m o r a n d u m

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+--------------------------+
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Subject: **Japan Trip Diary Index**

To: Distribution

Date: 13 SEP 78
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.:
2236

follow up 9/27/78

You're welcome to look at this 13 page (single space) document. It is a diary of the visit and formed the basis for the essay on "Some First Impressions of Japan". It's contents:

<u>July</u>

16 - Tokyo

17 - DEC office talk and their concerns over particular product issues; talk at Keio University

18 - NEC computer, their research, and TV manufacture; (the technologies they've assimilated from the U.S. and how they've gotten technology via license agreements)

19 -Fujitsu computer design and their M200; also the factory at Numazu...and how they got Amdahl's technology and are converting him into a distributor

20 - Electro Technical Lab of MITI and U of Tokyo

21 -Sony central research, VTR manufacture, and some interesting new video recorders

22/23 - Sightseeing at Kyoto and Nara

24 - Talks at Kyoto, Osaka and Kyoto Sanyo University

25 - NEC semiconductor manufacturing in Kyushu (Okinawa) where they are.

Gratis ones are sent to Henry Crouse, Carl Janzen, Ron Smart and Don Frost. I'd recommend it if you go there. Call if you want one.

GB:ljp

Distribution
OOD, Operations Committee,
Manufacturing/Engineering Committee,
Product Line Managers,
Jim Bell, Don Busiek, Don Frost,
Carl Janzen, Jack Shields, Ron Smart,
Don Zereski

D I G I T A L INTEROFFICE MEMORANDUM

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Mitch Kur	ML12-2/A16	Gene Mondani	ML1-5/E30
Dennis O'Conner	ML1-4/P11	Joe St.Amour	ML1-5/E29
George Wood	AC/E44		

July 20, 1982

Dr. H. Goto
Professor of Electrical Engineering
University of Tokyo
7-3-1 Hongo, Bunyo Ku
Tokyo 113, Japan

Dear Dr. Goto:

It was a great pleasure to meet you at last, for dinner on 30 June and to hear about your LISP machine.

It was a pleasure to discuss the Computer Museum with you and present the vision of continuing to build an international, industry-wide museum for this most significant invention--the "computer." The word "Digital" is being dropped from it's name to avoid confusion. Enclosed is the first report and a museum layout which includes an invitation to become a member.

I would like to invite you to become either an institutional or personal founder to make this a significant international museum. You will note that the list of founders includes pioneers such as Gene Amdahl and Bob Noyce.

The Museum also invites you to supply important artifacts for their historical preservation. The current list is included in the report and grows rapidly.

I hope we can make the arrangements so that you can describe the LISP machine at Digital when you attend the LISP conference in August. In addition, I would like to invite you to give a pioneer talk at the Museum on one of the historic aspects you've been involved with, such as Parametrons. Alternatively, you could give an overview of the historical machine and events in Japanese computing.

Sincerely,

Gordon Bell
Vice President of Engineering
Curator, The Computer Museum

CC: Dr. Gwen Bell, Director, The Computer Museum
    Dr. Tom Kobayashi
    Dr. Sam Fuller, Technical Director, Digital

July 20, 1982

Mr. Mako Watanabe
Deputy Director General
Research and Development Bureau
Nippon Telegraph & Telephone
9-11, 3-Chome Midori-Cho
Musashino-Shi, Tokyo 180
Japan

Dear Mr. Watanabe:

Please let me take this opportunity to thank you for the hospitality extended to me and Dr. Kobayashi when we visited the Electrical Communications Laboratory on 2 July. I especially enjoyed the lunch with you and Mr. Ariyoshi and the interaction with you and your staff. I was most impressed by the VLSI compiler that your laboratory has produced.

It was a pleasure to discuss the Computer Museum with you and present the vision of continuing to build an international, industry-wide museum for this most significant invention--the "computer." The word "Digital" is being dropped from it's name to avoid confusion. Enclosed is the first report and a museum layout which includes an invitation to become a member.

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The Museum also invites you to supply important artifacts for their historical preservation. The current list is included in the report and grows rapidly. Since NTT has contributed so much to computing, we would like you to consider preparing a special exhibit for the museum.

I'd welcome being able to show you the growing museum whenever you visit this area.

Sincerely,

Gordon Bell
Vice President, Engineering
Curator, The Computer Museum

CC: Dr. Gwen Bell, Director, The Computer Museum
     Dr. Tom Kobayashi

00 BURT DECGRAM ACCEPTED S 10238 O 51 30-JAN-82 13:29:10

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* d i g i t a l *
****

TO: DICK ECKHOUSE   DATE: SAT 30 JAN 1982

1:26 PM EST

ENG STAFF:
OPERATIONS COMMITTEE:
MAURICE WILKES

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: JAPAN COULD DOMINATE COMPUTING BY 1990 IF 5G EFFORT SUCCEEDS

Professor Moto-oka gave a very sketchy overview of Japan's 5th Generation Project on Thursday. He is responsible for directing the research project, and he is broad, bright and listens well. The published report is in our libraries and worth reading because it gives an excellent review of the whole area of computer science and engineering research.

In a discussion after the lecture, Maurice Wilkes warned that the first rule of warfare is to NOT overestimate the enemy. Probably the second rule is to disregard the first rule. We must not panic or be demoralized by the effort. Given their past success in research program management, this project could be successful in delivering to the Japanese industry the knowledge required to build this next generation of computers.

The research program is easy to dismiss because it is so broad. On closer examination, it is very nicely focussed on VLSI design, giving them a tough target that will allow domination of computing. The main thing to understand is that it is not a conventional research program, but a process for gathering knowledge about what to do. Like it's predecessor that allowed the Japanese

semiconductor industry to compete, the purpose is to define what
research to import and where to start. The reason for the presentation at all the major universities is to get critical feedback as to what to NOT do! They want a a 2080 (he asked about delivery) so as to run all the AI software at Tokyo U.

The program has operated for 3 years, and is funded at $50M for
the next 3 years (ramping up). The program has already spun off
a seperate 8 year, $100M program to build the world's fastest computer, which Moto-oka also chairs. There's also been a spinoff in NTT to work on communication networks.

Unless there are major changes in our system, I completely agree
with Moto-oka. By 1990 Japan will be the dominant supplier of
information processing systems, including computers, terminals,
robots, intelligent printing devices, and everything that is computer-based and interfaced to another information processing
entity (ie. human, network, other computer).

GB3.S2.61

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* d i g i t a l *

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TO: BOD/DEMO: DATE: MON 3 MAY 1982
1:22 PM   MCE GROUP   FROM: GORDON BELL
    OPERATIONS COMMITTEE: DEPT: ENG STAFF
    PEG: EXT: 223-2236
                                                LOC/MAIL STOP: ML12-1/A51

SUBJECT: THE JAPANESE ADVANTAGE: IS IT REAL?

Prompted by a recent presentation on this at MCE, here's my

cut:
INDIVIDUALS...
....
IQ's are higher by 10 points (Fortune 5/82). Higher literacy
Lower wages, but increasing.
They work harder. Net equals more thoughts and actions per yen
Less individualistic and willing to accept other ideas (anti-NIH)
SOCIETY...
...
More engineers available to fuel a high technology technocracy
Less lawyers and legal documents to waste time
Few MBA's, thus focus on content versus process of technology
Understands meaning of productivity and quality. They apply them
Understands timeliness, the parametric variable of ROI
Clear goal set of production domination with demonstrated success
Coded language which we don't understand. One way flow of ideas
COMPANIES...
....
Low operating margins are acceptable
Availability of cheap capital
Better professional demographics because marketing is done by US
Technical training programs
Permanent workforce with 1/2 workers in sweatshops structure
Good management and more stable technical workforce
Less venture capital firms to compete in getting critical mass
Protected market resulting from many factors
Better balance and experience in automation
Ability to manage flow of US research into Corporate products
INDUSTRY
INFRASTRUCTURE...
Have the basics including materials versus US trends to systems
Collaborative intercompany behavior for research
Ability to segment mkts. to reduce expense of covering all

bases
No "Eastern Electric", hence manufacturing is via companies
Successful acquisition and are beyond US technology in semis,
 magnetics, displays, optics, etc.
Dominance of consumer electronics for manufacturing
understanding
GOVERMENT..
....
No military creating no productivity for a large expenditure
Less of it to support
Supportive versus conflictive
Directs and funds goals to dominate various industries
OTHER..
....
Have a single, working view of the 5th Computer Generation
Incredible PR and self and US belief that "Japan Number One"
OUR
EDGE...
Individualists. Creativity. Much CAD/CAM is US based.
Software
engineering. Better higher education, even though it's used
for
foreigners. Science and research base (funded by DOD).
Entrepreneurial belief and structures to exploit ideas.
00 BURT DECGRAM ACCEPTED S 24176 O 04 27-JUL-80 11:48:51

****
* d i g i t a l *
****

TO: STEVE COLEMAN   DATE: SUN 27 JUL 1980
11:48 AM EDT
                                         FROM: GORDON BELL
cc: see "CC" DISTRIBUTION   DEPT: OOD
                                         EXT: 223-2236
                                         LOC/MAIL STOP: ML12-
1/A51

SUBJECT: JAPANESE DISCUSSION AND MORE THOUGHTS ON
UNDERSTANDING WHAT TO BUILD

Can you write up your version of this and possibly send it to me by Friday by EMS? Want to try to get the problem formulated and segmented as I raft down the Snake River on 8/5.

Also, appreciate any notes on the OC Woods on organization. Hope you build your version of a product/organizational model.

Am enormously frustrated by not having a good feeling about where we are investing big $'s in plants (and inventory) versus
where the revenue is. For example, we are going balls out to build MOS capacity and design capability. Our management heads, talent and thoughts are all there. The revenue is all coming from Comet and Venus I believe. We are violating the principle that if we don't sell it, then we should buy it (Have you read the policies on Make/Buy that I try to use in our M/E decison making?). Am really scared when you factor in Intel (who'll clobber us in MOS because they sell it) and Japanese who have key hi end bipolar, magnetic storage
and video and speech processing technologies.

Can I get one of your people to help us address this issue across M/E about segmenting and trying to understand TOTAL investment picture?

Similarly, I think we probably should look at selling disks simply to get the cost and volume and quality... but need a way to look at it. It may/may not make sense, but need to understand!

Note that Ken's model of Briggs and Stratton or Tecumseh as being competitive is probably falactious. Both are probably low growth, but both, no doubt are really backward integrated and automated to the foundry and would believe they are highly automated. Both supply a component to a relatively difuse, market (lawn mowers, garden tractors; air conditioners
dehumidifiers, refrigerators) hence they can dominate. The specials like Harley Davidson or Japanese make their own no doubt. In our case, we are not like Briggs and Stratton

because we have only a small foundry (Hudson) which supplies most of the work. Silicon Valley has always been our foundry and we have been an assebly shop supplying to our OEMs in iron and base software. Note that the % labor is significantly
decreasing as we buy more and more out (like the expensive 16K rams). With bigger parts and more performance in the micros cpus, our oems are going to Si valley for boards or chips. Alternatively, the cost is going into the magnetics and if we have volume there and are good, it may be our salvation. It feels like we are merely an assembler and when you consider we are 80% materials and 1/2 our added on manufacture is FAT that shouldn't be there in the first place, we may be heading toward big trouble in the mid-80's.

"CC" DISTRIBUTION:

SHEL DAVIS WIN HINDLE LARRY PORTNER
JACK SMITH

GB1.S6.11

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*****************
* d i g i t a l *
*****************
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TO: BOD/DEMO: DATE: MON 3 MAY 1982 1:22 PM EDT
MCE GROUP FROM: GORDON BELL
OPERATIONS COMMITTEE: DEPT: ENG STAFF
PEG: EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: THE JAPANESE ADVANTAGE: IS IT REAL?

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Lower wages, but increasing.

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Less individualistic and willing to accept other ideas (anti-NIH)
SOCIETY...
More engineers available to fuel a high technology technocracy
Less lawyers and legal documents to waste time
Few MBA's, thus focus on content versus process of technology
Understands meaning of productivity and quality. They apply them
Understands timeliness, the parametric variable of ROI
Clear goal set of production domination with demonstrated success
Coded language which we don't understand. One way flow of ideas
COMPANIES...
Low operating margins are acceptable
Availability of cheap capital
Better professional demographics because marketing is done by US
Technical training programs
Permanent workforce with 1/2 workers in sweatshops structure
Good management and more stable technical workforce
Less venture capital firms to compete in getting critical mass
Protected market resulting from many factors
Better balance and experience in automation
Ability to manage flow of US research into Corporate products
INDUSTRY
INFRASTRUCTURE...
Have the basics including materials versus US trends to systems
Collaborative intercompany behavior for research
Ability to segment mkts. to reduce expense of covering all bases
No "Eastern Electric", hence manufacturing is via companies
Successful acquisition and are beyond US technology in semis, magnetics, displays, optics, etc.
Dominance of consumer electronics for manufacturing

understanding
GOVERMENT...
....
No military creating no productivity for a large expenditure
Less of it to support
Supportive versus conflictive
Directs and funds goals to dominate various industries
OTHER...
....
Have a single, working view of the 5th Computer Generation
Incredible PR and self and US belief that "Japan Number One"
OUR
EDGE..
Individualists. Creativity. Much CAD/CAM is US based.
Software
engineering. Better higher education, even though it's used
for
foreigners. Science and research base (funded by DOD).
Entrepreneurial belief and structures to exploit ideas.

GB3.S5.20

FROM: GORDON BELL   DATE: THU 25 OCT 1979
5:07 PM EST
DEPT: OOD
EXT: 223-2236
TO: DICK CLAYTON
cc: ROY MOFFA
    JIM CUDMORE @CLEM
    JOHN CLARKE
    MARKETING COMMITTEE:
    MARKETING COMMITTEE: @CLEM

SUBJECT: CONGRATULATIONS ON JAWS AT THIS DECISION POINT

GB0005/30/EMS

The Jaws program has been timely to date and the
program/products certainly look good. Designing products

across organizations is difficult, but it feels good. Success in the 11/23, Jaws, and signs in the LSI-VAX show we're really engineering semiconductors. Congratulations.

GB:swh

```
+---------------------------+
|   |   |   |   |   |   |   |
| d | i | g | i | t | a | l |   i n t e r o f f i c e   m e m o r
a n d u m
|   |   |   |   |   |   |   |
+---------------------------+
```

Subject: **Jean Bow's Support**

To: Carl Janzen, AK
Ted Johnson, PK3-2/A55

CC: Bernie Lacroute, TW/A08
Ken Olsen, ML10-2/A50
Dick Yen, TA

Date: 24 JAN 79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

I met with Jean and am delighted that you've agreed to meet with her to see if her talents can be employed.

She wants to help during her forthcoming visit.

I'm glad you are formulating our trade position.

GB:ljp
ID#18/DOCNO8

Subject: **Memory Hierarchies and How Well Pulsar "Naturally" Supports Them**

To: Jega Arulpragasam Date: 5 OCT 76

From: Gordon Bell

CC: Jim Bell, Bill Strecker Dept: OOD

Loc.: ML12-1

Ext.: 2236

F/U 10/13

With the Pulsar, a key advantage may be to have explicit page transfers from CCD's (in Mp.MOS--Ms.CCD hierarchy) while **not** switching concept. In this way several will be idle (but probably will be anyway). Could Bill simulate?

Can we get a realistic problem to simulate 16 Pc's?

GB:ljp

October 15, 1984

Mr. John Payne
National Semiconductor Corporation
2900 Semiconductor Drive
Santa Clara, CA 95051

Dear John:

I enjoyed the interaction with you and the members of the team exploring the direct execution of an instruction set last Tuesday.

The 32000

I hope you folks will forgive me for not visiting Israel, but as I told you, we are bidding on a DARPA supercomputer project that would use several hundred processors. The proposal was due October 12. Much interesting work is coming out of this, and I may want to talk with you about designing a hot array processor as an alternative to gain performance.

This is clearly the right approach for some of the specialized functions such as filtering and array data-types, but it may be used in a more general fashion if we can integrate it into the overall architecture.

Dave Schanin was impressed and clearly the right one to interact with the designers. We briefly discussed the 532. Here, the approach feels wrong because it increases complexity and uses a deep pipeline. This is very much like the VAX Venus which is over 2 years late. A machine with the same technology and little pipelining is likely to go faster using a faster clock with less hardware. A small, simple chip gives you faster time to market... and can also be scaled. I don't think a complex architecture like VAX or the 32000 can be pipelined to any degree and the fact that the 16032 grabs twice as many instructions than it uses is a good indicator of the problem. This is pretty much what's come out of the 370 experience too.

<u>Process</u>
I don't think your process plan is aggressive enough. Today, a few users at ISI's MOSIS get 1 - 3 micron, 2 level metal CMOS with stacking contacts. Four foundries are running 1 micron. The trick here is a single set of scaleable design rules. Let me urge National to be a part of this effort, simply to get some feedback and clean up the foundry design interface. Attached is a letter I wrote to Bobby Inman at MCC on the subject.

<u>Direct</u> <u>Execution</u> <u>Chips</u> (ie <u>RISC</u>)
Enclosed are some articles on the MIPS chip. I have recently learned that Skip Stritter, and John Hennessy joined someone formerly of IBM, and they are off making a system product. I'll contact John to see if I can learn more.

Your ideas on a new architecture while interesting, really concern me because I don't think that a designer can cope with the hierarchy of clocks and distance. This adds one more design dimension to the overloaded designer. I don't think the design scales and this is fatal. Also, I'm pretty sure that anything that's serial loses on performance. This has been true over the last 4 generations of computing and I think it's true in your design. I believe you have to bind the design to CMOS, but if you come up with something trivial then maybe look at ECL.

<u>It is vital that you get on with a fast processor chip today</u>... call a meeting at once and see if there are more than these alternatives:

1. surviving and living with the 32000 architecture harmoniously. Just as I became convinced VAX wouldn't cut it as logic clock and memory speeds becoming equal, you have the same problem. The way to survive is to not support assemblers! Stay with your data-types and hence a user could operate so as to not see a difference in the architecture. An evolutionary approach is to look at aligning the current op codes into 16 or 32 bit instructions which are different codings of the current architecture so that it can be executed rapidly. Also, throw out anything that you don't use. You should have a good idea how to do this now as decent compilers are beginning to appear. This may be a much better approach for the 532, which I believe will be difficult to build in any reasonable time and at any reasonable performance as discussed above.

   I hope TI is working on this problem. Maybe a team effort would help. At least you folks should share trace data and design approaches.

   The measure is simply: the number of clock ticks it takes to retire each instruction. It now takes 8 - 10, and I believe you should target 1 - 2!

2. taking what you know of MIPS and then going to a compiler house to get them to write the compiler in tune with what you build. We know some people who could help. It is critical to not start from scratch.

3. make a relationship with Dave Patterson and evolve the RISC I or II design.

4. try to get Ridge or Pyramid to license their architecture, if either is good enough. Alternatively go to one of the semiconductor companies that you "suspect" are working on an architecture and make an agreement with them NOW!

5. put together an external team aimed at a chip which would be done on a quasi competitive basis with your internal effort where there's complete interchange of information between the efforts. This would be have to be managed carefully.

I believe an external effort would be interesting because I'm convinced that a large company environment requires more energy. Here are some alternative efforts:

.Professor Niklus Wirth, recent Turing Award winner and coming to spend 6 months to learn about VLSI at Xerox Parc. He's the designer of Pascal and Modula and just built a computer; he's outstanding. He's at Institue for Informatik, Zurich 8092. He could be a consultant to you to tune up the 32000 because he understands the compiler issue.

. Austek Microsystems, a new startup who do VLSI designs and know system design. Dr Craig Mudge is the president, and he was formerly at DEC and worked on VAX. His team is systems oriented. He's at Technology Park, Adelaide SA 5095, Australia, but would put a design team up anywhere including Santa Clara and Boston. They do designs for money and royalty. This would be a bargain.

.Encore might put a systems team together in a joint venture with you. We discussed this earlier and should have acted, because we could have gotten the Hennesy design team.

I am skeptical of going it from first principles like you're doing because you lack the language and architectural experience. It will take too long.

Languages

We also want to meet with you soon and discuss the whole issue of high quality languages for the 32000, including LISP from LUCID. What is the best way to do this?

Sincerely,

Gordon Bell
Chief Technical Officer

CC: Ken Fisher
Randy Parker
Dick Sanguini
Charles Sporck

Dave Schanin
Henry Burkhardt

+ enclosure inman letter

July 21, 1978

Dr. Peter D. Jones
P. O. Box 373
N.S.W. 2061
Australia

Dear Mr. Jones:

We received your letter of July 6 addressed to Gordon Bell. As Mr. Bell is away on an extended business trip, I have taken the liberty to send your questions regarding our VAX machine to Mr. Bill Demmer, who is directly involved with its development.

Sincerely yours,

Mary Jane Forbes
Secretary to Gordon Bell

MJF:ljp
ID#:0175

CC: Bill Demmer

September 8, 1978

Dr. A. G. Jordan
Professor and Head
Electrical Engineering Department
Carnegie-Mellon University
Schenley Park
Pittsburgh, PA 15213

Dr. W. A. Wulf
Professor and Acting Head
Computer Science Department
Carnegie-Mellon University
Schenley Park
Pittsburgh, PA 15213

Dear Drs. Jordan and Wulf:

I strongly recommend that Professor Siewiorek be given tenure at this time. Given his exceptional vitae, it seems redundant to say anything at all; however, I'll comment from watching him work here at DEC as a consultant, where he is truly exceptional. Rarely has anyone from outside been so rapidly accepted and so effective. He can communicate well with everyone from the person in charge of all DEC service to nearly all engineers. The respect he earns is solely based on his engineering ability to select the right approach and then back it up with creative analysis. He's contributed to numerous products and has been instrumental in setting up a data collection/control mechanism for our systems.

I can't directly comment on his precise position in the field, but I believe it's probably in the top five to ten. He is clearly accepted as an international expert by noting his talks, papers, and consulting. Furthermore, unlike many tenure decisions, I see no signs that his output will diminish with time.

The Eta Kappa Nu award last year should be about the best indicator that tenure is required! This award considers the top few people in all electrical engineering in the country -- not just a field.

If there are any points that need clarification, please don't hesitate to ask me.

Sincerely,

Gordon Bell
Vice President,
Engineering
Professor, Computer
Science and
Electrical Engineering
Carnegie-Mellon
University, on leave

GB:ljp
ID#0261
Subject: Visiting Josh Fisher and associates at Yale
to pg, cc kgf
I called Josh to find out how he'd reacted to my suggestion that they formed a software only company to start with instead of a major company to build their very complex, parallel hardware machine. They would manufacture some of the hardware that came out of the experiment at Yale. Similarly, I have a company in Oregon that would like us to buy them and could manufacture their hardware. In essence, it speeds up the Floating Point Systems boxes a factor of 10-20 by having enough memory.

He said they were really considering my comments over and over again because of the source and severity of the comments.

They've talked to 4 or 5 other groups including VC's and manufacturers. (I said IBM was the only one who could take it on, but he said no way.)

I'm worried a bit because they may be too committed to the machine to be very reasonable. Even with this, it might be possible to have a deal on the following basis:
1. Isolate the software and build a compiler in parallel for us.
2. Let a VC or someone fund the machine, perhaps with us. I said, I'd advise on the machine if there was something in it for us.

He wants us to come visit them. Let's go. They are the ONLY game in town regarding a compiler which would exploit HYDRA without special programming.

<subj>NATIONAL ACADEMY OF ENGINEERING
<from>NELSON, MRS. E. HENRIETTE
<to>BELL, GORDON
<date>80/7/28
<date rec>7/30/80
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<filed>
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<roll>
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<subj>XEROX
<from>SUTHERLAND, BERT
<to>BELL, GORDON
<date>80/7/25
<date rec>7/30/80
<log#>7-70
<dispo/date>CC: LARRY SAMBERG,(ON HIS REQUEST) - 8/1/80
<dispo/date>CC: TOM SIEKMAN - 9/10/80
<message>WE'RE DOING THIS. CAN YOU START TO ASK XEROX WHETHER WE COULD LICENSE IT? WHAT ARE RESTRICTIONS ON MY IDEAS WE FIND IN IT? ETC. LET'S TALK.
<answer>
<f/u>
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<ret-gb>ORIGINAL - 9/10/80
<roll>
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<subj>UNIVERSITY OF WASHINGTON
<from>GILLESPIE, ROBERT G.

<to>BELL, GORDON
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<date rec>7/30/80
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<filed>
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<subj>RESUME' -- EARL S. WAJENBERG
<from>WAJENBERG, EARL S.
<to>BELL, GORDON
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<subj>KENNECOTT CORPORATION
<from>SNIADO, JOHN L.
<to>SIEKMAN, THOMAS C.
<date>80/7/16
<date rec>7/29/80
<log#>7-67
<dispo/date>SIEKMAN 8/12/80 Tue 1:51
<message>AGREED! LET'S AVOID
<answer>
<f/u>
<filed>N
<ret-gb>

<roll>
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<subj>UNIVERSITY OF CALIFORNIA
<from>LUEHRMANN, ARTHUR
<to>BELL, GORDON
<date>80/7/17
<date rec>7/29/80
<log#>7-66
<dispo/date>ORIGINAL TO F/U - 7/29/80 CC: DEL, HEIDI, JOE MEANY, JIM BELL
<message>SEE ANYTHING HERE? JIM BELL, KNOW HIM? I NEED TO REPLY. PLEASE HELP.
<dispo/date>TO LETTERBOOK (GB1.S6.25) - 9/3/80
<answer>
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<subj>WESTERN DIGITAL CORPORATION
<from>MISSLER, CHARLES W.
<to>OLSEN, KENNETH
<date>80/5/28
<date rec>7/29/80
<log#>7-65
<dispo/date>CIRCULATE: CLAYTON, RODGERS, MOFFA, TEICHER, ZEH, GB - 9/3/80
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<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>ERDOS AND MORGAN INC.
<from>ERDOS, DR. PAUL L.

<to>BELL, GORDON
<date>80/7/25
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<log#>7-64
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<subj>EXCEL PERSONNEL (RESUME'--JEROME HAVLIS)
<from>WEBSTER, BILL
<to>BELL, GORDON
<date>80/7/9
<date rec>7/29/80
<log#>7-63
<dispo/date>ARMAND LA VALLE - 7/29/80
<message>PLEASE HANDLE.
<answer>
<f/u>
<filed>
<ret-gb>
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<subj>MANUFACTURING PRODUCTIVITY CENTER, THE
<from>SKAN, LEON N.
<to>BELL, GORDON
<date>80/7/22
<date rec>7/29/80
<log#>7-62
<dispo/date>HOLMAN - 8/13/80 Wed 18:01
<message>WANNA GO? I CAN'T
<answer>SOUNDS GOOD! I'D BE INTERESTED IN IT IF THEY ADDRESS PRODUCTIVITY OF CREATIVE TYPES.
<dispo/date>TOSSED OUT. NOTE: ANY MORE INFO FROM THIS CO. PLEASE SEND TO JOHN HOLMAN - 8/29/80

<f/u>8/22
<filed>
<ret-gb>
<roll>
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<subj>STANFORD UNIVERSITY (CHECK FOR TRAVEL TO STANFORD--$757.39)
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<date rec>7/29/80
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<subj>UNIVERSITY OF NORTH CAROLINA @ CHAPEL HILL
<from>BROOKS, FRED P.
<to>BELL, GORDON
<date>80/7/25
<date rec>7/29/80
<log#>7-60
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<f/u>
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<roll>
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<subj>RESUME' - JULIUS P. NEUMANN
<from>NEUMANN, JULIUS P.
<to>BELL, GORDON

<date>80/7/23
<date rec>7/28/80
<log#>7-59
<dispo/date>ARMAND LA VALLE - 7/28/80
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<f/u>
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<from>HALE, BILLIE
<to>BELL, GORDON
<date>80/7/24
<date rec>7/28/80
<log#>7-58
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<subj>SOFTWARE ENGINEERING REPORT (JUNE--BOOK 1)
<from>SHELDON, LIZ
<to>BELL, GORDON
<date>80/6/?
<date rec>7/25/80
<log#>7-57
<dispo/date>RETURNED TO LIZ SHELDON - 7/28/80
<message>
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<subj>STANFORD UNIVERSITY
<from>PARDO, LUIS TRABB
<to>BELL, GORDON
<date>80/7/16
<date rec>7/25/80
<log#>7-56
<dispo/date>SAM FULLER CC: NAT PARKE, TOM DUNDON - 7/28/80
<message>CAN YOU PLEASE CALL LUIS?
<answer>
<f/u>
<filed>
<ret-gb>
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<>

<subj>SCIENTIFIC TECHNOLOGY INC. (DR. LEONID LIPCHIN REF. #79)
<from>MANN, JERRY
<to>BELL, GORDON
<date>80/7/?
<date rec>7/24/80
<log#>7-55
<dispo/date>ARMAND LA VALLE - 7/24/80
<message>PLEASE HANDLE
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<f/u>
<filed>
<ret-gb>
<roll>
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<subj>COMPUTER SOFTWARE
<from>GILBERT, JULES
<to>BELL, GORDON
<date>80/7
<date rec>7/24/80
<log#>7-54

<dispo/date>SAM FULLER - 8/5/80
<message>WHAT'S THIS?
<answer>ON 9/12/80 MR. GILBERT CALLED US. HE ASKED "IF MR. BELL HAS SEEN THE MATERIAL THAT'S ALL I WANT TO KNOW". WE SPOKE TO SAM AND THERE WAS NO INTEREST, BUT THIS WAS NOT RELAYED TO MR. GILBERT BECAUSE HE TERMINATED THE CALL (POLITELY). - 9/12/80
<f/u>
<filed>
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<roll>
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<subj>ASSOCIATION FOR COMPUTING MACHINERY
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<to>BELL, GORDON
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<date rec>7/24/80
<log#>7-53
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<subj>DIGITAL DESIGN
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<to>BELL, GORDON
<date>80/7/?
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<message>
<answer>
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<subj>PIERCE ASSOCIATES (PERSONNEL CONSULTANTS)
<from>PIERCE, KATHLEEN M.
<to>BELL, GORDON
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<date rec>7/22/80
<log#>7-51
<dispo/date>ARMAND LA VALLE - 7/22/80
<message>PLEASE HANDLE.
<answer>
<f/u>
<filed>
<ret-gb>
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<subj>RUTHERFORD AND APPLETON LABORATORIES
<from>FOSTER, A. (PROFESSOR HOPGOOD'S SECTRETARY)
<to>BELL, GORDON
<date>80/7/16
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<dispo/date>
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<f/u>
<filed>
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<subj>CS&TB--COMMENTS ON ADP EQUIPMENT IN FED. GOV.
<from>BLACKBURN
<to>BELL
<date>80/7/17
<date rec>7/21/80
<log#>7-49
<dispo/date>CALLED BLACKBURN OFFICE 7/22/80
<message>GO AHEAD AND MODIFY IT AND SEND IT OUT IN THE NAME OF THE COMMITTEE ASSUMING THE MEMBERS AGREE. IT'S OK BY ME.
<answer>
<f/u>
<filed>CS&TB
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<subj>NEW YORK UNIVERSITY MEDICAL CENTER
<from>EISENBUD, MERRIL
<to>BELL, GORDON
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<date rec>7/18/80
<log#>7-48
<dispo/date>CC: TO LETTERBOOK GB1.S5.31 - 7/22/80
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<f/u>

<filed>NAE - 7/22/80
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<subj>APPLIED FUTURES INC.
<from>SIMMONS, W.W.
<to>BELL, GORDON
<date>80/7/15
<date rec>7/18/80
<log#>7-47
<dispo/date>LARRY PORTNER (CC:OOD, LORRIN, KOTOK, SHEL) - 7/23/80
<message>I PARTICIPATED IN A MEETING OF 14 (VERY OPINIONATED) PEOPLE WHOSE GOAL WAS TO SET RESEARCH PRIORITIES. IT WORKED VERY WELL. I'M SURE THERE ARE APPLICATIONS WITHIN DEC.
<answer>
<f/u>
<filed>
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<roll>
<>

<subj>R AND I PATENT CORPORATION
<from>GUBELMANN, JAMES B.
<to>BELL, GORDON
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<date rec>7/18/80
<log#>7-46
<dispo/date>TOM SIEKMAN - 7/18/80
<message>OK TO GIVE TO GB?
<answer>NOT UNTIL WE RECEIVE AN ANSWER TO MY LETTER, ATTACHED. WHEN WE DO, I'LL LET YOU KNOW. - 7/30/80
<dispo/date>HENK SCHALKE (CC:TAYS, HOLMAN) - 8/26/80
<message>YOURS.
<f/u>8/15
<filed>
<ret-gb>
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<>

<subj>WILKES, MAURICE
<from>WILKES, MAURICE
<to>BELL, GORDON
<date>80/7/9
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<dispo/date>CC: JIM BELL 7/21/80
<message>FYI
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<f/u>
<filed>WILKES
<ret-gb>Y 7/21/80
<roll>
<>

<subj>P.J. ARBORIO & ASSOCIATES INC.
<from>ARBORIO, PETER J.
<to>BELL, GORDON
<date>80/7/15
<date rec>7/17/80
<log#>7-44
<dispo/date>JOHN HOLMAN - 7/17/80
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<subj>DORLEN PRODUCTS
<from>WOLOSZYK, LEN
<to>D.P. MANAGER
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<log#>7-43
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<subj>NATIONAL ACADEMY OF ENGINEERING
<from>NELSON, MRS. E. HENRIETTE
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<filed>
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<subj>MASSACHUSETTS INSTITUTE OF TECHNOLOGY (MIT)
<from>FULMER, V.A.
<to>BELL, GORDON
<date>80/7/15
<date rec>7/17/80
<log#>7-41
<dispo/date>CARD RETURNED 7/21/80
<message>CANNOT ATTEND ANY NEW DATES: 11/24 OR 11/25
<answer>
<f/u>
<filed>
<ret-gb>
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<>

<subj>GMD
<from>GEBHARDT, DR. F.

<to>BELL, GORDON
<date>80/7/9
<date rec>7/15/80
<log#>7-40
<dispo/date>TO JAMIE FOR FILE--GB1.S15.18 - 7/22/80
<message>
<answer>
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<subj>HEWLETT-PACKARD COMPANY
<from>YOUNG, JOHN
<to>OLSEN, KENNETH H.
<date>80/7/9
<date rec>7/15/80
<log#>7-39
<dispo/date>GEORGE CHAMBERLAIN (CC:CUDMORE, CLAYTON, MUDGE, TEICHER, ZEH, FULLER, ECKHOUSE, J.BELL, KUSIK) - 7/23/80
<message>KEN ASKED TO MAKE A FORMAL RECOMMENDATION HERE. CAN YOU PUT A REVIEW TOGETHER?
<answer>
<f/u>7/25/80
<filed>CC:KEN OLSEN FILE
<ret-gb>
<roll>
<>

<subj>KEATING, JAMES P. CO.
<from>KEATING, JAMES P.
<to>NATIONAL MANAGER FIELD SERVICE ENGINEERING
<date>80/7/9
<date rec>7/15/80
<log#>7-38
<dispo/date>JACK SHIELDS - 7/15/80
<message>YOURS.
<answer>
<f/u>

<filed>
<ret-gb>
<roll>
<>

<subj>CENTER FOR PUBLIC RESOURCES
<from>TERJEN, KATHERINE GRIFFITH
<to>BELL, GORDON
<date>80/7/7
<date rec>7/15/80
<log#>7-37
<dispo/date>JOHN HOLMAN - 7/15/80
<message>PLEASE HANDLE.
<answer>SENT TO DICK BERUBE - PLEASE HANDLE FROM JH
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>PURDUE UNIVERSITY
<from>REEN, NOEL
<to>BELL, GORDON
<date>80/5/8
<date rec>7/15/80
<log#>7-36
<dispo/date>CALLED MIKE POWELL WHO WAS GOING TO REPLY
<message>AL AVERY SENDING A REPLY TODAY7/18/80 Fri
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>PRINCETON UNIVERSITY
<from>ARDEN, BRUCE W.
<to>BELL, GORDON
<date>80/7/10

<date rec>7/15/80
<log#>7-35
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>TWX--SHUGART TECH.
<from>RUMPSA, RON
<to>BELL, GORDON
<date>80/7/14
<date rec>7/14/80
<log#>7-34
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>TWX--SHUGART TECH.
<from>RUMPSA, RON
<to>BELL, GORDON
<date>80/7/14
<date rec>7/14/80
<log#>7-33
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>COLUMBIA UNIVERSITY IN THE CITY OF NEW YORK
<from>TRAUB, J.F.
<to>BELL, GORDON
<date>80/7/8
<date rec>7/14/80
<log#>7-32
<dispo/date>HEIDI 7/21/80
<message>ANY USE? FYI
<answer>
<f/u>
<filed>N
<ret-gb>
<roll>
<>

<subj>RESUME'
<from>P.O. BOX 3101, WOBURN, MA 01888
<to>BELL, GORDON
<date>80/7/11
<date rec>7/14/80
<log#>7-31
<dispo/date>ARMAND LA VALLE - 7/15/80
<message>PLEASE HANDLE.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>FAIRCHILD CAMERA AND INSTRUMENT CORPORATION
<from>HOGAN, C. LESTER
<to>BELL, GORDON
<date>80/7/8
<date rec>7/14/80
<log#>7-30
<dispo/date>
<message>

<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>STANFORD UNIVERSITY
<from>NII, H. PENNY
<to>BELL, GORDON
<date>80/7/9
<date rec>7/14/80
<log#>7-29
<dispo/date>CC: LETTERBOOK - GB1.S5.26 - 7/25/80
<message>
<answer>
<f/u>
<filed>WILKINSON (UNDER LECTURERS IN MUSEUM DRAWER) - 7/25/80
<ret-gb>
<roll>
<>

<subj>STANFORD UNIVERSITY
<from>FEIGENBAUM, EDWARD
<to>BELL, GORDON
<date>80/7/11
<date rec>7/14/80
<log#>7-28
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>ZUSE, KONRAD
<from>ZUSE, KONRAD

<to>BELL, GORDON
<date>80/7/1
<date rec>7/11/80
<log#>7-27
<dispo/date>TO LECTURE SERIES FILE--ZUSE (CC:TO LETTERBOOK (GB1.S5.25) - 7/22/80
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>BELL LABORATORIES
<from>MATHEWS, M.V.
<to>BELL, GORDON
<date>80/7/8
<date rec>7/11/80
<log#>7-26
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>XEROX
<from>STRASSMANN, PAUL A.
<to>BELL, GORDON
<date>80/7/7
<date rec>7/11/80
<log#>7-25
<dispo/date>
<message>
<answer>
<f/u>
<filed>

<ret-gb>
<roll>
<>

<subj>PRODUCT DESIGN AND ENGINEERING SERVICES
<from>MIDDLETON, CHARLES F. JR.
<to>OLSEN, KENNETH H.
<date>80/7/7
<date rec>7/11/80
<log#>7-24
<dispo/date>ORIGINAL TO DICK CLAYTON - CC:PICOTT, SCHNEIDER, STAN OLSEN, KEN OLSEN - 7/14/80
<message>LET'S NOT USE CHARLIE AND HAVE OUR IDEAS + HIS, SPREAD TO OTHER COMPANIES. NOTE: HIS MODULAR TERMINAL WORK WE SPONSORED WAS SOLD TO?
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>FREEDOM HOUSE INC.
<from>SNOWDEN, MURIEL & OTTO
<to>BELL, GORDON
<date>80/7/8
<date rec>7/11/80
<log#>7-23
<dispo/date>FREEDOME HOUSE 7/14/80
<message>SORRY, CAN'T MAKE IT CARD RETURNED
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>SPECIALIZED BOOK SERVICE INC.
<from>SCHEER, MICHAEL D.

<to>BELL, GORDON
<date>80/7/7
<date rec>7/11/80
<log#>7-22
<dispo/date>ORIGINAL TO MJ CC: JOE SANTINI, MARCY, DEL, JACK SHIELDS - (COPY TO LETTERBOOK (GB1.S5.22) - 7/14/80
<message>IS THERE ANYWAY WE CAN STREAMLINE THIS? WHY OR DOES DP GO THROUGH STANDARD ORDER PROCESSING? WHAT DOES THE ORDER PROCESSING LOOK LIKE?
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>T.D. DOWNING COMPANY
<from>BIRNBACH, M.S.
<to>BELL, GORDON
<date>80/7/9
<date rec>7/11/80
<log#>7-21
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>PAGE WHITMORE CONSULTING SERVICES
<from>WHITMORE, PAGE G.
<to>BELL, GORDON
<date>80/7/8
<date rec>7/11/80
<log#>7-20
<dispo/date>
<message>
<answer>

<f/u>
<filed>N
<ret-gb>
<roll>
<>

<subj>TWX--SHUGART TECH. 5.25 INCH DRIVE
<from>RUMPSA, RON
<to>BELL, GORDON
<date>80/7/10
<date rec>7/11/80
<log#>7-19
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>INDUSTRIAL RESEARCH & DEVELOPMENT
<from>JONES, ROBERT R.
<to>BELL, GORDON
<date>80/7/2
<date rec>7/10/80
<log#>7-18
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>INTEL
<from>O'NEIL, RUSS
<to>BELL, GORDON

<date>80/6/30
<date rec>7/9/80
<log#>7-17
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>NATIONAL RESEARCH COUNCIL
<from>RADER, LOUIS T.
<to>BELL, GORDON
<date>80/7/1
<date rec>7/8/80
<log#>7-16
<dispo/date>SAM FULLER (CC: DALEY, RODGERS) - 7/17/80
<message>THIS IS A PUBLIC MEETING - NO RESERVATIONS NEEDED. THERE IS NO CHARGE. IF YOU ARE INTERESTED IN ATTENDING PLEASE FEEL FREE TO DO SO.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>LABORATORY FOR COMPUTER SCIENCE
<from>CORBATO, F.J.
<to>BELL, GORDON
<date>80/7/7
<date rec>7/8/80
<log#>7-15
<dispo/date>FILE #13 - 7/14/80
<message>
<answer>
<f/u>
<filed>

<ret-gb>
<roll>
<>

<subj>RESUME' -- ROBERT V. QUINLAN
<from>QUINLAN, ROBERT V.
<to>BELL, GORDON
<date>80/7/3
<date rec>7/7/80
<log#>7-14
<dispo/date>ARMAND LA VALLE (CC:DICK, BILL PICOTT) - 7/8/80
<message>ARMAND, PLEASE HANDLE. INTERESTED?
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>AMERICAN ASSOCIATION OF ENGINEERING SOCIETIES INC.
<from>VAN NORDEN, MONTAGNIE JR.
<to>BELL, GORDON
<date>80/7/1
<date rec>7/7/80
<log#>7-13
<dispo/date>ED SCHWARTZ - 7/8/80
<message>DO WE NEED TO BECOME A MEMBER?
<answer>I DON'T THINK SO. PERHAPS BRUCE HOLBEIN WOULD DISAGREE, BUT I DON'T THINK SO. (TOM SIEKMAN) - 7/11/80
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>TWX -- MALSSIS CHAUVIN COLLECTION
<from>SOURNAC, CLAUDE
<to>BELL, GORDON
<date>80/7/7

<date rec>7/7/80
<log#>7-12
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>RESUME' (JIM BELL)
<from>BELL, JIM
<to>BELL, GORDON
<date>80/6/23
<date rec>7/7/80
<log#>7-11
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>OUDENSHA CO. LTD.
<from>NAKAJIMA, M.
<to>BELL, GORDON
<date>80/6/27
<date rec>7/7/80
<log#>7-10
<dispo/date>DICK SCHNEIDER - 7/7/80
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>IEEE COMPUTER SOCIETY
<from>TAYLOR, CHRISTINA E.
<to>BELL, GORDON
<date>80/6/26
<date rec>7/3/80
<log#>7-9
<dispo/date>RET TO TAYLOR 7/7/80
<message>PERMISSION GRANTED & SIGNED
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>UNIVERSITY OF CALIFORNIA, BERKELEY
<from>KUH, ERNEST S.
<to>BELL, GORDON
<date>80/6/27
<date rec>7/3/80
<log#>7-8
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>RESUME' JUNGHI (JAY) AHN
<from>SANDEL, GEORGE D. AND ASSOCIATES
<to>DONALDSON, ED
<date>80/7?
<date rec>7/3/80
<log#>7-7
<dispo/date>JIM CUDMORE - 7/7/80
<message>

<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>NATIONAL RESEARCH COUNCIL
<from>BLACKBURN, JACK F.
<to>BELL, GORDON
<date>80/6/30
<date rec>7/3/80
<log#>7-6
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>STANFORD UNIVERSITY
<from>WHITE, ROBERT L.
<to>BELL, GORDON
<date>80/6/30
<date rec>7/3/80
<log#>7-5
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>BELL LABORATORIES
<from>MATHEWS, MAX V.

<to>BELL, GORDON
<date>80/6/30
<date rec>7/3/80
<log#>7-4
<dispo/date>
<message>
<answer>
<f/u>
<filed>N
<ret-gb>
<roll>
<>

<subj>PERSONAL LETTER
<from>NODTVEDT,EINAR
<to>BELL, GORDON
<date>80/6/26
<date rec>7/2/80
<log#>7-3
<dispo/date>JACK GILMORE - 7/7/80
<message>WOULD YOU MIND SHOWING HIM AROUND?
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>SOFTWARE ENGINEERING MONTHLY REPORT FOR MAY 1980 (BOOK 1)
<from>SHELDON, LIZ
<to>BELL, GORDON
<date>80/5/?
<date rec>7/2/80
<log#>7-2
<dispo/date>LIZ SHELDON - 7/7/80
<message>
<answer>
<f/u>
<filed>

<ret-gb>
<roll>
<>

<subj>RESUME' - ANTON M. MAAS
<from>MAAS, ANTON M.
<to>BELL, GORDON
<date>80/6/29
<date rec>7/1/80
<log#>7-1
<dispo/date>ARMAND LA VALLE - 7/1/80
<message>PLEASE HANDLE.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>ABDO & ASSOCIATES
<from>SCHMALZ, DENNIS
<to>BELL, GORDON
<date>80/6/24
<date rec>6/30/80
<log#>6-74
<dispo/date>ARMAND LA VALLE - 7/1/80
<message>FYI
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>XEROX
<from>STRASSMANN, PAUL A.
<to>BELL, GORDON
<date>80/6/25
<date rec>6/30/80

<log#>6-73
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>GENERAL SERVICES ADMINISTRATION AUTOMATED DATA AND TELECOMMUNICATIONS SERVICE
<from>CARR, FRANK J.
<to>BELL, GORDON
<date>80/6/24
<date rec>6/30/80
<log#>6-72
<dispo/date>HARVEY WEISS - 7/1/80
<message>HERE'S AN OPENING. HELP. CAN YOU PLEASE GO OVER THIS SO I CAN GET BACK TO HIM.
<answer>
<f/u>7/11/80
<filed>
<ret-gb>
<roll>
<>

<subj>DIEBOLD GROUP INC.
<from>MILLER, N. RICHARD
<to>BELL, GORDON
<date>80/5/9
<date rec>6/30/80
<log#>6-71
<dispo/date>CIRC. TO OOD (CC: TRAVIS, GILMORE, VLACH, BROOKS, KOTOK) - 7/1/80
<message>THIS SAYS 1. VOICE FOR MGMT. 2. TELECONFERENCING, (IF WE CAN EVER GET IT)...AND WE NEED TO THEN ADD A COMPUTER CONTROLLED WPS FOR PASSING DOCUMENTS/SLIDE PRESENTATION).
<answer>
<f/u>

<filed>
<ret-gb>
<roll>
<>

<subj>FANNON METAL INDUSTRIES INC. (FMI)
<from>MUNGER, CRAIG L.
<to>BELL, GORDON
<date>80/6/25
<date rec>6/30/80
<log#>6-70
<dispo/date>NO INTEREST
<message>
<answer>
<f/u>
<filed>N
<ret-gb>
<roll>
<>

<subj>XEROX
<from>SANCHEZ, JOE
<to>BELL, GORDON
<date>80/6/20
<date rec>6/30/80
<log#>6-69
<dispo/date>
<message>
<answer>
<f/u>
<filed>XEROX - 7/1/80
<ret-gb>
<roll>
<>

<subj>NATIONAL ACADEMY OF ENGINEERING
<from>NELSON, MRS. HENRIETTE E.
<to>BELL, GORDON
<date>80/6/25

<date rec>6/30/80
<log#>6-68
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>BELL LABORATORIES
<from>CHESSON, GREGORY L.
<to>BELL, GORDON
<date>80/6/24
<date rec>6/27/80
<log#>6-67
<dispo/date>BILL DEMMER, CC:BILL HEFFNER - 6/30/80
<message>THANKS, LOOKS LIKE WE MADE OUT GREAT HERE.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>INFOTECH
<from>MULLER, BOB
<to>BELL, GORDON
<date>80/6/23
<date rec>6/27/80
<log#>6-66
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>SPECIALTY COMPOSITES
<from>PRYBUTOK, ROBERT
<to>BELL, GORDON
<date>80/6/?
<date rec>6/26/80
<log#>6-65
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>ASSOCIATION OF SCIENCE-TECHNOLOGY CENTERS
<from>TEMPLETON, MICHAEL
<to>OLSEN, KENNETH H.
<date>80/6/20
<date rec>6/26/80
<log#>6-64
<dispo/date>LETTER SENT TO MICHAEL (CC: OF LETTER TO MUSEUM) - 7/2/80
<message>NON-MEMBERSHIP FEE ($1250)
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>ROME SENTINEL COMPANY
<from>WATERS, STEPHEN B.
<to>BELL, GORDON
<date>80/6/23
<date rec>6/25/80
<log#>6-63
<dispo/date>

<message>
<answer>
<f/u>
<filed>N
<ret-gb>
<roll>
<>

<subj>MONTGROMERY PHISTER JR. SYSTEMS CONSULTING
<from>PHISTER, MONTY
<to>BELL, GORDON
<date>80/6/21
<date rec>6/24/80
<log#>6-62
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>RESUME' - KENNETH L. WILSON
<from>WILSON, KENNETH L.
<to>BELL, GORDON
<date>80/6/20
<date rec>6/24/80
<log#>6-61
<dispo/date>ARMAND LA VALLE - 6/25/80
<message>PLEASE HANDLE.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>DESIGN AUTOMATION INC.

<from>SOKAL, NATHAN O.
<to>BELL, GORDON
<date>80/6/20
<date rec>6/24/80
<log#>6-60
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>CORNELL UNIVERSITY
<from>EVERHART T.E.
<to>BELL, GORDON
<date>80/6/18
<date rec>6/24/80
<log#>6-59
<dispo/date>SAM 6/26/80
<message>CC: CHAMBERLAIN, ECKHOUSE FYI
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>SPEECH APPLICATIONS INFORMATION LABORATORIES
<from>ISENBERG, DAVID PH.D
<to>BELL, GORDON
<date>80/6/?
<date rec>6/23/80
<log#>6-58
<dispo/date>ORIGINAL RETURNED TO GB (CC:BOB GLORIOSO, JAN JAFERIAN) - 6/23/80
<message>WHAT GROUP WILL PROVIDE THESE PRODUCTS?...
<dispo/date>ORIGINAL F/U (CC: BILL DEMMER, GEORGE PLOWMAN, DAVE RODGERS, WAYNE ROSING, ULF) - 6/30/80

<message>WHO'S GOING TO WORK IN (SUPPLY PRODUCTS) THE SPEECH DOMAIN?
<answer>
<f/u>7/11/80
<filed>
<ret-gb>
<roll>
<>

<subj>AMDAHL, DR. GENE M.
<from>AMDAHL, DR. GENE M.
<to>BELL, GORDON
<date>80/6/18
<date rec>6/23/80
<log#>6-57
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>HARVARD UNIVERSITY
<from>WYATT, JOE B.
<to>BELL, GORDON
<date>80/6/19
<date rec>6/23/80
<log#>6-56
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>DIGITAL DESIGN
<from>SHERSHOW, HARRY
<to>OLSEN, DR. KEN
<date>80/6/19
<date rec>6/23/80
<log#>6-55
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>RUTHERFORD AND APPLETON LABORATORIES
<from>HOPGOOD, F R A
<to>BELL, GORDON
<date>80/6/18
<date rec>6/23/80
<log#>6-54
<dispo/date>TO LETTERBOOK (GB1.S5.18) - 7/2/80
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>NOMINATION FORM--UNIVERSITY OF NORTH CAROLINA
<from>BROOKS, FRED P. JR.
<to>BELL, GORDON
<date>80/6/?
<date rec>6/23/80
<log#>6-53
<dispo/date>
<message>
<answer>
<f/u>

<filed>
<ret-gb>
<roll>
<>

<subj>MIT (MASSACHUSETTS INSTITUTE OF TECHNOLOGY)
<from>GLASSER, LANCE A.
<to>BELL, GORDON
<date>80/6/20
<date rec>6/23/80
<log#>6-52
<dispo/date>ORIGINAL RETURNED TO GB (CC:ZEH, TEICHER, CLAYTON, MOFFA, MUDGE) - 6/26/80
<message>THIS LETTER SOUNDS ENCOURAGING. WHO'LL INTERACT? HOW'S THE PAPER SOUND?
<answer>
<f/u>7/11/80
<filed>
<ret-gb>
<roll>
<>

<subj>TEAG
<from>DAVIS, GERALD
<to>BELL, GORDON
<date>80/6/18
<date rec>6/23/80
<log#>6-51
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>NATIONAL ACADEMY OF ENGINEERING
<from>NELSON, MRS. E. HENRIETTE

<to>BELL, GORDON
<date>80/6/19
<date rec>6/23/80
<log#>6-50
<dispo/date>
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<f/u>
<filed>
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<subj>AMF
<from>BLACK, JAMES M.
<to>BELL, GORDON
<date>80/6/16
<date rec>6/20/80
<log#>6-49
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
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<subj>MAYNARD B.I.G. INC.
<from>DAVIS, SAMUEL
<to>OLSEN, KENNETH H.
<date>80/6/18
<date rec>6/20/80
<log#>6-48
<dispo/date>BERUBE 6/26/80
<message>SAY NO--NOTE DEC DOESN'T SUPPORT BABBAGE INSTITUTE
<answer>
<f/u>
<filed>
<ret-gb>

<roll>
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<subj>NATIONAL ACADEMY OF ENGINEERING
<from>NELSON, MRS. E. HENRIETTE
<to>BELL, GORDON
<date>80/6/17
<date rec>6/19/80
<log#>6-47
<dispo/date>
<message>
<answer>
<f/u>
<filed>
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<subj>NATIONAL SCIENCE FOUNDATION
<from>RESNIKOFF, HOWARD L.
<to>BELL, GORDON
<date>80/6/16
<date rec>6/19/80
<log#>6-46
<dispo/date>
<message>
<answer>
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<filed>
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<subj>UNIVERISTY OF MASSACHUSETTS (UMASS)
<from>STONE, HAROLD S.
<to>BELL, GORDON
<date>80/6/16
<date rec>6/19/80
<log#>6-45

<dispo/date>
<message>
<answer>
<f/u>
<filed>
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<subj>UNITED STATES DEPARTMENT OF COMMERCE
<from>BARUCH, JORDAN J.
<to>BELL, GORDON
<date>80/6/13
<date rec>6/18/80
<log#>6-44
<dispo/date>ADDRESS TO GB LIST
<message>
<answer>
<f/u>
<filed>N
<ret-gb>
<roll>
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<subj>TWX--11/44 STATUS UPDATE
<from>11/44 PROGRAM TEAM
<to>BELL, GORDON
<date>80/6/18
<date rec>6/18/80
<log#>6-43
<dispo/date>
<message>
<answer>
<f/u>
<filed>
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<subj>WULF, WILLIAM A.
<from>WULF, WILLIAM A.
<to>BELL, GORDON
<date>80/6/15
<date rec>6/18/80
<log#>6-42
<dispo/date>
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<answer>
<f/u>
<filed>
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<roll>
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<subj>PURDUE UNIVERSITY
<from>REEN, NOEL
<to>BELL, GORDON
<date>80/5/8
<date rec>6/17/80
<log#>6-41
<dispo/date>MIKE POWELL 6/23/80
<message>TALKED WITH NOEL REEN (317-749-6130, PURDUE UNIVERSITY) AND TOLD HIM MIKE WOULD RESPOND TO HIS LETTER 6/23/80
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>RESUME'S--RICHARD J. CHUEH, ROGER ERWIN PACKARD
<from>NELSON, NEIL G.
<to>BELL, GORDON
<date>80/6/?
<date rec>6/17/80
<log#>6-40
<dispo/date>TEICHER 6/20/80 (TEICHER HUDSON OUTSIDE #:617-568-4000 X4900

<message>PLEASE CALL NEIL G. NELSON 213-705-6345
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>HERTRICH DEVELOPMENT INC.
<from>HERTRICH, FRED
<to>BELL, GORDON
<date>80/6/9
<date rec>6/17/80
<log#>6-39
<dispo/date>
<message>
<answer>
<f/u>
<filed>N
<ret-gb>
<roll>
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<subj>ZUSE, KONRAD
<from>ZUSE, KONRAD
<to>BELL, GORDON
<date>80/6/9
<date rec>6/17/80
<log#>6-38
<dispo/date>
<message>
<answer>
<f/u>
<filed>
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<subj>INTERSIL INSIGHT

<from>PHELPS, MEL
<to>BELL, GORDON
<date>80/6/?
<date rec>6/16/80
<log#>6-37
<dispo/date>
<message>
<answer>
<f/u>
<filed>
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<roll>
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<subj>NETWORK SYSTEMS CORPORATION
<from>THORNTON, JAMES E.
<to>BELL, GORDON
<date>80/6/11
<date rec>6/16/80
<log#>6-36
<dispo/date>TO LETTERBOOK (GB1.S4.43) - 6/17/80 (CC:RODGERS, DEMMER, PLOWMAN, VONADA, FULLER, STRECKER
<message>LET'S NOT SCREW THIS UP. HOW ABOUT CALLING HIM IF THERE ARE QUESTIONS? ANY GOOD POINTS HERE?
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>ROME SENTINEL COMPANY (RSC)
<from>WATERS, STEPHEN B.
<to>BELL, GORDON
<date>80/6/13
<date rec>6/16/80
<log#>6-35
<dispo/date>ORIGINAL TO GB (LETTERBOOK COPY (GB1.S4.42) - 6/17/80
<message>

<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>POSITRONIC INDUSTRIES INC.
<from>MYERS, J.E.
<to>BELL, GORDON
<date>80/6/12
<date rec>6/16/80
<log#>6-34
<dispo/date>BOB GLORIOSO - 6/17/80
<message>FOR YOUR ROBOT.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>STANFORD UNIVERSITY
<from>FEIGENBAUM, EDWARD A.
<to>BELL, GORDON
<date>80/6/?
<date rec>6/16/80
<log#>6-33
<dispo/date>
<message>
<answer>
<f/u>
<filed>STANFORD - 7/7/80
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<subj>VISUAL INDUSTRIAL PRODUCTS INC.
<from>STEINER, PAUL S.

<to>BELL, GORDON
<date>80/6/11
<date rec>6/16/80
<log#>6-32
<dispo/date>
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<f/u>
<filed>
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<subj>NORMAN POWERS ASSOCIATES INC.
<from>POWERS, NORMAN
<to>BELL, GORDON
<date>80/6/?
<date rec>6/16/80
<log#>6-31
<dispo/date>LARRY 6/17/80
<message>I'VE MET HIM, SHOULD WE HAVE HIM IN?
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>MCMILLAN MACHINERY CO. INC.
<from>PIASCIK, FRANK
<to>BELL, GORDON
<date>80/6/10
<date rec>6/16/80
<log#>6-30
<dispo/date>
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<answer>
<f/u>
<filed>
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<roll>
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<subj>SOCIETY OF WOMEN ENGINEERS
<from>MCGONAGLE, JOAN & TRIOLO, VICTORIA
<to>BELL, GORDON
<date>80/6/1
<date rec>6/12/80
<log#>6-29
<dispo/date>JOHN MEYER - 6/17/80
<message>
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<filed>
<ret-gb>
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<subj>BEAVER ISLAND
<from>BROWN, GORDON S.
<to>BELL, GORDON
<date>80/6/10
<date rec>6/12/80
<log#>6-28
<dispo/date>
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<subj>NATIONAL RESEARCH COUNCIL
<from>BLACKBURN, JACK F.
<to>BELL, GORDON
<date>80/6/9
<date rec>6/12/80
<log#>6-27

<dispo/date>
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<subj>NORTHEAST INSTITUTE
<from>HUGHES, DAVID I.
<to>BELL, GORDON
<date>80/6/?
<date rec>6/9/80
<log#>6-26
<dispo/date>JANE GORING - 6/9/80
<message>
<answer>
<f/u>
<filed>
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<subj>TWX--LOCAL DECUS SYMPOSIUM IN JULY
<from>BURNET, MAX
<to>BELL, GORDON
<date>80/6/9
<date rec>6/9/80
<log#>6-25
<dispo/date>ANSWERED - 6/11/80
<message>THERE ARE NO SLIDES AND I NEVER DELIVERED IT VERBALLY.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>UNIVERSITY OF UTAH
<from>VAN VALKENBURG, M.E.
<to>BELL, GORDON
<date>80/6/4
<date rec>6/9/80
<log#>6-24
<dispo/date>
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<subj>T.D. DOWNING COMPANY
<from>DOWNING, T.D.
<to>BELL, GORDON
<date>80/65/30
<date rec>6/9/80
<log#>6-23
<dispo/date>
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<subj>MIT
<from>FORRESTER, JAY W.
<to>BELL, GORDON
<date>80/6/4
<date rec>6/9/80
<log#>6-22
<dispo/date>
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<answer>

<f/u>
<filed>
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<subj>NATIONAL ACADEMY OF ENGINEERING (NAE)
<from>NELSON, MRS. E. HENRIETTE
<to>BELL, GORDON
<date>80/6/6
<date rec>6/9/80
<log#>6-21
<dispo/date>
<message>
<answer>
<f/u>
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<subj>MITRE CORPORATION
<from>O'BRIEN, J.A.
<to>OLSEN, KENNETH
<date>80/6/3
<date rec>6/9/80
<log#>6-20
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>INTERSIL INSIGHT
<from>PHELPS, MEL
<to>BELL, GORDON

<date>80/6/?
<date rec>6/9/80
<log#>6-19
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
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<subj>SPECIALIZED BOOK SERVICE INC.
<from>SHEER, MICHAEL D.
<to>BELL, GORDON
<date>80/6/2
<date rec>6/9/80
<log#>6-18
<dispo/date>TO LETTERBOOK (GB1.S4.20) - 6/9/80
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>IBM
<from>LANDAUER, ROLF
<to>BELL, GORDON
<date>80/6/?
<date rec>6/6/80
<log#>6-17
<dispo/date>
<message>
<answer>
<f/u>
<filed>
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<subj>UNIVERSITY OF CAMBRIDGE, COMPUTER LABORATORY
<from>WILKES, MAURICE V.
<to>BELL, GORDON
<date>80/6/2
<date rec>6/6/80
<log#>6-17
<dispo/date>
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<f/u>
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<subj>GTE TELENET COMMUNICATIONS CORPORATION
<from>ROBERTS, LAWRENCE G.
<to>BELL, GORDON
<date>80/6/2
<date rec>6/5/80
<log#>6-16
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<subj>CALIFORNIA INSTITUTE OF TECHNOLOGY (CALTECH)
<from>SUTHERLAND, IVAN E.
<to>BELL, GORDON
<date>80/5/30
<date rec>6/4/80
<log#>6-15
<dispo/date>

<message>
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<f/u>
<filed>
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<subj>AFIPS (ANNALS OF THE HISTORY OF COMPUTING)
<from>GALLER, BERNIE
<to>BELL, GORDON
<date>80/5/29
<date rec>6/4/80
<log#>6-14
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<f/u>
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<subj>NANODATA CORPORATION
<from>SENFT, MICHAEL C.
<to>BELL, GORDON
<date>80/6/2
<date rec>6/4/80
<log#>6-13
<dispo/date>
<message>DON'T WISH TO RECEIVE 6/9/80
<answer>
<f/u>
<filed>N
<ret-gb>
<roll>
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<subj>TWX--11/44 BULLETIN (6/3 A.M.)

<from>11/44 PROGRAM TEAM
<to>BELL, GORDON
<date>80/6/4
<date rec>6/4/80
<log#>6-12
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
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<subj>CALIFORNIA INSTITUTE OF TECHNOLOGY (CALTECH)
<from>DAVIS, W. BEN
<to>TEICHER, STEPHEN
<date>80/5/21
<date rec>6/3/80
<log#>6-11
<dispo/date>
<message>
<answer>
<f/u>
<filed>N
<ret-gb>
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<subj>CASE WESTERN RESERVE UNIVERSITY
<from>ROGERS, JAMES L.
<to>BELL, JAMES R.
<date>80/4/18
<date rec>6/3/80
<log#>6-10
<dispo/date>
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<f/u>
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<ret-gb>
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<subj>MIT
<from>DYER, W. GIBB JR.
<to>BELL, GORDON
<date>80/5/30
<date rec>6/3/80
<log#>6-9
<dispo/date>
<message>NO 6/12/80
<answer>
<f/u>
<filed>12
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<subj>YALE UNIVERSITY
<from>PERLIS, ALAN J.
<to>BELL, GORDON
<date>80/5/30
<date rec>6/3/80
<log#>6-8
<dispo/date>
<message>
<answer>
<f/u>
<filed>
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<subj>RESUME' -- RAUL G. DOMINGUEZ
<from>DOMINGUEZ, RAUL G.
<to>BELL, GORDON
<date>80/5/27
<date rec>6/3/80

<log#>6-7
<dispo/date>ARMAND LA VALLE - 6/5/80
<message>PLEASE HANDLE.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>ETA KAPPA NU AWARD ORGANIZATION COMMITTEE
<from>D'ARCY, JAMES A.
<to>BELL, GORDON
<date>80/5/15
<date rec>6/3/80
<log#>6-6
<dispo/date>ORIGINAL - F/U (CC:OOD) - 6/6/80
<message>ANY CANDIDATES?
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN
<from>BITZER, DONALD L.
<to>BELL, GORDON
<date>80/5/30
<date rec>6/3/80
<log#>6-5
<dispo/date>ORIGINAL TO MJ LETTERBOOK COPY FILED (GB1.S4.24)
- 6/10/80
<message>
<answer>
<f/u>
<filed>
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<subj>RESUME' -- RONALD C. SELLE
<from>SELLE, RONALD C.
<to>BELL, GORDON
<date>80/5/27
<date rec>6/2/80
<log#>6-4
<dispo/date>ARMAND LA VALLE - 6/2/80
<message>PLEASE HANDLE.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>RESUMES' - 1)ROGER ERWIN PACKARD 2)RICHARD J. CHUEH
<from>NELSON, NEIL
<to>BELL, GORDON
<date>80/5/28
<date rec>6/2/80
<log#>6-3
<dispo/date>MJ LET'S CALL THEM 6/17/80
<message>7/8/80 Tue SENT TO CLAYTON--GB THINKS THIS IS PROBABLY WORTH INVITING HIM IN. WE NEVER MADE CONTACT.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>RESUME' - JAMES ZIVIC
<from>ZIVIC, JAMES
<to>BELL, GORDON
<date>80/5/21
<date rec>6/2/80
<log#>6-2
<dispo/date>ARMAND LA VALLE - 6/2/80

<message>PLEASE HANDLE.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>SNYDER ASSOCIATES INC.
<from>SNYDER, A.E.
<to>BELL, GORDON
<date>80/5/22
<date rec>6/2/80
<log#>6-1
<dispo/date>ARMAND LA VALLE - 6/2/80
<message>ANY INTEREST? OR TOSS?
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

GB0001/3

```
+---------------------------+
|   |   |   |   |   |   |   |
| d | i | g | i | t | a | l |   i n t e r o f f i c e   m e m o r a n d u m
|   |   |   |   |   |   |   |
+---------------------------+
```

Subject: **What I Heard at the January Jungle**

To: OOD

Date: 1/30/79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51

<u>Immediate Action</u>

We will implement a "Get Better" Campaign now...perhaps better named, "Feel Better".

Emphasis will be on what's going well, versus critiquing. I certainly will try to be more positive.

Hiring will revert back to previous controlling levels...namely, I will not sign reqs or offers.

Timely and Stable Decision Making--There are a number of issues in each engineering area that are contentious (e.g., charter, what product to build, future direction). These should be resolved quickly in order to avoid the uncertainty, frustration, and loss of people that is often associated with slow or unclear decision making and hassle.

Presenting the strategy --The main part of the program will center around presenting the strategy within Engineering (including Delagi, Savell, Holman, etc.). Bob and Bill will you please arrange the first, all engineering presentation to managers at direct report level, and then to the consultants? These will be the only meetings where all of OOD will present, albeit meetings with dinner. Although I'll give the broad strategy overview, each member of OOD should give the parts of the strategy they are responsible for. This can be in terms of what is really solid in the product or process domains, what is to be done, and what will take a long time. For example, Bill might talk about the machines and the problem of the interconnections at each of the levels. I would like Bob to orchestrate this presentation and what each of us will say. If we did this, it would take about 2-3 hours, given that we all spend 1/4 hour each. One or both could be videotaped for further dissemination.

Messages to me [And Replies]

RP -- Recognize the goal of more central process management, and integration is inconsistent with G and A budget growth of 15%. What do we do? [Here, I believe the key is to push much of the costs of running the various groups out to the groups so that what is central is really rules, measures, etc. Any of the decentralized stuff is done on a contract, rather than a centrally funded basis (e.g., project management, certain tools, personnel, F and A.)] Pay me more to make it worthwhile putting up with this much hassle. [I thought you were really running the place and thrived on it. You mean you don't want it either?]

RC -- Technical product innovation in video, printer, architecture. Sponsorship in mfg and mkt. [I'll try here, note work with Jack Smith.]

WD -- Stability. Overnight think time and discussion prior to declaring responsibility, budget, organization, or strategy change. [I've been waiting in the range of 1-10 weeks. This is variable with change, input, etc. I'll try harder, but you'll have to tell me why I should back off in light of inactivity.]

UF -- Any $ for large 32 bit budget? [Sorry, I thought you and Bill had this one covered.]

JM -- Fewer handgrenades, non-impulse management. [Sorry, I find it too hard to change.] Keep leading. Follow-up on action items. [I believe there should be someone who is helping me full-time in this regard. Who could this be???]

LP -- No new assignments for 6 mos. Help in fighting off the wolves. Occasional feedback. [Fine. I agree.]

BJ -- Don't force solutions until analysis is done. [All I ask is to tell me when to do the forcing... I get impatient if there is inactivity, wrong direction, no schedule, not knowing priority, seeing pain on other engineer's faces, etc.]

JC -- Learn how to act supportive--focus on "winning message" vs "how awful we are". Choose a limited set of dimensions for us so we can win in one or two versus losing on 10-15. [I only suggest or add dimensions when the organization, product, or process has none of its own!]

JK -- Before sending mortar shell, talk to me. Stability. [I want at least 2 out of 3 of us (you, Grant, I) to agree on what we're doing.] Let engineers design the products. [What is it about the products you want to hide?]

The Important Issues to Work [My Version]

RP -- I want help running this place. Hire someone to do your present job. The Product Manager x 3 issue and what the person does. Co-ordinate the strategy presentations. See BJ re Strategy Program Management. CAD (also with BJ). Resolve funding and decentralization conflicts. Get EBOD moving.

BJ -- Get a priority list of what you are doing and then I'll back off. Get rid of as many line functions as possible so you can help me. Charter. Help me get a Strategy Program Management function.

JM -- Measures about the health of engineering. Get time or alternative way (or person) to help the follow-up of OOD group or meeting issues. Engineering salary crisis. We now need really strong college recruiting.

JK -- Get a priority list for Grant, you and I and then get our issues in sync. Make Colorado and their projects really strong. Cover us in the mid-range disk offerings for 11/44, Nebula, Minnow, Comet, small 11/70's etc. where the bulk of the revenue is.

RC -- Get the charter resolved (nearly instantaneously) with DCG...this creates much heat. [Bob, could you also help here?] Roy and Mike need help in LSI future and priorities.

WD -- Leave the place in good hands and get the most out of MIT. Help Ulf. Interconnect.

UF -- Resolve, with all our help, the uncertainty surrounding the future direction of the 10/20. Delegate systems work and thinking to someone else for now and I'll help hold the wolves at bay.

LP -- Your direction is fine, but your hands are full. I'll follow your directions above...although I intend to watch HYDRA.

JC -- We really need you to help Dick in the LSI direction resolution and also all LSI!

GB:ljp

Digital **Interoffice Memo**

Subject: **Jungle Meeting Schedule - '76 - '77**

To: OOD

Date: 9 SEP 76
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

To help in planning your calendars, please set aside the following dates for Jungle Meetings:

	Month	**Date**
1976	September	27
1977	January	20 and 21
	March	31
	April	1
	June	23 and 24
	August	25 and 26
	October	20 and 21

GB:ljp

DIST: Dick Clayton ML5-2/E71 Ulf Fagerquist MR1-2/E78
Arnie Goldfein ML12-2/A16
Henry Lemaire ML1-4/A97
Julius Marcus PK3-1/M29 Larry Portner ML12-3/A62
Bob Puffer ML1-3/E38

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.___.___.___.___.___.___.___.
!   !   !   !   !   !   !   !
! d ! i ! g ! i ! t ! a ! l !
!___!___!___!___!___!___!___!
```

I n t e r o f f i c e M e m o

TO: see "TO" DISTRIBUTION

DATE: FRI 29 APR 1983 1:25 PM DST
FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5198355503

SUBJECT: GETTING ON WITHOUT JUPITER--TOPS 30 (SAYS RICK)

GB5.23

I want us to get out of the "we're going to have Jupiter in time" dream world and address how we're going to do the best possible job for our customers who rely on Tops 10/20 and KL's for their computing.

The capability to tightly interconnect CI and VAXen to
provide a
capablity beyond DECneting to VAXen is what we must offer.
Building
another 10 in light of our position and investment is really
dumb.

BACKGROUND AND WHY I WANT TO STOP BUILDING 36-BIT PROCESSORS
When I was in a Denver hospital and could think more clearly,
it was
extremely obvious (especially after hearing that one of our
managers
had committed Jupiter and a follow-on Jupiter to a customer)
that we
just have to STOP Jupiter, get on with building faster VAXen,
and STOP
having to develop two major architectures and 3 operating
systems.
When I returned and looked at the investment required to
finish
Jupiter, it was also clear that we shouldn't do Jupiter. A
few weeks
ago when Ulf described the design methodology and technology,
it was
clear that we could build a Jupiter with 2.5-4 x KL
performance. At
this point, I waivered because I'm currently in to
understanding
different design methods.

in the event an electronic mail system is installed under the
aegis of Admiral Inman's office, it would be helpful to get
your feedback on the current experiment to make a future MCC
electronic mail system an even better tool.

Because activity has not been high, I'd appreciate your
comments on the following:

Did you ever access your account?   [ ] yes   [ ] no

. If no,

do you have a terminal available to you? [ ] yes [ ] no

were you going to access your account personally? [ ] yes [ ] no

were you going to ask someone else to do it? [ ] yes [ ] no

Main reason for not accessing my account is:

To make electronic mail a more useful tool, I would suggest:

Sincerely,

Mary Jane Forbes
Secretary to Gordon Bell

MJ5.27 June 6, 1983

<g> <fn> <ln>
<co>
<add>
<csz>

Dear <g> <ln>:

How goes the MCC-ALPHA OMEGA electronic mail experiment?
ON'T THINK
THEY KNOW THAT WE'RE PROVIDING VAXen in the range of where 10's used
to be. Therefore, we owe it to them to be straight. This is what
we're finally trying to do by talking to a half dozen of them this
week. In the one case, the University of Pittsburgh, in which I
talked with a customer, they were delighted at "finally getting the
facts on which to make a decision". All I said: we screwed up, we're
basing future products on VAX, and the revenue/investment is much
greater in the case of VAX. (I think we had completely oversold
because they were thinking of taking their administrative load from an
Amdahl and moving it to the 10... which I consider idiotic and
immoral.)

I believe there will be something of a real trauma at DECUS if and
when we decommit to the long awaited Jupiter, unless we do it openly
and by saying what we are trying to do for them. Therefore, I would
suggest that there be 3 speakers. Ken or Win would give a big
overview talk, followed by a major announcement of the product
strategy direction. Details would be given in the session with Rose
Ann. The talks:

Ken or Win- presenting an overview message... which summarizes

Gordon or BJ- problems, product strategy, and general direction
with respect to DEC Architecture

Ulf or Pete and Heff- present the technical details

What I would like to say to all of DECUS:

1 We screwed up at the project level on several recent machines.
It was a case of complexity. We have drastically changed our
design processes. We didn't know that the 10/20 had this
problem until Novemeber. Now we see it as a large investment,
getting us a product to you too late and too expensive and too
low in performance. At sometime in the future, if you want to
hear about where we are in design systems, we'll present it.

2 The main development thrust (THE PRODUCT STRATEGY) is based on
a '75 decision to build VAX instead of a line of 10's.
Persuing both lines would have meant a rewrite of all software
to handle addressing and PC's. In '79, when it became clear
that VAX did all we intended, and provided a great
environment, we began a program called to Homogeneous Computing
structure whose goal is to provide cost effective computing at
all levels of use.

Our main development thrust is with VAX where we now have a range, more machines, more users and more software. This results in a ship rate of >10 times the 10/20, and our development resources in the VAX, and compatible 11 part (Pro, and RSX) are in the same ratio.

Two critical aspects of this plan were to higher level interfaces and to build the necessary bridges to have a totally homogeneous architecture. We're well along on this and will announce some more products now.

3 We're well on our way to achieving the architecture, and hope to have computing terminals that execute the VAX interface in the near future. We'll have higher performance machines too.

4 We're going to provide signficantly better products for the 10/20 customer along these lines:

. More users and better utilization of existing resources-

.PC's are the main thrust to off-load;

.HSC will provide more performance, again off-loading

.VAXen of all types will off-load... higher performance and better cost/user in VAX domain are forthcoming

.Pluto will provide front ending to offload

.Sharing of 10/20's on CI permits load balancing.

. More Processor cycles- already 780's better in some jobs, but the real answer is bigger machines. We're going this way in VAX. Three, major product announcements will be made in the next 6 months that address performance.

- Floor space- Disks, distributed i/o, >mips/sq ft (on VAX).
- Compatability with and portability tools to VAX

5 We're providing functions on the VAX that are new to 10/20:

- Large address, and common run time
- High reliability structures-V3B is being announced, nothing of this sort is planned in the Tops area.
- Programming environment and VIA- more languages, data access, data dictionary, special facilities (eg. TPSS)
- Significant office automation software with more to come
- Range of computing styles from VAX PC to large mainframes

6 We'd never really gotten around to pointing out that is the most positive thing we can provide. IN EVERY dimension of goodness, the VAXen in development ALL offer significant cost, cost/performance, performance, performance/sq ft, and functionality over anything we were planning in the 10/20.

PERFORMANCE, PERFORMANCE/$ AND PERFORMANCE/SQ.FT. COMPARISONS

what	when	$	Perf.	Size	Perf/$	Perf/sq ft
KL	74	.75	1.33	11x2.5	1.77	.048
780	78	.4	1	4-6x2.5	2.5	.066
Superstr	83	.4	1.5	4-6x2.5	3.75	.1
Venus	6/84	.6	5	6.5x2.5	8.33	.3
Nautilus	4/85	.25	4		16	
dual	"	.4	8	4x2.5	20	.8
Scorpio	85	.04-.1	1-2	2x2	10-20	.5
Jupiter1	+30mos	.75+?	3.33	10x2.5	4.44	.13
Jupiter2	"	.75+?	5.33	10x2.5	7.1	.21

WHERE WE GO FROM HERE?
I'd like to see a Tops 30 team formed around Pete which would include persons from VMS to plan and build the desired functionality. We might use a customer panel.

We should also get support from one of the PC groups, say Pro or Pro 32 to go after significant integration of PC's into TOPS 30. We should start by getting ALL the development team the appropriate PC's so they begin using them in the desired way... "Software comes from heaven when you have hardware", says Chairman Ken.

Right now I'd like to ratify this direction and get on with TOP30 and what we can confidently say at DECUS.

"TO" DISTRIBUTION:

RICK CORBEN ULF FAGERQUIST ROSE ANN
GIORDANO
WIN HINDLE PER HJERPPE BILL
JOHNSON
ED KRAMER KEN OLSEN JACK
SHIELDS
JACK SMITH

win re jupiter....

my comments to you this morning will seem like a mixture of a good
news and bads news. However, if you stop to think about it, what
looks at first blush like bad news is really good news, too.

The bad news is that it has taken us longer than we had originlly
hoped to develop a follow-on KL-10 machine (which we've been calling

Jupiter) and it looks now like we're still about three years away.
You have told us that this is too long, and we agree.

Thus, in order to stay on course and sustain momentum in pursuit of
the best possible solutions to your medium- and long-term needs, we
have decided to suspend development of Jupiter and instead, focus all
of our high-end development efforts on our more broadly-based VAX
architecture.

Now, lest you think that we are totally abandoning our 36-bit space,
and summarily denigrating the value of your investment in this family
of products, let me hasten to assure you that we will continue to

agressively develop software and communications tools which will
allow DECsystem 10s and 20s to be more easily integrated into our

corporate architecture and, in fact, to accelerate that transition

process.

Starting next week, we will begin to field support teams who will

works closely with each of our 10/20 users. They will
work closely with each customer to analyze specific needs

and to design a custom set of interim and alternative programs to
satisfy those customer-specific needs.

We believe we have developed a sound general strategy to take our

customers into the next generation and are prepared to work
dilligently to ensure that their specific needs are met.

00 CORE DECGRAM ACCEPTED S 002911 O 75 31-JUL-82 14:08:05

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* d i g i t a l *
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TO: PER HJERPPE DATE: SAT 31 JUL 1982
2:05 PM EDT

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

cc: ULF FAGERQUIST
ROSE ANN GIORDANO
BILL MCBRIDE

MESSAGE ID: 5171114445

SUBJECT: PRIORITIES IN JUPITER

I thought we had a product strategy on Jupiter to NOT do everything in terms of adding IBM channels and Massbus devices. Yesterday, I talked to several frustrated developers that say you must have this all back on Jupiter.

We are in direct conflict on this. I have been trying to limit the development on the 10/20's to the point where we can supply a quality product versus trying to do everthing poorly. This often gets mistaken to the fact that I'm against the product or product line. As the originator of the product, nothing gives me greater pleasure than to see it live and be highly regarded ... therefore, it's from this point of view that I come from.

I don't see the 10/20 as a quality product now in terms of being able to couple to other DEC or even IBM or international computers because it tried to go it alone and didn't make it. Customers still give me hell about the networking. This also impacts the reliability... Marlboro nodes are really quite poor and if this were a customer, they would have switched to IBM long ago.

Returning to an interface everything strategy is simply going to impact quality and I say we aren't going to do it. Furthermore, this means we must always support these interfaces forever on the 10/20. If you must have them, then look at getting them on the HSC, where they can be supported across a reasonable customer base and hence get the attention that's need for a successful product.

There are many higher priority projects: getting Jupiter-complete with NI and CI, getting NI and CI on KL's (so you can have a LAN at a site that works), and finally getting compatiblity.

WPS USERS - Leave HP mode and type <CR>

00 CORE DECGRAM ACCEPTED S 000355 O 33 08-MAY-83
12:03:09

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.___.___.___.___.___.___.___.
!   !   !   !   !   !   !   !
! d ! i ! g ! i ! t ! a ! l !        I n t e r o f f i c e
M e m o
!___!___!___!___!___!___!___!
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TO: JACK SMITH   DATE: SUN 8 MAY 1983
11:35 AM DST

FROM: GORDON BELL

cc: WIN HINDLE
KEN OLSEN
JACK SHIELDS

DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5199269698

SUBJECT: RE: TOPIC

GB5.38

Am sorry I had to attend a previously scheduled meeting (on a decent MicroVAX PC CRT controller), and couldn't attend the meeting on Thursday.

I concur with Jack. We have to get the party line, and the topic has to be scheduled every week until we have it.

Am really sorry we don't have a party line at DECUS because it seems like we're going to be forced to say by implication we're still on target for Jupiter. If we don't say this, then the revolution could be quite extensive.   Saying nothing will let everyone's imagination run wild. That's why I advocated an announcement at DECUS by Ken or Win. A later announcement of this type could be stronger if accompanied by Venus (but only when it runs).

Somehow, I really don't feel good that we've had to say so much about Jupiter when it's clear it has been a fabrication based on the status of the project! Now I continue to feel bad to not say what we're going to do:

1. Continue in limbo, engineers not flat out.
2. Do Jupiter at great expense for 30 months and no market.
3. Take our licks now with positive message
4. Continue to mislead (by implication) and wait for ability to present a stronger message.

Don't envy any of us in this.

FROM: GORDON BELL DATE: TUE 19 FEB 1980
3:54 PM EST
DEPT: OOD
EXT: 223-2236
TO: GRANT SAVIERS
RALPH PLATZ
DEMETRIOS LIGNOS
MIKE RIGGLE

SUBJECT: WHAT'S A K.PLI? FOLLOW UP: 2/29/80

What's a K.pli? What does the HSC cost look like now? Any alternative cheaper routes to connect HSC to systems besides the CI? What's a 2 chn UDA? Isn't UDA 4 chn?

Please forgive me for cancelling the January Woods in Colorado. I am looking forward to the next visit though.

Have enjoyed reading the UDA and HSC Functional specs. My only concern continues to be cost, and possibly power. Why don't you guys take a lesson from the rest of the world and start a mammoth cost reduction effort based on LSI and VLSI. It looks like we have a great architecture here, and I would rather cost reduce it than yield to the next round of pressure
that would force you to throw the whole thing out and start

over because it is too expensive. It feels clear to me that the
way to get the cost/byte down in all the mass storage drives and subsystems, is to work on electronics first and mechanics second. This is going to require incredible cleverness because
there are more demands for new drives. On the other hand, if you go after cost reduction in the electronics by LSI, maybe you can use or reuse electronics more than one drive?

GB:swh
GB1.S2.5

January 9, 1979

Vikram J. Kapoor
School of Engineering
Department of Electrical Engineering
and Applied Physics
Case Western Reserve University
Cleveland, Ohio 044106

Dear Professor Kapoor:

In looking at my calendar this Spring, I find that I've over committed and can't give a talk at Case Western. If there is interest in next Fall, we can set a time now.

I'm sorry.

Sincerely,

Gordon Bell

Vice President,
Engineering

GB:ljp
ID#413

CC: Eric Thompson
Bob Alessio

July 6, 1978

Karl V. Karlstrom
Assistant Vice-President
Editor, Computer Science
and Applied Mathematics
Prentice-Hall, Inc.
Englewood Cliffs, N.J. 07632

Dear Karl:

In reference to your letter of June 1, sorry I don't know who might publish a book in Distributed Processing Systems.

What do you think of the enclosed handbook we published?

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:ljp
ID#0155

Enclosure

August 1, 1979

Charrette
31 Olympia Avenue
Woburn, MA 01801

Attention: Sales Department

Dear Sir:

Please send me the following items:

Item#/Name	Price	
55 3305/Slide Comp	$6.98	
56 3606/Metric	6.25	
57 0216/Triangles & Line Spacers (10")		16.00
57 4296/Pantographs	26.00	
62 0300/Map & Plan Measurers		20.50
62 0005/Plainmeters	163.00	
Total:	$238.73	

A check for $238.73 is enclosed.

Ship to: Mr. Gordon Bell
Page Farm Road
Lincoln, MA 01773

Sincerely,

Gordon Bell

GB:swh

GB0003/70
Enclosure

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"___"___"___"___"___"___"___"
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! d ! i ! g ! i ! t ! a ! l !  I n t e r o f f i c e   M e m o
!___!___!___!___!___!___!___!
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TO: LEON PAYETTE

DATE: 9 June 1983
FROM: CLAIRE FLUET
DEPT: Engineering

Admin.

EXT: 223-4236
MS: MLO12-1/A51

SUBJECT: RESUME - KEVIN FLUET

Leon, attached is a resume for my son who would like a job in Plant Engineering. Can you recommend other department heads or which Personnel Office I should send it to?

Any help would be appreciated.

Thanks.

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* d i g i t a l *
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TO: AVRAM MILLER
5:22 PM EST

DATE: SAT 10 APR 1982

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION

DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: RE: RE: DAISY CAD KEYBOARD AND OUR KEYBOARD

The way you talk about the keyboard, I certainly applaud. It's how we get winning products. Unfortunately, I thought you had this responsibility because the person doing the keyboard worked for you (via Art, and Paul). Bill was also frustrated. When I got involved there was no real question except to argue out the last details and decide between the two camps.

The problem with the keyboard is that to me, it is through a clear chain: Avery, You, Art, Paul to the person. The only problem I detected was the person didn't know anything about keyboards, the management didn't help him anyway, and there wasn't anythig written down in terms of what the goals were.

I know I'm really going to be sick if I have to use the keyboard as I worked on the original keyboard for the Teletype which had for example < and > over , and .. As a result, many systems use <> for characters. IBM FINALLY GAVE IN AND NOW ALL KEYBOARDS USE THIS CONVENTION! You guys gave up 15 years of progress and reverted to the old typewriter. This is going to get me and Ken much hate mail, which I deserve, for allowing any myth to propogate that there's any other way to run things except by individual responsibility! Many of the programming languages use it, along with the people who have to type on it. Given that a couple of the human factors people said it looked fine to them, I lost much respect for them as understanding humans, factors or engineering. The good news is that training can make money retraining people.

Jack and Bill,
I thought THIS keyboard was closed and I certainly wanted to forget about it until we get the inevitable feedback.

I really hope I'm wrong on the keyboard. Given the way it was designed, only pure, dumb luck will be our savior. Pray!

"CC" DISTRIBUTION:

BILL AVERY DICK GONZALES WALTER HANSTEIN
KEN OLSEN JACK SMITH

GB3.S4.34
****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION DATE: MON 24 MAY 1982 2:03 PM EDT

FROM: GORDON BELL
cc: MARY JANE FORBES DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: RE: RE: WHAT DO YOU THINK ABOUT THIS

I say change the main keyboard back to what is now the industry
standard (including the IBM PC!) Many languages use it. We got
the industry to go to this in 64 with the <> over the ,.! Also
put the shift key back where it belongs. The upper case,. is nonsense because in shift lock position, these are still,. and
not <> so it works fine.

When can you give us back our electronic keyboard and through out the obsolete typewriter keyboard some nut came up with by speaking Ergonomics-eze.

"TO" DISTRIBUTION:

RON HAM AVRAM MILLER JEFF RUDY

ATTACHED: MEMO;39

****
* d i g i t a l *
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TO: AVRAM MILLER
DATE: WED 19 MAY 1982
10:46 AM EDT
FROM: MARY JANE FORBES
cc: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2237
LOC/MAIL STOP: ML12-1/A51

SUBJECT: RE: WHAT DO YOU THINK ABOUT THIS

Not much!

1) soft shift key - no problem
2) substituting [] or {} for <>. <> is a major function in WPS. My complaint is the location of the key--no substitutes please! [] and {} are used in other ways in the text, let's not confuse the issue, or the operators. {} aren't used very much (as far as I know), put <> there. But I really don't see why you are wasting the , and . keys with the same symbol in shift mode, which causes yet another key to be needed.

I'm not a programmer, but I would think that a substitution would cause a major rewrite of software, to say nothing of all the documentation.

As I understand, it is not just WPS users, but programmers also, who use <> constantly.

How can you look at a major share of the sales as a "too heavy a reliance." IT IS THE KEY THAT RUNS LIST PROCESSING ON WPS. DEC'S LIST PROCESSING IS THE MOST POWERFUL AND EASY TO USE IN THE INDUSTRY.

GB3.S5.46

00 CORE DECGRAM ACCEPTED S 001961 O 362 24-JUN-82 13:38:29

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* d i g i t a l *
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TO: see "TO" DISTRIBUTION DATE: THU 24 JUN 1982 1:37 PM EDT

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

cc: TOM KOBAYASHI
SMITH JACK @MLXX
T. NAGAMINE @TKYD

MESSAGE ID: 5167256665

SUBJECT: CAN WE BUY THE BROTHER KEYBOARD?

I AM TYPING ON A NICE DAISY WHEEL TYPEWRITER MADE BY BROTHER AND AM ANXIOUS
TO SEE WHAT THE ONE THEY ARE OFFERING FOR $200 FEELS LIKE AND IF IT'S THE SAME ONE THEY'D EELL
ONE THEY'D SELL US.

THE ATTRACTIVE THING ABOUT THE KEYBOARD

1. GOOD FEEL

2. CAPACITIVE INSTEAD OF ELECTROMEHCHANICAL. WE'RE GOINTG TO LOVE THE
EXTRA RELIABILITY.

(I HAVE FREINDS WHO USE OUR CURRENT D KEYBOARD IN HEAVY DUTY USE AND
THEY DON'T LIKE THE SHORT LIFE.) I CAN'T SEE HOW THE NEW ONE WILL BE BETTER.

WHILE THEY ARE LOOKING AT A DESIGN FOR US, COULD I SUGGEST WE GET THEM TO
MAKE IMPORTANT ECO'S?

1. MAKE THE TILT ADJUSTABLE SO THAT IS IT IS REALLY ERGODYNAMIC INSTEAD
OF JUST MADE TO SOUND THAT WAY

2.
2. CUT A FEW INCHES SO THAT IS/ T CAN FIT IN A STANDARD BRIEFCASE FOR USE WHEN WE
WE WANT IT PORTABLE

ALL IN ALL, THIS KEYOBOARD SOUNDS GOOD, ESPECIALLY SINCE IT IS CHEAPER, AND
MORE LIKELY TO BE MORE RELIABLE AND FEEL BETTER..

"TO" DISTRIBUTION:

BILL AVERY AVRAM @MLXX WALTER HANSTEIN

00 CORE DECGRAM ACCEPTED S 000077 O 20 22-JUN-82 2:01:58

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* d i g i t a l *
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TO: see "TO" DISTRIBUTION   DATE: TUE 22 JUN 1982
1:40 AM EDT
                                             FROM: GORDON BELL
cc: see "CC" DISTRIBUTION   DEPT: ENG STAFF
                                             EXT: 223-2236
                                             LOC/MAIL STOP: ML12-
1/A51

                                             MESSAGE ID: 5167256666

SUBJECT: CAN WE BUY THE BROTHER KEYBOARD?

I'M TYPING ON A NICE DAISY WHEEL TYPEWRITER MADE BY BROTHER AND AM ANZ///
ANXIOUS TO SEE WHAT THE ONE THEY ARE OFFERING FOR $200 FEELS LIKE AND
IF IT'S THE SAME ONE THEY'D SELL US.
THE ATTRACTIVE THING ABOUT THE KEYBOARD
1. GOOD FEEL
2. CAPACITIVE INSTEAD OF ELECTROMECHANICAL. WE'RE GOING TO LOVE THE EXTRA
   RELIABILITY (I HAVE FRIENDS WHO USE OUR CURRENT KEYBOARD IN HEAVY DUTY
   USE AND THEY DON'T LIKE THE SHORT LIFE.) I CAN'T SEE HOW THE NEW ONE
   WILL BE BETTER.

WHILE THEY ARE LOOKING AT A DESIGN FOR US, COULD I SUGGEST WE GET THEM TO
MAKE IMPORTANT ECO'S?
1. MAKE THE TILT ADJUSTABLE SO THAT IS// IT IS REALLY

ERGODYNAMIC INSTEAD OF
   JUST MADE TO SOUND THAT WAY
2. CUT A FEW INCHES SO THAT IT CAN FIT IN AA STANDAD BRIEFCASE O/ FOR USE
   WHEN WE WANT IT PORTABLE

ALL IN ALL, THIS KEYBOARD SOUNDS O GOOD, ESPECIALLY SINCE IT IS CHEAPER,
AND MORE LIKELY TO BE MORE RELIABLE AND FEEL BETTER.

"TO" DISTRIBUTION:

BILL AVERY   WALTER HANSTEIN   MILLER AVRAM @MLXX

"CC" DISTRIBUTION:

TOM KOBAYASHI   JOHN RING   JACK SMITH
T. NAGAMINE @TKYD

WPS USERS - Leave HP mode and type <CR>

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* d i g i t a l *
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TO: see "TO" DISTRIBUTION   DATE: WED 27 MAY 1981
13:35 EST

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: AN INTELLIGENT KEYBOARD AS A COMPONENT

In building our low end VT/CT strategy around common components, each of which can be sold in a wide variety of applications, it seems clear that we want user programmability in the keyboard, together with the ability to store information on power fail.

Some features:

1. Alternative, larger keyboards that can be programmed the same way so as to be transparent to the software.

2. The keyboard "tells" the computer about its key set, hence no more fooling around with the foreign character nonsense and having the computer NOT know what keyboard it has.

3. A good place to put the clock.

4. We could add a LCD display, giving it full, independent terminal characteristics.

5. Sequences could be "user programmed" by macros.

GB:swh
GB2.S6.22

"TO" DISTRIBUTION:

PETER F. CONKLIN SI LYLE AVRAM MILLER
KEN OLSEN BILL PICOTT ART WILLIAMS

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+---------------------------+                                    ID#0223
|   |   |   |   |   |   |   |
| d | i | g | i | t | a | l |   i n t e r o f f i c e   m e m o r a n d u m
|   |   |   |   |   |   |   |
+---------------------------+
```

Subject: **KIVIAT Graphs**

To: Terry Potter

Date: 78 AUG 15
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

KIVIAT Graphs are used in real time display in the Fujitsu computers in order that the operators can control the utilization of resources. They're impressive. Somehow your work has to get into the field. People are benchmarking and configuring VAX by the seat of their pants.

GB:ljp

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+---------------------------+                                    ID#398
|   |   |   |   |   |   |   |
| d | i | g | i | t | a | l |   i n t e r o f f i c e   m e m o r a n d u m
|   |   |   |   |   |   |   |
+---------------------------+
```

Subject: **KL10**

To: Ulf Fagerquist, MR1-2/E78
Per Hjerppe, MR1-2/E78
Walter Manter, MR1-1/S35
Bob Puffer, ML12-2/E38
Jack Shields, PK3-2/A58

Date: 19 DEC 78
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

CC: Marketing Committee

Note the vitriolic attitude (quoted below). I feel this way too as a user. Shouldn't we **downplay** KL10's in the field? 2020's are great -- but I have the same quality experience and want us to get rid of KL's within Engineering. They are unreliable!!

> "Quality assurance has apparently hit a new low, especially in LCG. We sold three KL systems in the last week of FY78 and one last quarter, and all the KL systems currently installed are in trouble. This leaves a feeling of gloom and despondency about the prospect of installing the new systems, together with achieving a massive budget at a cost of bookings of 9.6% - Crazy!
>
> The lack of price performance in KL10 systems, appalling maintenance problems, the long and difficult installations, the total inadequacy of KLINK diagnostics to solve anything other than the most trivial problems, the impact of large systems on our ability to reforecast - all of this has brought about the present situation, namely we bid 2020 systems.
>
> The conflict of 11/70/VAX/2020 is a lot less severe than the conflict with the LCG ex-Product Lines. The Company should note that it will take no more than six months to disband or dilute the large DEC-10 selling teams. Next year I would imagine manufacturing are going to

be up to their eyeballs in KL10 processors, which may just succeed in keeping the rubbish, which is installed at present, operating for a few years."

GB:ljp

(Quote from Bob Taylor, North Thames District, October report.)

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Win Hindle	ML10-2/A53	Ted Johnson	PK3-2/A55
Andy Knowles	ML10-2/A52	Stan Olsen	MK1-2/A57
Bill Thompson	ML12-1/F41		
Ulf Fagerquist	MR1-2/E78	Per Hjerppe	MR1-2/E78
Walter Manter	MR1-1/S35	Bob Puffer	ML12-2/E38
Jack Shields	PK3-2/A58		

December 6, 1978

Don Knuth
Stanford University
Stanford, California 94305

Dear Don:

Thank you for taking the time from your busy schedule to talk with us on the TEX system.

Hopefully we can help realize your goal to make TEX the standard accepted typesetting system. Personally I support this goal and urge now that we adopt it here. It looks like you have the base for solving the typesetting problem.

Although it's somewhat premature and perhaps presumptuous, I believe it should be an ANSII and international language standard.

We will proceed to review TEX internally and get demonstrations at MIT, if necessary. To assist this, we may contact Luis for a listing and internal documentation. If the evaluation is positive, having one or two of our people come to Stanford in January, when you're ready, and work on the conversion to Pascal would be an ideal way to adopt the system.

As an almost independent issue, let me urge you to work carefully with Alphatype so that they build a general system and not one that's peculiar to Stanford. (A small company can be flexible, but it may never reach critical mass because it is always building special systems.) We would like to see them build a standard product that can be easily interfaced to various computers -- including ours. Such a device is badly needed. Can I suggest you interface either via a standard format floppy, a magnetic tape or a standard RS232 terminal port? In this way, their product can be used immediately and universally.

We also look forward to discussing the high quality scope TEX needs with Forest.

Thank you again.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:ljp
ID#377
CC: Prof. Forest Baskett, Stanford
Jack Gilmore
Bob Glorioso
Bob Lane
Peter Raulerson
Pat White

****
* d i g i t a l *
****

TO: DICK CLAYTON DATE: WED 1 OCT 1980
4:11 PM EDT

FROM: GORDON BELL
cc: see "CC" DISTRIBUTION DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: ORG. OF THE KO/VT200 WRITTEN DOWN

C O M P A N Y   C O N F I D E N T I A L

Based on our discussion today with Larry and I, would you specify
the organization and responsibilities for the KO project? Ken is
anxious to see this. We all favor clear responsiblities (eg. the
mass storage effort is managed by a person with singular focus).
We favor a project for the system reporting to you, making
maximum use of implementation within the current, functional
groups. The detailed organization would go down to the
individual hardware component (option) level.

The details of the software organization should be forthcoming by
us and Bill Johnson.

I want it very clear that what we are building includes BOTH the
PDT 50 (now KOjr- the 64Kbyte system) and VT200 as I understood
it from the initial requirements.

"CC" DISTRIBUTION:

PAUL BAUER BILL JOHNSON AVRAM MILLER
BILL PICOTT LARRY PORTNER HERB SHANZER
ART WILLIAMS

GB1.S6.63
****
* d i g i t a l *
****

TO: DICK SNYDER DATE: SAT 11 OCT 1980
12:17 PM EDT

cc: JACK MILESKI
BRUCE STEWART

FROM: GORDON BELL
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: RE: KO AND LANGUAGES

You have a really valid concern!

We have to settle the issue of BASIC. For now, it clearly has to be DEC Basic given we don't have a marketing channel into the personal computer market. In the future, we probably
have to get the Microsoft Basic in order to get at this software... including the media.

On OBM: it is unique, taking ideas of Pascal and ADA, and written in Pascal. I have only seen a program in it and it's simple and looks pretty. I talked with Bill Wulf, a strong ADA supporter and he believes the world is going to do this too cause ADA is awfully roccoco and difficult to implement unless you build a machine and operating system especially for it. My belief we should stay within a subset of the ADA syntax with the OBM language. Since I don't know ADA that well, I don't know why we deviated... or if we had to. I do believe that we must not use Pascal cause we need the information hiding and ability to build these better data structures in a clean way as outlined in the architecture we initially described.

GB1.S7.48
DECGRAM NOT DELIVERED - MESSAGE TEXT NOT ACCEPTED

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION

DATE: FRI 24 OCT 1980 9:35 AM EDT

cc: JOHN MEYER

FROM: GORDON BELL
DEPT: OOD

EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: THE KO AND LACK OF PROGRESS AGAINST THE GOALS

We should all be vitally concerned about our future here. It appears we are not making any progress against this project. In rereading it, I don't find anything that I believe we should
change, yet we are dragging our feet within engineering.

Given that the video is relatively firm and part of the 200 series, it should have been breadboard by now, assuming that we are going to meet our product ship goal... or anything remotely resembling a competitive time to market. Alternatively,
if we think th 100 is too easy, then let's go to more lines and
offer a more attractive fcs product.

I'd like to meet with you sometime next week, spend about 5 on the organization and then as much time as needed understanding
how this organization is going to become an aggressive development
team. Also, I would hope to see by then an aggressive schedule
by art for the Tiny, the video, and monitor both as modules for
KO and as a packaged terminal.

Time is passing. Wang is coming out with a very good product here, IBM has one. Our stockrooms are filling up with VT100s and we have to have a super replacement now and in the future.
If you don't believe we can live with the packaging scheme, then
counter-propose, but do it now and get the work started.

I believe the only way we can win here is through modularity, incremental upgrading of the product family in terms of increased resolution and functionality... AND the VT and KO MUST use common components and are one in the same project/ program.

When can we get this together? When can we discuss?

"TO" DISTRIBUTION:

DICK CLAYTON AVRAM MILLER BILL PICOTT
ART WILLIAMS

ATTACHED: MEMO;242

****
* d i g i t a l *
****

TO: OOD: DATE: THU 28 AUG 1980
10:09 AM EDT
OPERATIONS COMMITTEE: FROM: GORDON BELL
cc: see "CC" DISTRIBUTION DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: KNOCK OUT: AN APPLICATIONS TERMINAL AND SMALL SYSTEM

Knock Out: Attentive Modular Personal Applications Terminal
...
Small Computer System

The following describes a system of building terminals and small,
personal computer systems. It is based on the current LA/VT200
and PDT efforts, assuming compatibility between them. It is also
the results of a Woods Meeting of Ken, Stan, Avram Miller, Bernie
Geaghan, Don Gaubatz and I. Bob Daley, Bruce Stewart and Bob
Travis came later and discussed the software options with

respect
to WPS. It is a project that Ken would like to do in 9 months
and we need maximum support from each group.

We will discuss the product on Tuesday at the Operations Committee to enlist maximum support

PROBLEMS THAT KO SOLVES:

.a small system based on the 11, concentrating programming
.lower cost, faster time to mkt. small system
.competitively sized (ie. desk top)
.competition from personal computer systems for WPS and business
.competition of new, stand alone WPS products
.concentration of scarce resources (eg. communications) to get
one good, versus multiple marginal, later products
.unreasonably long vt/la product introduction date
.all capabilities in proposed VT/LA200 applications terminals but
with earlier, first introduction based on common, highly modular,
customer merge and customer replacement approach to repair

PRODUCT RANGE AND APPROACH:

Introduce a common set of modules from which the range of all existing and proposed terminals and small systems can be built,
including: VT/LA200 series, fixed function editing VT's, GIGI,
PDT's, and RX's. Also includes the 11/03 and 11/23 with up to
256 Kbytes of primary memory and 10 Mbytes of secondary memory.

Aimed at evolving dumb, with increasing smart (pre-programmed function) functions, to intelligent (programmable) terminals and
terminal based small systems for both stand alone and host

coupled applications. Aimed at competing with personal computers
and being alternative to using semicomputer company micro for application terminal, but able to extend to larger system application for the single user.

Point of manufacture with customer merge by actual user (eg. secretary) and customer repair by replacement. Assembly requirements similar to Hi Fi. Modularity is a a key selling point, using a combination of rom on modules and floppy based ram
for achieving goal.

Market is anyone wanting to use the base modules and the supporting software for applications (eg. WPS, single user small
system as in a DIBOL machine, technical person's work station,
small business system)

GOALS:

Nine months till first product introduction, followed by a constant stream of new module introductions permitting the building of terminals and small systems with the capabilites well
beyond that envisioned by LA/VT/PDT plans.

Introduce and evolve by adding new modules and capabilities in
what is similar to approach used in the evolution of Unibus 11

Introduce, then cost reduce based on technology opportunities!

Maximum use of off the shelf one chip VLSI peripherals and other
peripheral approaches to get low cost. Use personal computers as
a model of the approach. Be prepared for all opportunities and

attendant incompatibilites and new interfaces such as wands, light pens, joy sticks, etc.

Base the architecure on semicomputer company architectures

Be as compatible as possible with current DEC peripherals, but
trade-off to get cost, sacrificing i/o compatibility in an explicit basis

Trade off cost for performance subject to inability to build fast
access mass storage based products or highly interactive systems

Support a physical address space appropriate to memories

Target applications with implied bounded software, not general
purpose use with implied compatibility, unboundedness, sys gens
and support of all operating systems.

KO IS AN APPLICATIONS TERMINAL- the alternative is to try and build such an application using the control microprocessor instead of an 11 which is now the controller

KO IS A COMBINED CONTROLLER AND SMALL SYSTEM WITH BOUNDED MASS
STORAGE AND INTEGRAL CRT CONTROL (for performance and cost) for
writing large applications programs such as WPS and small business systems. Our competitors use micros and IBM uses the
8086. It is not a gp 11!

Main target application: WPS and OFIS-type products with very good filing capability, sorting, list processing and table manipulation. Visicalc!

MODULES:

Large computer module based on Fonz processor, 256 Kbytes user
ram, system ram, rom, serial port for printer, and standard serial EIA port (US and European use, up to 9.6Kb, EIA data only
lines would connect to local systems)

Small computer module based on Tiny processor, 65Kbyes user ram,
system ram, rom, serial port for printer, and standard serial EIA
port

Rom/ram cartridges for specialized software packages

Telephone interface with 300/1200 baud modem, auto answer, auto
dial, phone line in and handset or telephone out. Ability to dial out for data or voice use.

Ethernet interface sans modem, but includes any necessary rom and
ram to operate interface

DECnet interface, X.25 interface, SDLC/HDLC interface using appropriate ram and rom for protocols

Dumb terminal mux with multiple standard serial EIA ports

Combined controller for T/E 5" diskette and 5 Mbyte Winchester

Controllers handle combinations of the following monitors:

- .BW, RS 170 Composite video and European std giving 240 lines
- .BW, 2 x 170, 480 lines (40 lines)
- .BW, 4 x 170, 960 lines (full page, 80 characters)
- .RGB Color, 240 lines
- .RGB Color, 480 lines

Each controller will handle BW with intensity or simple color and

keyboard interface. Multiple virtual terminals with ability to
assign split screens to various terminals. Four versions:

- .240 line, VT100 compatible, character only
- .960 line, full page black and white, character only
- .240 line, bit map, two plane, GIGI oriented
- .480 line, bit map, two plane, high resolution color

Serial printers with serial port and bus interface such that processor can be used in non-dumb versions. (It is unclear that we should add anything to base printer cost in order to provide for computer modules.)

Keyboard- probably should go to standard serial format

WHAT A USER MIGHT BUILD:

VT200 starter- small computer module and 24 line char gen, keyboard, printer option, telephone option, or Ethernet option
VT200 Basic WPS- above plus floppy. Deluxe WPS editing would include full page monitor

Remote hard copy unit- printer, small computer module, telephone option, keyboard ... unclear what characteristics should be

Student starter- small computer module, floppy, telephone interface, bit map, monitor

Single user deluxe WPS or Small system- large computer module, dual floppy and Wini or 2 Wini, comm option if in a large organization, appropriate printer.

Clustered system with shared single user database- above with serial interface to dumb terminals or multiple crt/keyboard/monitors

SOFTWARE:

Single user, operating system with well defined interface and including all aspects of language, file system, terminal (screen), and communications.

Able to be interconnected to DEC systems and write terminal emulators to other systems by applications or field programmers
using some form of state table or higher protocol description language

Able to be interconnected easily with other single user systems
of the same type for file and message transfer
Explicit decisions made on i/o compatibility, both now and as we
proceed with deign. We have three architectural alternatives:

.fully 11 compatible, which is most likely to be uncompetitive
from cost and performance standpoint

.incompatible i/o, which is marginally competitive based on 11
chip set, but requires modifications to selected handlers

.semicomputer company architecture (eg. 8086), language and operating system to get lowest cost and highest performance, but
may not be able to be brought in on a timely basis.
Unfortunately, our competitors such as HP and IBM are using this
approach! If we can not make changes in our own i/o ISP architecture, we must go this route. (Simple analogy to IBM's
introduction of 360 like Series 1 instead of modifying 370 architecture)

PEOPLE:

.Avram Miller is driving overall program to get the product

defined and resources assigned to implement it
.Ken is architecting the packaging
.Don Gaubatz (and I intend to be involved) will take on the responsiblity for the PMS and ISP (i/o) architecture, together
with Bernie Geaghan who has the implementation responsibility for
the modules necessary for terminals. ? has the implementation
responsibility for PDT.
.Bruce Stewart is driving the WPS project
.? has the responsibility for implementing the base system software including an special handlers, the operating system, language and file system

"CC" DISTRIBUTION:

PAUL BAUER	BOB DALEY	MARY JANE FORBES
GAUBATZ VIA FORBES	BERNIE GEAGHAN	BILL HEFFNER
BILL KEATING	AVRAM MILLER	BOB PUFFER
HERB SHANZER	BRUCE STEWART	BILL STRECKER
BOB TRAVIS		

GB1.S7.55
00 BURT DECGRAM ACCEPTED S 21254 O 74 14-SEP-80 21:42:52

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION DATE: SUN 14 SEP 1980 9:35 PM EDT

FROM: GORDON BELL
cc: see "CC" DISTRIBUTION DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: HELP NOW IN DEFINING THE II VIS A VIS THE Q AND Q

DERIVATES

WE NEED HELP BAD ON KO BUS DEFINITIONS. ANY IDEAS?

I am concerned that we have the right kind of focus on the issue of the II definition. It has been the assumption that the II is the interconnect of KO. As such we would expect II to have a long life such that a set of options built to II would be rebuilt on the next generation of microprocessors. My goal would be to see II have a 10 year life. What I see in II is a random collection of signals that are a superset of all the lines that all the semicomputer companies need to operate their peripheral chips. They build in a relatively freewheeling fashion on the basis of what fits on a chip, independent of how it couples to any neighbor chips at the system level. Thus, it is hard to believe that II will last very long. It will simultaneously shrink and the result is that it will grow!

Our performance in designing the Q bus is hardly exemplarary. We put out a Q on a quad board, reduced it to a dual with the same pin out, and then proceeded to have to add the 22 bit addressing and parity, resulting in 4 versions to date.

The dilema, the Q22 as we know it seems to large, yet by the time we make an II that might work, it could be substantially worse.
Also, I would hate to think we have a whole set of II-based modules for the KO and a completely independent Q bus based for

our board, box and small systems base. Somehow, we would like to
be able to use the Q stuff too.

I don't have the answer, but I know we have to get through this
very, very quickly. It seems like we have the knowledge in the
company to formulate and solve this problem. In the KO, the two
systems groups (T andd F based) are proceeding quite
appropriately to design systems based on their speculations of
II, but their principle thrust has to be on just getting things
together and not on the busses. Therefore, I would like to look
at getting the II definition really much more task force directed
with membership by people who really know what the peripheral
chips are and how they are likely to evolve. The whole thing of
course, would be a two week affair by not more than 5 persons,
given our understanding we have now.

Could I have your suggestions on how we are going to resolve this
so as to get a bus for KO (whether it be II, Q22, Q22 sans
drivers, etc.) that will have a 10 year longevity and will allow
us to use peripheral chips and build the 100 or so boards that
will ultimately be built for the KO module set?

Please help.

"TO" DISTRIBUTION:

BERNIE GEAGHAN   AVRAM MILLER   BILL STRECKER

"CC" DISTRIBUTION:

DICK CLAYTON	MARY JANE FORBES	SAM FULLER
GAUBATZ VIA FORBES	ROY MOFFA	BILL PICOTT
HERB SHANZER		

GB1.S7.8
****
* d i g i t a l *
****

TO: WAYNE ROSING DATE: SAT 20 SEP 1980
12:08 PM EDT

FROM: GORDON BELL
cc: AVRAM MILLER DEPT: OOD
DAVE RODGERS EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: KO BUS, MACHINE, QNI/UNI/LNI/NI

Wayne, I wonder about whether we are thinking far out enough? On one side, longevity will kill us in terms of today's cost and time to market, on the other hand, the evolution will kill
us in the future. There seem to be two issues: simple, program and dma i/o; and how to couple multiprocessors. This later one is a mess when you get into the sw. I'm sorry I couldn't stay on Friday morning. Your solution of packet switching between T and F sure doesn't feel right in terms of the software as I know it now.

Could you send the prolog bus around to us all?

Can you help more in terms of trying to sort the mess out? (Also think VAX ultimately is involved, plus NI .... it supports your model of F/T seperation via packet message switching)

Are you aware of what is supposed to be a QNI? Glorioso says it speaketh to NI. They are going to build several. Here's

what I'd like for all our boards that speak to NI: two connectors-
one to a local cable whatever that is; one to the modem (tap).
Is this possible? (Have asked to meet with all the folks building
this stuff to be assured that this is what is happening.) How
come their QNI has DMA and fits on a quad and the UNI is hex and
doesn't have it?

GB1.S7.12

****
*** d i g i t a l ***
****

TO: see "TO" DISTRIBUTION **DATE: TUE 30 SEP 1980 11:25 AM EDT**
FROM: GORDON BELL
cc: see "CC" DISTRIBUTION **DEPT: OOD**
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: THOUGHTS ON KOBUS AND ADDITIONS TO THIS MOD TO QBUS

This week, we are pursuing these two paths for the KO Bus:
1. Kotch/Miller are persuing the bus, based on an improved multibus approach
2. Bernie is pinning down the minimum bus, and then exploring the
incremental additions to satisfy the goals discussed last friday.

In doing 2, I expect Bernie to come up with a trajectory of
designs over the path from minimum, to the bus Paul is designing.
It is important for us to continually discuss both designs from
now till friday so as to understand the complete continuum. In

our discussion this evening, I found KOB(min) to be:

off board bus with simple programmed I/O and no DMA

(This would be fine for both Tiny and Fonz. It assumes DMA is
local to Mp to support the video and disk transfers are buffered.)

It is clear, this will evolve to support low cost DMA and as we
run out of bandwidth with Wini, NI, and get pushed by higher speed communications requirements. Therefore the following progression of bus capabilities will no doubt, occur:

DMA and Memory accessing
DMA of options and DMA of system processors ... note not all Pc's
have to have DMA as this is an implementation attribute, not architecture. Thus this values for this dimension are:
0. No DMA
1. DMA of System processors
2. DMA of System Mp (but not Control Mp)
3. DMA of all Mp on all Pc's (this is the only value to completely satisfy the goal of full state availability)

Clocks
Here, I think we just decide:
0. Central clock on the backplane
1. Clock on a processor that is active when placed in a particular slot (say 1)
2. Arbitration among multiple, possibly active clocks

Inter-Pc transfer of data to Mp
The problem here is for both data and for signalling, see below.
Some possiblities for data interchange:
0. Only one Pc can transfer data among among all the C's
1. A central board that allows a Pc to transfer data to any Pc
(Note this could be packaged with an option such as Wini or NI so

that it is available only as needed. However, it would be desirable to have each processor have this.)
2. All Pc's have ability to access all other Pc's Mp

Inter-Pc signalling (interrupts or semaphores) among C's
There has to be a method of posting events among the various computers. Here, there are more options, but I remember:
0. In the case of dedicated controllers like the VT200, have a
dedicated interrupt to Tiny via the on board connection and then
some method for global interrupts
1. Allow an adjacent controller to interrupt a particular processor such that there is a specific, positional relationship
2. Have only a single, system interrupt to Cs together with local
interrupts to specific control, computers as above
3. Have a single clock so that all Pc's interrupt together and
look for messages at preassigned locations
4. Have each Pc have an interrupt address by which any other Pc
can interrupt it in the most general fashion
5. Have a preassigned set of lines for each of up to say 4 C's
such that any C can interrupt any other one

Interrupts to Pc via Controllers,K (i.e. K's to Pc's)
0. 0, or 1 or 2 above as in Pc-Pc using either a local C or a Cs
to service interrupts
1. Specific addresses with Pc's assigned to handle them

ARCHITECTURE VS IMPLEMENTATION
We should remember that we don't have to implement every function
in every computer module. It is important to make the software
independent of any particular scheme... ie. the software should
be able to simulate a variety of alternatives without

rewriting.

THE KO BUS, and Computer Structure, my gut feel

Given where we are, it feels like we should:
0. Build mostly program interrupt controllers except when there
are the right kind of chips for DMA
1. Introduce DMA on the Tiny, if it is not very expensive (say $5
or 1% on the low end system) Make Tiny's Mp globally accessible.
The design goal is global accessiblity for all state.
2. Have the convention that slot one is the system computer and
it also supplies the clock. All interrupts come to the system
computer.
3. Allow on board interrupts when Tiny and a controller are on
the same board (or physically interconnected). Also, allow
convention of adjacent boards to interrupt Computer next to it.
This would use a C-D interconnect convention of some sort.
4. For C to C signalling, the best alternative would be a set of
addresses that are position specified such that any slot can call
any other slot (address) by writing in another's Mp (and
interrupting it). If this proves to cost more than $5 or another
1%, then have a clock by which intercommunication can occur by
convention.

This would give us a system structure of a system hierarchy consisting of a single system computer, Cs, which fields all interrupts and does block transfers of memory among the other control computers, Cc. Multiple Cc's could exist which could interrupt the system machine on a single interrupt line.

In addition to KO, we would extend the Qbus architecture

along
very simple lines in order to allow multi Cc's, and to allow Cs
to have private memory (on C-D) so as to decrease the bus time
and increase performance.

For starters, let's make sure the above alternatives are complete. Then by friday, I hope we can have the cost over the
base for the various options in order to come up with a good, lasting design.

GB1.S6.60

"TO" DISTRIBUTION:

BERNIE GEAGHAN VIA MILLERDON GAUBATZ BERNIE LACROUTE
AVRAM MILLER PAUL KOTCH VIA MILLER

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RUSS MOORE VIA MILLER HERB SHANZER BILL STRECKER

GB1.S6.60
00 BURT DECGRAM ACCEPTED S 21261 O 71 20-SEP-80 13:59:50

****
* d i g i t a l *
****

TO: AVRAM MILLER DATE: SAT 20 SEP 1980
1:12 PM EDT

FROM: GORDON BELL
cc: see "CC" DISTRIBUTION DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-

1/A51

SUBJECT: RE KO BUS VIS A VIS MULTIBUS

Should we look at the multibus when going to the multiprocessor
systems involving both f and t? I would hope that multibus would include a simple ii for when we are simply connecting dma and program controlled peripherals. Am deathly afraid of the issue of F and T connected via a packet interconnect. It is not upward compatible in any sense that I can see. (We could make it, but the performance issues would be a bitch.)

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MARY JANE FORBES GAUBATZ VIA FORBES BERNIE GEAGHAN
WAYNE ROSING RUSS MOORE VIA FORBES

GB1.S7.13

****
* d i g i t a l *
****

TO: KEN OLSEN DATE: THU 4 SEP 1980 10:59 AM EDT

FROM: GORDON BELL
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: RE: KO COMPUTER

I ain't doing it. The one most caught up in it and driving this defomity is us (you and I) and I don't believe it is me. I am getting two designs: one around a tiny with the smallest amount of memory that would be, because of modularity not more
than 10% more than a vt100 and would be expandable to an apple
II with floppy and 65Kbytes; the other would be your monster

box with power for the world and would be 256Kbytes and the Wini, etc. The delta, you should see, is very great between these systems.

I don't intend to see us build an uncompetitive system. I don't believe that a single back panel can cover this range though. You rejected the notion that the apple II uses that the processor and basic video are on the backpanel. Options plug into it to give floppy, etc.

Let us get the data on the options, we have put the people in one location with a name assigned to each part. We are drawing the whole system on a big sheet and then we are going to work on how we want it partitioned. Also, we are asking each person to give several designs. We have found:
an 8 chip design will connect to T/E, we also have a 20 chip that does program controlled data transferred under interrupt control and a 30 chip design does the works relieveing the processor. Apple II uses the 8 chipper, and we would probably
rule this out because it doesn't let you run a comm line at the same time or causes lots of rereead/rewrites... the Apple III seems to use the 20 chip design so as to be more useful in an organization with the ability to interconnect them.

Right now, I intend to get the data, look at it from what I think are going to be the softwAre architectural issues and to then recommend an approach by which I think will successfully cover this range of products. Also, I will make it very explicit what the choices were (eg. how much 132 columns are going to cost, etc.) if you can figure out how or who you want to look at this for review or changing it. Fundamentally, during this critical stage, I would like to get enough time to run in a very tight design mode in very much the same way I worked on VAX.

What you think?
g

GB1.S6.51
****

* d i g i t a l *
****

TO: BOB TRAVIS DATE: FRI 5 SEP 1980
6:00 PM EDT

FROM: GORDON BELL
cc: BOB DALEY DEPT: OOD
JACK GILMORE EXT: 223-2236
BRUCE STEWART LOC/MAIL STOP: ML12-
1/A51

SUBJECT: RE: RE: IDEAS FOR ENHANCING KO EDITOR

Am really glad to see the thinking on multi column (and multi row) editing. It is both wps and basis of real math

that the users need to do. I see Visicalc as the way to specify the operations on the columns, but WPS as the way to get them in and edit and manipulate them. The data-types of the OBM must understand arrays of text and arrays of numbers.

GB1.S6.52
****
* d i g i t a l *
****

TO: KEN OLSEN DATE: THU 21 AUG 1980
10:29 PM EDT

FROM: GORDON BELL
cc: MARY JANE FORBES DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: MEETING ON WEDNESDAY

Imperative it be at my house. Have a 78, 278, and 100 for reference and can have a full Apple II, and GIGI I. We want these to look at and not to carry around or waste time in the

air or riding.

Don Gaubautz will have all the power, cabling and space constraints for keyboard, floppy, modems/comm, winchester, scopes, etc. on our desks by Monday. Will get more info as needed. He'll also find out about ability to drive cable tv from a computer.

Call me Friday or weekend. Currently have Daley for sw, Gaubautz (Rand D who's trying to design this system ... we have been labelling GIGI II), and A Miller who's trying to design a bounded system like this.

Can also have other people, but am not sure it's productive. Also, why do we need anyone on SW?

The smaller the better.
gordon

GB1.S6.39
00 BURT DECGRAM ACCEPTED S 21255 O 75 14-SEP-80 21:46:46

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION DATE: SUN 14 SEP 1980 9:41 PM EDT

FROM: GORDON BELL

cc: MARY JANE FORBES DEPT: OOD
GAUBATZ VIA FORBES EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: GOALS AND THOUGHTS ON KO PACKAGE AND MODULE MODULARITY

We need some clear goals for modularity. There is a myth (which may have basis in fact) that modularity is expensive. In some cases like television sub-assemblies, it seems that it has not cost. The key is to understand what the really expensive investments are. I believe the modules we want to preserve are:

all the pc board modules that attach to a bus such that a customer can be assured (sold) that any module he has will be able to be used on an upward expandable version (This also let's us refine and add modules over time unlike we do now where every terminal is a new engineering project and has no basis on the past, nor can use anything we ever do in the future.)

software that runs across the range (our needs) such that we can add additional software modules and the old software will still run

NOTE: We must build KO on these principles otherwise we bring nothing to this marketplace. It is how we are going to get low cost. Also, the personal computer companies are going to take all our dumb terminal business away.

Furthermore, we must be modular in order to take advantage of cost reduction chips and build better terminals as the technology makes it possible. Here, I believe we want to set a goal of being able to track 10 years of evolution, or at a minimum, the next set of modules after those we see that consitutes all of the VT200 and PDT50 as we postulated them before the KO.

The things that are cheap to redo include: any random package (take a lesson from the television industry which uses the same basic sub assemblies and packages it as portable, consoles and in varying tube sizes). This also may mean that there are power supplies in varying sizes. Thus, at our last meeting, we

postulated a model numbering system that has power. Let's refine
it to include processor, available module slots and power and use
it for now. For example, Tiny/5/95, would be the first box and
capable of doing the WPS job. (Note there are 4 spares beyond
the Tiny-video board.)

In order to make the dumb terminal, all we have to do is to make
the tube housing big enough to hold the Tiny board which has
video on it and to decide how much power to put in to hold the
second board that we surely must have to have any escape.
Also, there would be a small power supply in the monitor or at
the AC power if the cost warrants it. This is a long way from
the 4 boards and power needed to build the WPS and hold the
floppy. Therefore, it seems to me, we can get the dumb terminal
as cheaply as the VT/X which is the cost-reduced box we are
talking about because there is no seperate box, cabling, back
panel and the power is only big enough for the terminal. Thus,
we have protected our investment by really only building a second
module power supply and we use the great Tiny/video board and its
associated software etc. This means sparing etc. is common. Can
we do this on a cost-effective basis?

CHARACTERIZING MODULES TO USE IN PACKAGES

Thus, it seems like our table of modules should include:
power, ic's, equivalent ic's, processor cycles required from any
other module, processor cycles available to any software running
there, connections to outside or inside the box (eg floppy),

and
what the functions the module performs, and any rom/ram assumptions. We need this table made on a weekly basis in order
to keep track of who's doing what and how the system is changing.

CHARACTERIZING PACKAGES TO HOLD MODULES
Our packages should be characterized by the module space they provide and if we don't think the power is seperate, the power
that can be dissipated by the box. Thus the boxes include: the
keyboard (and we might make some that leave room for modules; the
monitor that can be made to hold 2 modules and power supply in
the dumb terminal version; 95 watt box for low end wps; and 200
watt to hold both disks and run multi terminals with lots of bells and whistles.

EVOLUTION OF SOME PACKAGED SYSTEMS (PACKAGES FILLED WITH MODULES)
Ideally, we would have seperate modules between video and procesing so that we can mix and match as we transition between T
and F. Since the first video doesn't appear that way, then it
feels like we should really be skeptical of packaging this way
and just accept the direction. Therefore, it would seem we would
evolve:

T/2/25 inside monitor- 1 board in tube housing with a spare using
Tiny. No spare memory for programming. The dumb terminal.

T/5/95 Box with monitor that enables us to put floppy etc. to build the WPS system

Graphics would be added to either box, but we should watch out
that we don't require cycles because we need some guarantees to
build the WPS

F/?/200 Box which allows us to build either fancy wps or vt's or
multi terminals with hard disks.   Here, let's let the Tiny
continue to do what it had been doing so we don't have to migrate
the video control software on two systems.

Let's look at the issues of modularity. It is especially
important to hit the dumb terminal this way.

Can we do it?

"TO" DISTRIBUTION:

DICK CLAYTON	D GONZALES VIA FORBES	BERNIE GEAGHAN
AVRAM MILLER	KEN OLSEN	BILL PICOTT
HERB SHANZER	ART WILLIAMS	

GB1.S7.9
00 BURT DECGRAM ACCEPTED S 33058 O 430 16-SEP-80 17:06:05

****
* d i g i t a l *
****

TO: DICK STRAUSS   DATE: TUE 16 SEP 1980 5:03 PM EDT
FROM: GORDON BELL
cc: see "CC" DISTRIBUTION   DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: RE: DISPLAY INDEPENDENCE IN KO

I don't know where you got the idea that the graphics module is inside the display (as if it matters much anyway). We intend to make a product that has a lifetime of hopefully 10 years by defining the right modules. The modules would be mounted either in the tube (for dumb terminals), a seperate box,
or a bigger keyboard if we wanted to do it that way. I intend
to have a very good architecture (PMS, ISP and Software) that supports the widest range of graphics we know how... well beyond the current GIGI!

"CC" DISTRIBUTION:

DON GAUBATZ @MP30 PETER JANSEN ANDY KNOWLES
AVRAM MILLER

GB1.S7.10
14 October 1982

Dr. Robert Szakonyi
Institute of Public Administration
1717 Massachusetts Avenue, NW
Washington, DC 20036

Dear Dr. Szakonyi:

Ken Olsen gave me your letter on R and D Management.

Thank you for your papers on managing research. We quite agree that this is a very difficult area to manage; therefore, we certainly appreciate and encourage your research. We rely on work like this to guide our own thinking and have been aided by the work of Allen, Frohman, Roberts, vonHippel and others.

Certainly we're interested in the study and look forward to seeing the results.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

CC: Ken Olsen

GB3.S8.15

00 BURT DECGRAM ACCEPTED S 22451 O 86 28-AUG-80 10:20:27

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* d i g i t a l *
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TO: OOD: DATE: THU 28 AUG 1980
10:09 AM EDT
OPERATIONS COMMITTEE: FROM: GORDON BELL
cc: see "CC" DISTRIBUTION DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: KNOCK OUT: AN APPLICATIONS TERMINAL AND SMALL SYSTEM

Knock Out: Attentive Modular Personal Applications Terminal ...
Small Computer System

The following describes a system of building terminals and small,
personal computer systems. It is based on the current

LA/VT200
and PDT efforts, assuming compatibility between them. It is also
the results of a Woods Meeting of Ken, Stan, Avram Miller, Bernie
Geaghan, Don Gaubatz and I. Bob Daley, Bruce Stewart and Bob
Travis came later and discussed the software options with respect
to WPS. It is a project that Ken would like to do in 9 months
and we need maximum support from each group.

We will discuss the product on Tuesday at the Operations
Committee to enlist maximum support

PROBLEMS THAT KO SOLVES:

.a small system based on the 11, concentrating programming
.lower cost, faster time to mkt. small system
.competitively sized (ie. desk top)
.competition from personal computer systems for WPS and business
.competition of new, stand alone WPS products
.concentration of scarce resources (eg. communications) to get
one good, versus multiple marginal, later products
.unreasonably long vt/la product introduction date
.all capabilities in proposed VT/LA200 applications terminals but
with earlier, first introduction based on common, highly modular,
customer merge and customer replacement approach to repair

PRODUCT RANGE AND APPROACH:

Introduce a common set of modules from which the range of all
existing and proposed terminals and small systems can be built,
including: VT/LA200 series, fixed function editing VT's, GIGI,
PDT's, and RX's. Also includes the 11/03 and 11/23 with up to

256 Kbytes of primary memory and 10 Mbytes of secondary memory.

Aimed at evolving dumb, with increasing smart (pre-programmed function) functions, to intelligent (programmable) terminals and
terminal based small systems for both stand alone and host coupled applications. Aimed at competing with personal computers
and being alternative to using semicomputer company micro for application terminal, but able to extend to larger system application for the single user.

Point of manufacture with customer merge by actual user (eg. secretary) and customer repair by replacement. Assembly requirements similar to Hi Fi. Modularity is a a key selling point, using a combination of rom on modules and floppy based ram
for achieving goal.

Market is anyone wanting to use the base modules and the supporting software for applications (eg. WPS, single user small
system as in a DIBOL machine, technical person's work station,
small business system)

GOALS:

Nine months till first product introduction, followed by a constant stream of new module introductions permitting the building of terminals and small systems with the capabilites well
beyond that envisioned by LA/VT/PDT plans.

Introduce and evolve by adding new modules and capabilities in
what is similar to approach used in the evolution of Unibus 11

Introduce, then cost reduce based on technology opportunities!

Maximum use of off the shelf one chip VLSI peripherals and other peripheral approaches to get low cost. Use personal computers as a model of the approach. Be prepared for all opportunities and attendant incompatibilites and new interfaces such as wands, light pens, joy sticks, etc.

Base the architecure on semicomputer company architectures

Be as compatible as possible with current DEC peripherals, but trade-off to get cost, sacrificing i/o compatibility in an explicit basis

Trade off cost for performance subject to inability to build fast access mass storage based products or highly interactive systems

Support a physical address space appropriate to memories

Target applications with implied bounded software, not general purpose use with implied compatibility, unboundedness, sys gens and support of all operating systems.

KO IS AN APPLICATIONS TERMINAL- the alternative is to try and build such an application using the control microprocessor instead of an 11 which is now the controller

KO IS A COMBINED CONTROLLER AND SMALL SYSTEM WITH BOUNDED MASS STORAGE AND INTEGRAL CRT CONTROL (for performance and cost) for writing large applications programs such as WPS and small business systems. Our competitors use micros and IBM uses the 8086. It is not a gp 11!

Main target application: WPS and OFIS-type products with very good filing capability, sorting, list processing and table manipulation. Visicalc!

MODULES:

Large computer module based on Fonz processor, 256 Kbytes user
ram, system ram, rom, serial port for printer, and standard serial EIA port (US and European use, up to 9.6Kb, EIA data only
lines would connect to local systems)

Small computer module based on Tiny processor, 65Kbyes user ram,
system ram, rom, serial port for printer, and standard serial EIA
port

Rom/ram cartridges for specialized software packages

Telephone interface with 300/1200 baud modem, auto answer, auto
dial, phone line in and handset or telephone out. Ability to dial out for data or voice use.

Ethernet interface sans modem, but includes any necessary rom and
ram to operate interface

DECnet interface, X.25 interface, SDLC/HDLC interface using appropriate ram and rom for protocols

Dumb terminal mux with multiple standard serial EIA ports

Combined controller for T/E 5" diskette and 5 Mbyte Winchester

Controllers handle combinations of the following monitors:
    .BW, RS 170 Composite video and European std giving 240 lines

.BW, 2 x 170, 480 lines (40 lines)
.BW, 4 x 170, 960 lines (full page, 80 characters)
.RGB Color, 240 lines
.RGB Color, 480 lines

Each controller will handle BW with intensity or simple color and keyboard interface. Multiple virtual terminals with ability to assign split screens to various terminals. Four versions:
.240 line, VT100 compatible, character only
.960 line, full page black and white, character only
.240 line, bit map, two plane, GIGI oriented
.480 line, bit map, two plane, high resolution color

Serial printers with serial port and bus interface such that processor can be used in non-dumb versions. (It is unclear that we should add anything to base printer cost in order to provide for computer modules.)

Keyboard- probably should go to standard serial format

WHAT A USER MIGHT BUILD:

VT200 starter- small computer module and 24 line char gen, keyboard, printer option, telephone option, or Ethernet option

VT200 Basic WPS- above plus floppy. Deluxe WPS editing would include full page monitor

Remote hard copy unit- printer, small computer module, telephone option, keyboard ... unclear what characteristics should be

Student starter- small computer module, floppy, telephone interface, bit map, monitor

Single user deluxe WPS or Small system- large computer module, dual floppy and Wini or 2 Wini, comm option if in a large organization, appropriate printer.

Clustered system with shared single user database- above with serial interface to dumb terminals or multiple crt/keyboard/monitors

SOFTWARE:

Single user, operating system with well defined interface and including all aspects of language, file system, terminal (screen), and communications.

Able to be interconnected to DEC systems and write terminal emulators to other systems by applications or field programmers
using some form of state table or higher protocol description language

Able to be interconnected easily with other single user systems
of the same type for file and message transfer
Explicit decisions made on i/o compatibility, both now and as we
proceed with deign. We have three architectural alternatives:

.fully 11 compatible, which is most likely to be uncompetitive
from cost and performance standpoint

.incompatible i/o, which is marginally competitive based on 11
chip set, but requires modifications to selected handlers

.semicomputer company architecture (eg. 8086), language and operating system to get lowest cost and highest performance, but
may not be able to be brought in on a timely basis.
Unfortunately, our competitors such as HP and IBM are using this
approach! If we can not make changes in our own i/o ISP

architecture, we must go this route. (Simple analogy to IBM's introduction of 360 like Series 1 instead of modifying 370 architecture)

PEOPLE:

.Avram Miller is driving overall program to get the product defined and resources assigned to implement it
.Ken is architecting the packaging
.Don Gaubatz (and I intend to be involved) will take on the responsiblity for the PMS and ISP (i/o) architecture, together with Bernie Geaghan who has the implementation responsibility for the modules necessary for terminals. ? has the implementation responsibility for PDT.
.Bruce Stewart is driving the WPS project
.? has the responsibility for implementing the base system software including an special handlers, the operating system, language and file system

"CC" DISTRIBUTION:

PAUL BAUER	BOB DALEY	MARY JANE FORBES
GAUBATZ VIA FORBES	BERNIE GEAGHAN	BILL HEFFNER
BILL KEATING	AVRAM MILLER	BOB PUFFER
HERB SHANZER	BRUCE STEWART	BILL STRECKER
BOB TRAVIS		

GB1.S6.23

FROM: GORDON BELL DATE: SAT 2 FEB 1980 9:40 AM EST
DEPT: OOD
EXT: 223-2236

TO: JOE CARCHIDI
cc: BERNIE LACROUTE
    BILL JOHNSON
    BILL HEFFNER
    TERRY POTTER
    SAM FULLER

SUBJECT: RE: DAVE KOSKO

I believe it is encumbent on you and the developers to make him succeed and
to get help from outside if he isn't getting the work done that is necessary.
One of the first tasks that seems necessary to me is to get a good RTE into
a system so that we have some idea of what a 780, a comet or nebula will
deliver, where the bottlenecks are, what we will do when the higher
speed terminals are attached that will ultimately make more conversations
into vms and cripple it in terms of number of users. Also, the high powered
editors will all suck up much power and we'll be wondering why there
can only be 10 users on a 780.

I'm delighted to hear that you are committed to success this time around. Losing a competent manager during the buy in process seems expensive to me though.

GB1.S1.59
14 October 1982

Dear Dr. Thorsheim and Dr. Roberts:

Ken Olsen gave me your letter with reports of The Community and Its Institutions: A Symphony of Communications and The Impact of Space Development on Educational Motivation.

You asked to be kept informed about the Communications and Signal Processing Center at North Carolina State. This effort is primarily aimed at future architectures for high speed signal processing to encode all forms of images and voice. Since the Center is doing the work and we're only receiving it, it would seem appropriate that you get information directly from them.

You might write us again.

Sincerely yours,

Gordon Bell
Vice President, Engineering

CC: Ken Olsen

GB3.S8.14

00 BURT DECGRAM ACCEPTED S 32436 O 361 08-SEP-80 22:40:51

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION

DATE: MON 8 SEP 1980 10:37 PM EDT

FROM: GORDON BELL

cc: KEN OLSEN

DEPT: OOD

EXT: 223-2236

LOC/MAIL STOP: ML12-
1/A51

SUBJECT: WED. MORNING (7:45) MEETING WITH KEN AND DEVELOPERS

You are invited to the above meeting with developers.
Ken is going to come to it. We (Ken and I) are agreed on the approach for now:

design both small (vt200) and large (pdt50) concurrently
go out like crazy now with the vt200 (the vt200 as we knew it but only 24 lines, floppy, and 65Kbyte x 2 , comm.) followed
by the large fonz based one.

On Wed. we expect to see just where we are on the modules. (power, ic's, functionality, pin needs, bus latency, bus bandwidth, etc.).

Asked Ken to arbitrarily select some module size (within some general range of 6-8 x 7-12 and try a dummy mock-up so as to understand overall power, cabling and users ability to build it in field . (Here, we'd have various trial implementations with Ann, Mary Jane, other secretaries, engineers, perhaps a marketing or sales person to make sure that anyone can build it.)

If there were ideas in our approach to get cost in the VT200, I would like to know about them, cause I don't want to blow any of the goals that were set for the 200! The only change I think we've made is to do a VT100 version (should be trivial) now, rather than figuring out the whole mess somehow and then getting the whole mess into production somehow. Tothis likes an excellent development strategy, but I want to ask whether I'm missing something or if there are some ideas to be utilized in order to make it happen. Again, I repeat:
introduce, and then cost reduce
introduce, and then evolve it

I want to get Art and Bill's concerns in particular about how we are doing on the 200 against their visions?

"TO" DISTRIBUTION:

DICK CLAYTON GAUBATZ VIA GLORIOSO AVRAM
MILLER
BILL PICOTT ART WILLIAMS

GB1.S6.56

October 16, 1978

Professor Don Knuth
Stanford University
Department of Computer Science
Stanford, California 94305

Dear Dr. Knuth:

I'm sending under separate cover a copy of the book Computer Engineering of DEC's computers. Hopefully it might be of interest and use to you.

I've heard a great deal of praise about your recent work on typography. Could you please send me a user's manual describing the system you've built?

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:ljp
ID#0287

FROM: GORDON BELL DATE: MON 29 OCT 1979
1:47 PM EST
DEPT: OOD
EXT: 223-2236
TO: PETER VAN ROEKENS
DAVE RODGERS
cc: ULF FAGERQUIST
BERNIE LACROUTE
BILL STRECKER
BILL DEMMER
GEORGE PLOWMAN
GEORGE HOFF
SAM FULLER
WAYNE ROSING

SUBJECT: L.COST (ICCS)-- FOLLOW UP:11/9/79
GB0005/36/EMS

I understand the concern about CI cost. The situation looks like the following to me:

<u>Given</u>
C(780; 18K), C(750; 7K); C(730; 3.5K)
C(HSC or Hg; 2K)
L(ICCS;780: 3K; 750: 3.5K; 730:2.5, Hg: 2.5; HSC:2.5)
Ms(disk, 8K)

T.comm line (0.5K)/line
T.terminal 1K to 5K depending on # active

A minimum system sans terminals costs

2 - C(750), 2 (Hg), 16 lines; 2 Ms;

2x(7+3.5) + 2 x (2+2.5) + 16 x .5 + 2x8 = 63

of which L(ICCS)= 12 or 19% of cost. This seems a bit high...10% would be better, but have I, figured right?

A bigger, 32 line system:
2x(7+3.5) + 2 x (2+2.5) + 32 x .5 + 4x8 = 87
or 14%, and 18% if C(HSC) is added.

Would someone calculate this accurately?

GB:swh

GB3.S10.10

00 CORE DECGRAM ACCEPTED S 003048 O 140 03-NOV-82 15:31:22

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TO: see "TO" DISTRIBUTION   DATE: WED 3 NOV 1982 10:05 AM

FROM: GORDON BELL

cc: ART CAMPBELL   DEPT: ENG STAFF
    ANDY KNOWLES   EXT: 223-2236

LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5180664684

SUBJECT: AN AGGRESSIVE, WINNING, EVOLVING LA12 VS ROBIN II?

I think we've convinced ourselves that you could have a winning portable (and desk top) printer/editor/computer if you'll simply rapidly evolve the LA12 by adding over time:

1. larger ROM and RAM (64K CMOS statis)

2. battery for keeping files

3. a micro cassette for removing files

4. higher resolution print head.

This would provide the corresponding nice product evolution:

1. Full editing, a built-in calculator, a printer with built-in spooling for PC's, and useful as a PC printer/portable terminal/portable editor.

2. Ability to store data over time and to become more like a personal computer. With the right stuff, you might be the low cost PC we need e.g. a video output chip or a LCD is all it needs.

3. Full use as a Teletext Terminal and as a poor person's WPS.

4. More use by having higher quality printing.

This approach to be an aggressive, competitive portable unit supplier is in direct conflict with your direction, where you have no control over your destiny and have to provide a kludy option box (Robin II) so that all terminals can use this kludge too and you find there's a Robin-sized market. TI, GE, Teletype and Si Lyle's company will all have nice integral, portable units because they don't have your constraints both to produce Robin II as the universal kludge box that fits all our terminals and they don't have a messy organization where the designers are smeared everywhere across DEC Engineering with no product identity. At the very least, you might package Robin

II with
the DFO3 simply to save cables, power supplies and user desk space if
you want to consider the user..

My guess is that you'll have to produce Robin II because you'll never
get it through the bureaucracy because it might be a good product.
Alternatively, maybe one of the engineers or product managers who can
program will simply ECO the board and write the program if he can get
a listing of the LA12 firmware.

VT's must have the ability to edit a full message ala the LA12 editor
simply to off load a VAX host if we sell DEC MAIL.

GETTING A REALLY PORTABLE TYPEWRITER ASSUMING WE DON'T DO IT.

I'd like to work with you in getting a really nice unit from Japan.
We still may want to even for cost reasons. They listen well, are
concerned with quality, user convenience, size and the correspondingly
lower cost. They also are heavily automated. Brother's got the start
of something good, and with just a little help they can produce a
great product which we and others can market. I think Brother, who
wants our business badly can be of enormous help just like they helped
Centronics into (and out of) the business.

"TO" DISTRIBUTION:

BILL AVERY BOB HUETTNER JOHN RING

JACK SMITH

EMS 27-JUN-79

20:20:13 550 1

To: Art Williams, Dick Clayton

CC: Mary Jane Forbes

From: Gordon Bell

Date: WED 27-JUN-79 20:20:13 ED

Subject: First impression of LA34 with built in modem

Overall, the built-in modem is realy nice as fooling around with the acoustic
coupler, cord etc. is a drag. It passed the test of my not reading anything
to work the terminal, but I haven't called into a machine that expects tabs,
but that should be ok.

Somehow the keyboard seems to require some real work . It sure feels sluggish
and cheap, with stickiness and plasticness as some of the ways I'd describe
it.

The rolpaper memories of my childhood are brought back. Cutting the finger,
living with an array of wierd size sheets of paperand trying to take the curl
out of them to hold them in my otherwise 8.5 x 11 world. The curly paper also
curls around the roller too. I would like to have only a short carriage, but
since others may want the wide p

paper for goodness knows why, it probably means the product has to be o big.
I am also using a TI terminal which is also hard to read and use too. Yhr
hand rest below the space bar is fully as cheap feeling (like it might break)

as the TI. Now that they have gotten us into their price market
I suspect I
can expect future products to be even poorer quality feeling.
If someone
say like HP goes the quality route, they probably can get most
of the market
taht IBM doesn't have.   Also, the Japanes might get in and
do both price
and quality to upset us all.

I like the noise level...it being better than a selectricor a
36. The FCC
I hope will get on the stick because I don't listen to a low
power radio
station (my favorite at this time of day) and use the terminal
simultaneously.

(note I have not edited this and am not really that bad at
typing... the
stickiness is doing it to me.)

All in all I hope we sell a bundle...I would like to stay firm
in my resolve
to review all terminals before we ship them or even earlier so
as to argue a
little bit about what they should feel like and what the output
should be.

Teh print qualtiy is nice and I'm excited at teh HRDM
possibilities.

Command:

EMS   28-JUN-79
22:14:15 120 1
To: Art Williams, Dick Clayton
CC: Stanton Pearson
From: Gordon Bell
Date: THU 28-JUN-79 22:14:15 ED
Subject: more on the 34

The plastic cover on the La34 certainly is something I wonder about. What is
it for?   Who suggested it? It only seems to get in the way of seeing the
yop few lines clearly, but surely there's anothr function which I can't figure
out.

Command:

FROM: GORDON BELL   DATE: SUN 16 SEP 1979 10:58 AM EST
DEPT: OOD
EXT: 223-2236
TO: DICK CLAYTON
    ART WILLIAMS
cc: MARY JANE FORBES

SUBJECT: LA34

I believe there are several problems with said device.   On a new
role of paper the spring is too tight and makes lines too close to
gether.   On end of roll, the spring hits the   paper collar and makes the
roll holder ride out of the retaining socket.\par
Since I don't have a typing table of the right kind so that I can
operae with   tractors and form feed, and I can't get used to the
roll paper,   I'm   returning my la34. so that someone less critical thatn
I can use it.   It doesn't feel up to the la36 and this is quite
depressing to me.

I do like the builtin modem.

I didn't get around to changing the keyboard, but someone can

look
at mine and see if this is a problem.

I predict some more ecos due to the way the carriage slides acrosss the page in a catching fashion.

Command >

How can this be in trouble?

What happened?

What's the level of the head designer(s)?

Are there consultants who can help?

Can we buy a head from someone if we can't engineer it?

What can be done to get it back on a more aggressive schedule (eg. derating the head by slowing it down)?

Who's looking at the alternatives?

GB3.S7.21

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+---------------------------+                              GB0001/2
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a n d u m
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+---------------------------+
```

Subject: **Leading in Pricing/Deliveries for LA120 and Memories**

To: Dave Cotton, ML5-3/E12
Mike Gutman, ML3-6/E94

CC: Marketing Committee,

Date: 31 JAN 79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

Steve Coleman, ML12-1
Bill Green, ML1-4/E34
Mike Tomasic, ML12-2/E71

Two conditions have come up which the Marketing Committee would like your leadership in regard to pricing and delivery to effect the market, NOR and profitability. Please come forward with appropriate proposals.

<u>LA120</u> - Our internal requests have come through at less than 1/2 the original forecast. LA36 forecasts are up! Given that there is only slightly more cost (150) and much more NOR (750), we should not make the lower cost, lower profit terminals.

This is doubly immoral because the higher speed will be paid off in less than a year by less user time. Delivery can effect this!

<u>Memories that use 16K chips</u>

We can't get 4K bit chips! We have to move our customer base to memories that use 16K chips as opposed to the increasing forecast for 4K chips. Certainly price and availability can control this.

Bill Long will schedule you at Marketing Committee when you have a plan.

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST: Steve Coleman ML12-1 Dave Cotton ML5-
3/E12
Bill Green ML1-4/E34 Mike Gutman ML3-
6/E94
Mike Tomasic ML12-2/E71

Bill Hanson ML1-4/P11 Win Hindle ML10-
2/A53
Ted Johnson PK3-2/A55 Andy Knowles ML10-
2/A52
John Leng MR1-1/F35 Bill Long ML10-
2/A57
Julius Marcus MK2/C37 Ken Olsen ML10-
2/A50
Stan Olsen MK1-2/A57 Jack Shields PK3-
2/A58
Bill Thompson PK3-2/C12

00 BURT DECGRAM ACCEPTED S 24311 O 33 27-JUL-80 18:31:35

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION DATE: SUN 27 JUL 1980
6:26 PM EDT

FROM: GORDON BELL
cc: see "CC" DISTRIBUTION DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: LA200/VT200 SPECS AND SCHEDULE

Sorry I can't be at the review. Mostly I have only one concern: HOW CAN WE WAIT SO LONG FOR IT?

It has most of what I see as important and am glad to see the calculator, telephone interface, etc. that we are putting together this summer. Am working with Jim McIninis, and Bill Zimmer and Anton Chernoff as to its contents and how to access them. Our discussion Friday centered on a quick implementation of a WPS/EMS compatible set of options for editing, tickler, notes, setting parameters (not in WPS), calculator (also not in WPS) just to get the experience of implementing functions in a fixed function terminal. After this we would try to improve the human interface, but right now we need to implement something in order to understand the internal architecture (versus the more subtle issues of the human interface). Also, this would get us to do something rather than just attend meetings and talk.

Why don't you assume that the functions you need will be specified by Jim in Q3. What would the schedule look like then?

Is there a way to work on a terminal with Vt100+ resolution and these features and then ease into the high resolution and/or color that we are queasy about?@ (Make sure that the power wand logic will support the resolution.)

Another way to look at this is to plot the family tree of La and Vt products starting with the 30 and 05. The tree shows offshoots like the vt 52, but the key parts of the tree are the start of a branch when the project starts and a nodule on the limb when fcs is and the end of a branch when the product is retired. (This enables you to compare the project historically in terms of development time, and product lifetime. With these, I'd feel better knowing we are ok in terms of history. Could you get the key dates and events for these and do the plotting (this is what the PDP trees I plot are.) (the tree might contain la30,36, 34, 180, 120I, 120II, proposed 12, 34g, 200, etc. and vt 05, 50,52, 61,62, 162, 101,102, 131,etc.) Until there is a better measure, I think it is worth using history as a metric... that's why I personally plot the trees and have them from 1960 out to 1990. Given the bigness of this base I'd hope you will, and if not, let me have the data so I can.

Bottom line: it's good, probably too late, but get some way to test this based on history. Believe the parts and specs can/will/must be ready more rapidly. What can we do to stage it differently so that it is timely and can protect the base?

"TO" DISTRIBUTION:

DAVE COTTON JERRY COX HANEY AND PICOTT
BILL PICOTT DAVE REED ART WILLIAMS

"CC" DISTRIBUTION:

DICK CLAYTON FORBES AND CHERNOFF FORBES FOR MCINNIS
FORBES FOR ZIMMER MARY JANE FORBES

GB1.S6.12
<name>
<ms>

<!E>

GB9.5
Subject: LAN and PC server, backbone of products. Nestar Visit
importance, It's clear that the LAN, complete with communications gateways, and ability to connect PC's and terminals (eg. using a concentrator) is pivotal to our products. In this regard, we need to move this to the same priority as our basic, meat and potatoes product (eg. CT/Plexus/Auragen system). We're looking at:

1. Interlan ($6M/year, 70% OEM, based on Ethernet, financed by JH Whitney et al). We've met once, like their product, and have ask them to NOT build an end user sales force, but rather have us do this so they can become the LAN technology company.

2. NESTAR ($6M/year, 100% end user, based on Arcnet, financed by Rank). My Silicon Valley sources say they're in trouble, with people bailing out.

It sounds like they pretty much have the product that Ed is proposing (sans the accessories and programs distribution aspect). They have a range of file servers from 30 to 150 Mbytes and link to Apple and IBM PC's with the appropriate code to distribute programs. In addition they have low cost servers constructed from IBM PC's. A net can gateway to IBM as a 3270 terminal.

Their president, Chuck Hart and chairman, Harry Saal, are visiting next Wednesday at 9. Karl's hosting them with Ed and Steve. It would be good to have other folks come too to hear about the company and products. I'll be back about noon. I hope Henry and Ken can be available to talk with them. Obviously they're interested in us when I ask how we might distribute their product.

In addition, we need to look at the other alternative suppliers and possible competitors:

1. 3Com (Bob Metcalfe's company. Bob invented Ethernet). Made a recent agreement with Xerox and Visicorp to supply interfaces to IBM PC's. Aimed at a disk server but extends the XNS protocols into the human interface. Unclear who's doing what or who'll market the products.
2. Bridge... Ethernet based and has interesting products.
3. Ungermann-Bass is mainly Ethernet. The largest at 20M, and oriented to networking.
4. Corvus (30M). They have a 1 Mbit Omninet that's easier and cheaper to use than Ethernet.
5. Excelan (Ethernet), Appletek, Hinet (500Kb), Comtel, NSC (very high performance) are others.

Subject: **Language Support in New Terminal (e.g., LA120s)**

To: Distribution

Date: 20 SEP 76
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

F/U 9/27

In listening to DECUS and other users this last week, I got a couple of inputs:

1. Users of APL like the LA36.

2. Users of BASIC believe the WANG approach which puts language syntax elements on keys is quite nice...and wonder why these aren't available.

With the BSR and/or LA120s (and future LA120) we could provide this (and perhaps other) capability specialized to COBOL, FORTRAN, and BASIC.

Could we breadboard such a system and see how it would feel by trying it within DEC?...and if useful, try it on some customers.

Ed and Roy, could you get several of us together to see how it might get kicked off and what it might look like?

Is it worth doing?

How effective would it be?

(John Xenakis, could you give me a quick, simple analysis in terms of improving throughput?)

Will this provide a very good mid-life kicker on the LA36?

GB:ljp

Distribution

Jim Bell
Bill Chalmers
Al Dziejma

Chuck Bickoff
Ed Corell
Ken Fine

Ron Ham
Andy Knowles
Roy Moffa
Mark Sebern
John Xenakis
Al Huefner
Roy Lomicka
Bob Puffer
John Wolaver

ID#0309

| d | i | g | i | t | a | l | i n t e r o f f i c e   m e m o r a n d u m

Subject: **Large Systems Strategy Team**

To: OOD, Marketing Committee,
Large Systems POT,
Ulf Fagerquist
Midrange POT, EBOD,
Alan Kotok, Jud Leonard

Date: 20 OCT 78
From: Gordon Bell, Bill Demmer,
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

follow up 11/2/78

Approved

A strategy team composed of MSD/LSG hardware development representatives will be formed to develop a large systems hardware development strategy proposal. The effort will be the first phase of a process to establish firm engineering plans and business plans for the large systems area. The first phase is focused on hardware development strategy and is chartered to complete a proposal by the end of Q2.

Membership: George Hoff (team leader), Alan Kotok and Jud Leonard. Additional assignees will be pursued by this group from MSD/LSD as the need arises.

Goals

.Assess potential VAX-780 competition in the 79-82 time frame. Propose FCS target and cost/performance target for a 780 replacement which will head off competition and protect/expand 780 base/market share.

.Evaluate alternative solutions for a 780 replacement considering available technologies, bus structures and positioning relative to Comet and available market.

.Positioning of Dolphin vs VAX high end product must also be considered and alternatives presented to the POTs and EBOD.

.Primary metrics to be considered in evaluating alternatives are: development cost, development risk, total start up cost, product cost, product performance, RAMP, schedule and feasibility vs available/achievable resources.

.A major goal is to minimize risk and achieve efficiency in this product space by attempting to find common solutions in the area of technology, bus structures, IO subsystems, power subsystems and packaging. We cannot afford to introduce multiple high impact items to manufacturing and the field in a relatively low volume area.

.The overriding consideration is to maximize net revenues and to protect and grow the base of customers who have invested in Digital products.

.The team will consider coexistence/consolidation alternatives for the VAX and DECsystem 20 product families through the mid 80's.

.The team will review progress with Gordon Bell, Bill Demmer and Ulf Fagerquist on a bi-weekly basis.

Non Goals

.Detailed financial analysis of markets and business plans.

.Software strategy.

.Detailed engineering plans.

GB,WD,UF:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Dick Clayton ML12-2/E71 Jim Cudmore ML1-
5/E30
Bill Demmer TW/D19 Ulf Fagerquist MR1-
2/E78
Bill Johnson ML21-3/E87 John Kevill ML1-
3/E58
John Meyer ML12-1/A11 Larry Portner ML12-
3/A62
Bob Puffer ML12-2/E38

Win Hindle ML5-2/A53 Ted Johnson PK3-
2/A55
Andy Knowles ML5-2/A53 Stan Olsen MK1-
2/A57
Bill Thompson ML12-1/F41

Art Campbell PK3-1/M12 Brian Croxon
TW/C04
Bill Demmer TW/D19 Ken Goldner MR1-
1/M72
Bill Heffner TW/C10 George Hoff MR1-
2/E47
Peter Jessel ML21-1/E81 Bernie Lacroute
TW/A08
Jim Marshall TW/C03 Mike Marshall ML5-
2/M46
Glenn Reyer MK1-2/D03 Pete van Roekens
TW/B10
Jerry Witmore PK3-1/M40

Tom Campbell MR1-1/M74 Joe Carchidi
TW/D08
Ulf Fagerquist MR1-2/E78 Dave Fernald ML5-
2/M17
John Jorgensen MR1-1/M74 Bill Koteff MR1-

1/M82
Jon Kropper ML1-4/P14 Si Lyle MR1-
1/M42
Dave Micciche MR2-2 John Mucci MR2-
4/M38
Dick Rislove MK1-2/L35 Ken Senior PK3-
2/A45
Dick Snyder MR1-2/E37 Fred Wilhelm MR1-
1/M85

Bruce Delagi MR2-1/M64 Bill Kiesewetter MR1-
1/M81
Ed Kramer MR2-2/M70 Charlie Spector ML5-
2/M17
Harvey Weiss MR1-1/M85 Stan Pearson ML12-
2/E38

Alan Kotok MR1-2/E47 Jud Leonard
TW/C04

#14

Dear Jack:

Thanks for the offer to attend the conference, and I regret that I can't attend because I'm recovering from a by-pass operation, and am trying to limit my commitments, especially those requiring travel. I would have liked to hear about the Cray, Dennelcor and CDC machines. Bill Strecker's attending from Digital, so I feel we're represented.

If it's not too late, let me urge you to reconsider the speakers from academia and invite someone who has produced results. None of the speakers, besides Kuck have every built anything. The folks at Carnegie and Manchester are about 10 years ahead of their colleagues in understanding parallelism and how to build systems. The attendees should understand that parallelism does exist and can be exploited to varying degrees using dataFLow and multiprocessors.

Sincerely,

Gordon Bell

Vice President, Engineering
October 11, 1982

Dr. Robert Ewald
Dr. Bill Buzbee
Los Alamos National Lab
Computing Division
MS: B260
Los alamos, NM 87545

Dear Bob and Bill:

Let me express my greatest thanks to you for hosting our Alpha Omega technical definition meeting and the site visit to LANL. I know everyone was as impressed as I have been with the LANL resources and your ability to manage them.

I'm sorry you had to suffer through our deliberations on the program definition, but at least you understand what some of the pressures are on our program. It's going to be a frantic time ahead as we try to sort out and define the next stage of the program. I hope we'll be able to extend the program to include work on PUP II. It seems to me, that's exactly the kind of base we should be helping prove so that your researchers can be as effect as soon as possible.

We'll be trying to get AO defined as soon as possible so that we can proceed on to the work.

Again, thanks for the fine hospitality of you and your staff.

Sincerely,

Gordon Bell
Vice President of Engineering
Chairman, Alpha Omega Steering Committee

GB3.S8.5

June 18, 1982

Mr. William Buzbee
Los Alamos National Laboratory
Mailstop B260
Los Alamos, N.M. 87545

Dear Mr. Buzbee

Enclosed is the paper Gordon wrote upon his return from Japan in 1978. This is the last iteration.

He also asked me to let you know he doesn't have any IBM information to send.

Sincerely,

Mary Jane Forbes
Secretary to Gordon Bell

00 CORE DECGRAM ACCEPTED S 002794 O 510 02-JUN-82 20:00:20

****
* d i g i t a l *
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TO: PRAKASH BHALERAO DATE: WED 2 JUN 1982 7:41 PM EDT
ARNY GOLDFEIN
JEFF KALB
BOB SUPNIK
STEVE TEICHER

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5165226714

SUBJECT: WORKING WITH LATTICE LOGIC

Prakash,

I'm really delighted we're taking an interest in a fully automatic standalone design system like Lattice has. I appreciate our compete system based on CHAS and it's clearly the basis for our major designs. It would seem that the Lattice system might be like one of the point processes say like Applicon, or Caldec where we do PWB's in a very simple disconnected fashion just to get a chip asap.

Is it possible that we are going about the evaluation the wrong way? Here, it's possible that we are going to cause a tremendous hardship on John in time and money by having him come here for harassment and interrogation.

Since we are evaluating several systems, I would like to suggest WE take several benchmark designs and visit each of the vendors and try their systems at our expense. Here, the little book has enough detail to allow a designer to do the job. What will be accomplished by having the 48 people on your list attend a lecture (we all have the book and notes of his last lecture)? Why can't WE do some work rather than putting the onus on him?

I've also ask Cutler and Gutman to couple into your work because they too want a very easy to use gate array. (Here, a very cursory analysis of our boards show a distribution of chips are mostly ssi, then msi, then lsi (if you ignore memory chips). We could win in board area like crazy and at the same time educate our designers and get them ready for VLSI design.

The leadership I want from SEG is to get designs into the design groups really rapidly using no muss, no fuss gate arrays, whether they be tat, cmos, or whatever. Right now, the best system I've seen in my limited wanderings is John's system. Since you say there are several good ones, let's have them all evaluated no later than September 1 by trying several REAL designs.

This is a problem that is solved by analysis, design and work, not by lectures and talk.

WPS USERS - Leave HP mode and type <CR>

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION DATE: SUN 25 APR 1982
4:06 PM EDT
FROM: GORDON BELL
cc: see "CC" DISTRIBUTION DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: USING LATTICE LOGIC'S CMOS GATE ARRAY DESIGN SYSTEM

LATTICE LOGIC
John Gray visited us last week to sell his software to make CMOS
gate arrays that can be either as flexible or as restrictive as
desired. It does not cope with a particular gate array. They're
at 6 Albany Lane, Edininburgh EH1 3QP, 031-557-3215. The design
system takes an algol like input, complete with macros and
arrays, and then builds the array and the test patterns for it.
It has simulator, timing verification and is complete! No other
software to lash together. Regular logic diagrams are easily
converted to the notation, but some folks may just stay with the
programming notation. Staying away from logic diagrams, may gain
speed of design. I have a manual of their system.

ENGINEERING USE
I'd like to see us try it for making CMOS gate arrays which would
substitute for TTL circuits. Someone inside would get the
software, try it and then act as the clearing house.

Ideally, this would get integrated into the SEG training

program.
Given that the introductory course is a week, I think it would be
worth 2 days to learn this method and do a design so as to give
people the confidence that can start to cope with VLSI.

EDUCATION SERVICES COURSE
John may contact Del Lippert about setting up a DEC Education course, complete with a VAX that people would take from both inside and outside DEC. The course would take students in who
have a known, working TTL design, and would take 2 days and the
output would be a tape to a Silicon Foundry which would be part
of the course results. The goal would be only TWO days to a working chip. The chip would be returned to the students in a
few weeks or days, depending on the turn-around of the foundry.

ESG PRODUCT
I didn't suggest this, but Pete should contact John to sell the
software for him. It looks like the right way to do your own chips in a very flexible way without the massive custom hassle.

We've got to get our engineers away from costly ttl and into modern design. Let's try this, cause nothing else is working.

"TO" DISTRIBUTION:

DEL LIPPERT PEG: PETER SMITH
DEL THORNDIKE

"CC" DISTRIBUTION:

TOM BURNIECE DAVIES AND WADE BOB
GLORIOSO

ARNY GOLDFEIN	PETER JESSEL	BOB KUSIK
JIM LACEY	AVRAM MILLER	ROY REZAC
DAVE RODGERS	BILL STRECKER	JIM WADE
SULTAN ZIA		

GB3.S4.23
March 14, 1980

Lowell Wood
Lawrence Livermore Laboratory
Univeristy of California
P.O. Box 808
Livermore, CA 94550

Dear Lowell,

I'm having great fun creating a DIGITAL COMPUTER MUSEUM and I have heard that you might have some old computers or components that you might make available to us.

Our displays begin with pre-computing calculating devices, such as Napier's bones, a Thomas arithmometer, etc. and move right up to the fifth generation of computing devices. We have a lot of Whirlwind in storage and some on display and have recreated the TX-0 as it was at MIT in the fifties.

If you come to the Boston area, I'd enjoy personally showing you the display...and am interested in obtaining more non-DEC early computers.

Regards,

Gordon Bell
Keeper, Digital Computer Museum
Vice-President Engineering
Digital Equipment Corporation

GB1.S2.52
April 6, 1981

George A. Michael
Lawrence Livermore Laboratory
University of California
Leader, Computer Research Group, L-76
P.O. Box 808
Livermore, CA 94550

Dear George:

Thanks for organizing the stimulating conference on high speed computing and for hosting the conference. The interaction among users and builders was interesting and intense. Thanks for allowing me to attend; I learned a lot. As members of the Digital Computer Museum staff, Gwen and I also found the interaction worthwhile.

Please also pass along my thanks to the Workshop Committee and Workshop Staff.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:swh
GB2.S5.5

Dr. Creve Maples, LBL, 415-486-6323 has built, is benchmarking and plans to put in service (in January) a facility that is very much like our architecture.

They have a fast switch (40 Mbytes/sec) among concentrators, disk servers and compute servers. The compute server is interesting; a standard Modcomp machine controlling and monitoring the tightly coupled multiprocessor made of 6-8 Modcomp processors(like PPA). The control machine places identical binary images in each of the machines and the user specifies message passing among the parts on a very simplistic pipelined and/or parallel basis. They assume very large grains (seconds/minutes synchronization) and the disks feed the work in a pipelined fashion.

The very simplistic approach (on the 4 Pc system) avoids going after fine grain parallelism and has been benchmarked to outperform the 7600! (A big gain is the disk).

Again, with 784's together with CI/HSC we can sell this now and do the same thing. Note the MA780 must be reimplemented to be a very large memory -- say >32 Mbytes/box!

I'm encouraged that we can and must now sell this simple structure based on simple parallelism within a job . . . if we can get on the ball.

Creve has done a nice job and has built an interesting and useful system. Let's get him to come, speak and consult after it's in production in January! Who'll invite/host him? (We need this knowledge for PPA and for marketing the 784 and CI clusters).

Gordon

P.S. The tragedy is we would not sell him 780's or interact with him to build this out of VAX's three years ago!

GB3.S10.21

00 CORE DECGRAM ACCEPTED S 005534 O 528 16-NOV-82 20:16:47

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M e m o
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TO: see "TO" DISTRIBUTION DATE: TUE 16 NOV 1982 1:19

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5181987996

SUBJECT: SPEAKER/CONSULTANT/WORK MULTIPROCESSOR @ LBL

Dr. Creve Maples, LBL, 415-486-6323 has built, is benchmarking and plans to put in service (in January) a facility that is very much like our architecture.

They have a fast switch (40 Mbytes/sec) among concentrators, disk servers and compute servers. The compute server is interesting; a standard Modcomp machine controlling and monitoring the tightly coupled multiprocessor made of 6-8 Modcomp processors(like PPA). The control machine places identical binary images in each of the machines and the user specifies message passing among the parts on a very simplistic pipelined and/or parallel basis. They assume very large grains (seconds/minutes synchronization) and the disks feed the work in a pipelined fashion.

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Gordon

P.S. The tragedy is we would not sell him 780's or interact with him to build this out of VAX's three years ago!

"TO" DISTRIBUTION:

CFM TASK FORCE:	PETER CHRISTY	BILL DEMMER
FU 11/19	SAM FULLER	BILL JOHNSON
BILL LONG	SUSANNAH NATHAN	BRUCE A RYAN
BILL STRECKER	DEL THORNDIKE	MAURICE WILKES

ID#360

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Subject: **LCG Commercial Software Funds**

To: Andy Knowles, ML10-2/A52
Julius Marcus, MK1-2/C37
Bob Puffer, ML12-2/E38

Date: 21 NOV 78
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

follow up 12/4/78

Julius asked why he has a high central engineering tax. Could it be that he is paying for both the 11 and 20 commercial software developments that we looked at in the Minnow task force?

If this is not the case (and the Technical Group is paying for the commercial 20 development) as has been the past case, please see that there is the clear allocation of commercial product development to Bill's and Charlie's groups.

Bill has been effective at getting a significant amount of software and hardware for commercial using the standard techniques of engineering and management commitment by getting us to sell futures to our customers (e.g., minnow to ADP) and to DECUS.

<u>Ulf</u> I want to approve any "future's" we're announcing at DECUS in this regard!

GB:ljp

CC: Ed Fauvre, MK1-2/E06
John Leng, MR1-1/A65
Dick Snyder, MR1-2/E37

Minnow Task Force
Gordon Bell, ML12-1/A51
Bill Demmer, TW/D19
Ulf Fagerquist, MR1-2/E78
Bob Flynn, ML12-2/E81
Bill Kiesewetter, MR1-1/M81
Andy Knowles, ML10-2/A52
Si Lyle, MR1-1/M42
Larry Portner, ML12-3/A62
Mike Tomasic, ML12-2/E71

EMS 13-APR-79 11:52:50 520 1

To: Julius Marcus
To: Gordon Bell
To: Ted Johnson
From: Odette Hebert
Date: FRI 13-APR-79 11:52:50 EST
Subject: LARGE COMPUTER

IN THE PROCESS OF REVIEWING THE CORPORATE PRODUCT STRATEGIES WE HAVE AGREED ON
THE NEED FOR A FOLLOW-ON SYSTEM TO EVENTUALLY REPLACE THE KL10. THIS WILL BE
KNOWN AS THE 2080 AND WILL BE DEVELOPED IN MARLBORO, THE CENTER FOR ALL FUTURE
CORPORATE HIGH-END DEVELOPMENT.

THE HIGH-END BUSINESS CONTINUES TO BE VERY IMPORTANT TO US AND WE WANT THE
FIELD TO CONTINUE WITH THE SPECIALTY SALES EFFORT FOR 10/20 PRODUCTS. IN
ADDITION WE WANT TO MAINTAIN THE LCG SALES UNITS OR WHERE THESE DON'T EXIST TO
PROVIDE THE EQUIVALENT WITHIN ONE OR MORE, IF PRACTICAL, OF THE MARKETING
SALES UNITS. WE BELIEVE THAT THIS IS IMPORTANT TO AVOID DISPERSING THE SALES
RESOURCES AND THUS MAINTAIN THE ADVANTAGES OF CRITICAL MASS.

IN ORDER TO MAINTAIN OUR COMPETITIVENESS WITH EXISTING 10/20 PRODUCTS, WE WILL
BE ENHANCING THESE FROM TIME TO TIME AND ASSURING THAT THEY ARE
PRICE-PERFORMANCE COMPETITIVE. IN ADDITION, WE HAVE A SIGNIFICANT
MAINTAINABILITY ENHANCEMENT PROGRAM UNDERWAY FOR THE KL10

IN ORDER TO PROVIDE GREATER FOCUS FOR OUR TECHNICAL MARKETING EFFORTS OF 10/20
PRODUCTS, WE ARE CREATING A NEW POSITION OF PRODUCT GROUP MARKETING MANAGER
FOR LARGE SYSTEMS. WE ARE PLEASED TO ANNOUNCE THAT JIM MILLER WILL SHORTLY BE
RELOCATING FROM SALES MANAGEMENT IN THE FIELD TO FILL THIS POSITION.

FOR YOUR COMMENTS. PLEASE REPLY BY EMS.

THANKS..

EMS 15-APR-79 14:55:23 590 1
To: Odette Hebert
From: Gordon Bell
Date: SUN 15-APR-79 14:55:23 EST
Re: LARGE COMPUTER
From: Odette Hebert Date: FRI 13-APR-79 11:52:50 EST
Message ID: EMS 13-APR-79 11:52:50 520 1

OK by me. I think you are saying too much and now is a great time to stop giving model numbers, names etc to the field and to our customers. I am in charge of the effort here for the new machine and fully support it, but I do not support the "LCG Open Mouth Policy". As of now, please act to stop it.

Command:

GB0003/32

| d | i | g | i | t | a | l | interoffice memorandum

Subject: **LCG Versus P/L Focus in Europe**

To: Bobby Choonavala, GE
Geoff Shingles, GE
Jean-Claude Peterschmidt, GE

Date: May 29, 1979
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

CC: Ted Johnson, PK3-2/A55
Andy Knowles, ML10-2/A52
John Leng, MR1-1/A65
Julius Marcus, MK1-2/C37
Jack Shields, PK3-2/A58

Follow-Up: 6/15/79

Somehow the decision in ESSC to re-institute the LCG sales unit seems strange, given that the overall projection of 10/20 is only 5% of Europe's sales. Doesn't it stand to weaken the P/L focus, and require more support at a time when we have many other products (that can take up this slack)? While such a structure may make sense in N.A. which has a 10/20 focus, already one could certainly question it in light of increased focus on the low end and Europe's need for very long term commitments to products forever (eg. MUMPS, PDP-8).

Why not de-emphasize and not build the business in this fashion, but go more into 11's, VAX's, and low end systems? We'll get the 5% anyway. Even though we can get incremental sales, wouldn't supporting fewer, higher volume products in Europe be more profitable and satisfy our customers better?

GB:swh

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Bobby Choonavala GE Geoff Shingles GE
Jean-Claude Peterschmidt GE

Ted Johnson PK3-2/A55 Andy Knowles ML10-2/A52
John Leng MR1-1/A65 Julius Marcus MK1-2/C37
Jack Shields PK3-2/A58

EMS 26-APR-79 14:05:35 420 1

To: Len Halio, Bill McBride, Dick Clayton, Bob Glorioso
CC: Bill Johnson, Jan Lounsbury
From: Gordon Bell
Date: THU 26-APR-79 14:05:35 EDT
Subject: Interface with LDP on Graphics SW

Just talked with Steve Mullen of LDP re SW for vt 125 and gigi. LDP is
starting an effort on sw because they felt we aren't doing antyting. Isaid
that the graphics work included software and its architecture and if there
were resources, we wanted them applied to be compatiblbe with the architecture
we are implementing so that over time we could migrate sw (interpreter) into
the terminal. We just can't permit a n independent sw effort that gets us no
where...otherwise, all we get is the sw analog of the point product

Bill and Len...please bring the multitudes together on this issue so that we
get a complete product versus a bunch of 1/2 done things. We have the
potential to be the instantaneous grpahis leader and to set the standard of
excellence. Let's not blow it by having armed camps.

As a technical issue, I would like to see the SW interpreter built very much
the way the sort package on vVAX works and that it would take advantabe of
vax especially when used there.   When used on VAX it could be called either
by a terminal, (keyboard interpreter), by a command file, or by any program it
is loaded iwth. When used on a 10 11 or 20, it would be used in a seperate
address space such that it would be on the basis of independent processes
communication. The program should terefore be written in something
transportable such as bliss, basic or fortran...It should not be a macro
program!!!!

Command:

Digital **Interoffice Memo**

Subject: **LDP Review Schedule**
(Please check your calendars)

To: LDP Review Team

Date: 1 NOV 76
From: Mary Jane Forbes
Dept: OOD
Loc.: ML12-1 Ext.: 2237

Date	**Time**	**Location**
11/4	5:30	Lower Village House Stow
11/10	8:00-10:00 AM	Bill McBride's Conference Room Marlboro
11/17	8:00-10:00 AM	Gordon Bell's Office Mill
11/24	8:00-10:00 AM	Ed Kramer's Office Marlboro

Team

Gordon Bell	John Fisher
Rob Katz	Ed Kramer
Bill Long	Bill McBride
Mike Portanova	Joel Schwartz

MJF:ljp

LDP Review Team Conclusions

November 24, 1976

G. Bell, J. Fisher, R. Katz, E. Kramer, W. Long, W. McBride, M. Portanova, J. Schwartz

LDP - The lean, aggressive, responsive, supportive PL

Computers to researchers as state-of-art tools.

Computers to applications research, that will end in Engineering, Industrial, Education, Communications, OEM and possibly BUS sales.

1. Traditional LDP - {4 sizes; 3+ disciplines; 4 institutions; ? applications} .

2. Medical - {3-Clinical Instrumentation Systems, Small (group practice) Medical Information System} .

3. Graphics - Being reviewed elsewhere {4+ sizes} .

Recommendations

1. Continue to allocate corporate growth (not 17%) to traditional LDP...requires most technically competent sales and products.

   a. Sufficiently untapped markets (industrial and engineering labs--charter issue).

   b. Sufficiently untapped products
   (e.g., personal RJE station/WPS/Computer;
   Nets and shared data bases;
   Instruments to microcomputerize) which we're currently missing)
   Software Applications (e.g., Peaks)--minimal understanding or plan

2. Encourage a clearer, working 5 year plan by including a detailed product development strategy which complements the marketing summary.

3. Aggressively assist LDP in their low end marketing.

4. Develop 11/60 now, and low end VAX to get them back to "hot box image".

5. Encourage a distinct Advanced Development Marketing Program within LDP (i.e., products they don't ship and marketing approaches they don't use) to help focus planning and to get better products. Proprietary products will also help buffer LDP from need for purely hot, basic products.

6. Medical is probably viable, based on BUS/LDP products but must be watched carefully vis a vis products proliferation and support costs/resources. Some specific issues being:

a. Movement from sophisticated MIS user to >95% solution user.
b. Selling strategy for doctor's group practice.
c. Competition with various other DEC OEM's.
d. Using "free" externally developed MUMPS applications locks us in, and allows users to migrate.

7. There is no formal method of identifying and transporting applications from LDP to the other science-based P/L's (i.e., IPG, EPG, ESG, DCG/LSI). Also, OEM and Components don't have a market orientation, hence a joint plan with LDP/Medical is recommended to capture the OEM/Components business.

8. Pricing is not satisfactorily resolved. We did not review it.

Marketing Committee - Please give me your inputs at Monday's meeting (10/9/78).

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|   |   |   |   |   |   |   |
+---------------------------+
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Subject: **Some Large, LDP User's Perspective on Our Products**

To: John Leng, Joel Schwartz,
Marketing Committee

Date: 6 OCT 78
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

I'm just coming back from visiting large LDP users (NCAR, NOAA, LLL and Cal Tech) so I'm a marketing person with a clear bias -- listening only to the last customer input. Beware! Although I've got a separate trip report with their (and our salespeople's) input and observations; here are some quickies:

0. They want, identify with VAX. (They're generally at limit of address space.) They say hold the 10/20 base, but not expand it. VAX is like the 10 was 10 years ago! They want bigger (Cray and 7600) replacements, but for group-level computers. Thus, the Dolphin/VAX is as high a priority as Comet and the Dolphin 10/20.

1.All the little groups are going to gun for the 780! (SEL, DG, Modcomp and even HP!)

2.We're spending a great deal in the LDP development area in the low end and our customers are in the hi end. That is, are we making it where we're spending it? (There's no way to sell MINC's...and who needs it?)

3.These computers are worthless without good terminals (9600 baud), graphics and in some cases color graphics (ala IPG market). We need to be in graphics. Now we insult our users with things like VT105. How would any of us like to sell a VT105, even if it were defined?

4.They have communications and network problems we're not solving. Some are hard, others are obvious and we're negligent.

5.We could get the market. Univac and IBM aren't there now because they chose the infinite commercial market. Furthermore we've got the best, basic architecture (versus HP, IBM, CDC, Intel) for their products. All we have to do is concentrate!

6.I believe we should put a $200K ceiling on the average selling price of all future large Dolphin (VAX/10/20) systems. (The maps will go much higher.) This gets systems into selling price of our sales force.

It keeps us out of the range of the big, slow people (IBM, DPD, Honeywell, Univac, CDC) that make us spend resources in buying and supporting trivia. Now there's a new government rule permitting local procurement if sale is under $300K!

Note a $300K buying price is roughly 5-10K/month <u>or</u> the cost of another person in a group!

We have to believe we can build a computer that is at least as capable as <u>another</u> person in a group. This lets the buy decision be made lower in the organization on a bottom-up decision basis...and we'll chew up the large, monolithic centers and can go around the internal IBM salespeople. (Note we have to have easy to install, and operate centers!)

7.The LDP ads on VAX vs the 7600 are really true!! Few 7600 users or groups of users get more than 1/2 - 1 hour/day. At the prices of 7600's, a dedicated VAX (either in the computer center or in their own area) is much more cost-effective. Whetstones rank VAX at 1/6 of a 7600 at NCAR, LLL ranks:

1. VAX .05 to .1 X a 7600. (They have highly tuned programs.)
2. STAR 100 is .2 to 5 X a 7600.
3. Cray 1 is 4 to 10 X a 7600.

Thus, a dedicated VAX running all night gives better cost/performance, better turn-around and better control for the users (at the group level) than a 7600 especially for the 2000 third worlders!

An ad can really sell this! Let's support the third world computing masses.

8.This group feels we should treat the 11 like we do the 8. They believe VAX is the only architecture capable of being useful as a personal computer. Their programming costs far outweigh their hardware costs.

GB:ljp

CC:	Gus Ashton	PK3-2/M18	Jim Bell	ML3-2/E41
	Roger Cady	MK1-1	Dick Clayton	ML12-2/E71

Bill Demmer	TW/D19	Ulf Fagerquist	MR1-2/E78
Len Halio	ML5-2/E93	Ed Kramer	MR2-4/A67
Si Lyle	MR1-1/M42	Ward MacKenzie	PK3-1/A60
Bill McBride	MR2-3/E70	John Mucci	MR2-4/M38
Dick Pascal	PK3-2/A66	George Plowman	ML5-5/E97
Harvey Weiss	MR1-1/M85	Jerry Witmore	PK3-1/M40

D I G I T A L INTEROFFICE MEMORANDUM

DIST: Gus Ashton PK3-2/M18 Jim Bell ML3-
2/E41
Roger Cady MK1-1 Dick Clayton ML12-
2/E71
Bill Demmer TW/D19 Ulf Fagerquist MR1-
2/E78
Len Halio ML5-2/E93 Win Hindle ML5-
2/A53
Ted Johnson PK3-2/A55 Andy Knowles ML5-
2/A53
Ed Kramer MR2-4/A67 John Leng MR1-
1/A65
Si Lyle MR1-1/M42 Ward MacKenzie PK3-
1/A60
Bill McBride MR2-3/E70 John Mucci MR2-
4/M38
Stan Olsen MK1-2/A57 Dick Pascal PK3-
2/A66
George Plowman ML5-5/E97 Joel Schwartz MR2-
4/M51
Bill Thompson ML12-1/F41 Harvey Weiss MR1-
1/M85
Jerry Witmore PK3-1/M40

Digital **Interoffice Memo**

Subject: **LDP Customer Interviews Regarding Future Computing in LAB**

To: LDP Review Team
Marketing Committee
OOD

Date: 18 NOV 76
From: Gordon Bell
Dept: OOD

Loc.: ML12-1 Ext.: 2236

Overall
Customers generally live hand to mouth and wait for vendor supplied tools or exogenous problem statement. At least one week would be required to do an adequate survey with many users. The industrial sample (Schering Labs and Dupont) did provide good input reflecting long term planning and thought.

LDP sells significant equipment to researchers as tools, and to applications researchers in EDU, IPG, COM, EPG, BUS?, OEM, etc. It behoves us to figure how this research in applications is carried over to the appropriate P/L...or should it be sold through another P/L to start with?

1. Networks - Nearly all users have or are concerned with networking, and want more of it. Compatability or some form of gateways products is essential. Want 10's, 11's (including LSI-11) in net embedded in hardware.

2. Instruments to Nets - Old instruments and free standing instruments are there to be interfaced. New instruments are there to be interfaced. New instruments have micros and minis with somewhat better communications. The IEEE bus is just starting.

3. Terminals - The personal computer for WP and RJE station is ripe...especially to off bad comm. lines and high connect to 370 charges. Note it combines keypunch, card reader, and printer.

Tektronix is really the low end terminal business, and is expected to be better and supply the "great American graphic terminal" at $2.0K! Hard copy is essential on these personal computers/terminals.

4. The high performance market is there and needed for large arrays/big problems.

5. Add ons to 11's to go over 128K on installed base would

be ideal.

6. DBMS is next, to handle data torrent with new, smart, instruments.

7. Word processing is ripe at right price. Also as RJE terminal.

8. Dupont favors a CAMAC LSI-11. (AO would let an OEM or us do this.)

SPECIFIC COMMENTS

NASA (Greenbelt)
Telemetry and image processing (with local displays) and interconnection to central computer via 230Kb line + disk. Using an 11/70 with some address-space hassle...probably due to good selling. Throughput oriented. Standard image processing library functions. No understanding of tomorrow or whole Lab. Wants speed and address space.

UCLA (Chemistry dept.)
Real time lab automation via centralized 11 supporting many instruments and groups. 11/45 --> (2-8's + 11/40 + Nova). Central does plots, calculation and data base storage. Doesn't want more equipment, but rather support what he has already (e.g., LPS), wants better tested software, greater than 128K on 45.

No understanding of IEEE bus; future; buys what's available w/o planning.

New instrument with embedded (non-DEC) mini...no plans/worry about tie-in to his network.

NRL
Largest lab with multi-disciplines, multi-time phases. The application is high reliability for communications and should not be sold through LDP! Trying to build 4.9 yr MTBF system with security. Sell through GSA 66 NOT GSA70! (Note Comm. Application Research.)

Since their application is programming a 2K-4K LSI-11 terminal for local editing, program storage would significantly increase throughput...give more power to individual user. Of their jobs, 90% could be done on LSI-11's! Lots of pressure to network and share files. Would like F4P everywhere so as to get rid of threaded code. $10K was too much for an individual's machine.

Shering Lab (John Hay)
Builds prototypes for production use and supports the

pharmaceutical researcher. Not a good pass off to his or our (IPG) production groups. Wants IEEE bus to get instrument support in instruments. Will really help non-C.S.-type user...which Peaks-11 with LPS helps too.

Their network:

```
              C(168)--L(19.2Kb)--C(11-Hasp rje entry)
                   ! C(128K)--4x C(Labs-local) - T(instr.)
                   ! C(Tektronix)-Magtape.
```

The local lab machine must hold 1 week's worth of data and do switching. Note the network mirrors the org. structure (we observed)! All pharmaceutical labs are organized the same way.

They are beginning to use local computers ala 370/Tektronix 4051 to do editing and to reduce massive 370/T50 support costs! (Is this a big Krypton or VT52 with CMOS-8 Market? I.e., the <u>personal</u> <u>RJE</u> <u>terminal</u>?) (He buys Versatec direct.)

His real function is providing an automated lab. <u>Notebook</u>. The FDA puts lots of constraints on reliability, integrity, security. (e.g., Searle got fried for poor records).

With all new instruments having intelligence, we need a good support plan! We need a good method of converting old instruments!

All the new instruments will drown them in data...hence DBMS in lab is essential to hold all the crap with retrieval!

<u>Dupont</u> <u>Research</u>
2KA + KI.KA used as front end to 190 instruments in 20 buildings. Switching to a network hierarchy with own protocols because DEC10 wasn't there in time!

They have many minis on instruments which they don't know how to support...suggestion of a <u>dummy</u> <u>paper</u> <u>tape</u> <u>reader/punch</u> connection so that instrument could operate as is. Also connect via Teletypes. This presents a software/interface problem!

They're buying Tektronix 4010's due to cost and hardcopy (now 6 mos. delivery).

Their thesis: No one will buy a Graphics (or any other CRT) unless it has a quick look hardcopy output too! They don't like our copier...but want a good one. They believe there's a great terminal in wings at Tektronix with scan graphix to sell at $2K. Len/Herb/Bill what's the story here?

They're standardizing on Intel board to get instruments into central system via 300-2400 board serial. We can sell, and I've invited them here.

Dupont Engineering [note poor match with EPG really IPG Research, not LDP]
Plant instrument, materials movement, robots, ID checking, and transducer automation, through a hierarchial network structure. They're either:

1. Developing local control for a device by using 8080 boards; or

2. Developing intelligent input for a mini.

Their applications are to provide a serial 300-2400 board control/data reporting stream back to a central site. Price is important because capital equipment costs are hassled, although they could fight for LSI-11 on labor costs. The LSI-11 would solve more problems due to speed.

They went to Intel because:

1. Single board was just right for them in terms of parallel, serial ports, ROM and RAM (2K<ROM<4K; 0<RAM<2K - Note 2 to 1 ratio).

2. PL/M is good, even great, and requires no run time support ala Fortran. [They would use BLISS-11!]

3. 1 card = all electronics simplifies maintenance. [Some form of battery backup to hold vital state

information when lines, or central site fails might be useful in Annie Oakly. gb]

When problems get too big they prefer 2 8080 cards versus 1 larger 8080 due to spares, etc.

Their program structures are simple: one task does control; a second task monitors serial line and reports back/changes status.

They want us to supply good analog equipment? They want LSI-11 packaged into CAMAC so as to get 11 programming and network-ability.

The person supplying this input is an ideal candidate to develop IPG products. (He'll visit us shortly to listen to an LSI-11 switch pitch.)

Dupont (Central) Plant Engineering (now IPG/EPG/BUS/LDP)
They do 5 activities which may be the segments of Engineering:

1. General EDP (IBM)

2. Project Control (IBM)

3. Engineering computation using simulation, graphics, and computation in chemical discipline (Univac). Their graphics is for piping...and very sophisticated, coupled with a data base.

4. Plant process control design. (DEC)

GB:ljp

CC: Sam Bosch, Rick Corben, Dave Fernald, Bob Glorioso, Len Halio, Bill Kiesewetter, Herve Lavoie, John Leng, Jack Mackeen, Charlie Spector, Steve Teicher, Nate Teichholtz, Jim Willis, Gerry Witmore

D I G I T A L INTEROFFICE MEMORANDUM

DIST:	Dick Clayton	ML5-2/E71	Ulf Fagerquist	MR1-2/E78
	Arnie Goldfein	ML12-2/A16	Win Hindle	ML5-2/A53
	Ted Johnson	PK3-2/A55	Andy Knowles	MR2-2/A52
	Henry Lemaire	ML1-4/A97	Julius Marcus	PK3-1/M29
	John Meyer	ML12-1/A11	Stan Olsen	PK3-1/A57
	Larry Portner	ML12-3/A62	Bob Puffer	ML1-3/E38
	Bill Thompson	ML12-1		
	LDP Review Team			
	John Fisher	PK3-2/A93	Bob Katz	MR2-4/M79
	Ed Kramer	MR2-4/M16	Bill Long	PK3-1/A60
	Bill McBride	MR2-4/E14	Mike Portanova	ML12-1/F41
	Joel Schwartz	MR2-4/M51		
CC:	Sam Bosch	MR2-4/E14	Rick Corben	ML12-3/A62
	Dave Fernald	MR1-1/M42	Bob Glorioso	ML3-4/E41
	Len Halio	ML1-2/E60	Bill Kiesewetter	MR1-1/M81
	Herve Lavoie	MR2-4/E14	John Leng	MR1-1/A65
	Jack Mackeen	MR2-2/M65	Charlie Spector	ML5-2/M17
	Steve Teicher	ML1-2/E65	Nate Teichholtz	ML12-3/A62
	Jim Willis	PK3/M34	Gerry Witmore	ML5-2/M40

00 BURT DECGRAM ACCEPTED S 25517 O 25 28-MAR-81 12:56:29

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION   DATE: SAT 28 MAR 1981
12:53 EST

FROM: GORDON BELL
cc: GROUP VP COMMITTEE: DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: FUNDING THE NEXT PHASE OF A LEADERSHIP 11/73 AND/OR A LOW COST VAX

It seems clear to me that we have to do something to keep our 16-bit business viable in the transition phase.

In retrospect, neither the 23b, nor 24 products look particularly good in terms of price and performance... and we are at risk in these businesses that depend on them.

We must get the necessary breadboard of a really good product together and measure it in terms of competitiveness with the outside world. It is also unclear to me that we can wait for Aztec, ie. we maybe should consider an interim product disk. Given our very high installation and FAT costs for these products, we have to drastically rethink/redo our manufacturing processes to make this product more in line with the thinking on the CT, or a product like the 278.

At the same time we work on the aggressive 73, I would like to urge that we work on an aggressive vax, using whatever techniques/ideas that will get us the 73 (other than the vlsi Jaws chips) to see what the cost difference would be. Both of these would be done as advanced development during 82 to see where we go to market, maybe both.

"TO" DISTRIBUTION:

BILL DEMMER TED JOHNSON JESSE
LIPCON
SI LYLE LARRY PORTNER HERB
SHANZER
MIKE TOMASIC

ATTACHED: MEMO;38

****
* d i g i t a l *
****

TO: GORDON BELL DATE: FRI 27 MAR 1981
13:12 EST

FROM: JESSE LIPCON
cc: SI LYLE DEPT: CSD
HERB SHANZER EXT: 223-3207
LOC/MAIL STOP: ML12-2/E71

SUBJECT: FUNDING TIMING

Given your reluctance to COMMIT large sums of money to ideas which
have not yet been proven with real advanced development breadboards
and models (a reluctance to which I subscribe), given that the op-
erations committee will shortly be allocating incremental development
funds for FY'83 and '84, and given that if we are to produce com-
petitive products we can't afford a 15-month gap between a work-
ing model and the beginning of product development, I assume that
most of the scenario B and C stuff is in fact "unproven", that the
April operations committee allocations are for planning purposes,

and that you are reserving the right to not appropriate B and C funds
when the real FY'83 and '84 budget cycles come around, if adequate
progress (e.g. breadboards) has not been made in advanced development.

In thios context, I would hope that the current lack of breadboard of
an advanced 11/73 integrated packaging concept does not prejudice
the decision against funding a leadership 11/73, and conversely, if
the decision isd made to invest in a final generation of winning
16-bit products, you will hold Herb to a commitment to back up his
claims of leadership packaging with adequate advbanced development
models in the next year.

27-MAR-81 13:16:20 S 21350 MLDP

GB2.S5.28

ID#393

d i g i t a l **i n t e r o f f i c e m e m o r a n d u m**

Subject: **Learning/Acquiring TEX**

To: Bob Glorioso, ML3-2/E41
Bill Zimmer, ML3-2/E41

CC: George Berry, MK1-2/E09
Dennis Fiore, MK1-2/B11
Joe Ford, MK1-2/B11

Date: 19 DEC 78
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

Bill Johnson, ML21-3/E87
Bob Lane, MK1-2/B11
Ike Nassi, ML3-5/E32
Bill Segal, ML3-5/E82
Roger Willis, MK1-2/C08

As a follow up to a meeting with Joe and Dennis, please set up a field trip to MIT so that Joe, Dennis, and the software engineering from Typeset and Tools can see TEX and talk/argue with the local MIT users. Let's get their view of why it's needed.

Joe and Dennis tentatively agreed to send a person for 1 to 3 months to Stanford to aid the conversion of TEX to Pascal in order to learn the H, J, character layout ... page layout structure/algorithms. Someone from Bill Segal's group who did the PUB/TYPESET/Runoff programs should also go there. In the event TEX becomes part of Scribe as a standard product, we will use it when it becomes complete. Also, we'll use SCRIBE, I trust.

I say let's bring in TEX <u>now</u> for our standard engineering typeset until one is available from Typesetting. Also let's select and get a "standard" typesetting machine.

GB:ljp

Attachments

D I G I T A L INTEROFFICE MEMORANDUM

DIST: George Berry MK1-2/E09 Dennis Fiore MK1-
2/B11
Joe Ford MK1-2/B11 Bob Glorioso ML3-
2/E41
Bill Johnson ML21-3/E87 Bob Lane MK1-
2/B11
Ike Nassi ML3-5/E82 Bill Segal ML3-
5/E82
Roger Willis MK1-2/C08 Bill Zimmer ML3-
2/E41

****
* d i g i t a l *
****

TO: PEG: DATE: THU 6 MAY 1982
8:39 PM EDT

FROM: GORDON BELL
cc: DIGITAL MUSEUM DEPT: ENG STAFF
DEL THORNDIKE EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: DEC TECHNICAL LECTURE SERIES: FOR RECOGNITION AND INFORMATION

Several of us were discussing technical training today and we stumbled on to an idea that is multi-avaried with single rock.

DEC Contributor Lecture
A signficant, technical presentation / lecture by the contributor at Marlboro and the Museum in the format and style
of the external lecturers who are pioneers. Open to the DEC

community. Carries a 500 honorarium and plaque and poster!
Lecture is followed by reception in Museum and dinner for 50
or
so. We'd have 4 or so a year. EMC would approve them based
on
PEG member nominations.

The purposes: recognition, trying to regain some comraderie that we've lost with having 12 sites, transfer of significant information to the DEC community (engineering mostly). Note, Richy Lary did one of these in the HL cafeteria and packed the place. We need community wide recognition and interaction.

I see that we've made significant product and process
throughs
and this would be a way of honoring and informing one's
peers.

Some things that come to mind: CT, R81, HSC, CI, 782, Ofis (if we ever get it), the timing verifier, the router, DECsim, Engineering Net, NI, NI products, specific machines (2080, Nautilus, Scorpio, Venus, etc.).

Maybe this would have gone a long way to addressing some of
the
needs that we are not satisfying vis a vis recognition. I
know
it might have helped save Cane in the case of Comet... at
least
those of us who recognized it as a major piece of engineering would have had a way of saying thanks and letting the lessons be spread to other groups. This of course will cause lots of problems (eg. an individual, a pair, a team or the team
leader).
I think we can figure out how to cope.

I propose that Bill and Jack cohost such a lecture on June 17 with me for Avram and the CT group. What you think?

GB3.S5.25
I talked with David on Saturday nite, and believe he would be

an excellent addition to our AI Group. He'd be very happy working for us. He would live under Forest's wing and get work direction as part of Bill and/or Mahendra's projects.

He'd also work with Stanford and use their 784/PPA after he gets the Prolog product out.

Sam and Bruce
Why don't we go after some ARPA funding instead of having SRI get the money and then worry about the technology transfer?

We funded him full time last year to do microcode work and to do work in evaluating a parallel Prolog, which he's now working on. In August, unless something happens, he's going to go to work on some other project at SRI and probably take OUR work on microcode and parallelism and apply it to some other NON-DEC product. He's looking at microcoding the Symbolics machine for Prolog, for example, and then would go on to do work for ARPA on a special machine.

Will you folks get together and hire him please now that we've got the $'s in the CFM Project?
.
Dear Members,

The Museum has now been open for a year. A year in which we have learned alot and hope that we know better how to serve you in lots of ways: putting on a wide variety of programs; scheduling special temporary exhibitions; doing a diversity of benefits; and developing new products that let you "have a bit of the Museum" for yourself, wherever you are.

Our "lecture" series to serve our members and bring in the public has also diversified. The Fourth of July we put on our first computer animation festival -- and had one of our best afternoons. This is now followed by a winter Thrusday evening films. A simple talk on "micro-mice" escalated into the Boston Mouseathon, described by Oliver Strimpel in the first article. Museum founder Alan Frisbie from Los Angeles wandered in for the day and didn't leave... and it turned out to be an appropriate repeatable event. A February kids fair included widespread participation, including Peter Rony from

Blacksburg Virginia.

Then, we also "fell into" doing temporary exhibitions in the area near the lecture hall. This started with the exhibit of the original Byte magazine covers put up to mark the magazine's tenth anniversary. The cover of this issue is from one of the works in a temporary exhibit called "The Electronic Paintbrush." The result of a competition sponsored by CalComp for their 25th anniversary, the exhibition was first put on at the California Museum of Science and Industry. It will be here until March 31. "Colors of Chaos" an extraordinary set of computer generated fractal images will be on display in from April 10th through June ... The space works for such exhibits and we would like your suggestions of other things that might be appropriate for the Museum to show.

Before we moved, the annual benefit was established; our fund-raising efforts have also grown and diversified. The Marlboro "yard sale" was transformed into an even more successful "attic sale" appealing to the collectors and tinkerers. In December the first "Real Time Event and Auction" was held providing fun with lots of special holiday purchasing as evidenced by the Report at the back of this issue. Feburary's Fortieth Birthday Party for ENIAC was inspired by Member Annie Roe Hafer and heavily supported by Bitstream, a member company. June 8th will bring our annual with the Board of Directors and another chance to hear from one of them on the state of computing. Each of these are fun and fund raisers that appeal to different parts of the Museum's audience allowing alot of participation of the members with the staff.

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The suggestion box is open. Most of these ideas came to us from members and then they grew. In just reviewing this, its clear to me that the Museum has one of the best and most interested member's groups. And, we're here because you are too.

LIST FOR PACKAGES OF 25TH ANNIVERSARY POSTERS
GB3.S14.8

# PACKS	PERSON	ADDRESS	PICKED UP
18	JOHN O'BUCK (225-4043)	HL02-2/L06	

# PACKSPERSON	ADDRESS	PICKED UP	
3	SUSANNAH NATHAN	MRO1-2/E16	YES
2	BILL JOHNSON	MLO12-3/A62	YES
1	DICK CLINTON	MLO12-2/A16	YES
1	GRACE CIUFO	MLO6A-3/T84	YES
1	DON METZER	MLO1-5/B98	YES
2	SAM FULLER	HL2-3/N11	
1	STEVE TEICHER	HLO2/N07	
1	BILL HEFFNER	ZKO1-3/J35	
3	BERNIE LACROUTE	TWO/A08	
1	DIGITAL MUSEUM	MRO2-1/A4	
2	BILL DEMMER	TWO/D19	
1	DAN HAMEL	LM02	

DISTRICT SALES MANAGERS

SOUTHEAST, ATLANTA	ALBERT TETRAULT	ATO
NEW ENGLAND, BURLINGTON	MIKE MARSHALL	OFO
SOUTHERN, CHARLOTTE	FRANK BOWDEN	CEO
CENTRAL, CHICAGO	JACK BAUM	RLO
MID-ATLANTIC, CINCINNATI	CECIL DYE	CYO
SOUTHERN CALIF, COSTA MESA	AL PIRES	CWO
ROCKY MOUNTAIN, ENGLEWOOD	ROY WICKLUND	DVO
CENTRAL, NOVI MICH.	JIM DALE	FHO
SOUTHERN, HOUSTON	MURRAY COOK	HSO
SOUTHWEST, CULVER CITY	SHEL SHERMAN	LAO
SOUTHERN, MEMPHIS	JIM GALLAGHER	MMO
NORTHEAST, MERIDEN	HOWARD WOOLF	MDO
NEW YORKJERSEY, NY	JON CAPUTO	NYO
MID-ATLANTIC, BLUE BELL, PA	RON HEVEY	PHO
SOUTHWEST, PHOENIX	GARY PATTENGILL	PXO
NEW YORK/NEW JERSEY, PISCATAWAY	JAMES MANIAS	KYO
NORTHEAST, FAIRPORT,NY	MICHAEL DILLON	RCO
CENTRAL, ST. LOUIS	NEAL HOUTZ	STO
WESTERN, SAN FRANCISCO	APURVA CHANDRA	SZO
WESTERN, SANTA CLARA	JOE DINUCCI	WRO
WESTERN, SEATTLE	JOHN HANNAHS	SEO
NEW YORK/NEW JERSEY, SOMERSET	RICHARD GORTIER	SJO
NORTHEAST, WALTHAM	JIM PITTS	WAO
MID-ATLANTIC, LANDOVER	FRANK POSEY	DCO
INT'L MKT DEV DIST (IMDD)	RAY LINDSAY	LKO
MELBOURNE, AUST.	NIALL MILTON	MEO
SYDNEY, AUST.	LES HAYMAN	SNO
CALGARY, CANADA	DAVE THOMAS	CGO
MONTREAL, CANADA	JOHN C. LAMB	MQO
OTTAWA, CANADA	EVERETT ANSTEY	OTO
TORONTO, CANADA	BOB LUNDVALL	TRO
TOKYO, JAPAN	ED REILLY	TKO
AUCKLAND, NEW ZEALAND	ALLAN BAKER	NZO

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June 6, 1983

William Perry
Hambrecht and Quist
235 Montgomery Street
San Francisco, Ca 94104

Dear Bill,

It was a pleasant surprise to meet you in California and learn of your interest in The Computer Museum. Bob Everett has been a splendid supporter of our efforts from the very beginning and delighted with your offer to help.

Several recent issues of the museum's quarterly, The Computer Museum Report, are enclosed. They can give you a better feeling of what the Museum has, what it does, and its first supporters.

More to the point, the press release about our move to Museum Wharf in downtown Boston is enclosed. This has thrust the museum from its incubation stage within a Digital building to having to fly on its own wings downtown. This fall we will be undertaking a $5 million capital campaign in order to accomplish this move and provide a small endowment. You can be of the greatest help by joining Lester Hogan's team of solicitors on the West Coast.

Bob plays the role of overall Chairman of Fundraising and I'm on his committee so any ideas that you might have please let one of us know.

I'd be happy to show you around the Museum on one of your trips to Boston and will keep you informed.

Cordially,

Gordon Bell

Vice President of Engineering,
Digital Equipment Corporation

Director, The Computer Museum

June 6, 1983

Brian Randell

Dear Brian,

Gordon and I are both home for the summer. And I am beginning to feel relaxed, rested and ready to face the new opportunities ahead.

Oliver Strimple has been here for the last three weeks and I believe is quite excited to come to the States for a year. He is not interested in a "historic" gallery per se, but in doing a thematic gallery with an historic approach. He will probably do one on "The Computer and the Image" that will open in November 1984. If all goes well, Oliver will come January 1984 and leave a year later. It is not yet fixed with his director so please don't talk about it.

Jamie, Beth, Meredith, Bruce McIntosh (designer), and I will be working on revamping the present materials to do an integrated historic exhibit (using video) and being much more involving. This will open (with luck) on May 11.

As the Chairman of the exhibits committee, I think it would be a very good idea if you would/ or could call a meeting sometime in the winter to review what we will be doing (before it is done). The best time would be between November 1 and February 1. We'll work out a way to bring you over.

Then I think that a meeting of the committee on May 13th - Saturday - to review Oliver's ideas would also be a good idea.

The committee is made up of you, Ken Olsen, George Michael, and Eugene Fairfield (who declined). See enclosed letter. I will see if we can get an alternative IBMer, or a least, I. Bernard Cohen. Any other ideas? Let me know your preference on this.

CBI Bibliography. I'm enclosing my critique. It was written on just an awful terminal that we had in Gordon's hotel room in California. But the job got done. We approached the same problem from different angles.

Books at the store. Books still make up 25-30% of the purchases at the store; but for the amount of inventory and diversity that we must keep any individual title moves quite slowly. Yet, we believe that this is an important element in our stock and perhaps over the years, people will get into the habit of buying from us. (But, I believe that your remark on books at Sturbridge probably were much less costly and technical books than we carry.) Books like Randell, History of Programming Languages, History of Computing in the Twentieth Century, etc. are not impulse purchases. The best selling books are: Computing Catastrophes ($11.95 paper); Soul of a New Machine ($7 paper); Discovering Computers ($10.95 for children); 101 Basic Games
($10 paper). But the people who find the historical book that they want at the museum are very happy.

Thanks for coming,

Cordially,

Gwen Bell
Director

June 6, 1983

Walter Safford
GTE

Dear Walter,

Delighted that I had the opportunity to meet with you -- even for such a short time.

We are very interested in your participation in The Computer Museum and that of GTE. In particular the whole area of applications is an important story that needs to be told. Without insatiable users experimenting and demanding more and more equipment, the progress would have been much slower and computing much smaller.

At the very least, we would like a good copy of the first computer generated telephone bill. Then we would like some ideas of what you think we might do to tell the application story. The time to do this is now, since The Computer Museum is planning its move to downtown Boston. I'm enclosing a copy of the press release regarding this move.

The move to Boston means that The Computer Museum will be weaned from its protective Digital incubator -- and must stand on its own as a generic museum for the entire industry. We have been very fortunate to have been able to get ready-made museum space at a very favorable price allowing us to make the move with a $5 million capital campaign in the fall of 1982. This will get us into new quarters with 55,000 square feet and provide a small endowment to pay off the Industrial Revenue Bond of $1.6 million (at 8.5% interest). Can we count on you to help? What ideas do you have? The Museum is at a very formative stage and your ideas will really count.

Looking forward to hearing from you,

Cordially,

Gwen Bell
Director
18 October 1982

Dr. Arnold Weber
President
University of Colorado
Regent Administrative Center
Boulder, CO 80309

Dear Dr. Weber:

I'm really sorry that I can't attend the dedication ceremony on October 26, but I would like to visit you the next time I'm in Colorado Springs. As you know, we strongly believe in supporting this kind of relationship and stand ready to help in order to set better training of engineers.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:S8.20

In Macro Wonders From the Latest Micros, December 10, 1984, my picture appeared with a printed circuit board from what I believe will be an impressive, "multi". The above photo is of the founders and leaders of Hydra Computer Corp., a wholly owned Encore company, who did the real work and deserve the credit: Dave Schanin, architect; Russ Moore, head of hardware and Steve Chapin, head of software.

Gordon Bell
Chief Technical Officer
Encore Computer Corporation

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Gordon Bell
Chief Technical Officer
Encore Computer Corporation
Mr. Henry D Pahl, Jr. Esquire
Kenway and Jenney
60 State Street
Boston, Massachusetts 02109

Dear Mr. Pahl:

Enclosed are the following documents which describe the Hydra Computer Hardware:

Hydra Architecture Summary Rev. 1.3 11/8/84
HydraBus Specification Rev. 2.2 4/30/84

Hydrabus Memory Specification Rev. 0.1 5/84

HydraSystem Steve Corbin Module Spec Rev 1.2 7/6/84 and
Chapter 3, System Control Card System Programmer's Guide
-essentially the same as spec, but from programmer view

Hydrabus DPC Spec Version 2.1 9/13/84 and
Chapter 2, Dual Processor Card System Programmer's Guide
-essentially the same as spec, but from programmer view

Hydrabus EMC Functional Specification Rev. 1.0 July 1984

I recommend that they be read in roughly the order given above. The first document is a user and marketing overview, but it does give a context for descending into the details of the other documents.
Rather than spending a lot of time looking at these documents which lack most of the details and issues regarding potential patents, I believe they should be studied in a cursory fashion to gain some familiarity with the computer.

In accordance with our phone call on 11/21, I look forward to the meeting at Hydra Computer in Natick at 9:00, on Friday, 30 November to go over the details of the design with the engineers who developed the product.

Sincerely,

Gordon Bell
Chief Technical Officer

CC:
Henry Burkhardt
Len Hughes
Russ Moore
Dave Schanin

September 15, 1982

Dr. Per Brinch-Hansen
Henry Salvatori Computer Science Center
University of Southern California
University Village
University Pack
Los Angeles, CA 90007

Dear Per:

Sorry I couldn't come to your seminar as my secretary indicated earlier.

Congratulations on your well deserved appointment. I look forward to seeing a report of the seminar.

Sincerely yours,

Gordon Bell
Vice President,
Engineering
Digital Equipment
Corporation

GB:ds

<GB3.S7.30>

PARALLEL COMPUTING

NETWORK - with LAN or WAN interconect
CLUSTER - with LAN interconect
FUNCTIONAL - one processor per function
CLOSE AREA NET CLUSTER - high speed interconnect
TIMESHARING - one processor per user
PARTITIONED - one processor per process
TRANSACTION PROCESSING - processor per transaction step
FAULT-TOLERANT - different processors assigned per step with redundant computation
CONCURRENT-TASK - parallel processing of a task by partitioning for independent data
PIPELINED-TASK - parallel processing of a task
PARALLEL PROCESSING - processors work on a single task

"If a computer understands English,
it must be Japanese."
-Alan Perlis

THE FOURTH GENERATION

- **Evolutionary use** based on traditional word and data processing, machine-aided engineering and manufacturing, and embedded computing
- **massive inter-communications** and **productivity needs** to increase use
- **well-developed technologies**, including powerful VLSI microprocessors, LANs, magnetics, displays and standard software
- **new organizations** to build new computer structures, but

- **new uses** that evolve from greater access won't be apparent for at least a decade

----

THE NEXT GENERATION: REVOLUTIONARY VIEW

- **Revolutionary use** depending on voice and natural language communication
- **sophisticated inter-communication and productivity needs** including robotics, speech and natural language,
expert systems to handle complexity and improve productivity
- **robotics**, and **artifical intelligence**,
fast-WANs to serve LANs,
based on **U- and VLSI and parallelism** technologies
- **avant garde organizational co-operation**
between researchers and industry to pioneer new computer structures

----

THE NEXT GENERATION: EVOLUTIONARY VIEW

- **Evolutionary use** with widespread **electronic mail** and **electronic-based logic** to encode knowledge (eg. CAD/CAM)
- **need to have information at "fingertips"** (in the system and not in papers and books)
- **evolutionary technology** with larger, distributed memories
- **new companies** to build with evolving technologies

A **GENERATION** is the convergence of:

- **need** (eg. threat of annihilation, greed) freeing resources
- **technology and science** that provide for building machines
- **organizations** that build new **computing structures**

- **use** to confirm a generation (after the fact).

LIMITS TO MICROSTRUCTURES

THE TECHNOLOGY PROCESS TO BUILD IT (e.g., instruments and robots)

DESIGNERS AND COMPUTER AIDED DESIGN

IDEAS FOR NEW STRUCTURES

LACK OF STANDARDS -- TOO MANY STANDARDS

ALGORITHMS FOR EFFECTIVE USE

EDUCATION OF INTERDISCIPLINARY ENGINEERS AND SCIENTISTS TO APPLY

MARKET SIZE AND USEFUL APPLICATIONS

COMPETITION FROM THE JAPANESE

Mr. Bell asked me to make sure this got out to you.

He dictated it and then went on a business trip.

Louise Principe

July 13, 1978

Mr. George Lindamood
National Bureau of Standards
Building 225, Room A231
Washington, D. C. 20234

Dear George:

When you and I set up Tuesday's appointment for me to talk informally with you and the Government's outside economists about what form the Government's proposal for relief in the IBM case, I was not aware of matters which now seem to make it inappropriate for me to talk. First, the company's lawyers are of the opinion that Dr. McAdams is a likely witness in support of whatever relief the Government may propose. Second, the company's lawyers believe that Digital, as a company, will be given an opportunity to present its views in Court as to what would consititute appropriate relief.

The significance of the first matter, as I understand the situation, is that the Court has the power to allow interrogation of Dr. McAdams as to his sources. As a result, I could become embroiled in "discovery" by IBM as to what I did or did not tell Dr. McAdams. The significance of the second matter, as I understand it, is that Digital might well want to present the Court with an affidavit as to my opinions as to what the future structure of the "computer industry" should be. From that point of view, the company might well prefer that I remain independent of Dr. McAdams' "data base" in preparing the Government's position.

I do not wish to appear uncooperative. While I and Digital may question the wisdom of instituting major changes in the structure of the computer industry, we will continue, to provide discrete pieces of information without legal compulsion. This willingness may even extend to providing the Government with a limited number of opinions as to the predicted course of events as to <u>specific</u> aspects of the industry; <u>e.g.,</u> projected impact of fringe developments, such as videotape. However, any such expression of views would be a company function, not an individual one. As in the past, any information provided to the Government would also be made available to IBM.

I personally regret that Tuesday's meeting was not the constructive one which we had foreseen. Both sides were trying to adjust to unforeseen developments, which is always a difficult task. From my point of view, I expect our relationship in standards and commerce to continue and I look forward to an exchange of views on the Japanese computer and semiconductor industry after we have both returned from Japan.

Since our discussion I have re-read the first three chapters of my forthcoming book on Computer Engineering. I believe they give the basis for many aspects of the view I was thinking about. I would be happy to forward to you a copy as soon as it's available.

Again, I'm sorry for the inconvenience.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:ljp
ID#0172

CC: Steven Woghin
Alan McAdams
Charles Osborn
Ed Schwartz
Ansel Chaplin
Sid Fernbach, LLL

August 16, 1983

George Lindamood
Department of the Navy
Office of Naval Research
Liaison Office, Far East
APO San Francisco, CA 96503

Dear George:

As you can see, I've changed my affiliation. Please change my address accordingly. I'm enjoying your observations about Japan.

I hope your're getting lots of input from the various corporate visitors there. Let me urge you to establish a strong tie with DEC Japan. This can best be done by interfacing with Grant Saviers who the Tokyo group reports to.

Your observation on the 5th generation effort is really correct. More important, I believe, is that Japan has correctly called out the future and have said they'll challenge all comers to race for it. In the past, we have never raced for or even admitted that there was a long range target in computing. While this is significant in itself, the main effect of the project is that a dialog has been opened up with the rest of the world that did not exist. Now they're able to get some real insight, intelligence and feedback about computing which they do not know possess to any degree. In contrast, even today, the Japanese have been late into the PC market which I think is due to a fundamental lack of understanding computers. The project has sucked us in to not ignoring them, and forced us into a race that's structured on terms that are clearly not to our advantage!

Sincerely,

Gordon Bell
Chief Technical Officer

GB8.12
GB5.8

F.Y.I.

Harvard University
CENTER FOR RESEARCH IN COMPUTING TECHNOLOGY

C O L L O Q U I M

"ARCHITECTURE OF THE LISA PERSONAL OFFICE SYSTEM"

Mark Cutter
Brad Silverberg
and Colleagues

Apple Computer, Inc.

Thursday, April 14

1:00 - 3:00 P.M.

Pierce Hall 110

ABSTRACT

This seminar will give an overview of Apple Computer's newly released product, the LISA Personal Office System. It will begin with a live demonstration of the electronic desktop user interface, followed by a three-part technical discussion of the underlying architecture.

Demonstration of the electronic desktop user interface will illustrate use of the mouse, multiple overlapping windows, document filing using icons, integration and sharing of data among the five major applications, as well as selected features of the applications.

The first part of the technical discussion will detail the architecture of Lisa's most distinguishing characteristic, its innovative graphics sybsystem. Two challenging problems were meeting the speed requirements of an interactive system, and developing a window manager that both multiplexes events and efficiently handles non-rectangular screen updates. A variety of graphics primitives had to be supported, as well as high-resolution printing.

The second part of the technical discussion will cover interesting aspects of the hardware, including constant linear sector size of the floppy disk drives, softpower-off and disk eject, and packaging. It will also discuss details of the in-house developed, single-user, multi-processing operating system.

The third part of the technical discussion will describe the Pascal-based development system used to write LISA applications. The interchange mechanisms developed to support data sharing between applications will be discussed, as will be the Lisa Toolkit. The Toolkit makes it easy for third-party developers to write software integrated into the Lisa Office System.

Host: Professor Harry Lewis

Aiken Computation Laboratory
Cambridge, Mass. 02138

HIGH PERFORMANCE AI

Given the (hopefully) blazing speed of the 2080, we should re-establish ourselves as the leader in this market. The irony is that the six targetted LISP, and now, 20 years later, LISP appears to be coming into its own. Right now the AI researchers need this because they've run out of address space and are switching to the Symbolics and LISP machines built by new startups. The machine will get faster and approach a KL. Thus, it's really important to get a LISP without memory limits AND a much faster machine to address new problems. This will "get" the AI market at many sites.

PERSONAL LISP MACHINES

Symbolics and LISP machines are making merry. Ironically Symbolics is evolving their machine for Fortran, C, Pascal etc. as their customers need it.

Also, Symbolics notes that the machine's special memory management functions are being removed and put in software as the microcode is too inflexible.

Similarly Xerox, PERQ and Appollo are probably heading to sell LISP.

We need LISP on a personal VAX and it also requires the high resolution VT - (Agate, Onyx, Opal) terminals to support it.

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION   DATE: THU 6 MAY 1982 1:23 PM EDT

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: LISP AND AI MARKET

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Figure 1.15"Onion-skin" model of a computer system as seen by various users.

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2	BILL JOHNSON	MLO12-3/A62	YES
1	DICK CLINTON	MLO12-2/A16	YES
1	GRACE CIUFO	MLO6A-3/T84	YES
1	DON METZER	MLO1-5/B98	YES
2	SAM FULLER	HL2-3/N11	
1	STEVE TEICHER	HLO2/N07	
1	BILL HEFFNER	ZKO1-3/J35	
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Subject: **LLL BASIC, Is it Our Standard?**

To: Jerry Witmore, PK3-1/M40

CC: Dick Clayton, ML12-2/E71
Len Halio, ML1-2/H26
Bill Johnson, ML21-3/E87
Bill Keating, ML12-3/A62
Pat White, ML12-3/E51

Date: 1/17/79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

follow up 2/7/79

The GIGI terminal you are considering marketing might have the BASIC chip designed by LLL in it. This brings up two interesting questions:

1. With the press to the strategy of distributed processing based on a standard set of languages and architecture, is this version of BASIC we would buy from National and designed by LLL an exact subset of DEC BASIC?

2. This is further support of the 8080 ISP which we agreed not to do. The first policy was a set of fixed programs which shielded users from investing any programming in the 8080. While this was targeted at doing anything that made the 8080 visible (and investable) to field support and our users, putting out this BASIC gets closer to this region.

Assuming the product is crucial in the time frame and that we aren't going to get Tiny in time, I would feel we could still have a viable and good strategy if the LLL BASIC is a <u>true</u> subset of DEC BASIC.

What do yous think here?

D I G I T A L INTEROFFICE MEMORANDUM

DIST: Dick Clayton ML12-2/E71 Len Halio ML1-2/H26
Bill Johnson ML21-3/E87 Bill Keating ML12-3/A62
Pat White ML12-3/E51 Jerry Witmore PK3-1/M40

February 9, 1979

Dr. George Michael
Lawrence Livermore Lab
University of California
P.O. Box 808
Livermore, California 94550

Dear Dr. Michael:

Gordon confirmed what I related to you. He hasn't received the CDC6600, 7600, Star, or Cray pieces. He is still most interested in them.

Gordon sent you a copy of his new book, "Computer Engineering" via Roger Anderson yesterday. Hope you enjoy it.

Sincerely,

Mary Jane Forbes
secretary to Gordon Bell

MJF:ljp

GB0001/9

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i n t e r o f f i c e
m e m o r a n d u m

SUBJ: **Los Alamos/Livermore Labs Conference on High Speed Computing and Some Action**

TO: Distribution

Date: 4/8/81 Wed
From: Gordon Bell
Dept: OOD
MS: ML12-1/A51 Ext: 223-2236

EMS: @CORE

George Michael and Bill Buzbee put this three-day conference of about 100 people together to communicate among LASL, LLL and a few other users, some academics (Dennis, Kuck, Fredkin, Schwartz) and builders (ACSYS, Amdahl, Burroughs, CDC, Cray, DEC, FPS, IBM, SEL).

Summary

VAX is a support processor now in this part of the Technical Market. Scorpio, at 780 power, is a pivotal machine because it could provide many scientists with personal computers of Cray 1 power since only a few get at most one hour of Cray 1 time and a 780 is generously regarded to be 1/25 of Cray 1. They want a bigger VAX from us (and SEL is going to soon announce a 3 x 780). They also understand and want VAX architecture to support:

.
vectors
.
multiprocessors and
.

interactive computing with very good graphics

<u>Their Messages</u>:

. High speed computers are vital to our defense/energy needs.

. They want bigger (more memory), faster (2-5) x Cray 1, compatible, easier to use (interactive) computers. Their desires are a factor of five. (During the 70s they got only 2-4 x performance [Cray's 6600, 7600, Cray 1].)

. Seymour Cray could solve their problems if he believed in caches for large memories and virtual memories. They ran out of physical memory, since they use them timeshared.

. Interaction means: being able to see what's going on via graphics, being able to guide the programs, and being able to stop them before they compute too much nonsense.

. Graphics, including color is vital to their computing.

. They believe in (want) vectors ala Cray and CDC 205.

. They believe in (want) multiprocessors even though they have no experience with them.

Tidbits:

The Japanese are coming with a 3 x Cray 1-5 in 1983!

SEL will announce a 3 x 780 ECL 10K in April, delivery July, upward compatible and using old peripherals and memories. They are 60 percent OEM in n.s. mini market, selling 600 machines @ $200K for $120M revenue. No vectors. A uniprocessor. Len Hughes is responsible for hardware, software, and manufacturing.

FSP ships about 600 floating point processors @ $70K. Their new machine with 64 bit floating point might get up to 40 mops with 20 mips at a 50 ns cycle. This is 3 x faster than now. About 75 percent of their machines go on DEC hardware. They are planning to connect to the DR780. This is wrong. It has to be CI! It will take them 14 months after they start.

Carl Amdahl was there, but Gene was out raising the rest of the $100m they need to get ACSYS going. CII-Honewell - Bull invested $8M and have access to their semis. They are going for large, ECL gate arrays not CMOS. They would like to talk with us about a joint venture whereby we could also use their technology.

Bob Barton was there, having just resigned from Burroughs. His notable quotes:

"I quit, but I think they'd have fired me. I never did like cigars."

"My only vested interest is in change."

"Blumenthal's rebuilding Burroughs from deadwood."

.

"Burroughs will probably end up as a front for a Japanese corporation."

.

Burroughs (Blumenthal) had just stopped work on the BSP, Burroughs Scientific Processor. They've stopped work on their high speed semiconductor circuits.

.

John Cocke, Herb Schorr, and several others from IBM were observing. John has built a hardware box to assist in simulation. IBM is really pushing on design turnaround!

John asked me about the effort on the HP 450K transistor chip - we agreed it was approximately 75 man years. He replied, "Boy when those folks learn about computing, we'll all be in trouble"!

.

IBM is adding vector to the 370 architecture.

.

CDC is bidding on a super computer for NASA wind tunnel. Their designer, Niel Lincoln believes they can get 15 gigaflops. The gestation time CDC is aiming for is 4 years on these very large computers.

.

Jack Dennis talked about data flow machine. He benchmarked it on the weather problem. He posited a machine with only 3000 chips (including memory) that would be 100 x Cray 1. I want us to help him build it _if_ it can be built.

.

Dave Kuck, University of Illinois, described their program used to analyze various machines and programs for parallelism.

.

Tim Rudy suggested their VAX might be 1/25 of a Cray.

.

Barry Oliver of HP confirmed they were putting together a first class research lab for computing headed by Joel Birnbaum. Jim Bell is the liason to the development groups. They are putting $20M/year incrementally into this ASAP! Sounds like we should sell 'em machines. (I'm glad we're 10x as bright and more efficient.)

Action

1.

Connect the FPS via CI - we should decide that CI is a public interconnect and get the FPS Array Processor connected to it. I'd like this cleared in our bureaucracy so that when their VP of Engineering visits here in May we can get him to describe the FPP and outline how to connect it to VAX via the CI!

It could be operational as early as June '82. This will both help against SEL and also let people build high speed systems. Bill, can you get someone to take charge of this now?

2.
780mP for Performance Systems - must sell both labs on installing quad processor 780s. We have truly good hardware for it. I believe they are fundamentally convinced that they need this experience before going on to building Quad Supercomputers. (It could also be useful against SEL). This also gives us another shot at getting performance without a technology investment. It also prepares us for Scorpio.

3.
VAX Software Against SEL - software is another way to hold off SEL (and future IBM). I believe we should direct our work at graphics, debugging, control of multiple processes by simultaneous viewing of many parts of an active program etc.

4.
Accelerate Venus - SEL's going to be a pain. We must speed up Venus by:

.
getting it right in the first place via simulation of whole machines not just the MCA's. Ulf should look at our simulation effort which seems to be of questionable use. Tom McWilliams will visit in May and review how they've simulated their new machine (at 7 sec/50nsec clock).

.

getting a Multiwire facility so that we achieve our One Week Turnaround Goal. IBM has many of these in their facilities for prototyping and possibly some production...let's follow! John Cocke, one of IBM's brightest computer scientist/engineers believes it is the best way to build high speed machines. It's more dense and easier to work with then PWB's! We must get into a
non-proprietary higher level language quick. Note BLISS doesn't let us move our CAD tools to other machines such as Cray when we need the speed.

5.

Scorpio - is super vital! At the same power of a 780 it represents a great machine, and an alternative (I believe) to a Cray 1 for many scientists as a personal computer. Note that since a 780 = 1/25 of a Cray, and since few get more than an hour a day, this is an enormous amount of computing. We should also get Scorpio to be used as a quad processor for larger computer. This is why the multiprocessor experiments at LLL & LASL are essential.

6.

Amdahl's (ACSYS) Technology - Ulf should take the leadership in obtaining ACSYS technology.

7.

VAX Architecture Enhancements - for high performance vectors are essential! I'd like to have Bill Strecker convene a small group to do this. The most elegant way would simply be to put 16 vector registers of say length 64 as extensions to the 16 Scalar register sets and have all instructions that are Scalars be vectors of length n specified by some register.

Lloyd Dickman, Dave Kuck, and these folks should all be helpful critics. This seems essential to have VAX vital as a technical machine. Note if we build something that will have a 3-10 x speed improvement for vectors over Scalars, then assuming a given problem can use vectors 75 percent of the time, then this gives us a 2-3 x speed up. (A paper is being sent around.)

8. Dennis' Data Flow Machine - this is the first time this made sense. Jack is going to meet with us in Marlboro, on April 14 in the afternoon. Sam and Ulf should sponsor and invite Ivan Dobes, Dave Cane, Dave Orbits, and others who are interested in high speed machine. I offered to build several chips for him, if he'd design them - presumably using 4 micron HMOS. This would also help get FTA working. If there's a good idea, I'd like to build the machines.

Bottom Line (Technical Leadership)

I don't think we're driving our resource allocation right. The Technical Group is selling 70 percent of the machines and we run a high risk of losing this market by not driving VAX hard enough in this market. We have to change! In retrospect, IBM gave up the university market as they went totally commercial. There appears to be only a few unique features for this market, and we're spending money that appears to go after the more traditional IBM commercial business.

Let's get Scorpio, plus go for these changes:

Technical	Commercial
+ Multiprocessor	slow down Hydra
+ Architectural enhancements	
+ Relational data bases	less TPSS
+ Graphics uniqueness	

We must get a way to measure the dimensions of VAX so we can allocate resources explicitly, rather than implicitly. Some dimensions:

. real time

. security

. files, data management

. programming environment (productivity for various user classes.)

. user interface, including graphics

. languages (commercial, technical, both)

. network and distributed processing

GB2.S5.7

Dist: Eng Staff
GVPC
Bill Avery, MR2-4/E79
John Buckley, HZ
Joe Carchidi, ZK1-1/D42
Dave Cutler, ZK1-1/C27
Lloyd Dickman, U. of California
Bob Glorioso, ML3-2/E41
Rich Grove, ZK1-3/D40
Bill Heffner, ZK1-3/J35
George Hoff, MR1-2/E47

Dick Hustvedt, ZK1-1/D42
Alan Kotok, ML2-2/H33
Ward MacKenzie, PK3-1/A60
Joe Meany, MR1-1/M40
Joel Schwartz, MR2-4/T75
Pete Smith, MR1-1/M42
Bill Strecker, TW/B05
Steve Teicher, HL1-1/R02
Maurice Wilkes, ML3-2/E41

15 November 1982

Mr. George Michael
Lawrence Livermore Laboratories
University of California
Leader, Computer RES Group, L-76
P. O. Box 808
Livermore, California 94550

Dear George:

Thanks for the presentation to the Alpha Omega group. I think we covered a lot of ground, and the work looks interesting.

I am concerned about your priorities. I hope there's some way we can help get some multiprocessor work started there in the next few months before you are faced with TWO new multiprocessors (CRAY 2 and S1) that you're supposed to use. I find it impossible to understand why you are not doing the basic work on a real machine such as the 780 multiprocessor, with 4 processors, when the machine has been available so long. It would seem that it would make sense to leave the farther out work on Dataflow to the universities until you get this basic work done. Therefore, I don't have much sympathy with the statement that you have no people to do the work. Anyway, so much for the free advice.

Since I've heard so many concerns about the S1 in the form of rumours, I was happy to visit it at last. Based on the brief presentation and confidence of Tom and Lowell, I am quite impressed and supportive of the machine. If they accomplish their plan of the IIA, moving to multiprocessors and the III, this will be a major accomplishment.

Again, thanks for the hospitality.

Sincerely,

Gordon Bell
Vice President of Engineering

GB3.S8.44

15 November 1982

Drs. Lowell Wood and Tom McWilliams
Lawrence Livermore Laboratory
University of California
P. O. Box 808
Livermore, California 94550

Dear Lowell and Tom:

Thanks for the hospitality and fine dinner when I visited San Francisco and Livermore last week. I especially enjoyed the visit to the S1.

Since I've heard so many concerns about the S1 in the form of rumours by people outside the project, I was happy to visit it at last. Based on you brief presentation and confidence, I am quite impressed and supportive of the machine. If you accomplish the plan outlined in your talk (the IIA, multiprocessor IIA's and the III) this will be a major accomplishment... comparable to a "Cray". The wafer based machine, of course, is exciting too, but beyond my visibility.

The innovation in the machine and design tools is really exciting, and almost independent of how well it performs across a wide set of benchmarks, it is worthwhile to build the S1. Like vectors, it may take users time to fully use the fast, built-in functions. I am especially sympathetic about the issue of building in so much into an architecture using microprogramming at a time the world has just re-discoverd simple, hardwired, Cray-type machines (RISC,801,etc.). With VAX, we also tried to build in all the necessary functions we could for the price. It will be interesting to see the comparative benchmarks because the Cray and S1 are so different in structure, and basic clock speed.

Again, thanks for the hospitality. I trust the world will know when it starts running. If I can be of any help, please let me know.

Good luck,

Sincerely,
Gordon Bell

GB3.S8.46

****
* d i g i t a l *
****

TO: BERNIE LACROUTE DATE: FRI 6 NOV 1981
5:22 PM EST
BOB SAVELL FROM: GORDON BELL
cc: SAM FULLER DEPT: ENG STAFF
BILL STRECKER EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: LNI/REPEATER BY THANKSGIVING

The LNI's trivial groups are meeting. Please stop all meetings and
ask the attendees to come with breadboards within 2 weeks! We don't
want an optimum design. We want a design. To not have a breadboard
is a disgrace.

After the 2 weeks, set a deadline for the repeater of 1 more week.
Get it out.

I expect to be running these by Thanksgiving 1981. At the demo, I'd
like to discuss the gateways too.

GB3.S2.32
<item>INTRIN INCORPORATED REPORT
<to>BOB DOCKSER
<ext>
<date out>11/5/82 Fri 8:52
<approx ret date>
<>

<item>DEPARTMENT OF ELECTRICAL ENG. AND COMPUTER SCIENCE, MIT
LIFE LONG REPORT.
<to>JEFF KALB
<ext>225-4025
<date out>10/14/82 Thu 13:46
<approx ret date>
SUE NATHAN WOULD LIKE TO BORROW WHEN IT COMES BACK
<>

<item>IBROTHER PORTABLE TERMINAL
<to>TOM DUNDON AND YASH GARGE
<ext>3-8305 ML5-3
<date out>8/20/82 Fri 11:30
<approx ret date>SAID THEY PAID FOR IT, SO THEY CAN KEEP UNLESS WE NEED

<>

<item>OVERHEAD PROJ.
<to>KATHY JOHNSON
<ext>8054
<date out>8/3/82 Tue 9:36
<approx ret date>8/3/82 Tue 9:36
<>

DRAFT 8/21/80 Thu 3:25

Digital Computing Museum
for the preservation of computing history.

PROPOSED PROGRAM

Collections and archives: maintain 50/50 DEC/non DEC--triple number of artifacts shown and stored. Develop a catalog.

Tours and visitors: Move from an average of three special tours per week (Fall 80) to three special tours per day, plus a large number of ad hoc tours.

Exhibits:

Ground floor lobby - Set up with permanent exhibits.

Elevator spaces -- Established for travelling exhibits that will change.

Stairwell -- Established with a time line of the history of computers -- with computer portraits and appropriate artifacts starting with 1936 to the present day.

Corridor to cafeteria -- Expansion of pre-computer computing device exhibits.

TX-0 and Whirlwind exhibits

enhanced and documented. TX-0 should run with demonstration programs that are documented with video-tape before it is once more decommissioned.

Software - incorporated and explained in exhibits.

Computer art. The Cohen mural, painted in 1980, will be complemented by a second mural in 1982, and a piece of computer generated and user activated music in 1981. Art will be added on a yearly basis.

Viewing room on triangular office with full set of 10 one-hour video tapes of pioneer computer lectures and a number of 10-15 minute audio-visual user-activated tapes including the Whirlwind film, the EDSAC film, the logic talk, the calculator talk, the LDP talk, and a film on how the Cohen mural was made.

Museum store will have moved from the lobby desk to the second triangular spaced room and will serve the visitors and Marlboro working population with books, audio and visual tapes, replicas of calculating devices, photographs, slides, postcards, posters, wall charts, and various computer history and computer user articles.

Events:

Quarterly pioneer computer lecture series will conclude with the tenth machine and the second series will feature pioneering software efforts.

Yearly event on computer and the arts.

Yearly event honoring a DEC history-making object, e.g., the April 80 VAX party. Other candidates: 20 years of 36-bits or 12-bits; or CAD; 10 years of RSTS, RT11, M, the LA's, VT's, Disks, DECnet.

Alumni gatherings for the TX-0 and PDP-1 to run programs and do video tapings.

Bi-annual event with publication of each DEC Press book in the history series.

Occasional scheduling for meetings for educational groups, eg., Sept. 27th meeting of ASTC committee preparing an exhibit on "The Computer in the Pocket." Suggest CBI board meetings, and other groups hosted by museum.

Gordon Bell, Keeper
Gwen Bell, Assistant Keeper

GB1.S5.65

To kgf staff, dudley
Subject: An interesting, immediate product: Designing High Quality Software

Lou Cohen has been engaged in teaching various software quality courses for the last several years with a great deal of success. The software comes out faster, has fewer bugs, meets specs, and requires less maintainence. While his teaching has been confined within a company to a very large number of hardware, vlsi and software engineers, he has a following outside too. The world is starting to ask him to give the course(s) full-time outside.

I propsed that he form a TRAINING COMPANY within Encore to do this. He has a partner, perhaps who'd attend to some of the administrative aspects. The two of them might take on the whole training for dollars bag, and get going now. The investment is such that we could get a payback in a month or two. Also, it's something that the sales force could sell.

Like any disciple of Demming's, he has a certain fervour and zeal. He's thinking about it, and before proceeding with us at all would like to understand if we are committed to quality from the top, down. Thus, everyone has to take the course, which we'd give for 1/2 to 1 day on the weekend. I agree with him!

The courses he envisions:
1. Introduction to Quality (ie. Demming) 3 days...
2. Introduction to Sofware Quality or Software Quality Workshop 2 days
3. Introdctuion to Inspections (for quality) 2 days
4. Overview (all 3) in 1/2, or 1 day
5. Combined course in 3 to 5 days

This could be started up within a month, requires only the printing of some course materials and an edited videotape from the Demming course. 15 Walnut could house the lectures. There's the usual logistics, PR, Sales and Advertising.

I think it presents an interesting and unique opportunity as our first deliverable product. What youse think?
.
9/20/78 Wed 14:31:15

Type up GB 3x5 card for 9/26 and leave on his phone monday. Clip PS memo & Marriot invitation to it. Other backup for 9/26 also attached here, but don't give to GB.

Check Ulf/Leng on GB going to Leng's staff--what time (hopefully around 7:30 as he does have his Jungle meeting). Where--Marlboro is probably best.

9/26 he is at PK3 all day--it is a tight schedule, so don't schedule anything else that day.

Marilyn Arbuckle has made all the arrangements for Monday. If you have any questions, she said she would handle it.

mj

```
+---------------------------+                                ID#0292
|   |   |   |   |   |   |   |
| d | i | g | i | t | a | l |   i n t e r o f f i c e   m e m o r a n d u m
|   |   |   |   |   |   |   |
+---------------------------+
```

Subject: **Let's Now Go Get the Low Cost Alphanumeric Terminal You Killed**

To: Carl Gibson, ML5-2/M11

Date: 10 OCT 78
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

Congratulations on killing the above terminal! You have succeeded when I failed in being able to stop the expensive IPG terminals that are nowhere near their sales plan, and create and perpetuate what will ultimately be an abortive, but is a low volume, high cost interface.

Having failed to stop the PDP-14, nearly all the graphics scopes (with little or no software or way of using them) and many other losing basically CSS products outside of CSS, I envy your lethal ability. Much corporate money and pain to our users would be saved if you can impact your secret to me.

Unfortunately your action on this product is opposite to my feeling and given the history of IPG products, I believe you are again wrong. The product is basically right, necessary for our users (not necessarily for us to build) and will become a fundamental part for use. The price will decline based on the LEDs and the cost, due to lower power, the small interface, and basic simplicity. The only condition that you could be right is that the product is so basic that it will be in such high volume to become a commodity, and hence we can buy them very cheaply as components. But then we still have to resell them and tailor them; however, with commodities we end up selling the system and someone gets the terminals so we do need some control, and it would be nice to get the profit too.

Basically in your decision I don't think the real users are identified very well because you don't have an understanding or view of what users do or could do with our computers (especially if we make TRAX go!).

My belief about high volume use:

1. TRAX will spawn an incredible demand for terminals because all transactions need to be captured. The easiest way is to give every "transaction maker", i.e., person, their own terminal. We'd program the multidrop protocol.

2. We would use it universally as lower cost consoles on all peripherals (e.g., Mass storage drives and subsystems) and computers (remote consoles).

3. Perhaps the most interesting use is as a standalone computer! Here the users would do all the things that require alphanumeric i/o. There are a number of these uses and each would be sold as specialized calculators are now. Here we'd need a plugable rom and special keypad to do the "tailoring".

4. As an appendage to a phone doing a number of control and data entry tasks. Here some non-volatile memory is probably also required.

Since there isn't an internal product interest, and since it is clearly a commodity like thing, and since we could probably use them internally as products, should we get some outside? Who (e.g., TI)?

GB:ljp

CC: Marketing Committee
Dick Clayton, ML12-2/E71

Bruce Delagi, MR2-1/M64
Ed Kramer, MR2-4/A67
Roy Moffa, MR2-1/M64
Bob Savell, ML5-2/E50
Grant Saviers, CZ

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Win Hindle	ML5-2/A53	Ted Johnson	PK3-2/A55
Andy Knowles	ML5-2/A53	Stan Olsen	MK1-2/A57
Bill Thompson	ML12-1/F41		
Dick Clayton	ML12-2/E71	Bruce Delagi	MR2-1/M64
Carl Gibson	ML5-2/M11	Ed Kramer	MR2-4/A67
Roy Moffa	MR2-1/M64	Bob Savell	ML5-2/E50
Grant Saviers	CZ		

To: Distribution

Date: 28 SEP 76
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

F/U 10/5

Q. Can we handle the market?

A. It's big and vast, and soon to be totally semi-vendor dominated with their attendant agressive development, lots of $ in development, lower profit, and faster turnaround. They may be too fast moving and too low profit to compete with.

Q. Is it safe to say that we should either get our act together here, or forget about this market?

A. The problem may be that tomorrow's microprocessor is today's minicomputer, and by not participating we may lose if we aren't able to continue to convince our customers they need our high overhead support versus the dedicatedness of the micro. In essence, we're to SiValley as IBM is to us.

Q. Have we missed the opportunity by either offering our small microprocessor (e.g., the 8) or dominating by packaging other microprocessors (e.g., 8080, 6800, 9900)?

A. Not clear it's lost yet...although it's fading rapidly. If we'd employed the module business to hold it, buyers may have moved to the semi-vendors to eventually get chips...not just software, boxes, and boards.

Q. What's not together?

A. We only have a product at the high end sum-of-boards level, and also at the system level (11V03), with no way to beat the cost (the expensive chips, bus, and green blocks) at lower levels of integration. It protects low end of mini-box, but is miles away from micro market of boards and chips.

Q. Why not use the 8 at the low end to go against INTEL, et al.

A. I don't know; but, since we don't sell chips we could steer users to INTERSIL. Also, I still fail to see why we don't permit WD to sell 11 chips. Does anyone else know why we don't?

Q. What would an aggressive market/product posture look like?

A1. Selling. Significant self-selling catalogs. Application engineers at the chip level. We would put on microprocessor courses including video/cassettes to get the info out widely. The universities and technical school training market has to be addressed so they do the education/selling like they did with minis. A recent survey showed we had only 5% activity in universities and trade schools and were a recognized micro. SiValley vendors are selling that we aren't a micro, but a mini!

A2. Software - Here we are doing nothing, but waiting for Silicon Valley to hire our people, build forces and attach us. We could build a superset of PL/M...following INTEL, or we could move people to Fortran, BASIC (not very good) or Pascal! We must have a product/direction! I don't have an opinion.

A3. Chip level products - We don't sell here now. We would offer 8, 11 as chips and work with both INTERSIL and WD to be high quality chip suppliers to the world...or we can try to kill them like we've been acting! More significantly, we have to either have compatibility with INTEL or Motorola at the bus level, or agressively go after the 1 chip interfaces needed to build small systems. These 1 chip interfaces include: UARTs (including DDCMP support), floppy controllers, display generators, digital i/o, and analog i/o so that a user can build a system up from chips easily.

A4. Board-level products - Our option list is sparse compared to semivendors and the box vendors (MITS, Prolog). We probably have to consider board relayout to get over green blocks and large pin count that limits us. Also, we could supply all processors (8, 11, 6800, 8080) on boards! For now, we should migrate to a Q-bus only to get volume with Q-Unibus conversion! Let's use the OEM channel to get volume for our end-user lines.

A5. Systems/Box level - We're doing a lot (e.g., 11V03, Boxes, Krypton) but probably have to do more! More would be:

1. Design/Debug system. Appropriate interfaces so a user could design and debug his system in the same way INTEL has ICE-8080.

2. Manufacturing Test Systems. This is a new idea! We would support users who build with our chips, boards, and boxes so they could test their systems in manufacturing!

A6. Applications-level products - In essence we need a testimonial (e.g., LSI-11 in a suitcase) that one can build products at this level. What are some alternatives?

A7. Organization - I believe the development groups are sufficiently diffused (Teicher, Moffa, P/L's) and defocussed (e.g., Teicher has many levels-of-integration as his responsibility). Similarly, there is not clarity in the marketing.

GB:ljp

Distribution

OOD
Vince Bastiani
John Clarke
Lorrin Gale
Bill Green
Jack Mackeen
Ken Olsen
Rob VanNaarden
Gerry Witmore

Marketing Committee
Jim Bell
Gary Cole
Bob Glorioso
Bill Hogan
Roy Moffa
Steve Teicher
Jim Willis

ID#408

| d | i | g | i | t | a | l | i n t e r o f f i c e   m e m o r a n d u m

Subject: **Low End Task Force; Comments and Questions**

To: Dick Clayton, ML12-2/E71
Gary Cole, PK3-1
Bruce Delagi, MR2-1/M64
Len Halio, ML1-2/H26
Don Haney, ML1-2/H26
Andy Knowles, ML10-2/A52
Mike Leis, ML1-3/E63
Roy Moffa, ML1-2/H26
Stan Olsen, MK1-2/C36
Dick Strauss, ML5-2/M11

Date: 8 JAN 79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

Art Williams, ML5-3/E12
Jerry Witmore, PK3-1/M40 follow up 1/22/79

<u>Q vs Toby</u>
I'm still for the "management bounding" terminal for the Fonz based on the Q-bus approach instead of TOBY. Two new reasons beyond my earlier memo (see attached):

1. We're doing the VT103 already. That gets us well on the way. Otherwise we duplicate products.

2. There are/will be some useful fall out modules of using the Q-bus approach.

<u>White Tornado</u>
Please, please, let's make the VT162 be done with the White Tornado. This gets us volume and 1 less product. Also the WT costs less than the VT162.

Jerry Witmore has interest in a low cost <u>Basic</u> terminal. WT is pretty good. Can he use it?

To really get low cost <u>with</u> Mass Storage, the TU58 "cached" by a few CCD chips is best. Let's do this and really get a high performance, low cost terminal to beat out the floppy-based ones.

GB:ljp

Attachment

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Dick Clayton	ML12-2/E71	Gary Cole	PK3-1
Bruce Delagi	MR2-1/M64	Len Halio	ML1-2/H26
Don Haney	ML1-2/H26	Andy Knowles	ML10-2/A52
Mike Leis	ML1-3/E63	Roy Moffa	ML1-2/H26
Stan Olsen	MK1-2/C36	Dick Strauss	ML5-2/M11
Art Williams	ML5-3/E12	Jerry Witmore	PK3-1/M40

Proposal for a LOW END TEAM (LET)

PROPOSAL
Form an integrated marketing, engineering and manufacturing team for >100K/year, <$2.5K, CT, VT and LA products and components.

CHARTER
The team will develop, build and market our current terminals, and evolving computing terminals, including stand alone Word Processing products (ie. 278), and possibly other low cost products (eg. 11/23). Within the group there would be clear segmentation and responsiblility for the kinds of terminals, computing terminals and applications.

Market/Product Priorities:

1. Protect terminals video (VT) and printer (LA) market.
2. Enhance DEC-host systems via CT's, VT's and LA's.
3. Stand alone word processing
4. Workstations for DEC and non-DEC systems.
5. Small business systems.

MOTIVATION: PROTECTION OF TERMINALS AND 16-BIT PLUS EXPANSION
The group is predicated on the fact that we must move rapidly to support our terminal base that will be totally eroded in TWO years

by personal computers! It is also essential to provide an aggressive alternative to our 16-bit, shared systems. WE MUST MOVE FAST AND UNINCUMBERED!

Similarly, the shared, group-level systems must focus on lower costs too, but with support for our conventional RSTS, RSX-11 and RT systems which are characterized by larger size, sharing and more support. The 16-bit Group must concentrate on competitive, 16-bit boards, boxes, and systems for our oems and end users.

Low end (personal computer products) have one user for each computer sold, versus being timeshared with dumb terminals. They are much higher performance in terms of user interface, and they are customer installable by non-computer users. Eventually, clustered systems may offer capabilities similar to our current, shared sytems... we'll worry later.

RELATIONSHIP TO OTHER PRODUCT LINES
All other product groups may take the low end (personal) products at transfer cost and market them as appropriate (eg. bundled into systems, in quantity) on a case by case basis. Unique software or hardware would usually distinguish the products.

RELATIONSHIP TO OTHER ENGINEERING GROUPS AND PRODUCTS
Most resources will be directly controlled. The group would typically contract projects with the semiconductor, mass storage and software groups. Similarly, Word Processing software that would support the OFFICE Program would be done by the OFIS group.

The group would be responsible for providing competitive terminals and personal computers to the various computer groups according to clear, architectural specifications.

Proposed Organization

```
                       OC Member
                           |
                           |
                           x
                           |
          ______________________________|___________________
____
          |                 |              |            |
 Engineering          Manufacturing   Marketing       CSvs
--------------   ---------     -----------------
|           |    |      |      |      |     |        |
VT/CT       LA   278    VT/CT  LA     TPG   WPS(S/A)  Small
Business

            (incl.11/238
                                                    for
dist.)

-------------------------------------------------------------
----------
```

PROPOSED PRODUCT FLOW

```
                 -----------                  ------------
                 |  Users |                   |  Users  |
                 -----------                  ------------
                     ^                             ^
                     |                             |
                 -----------                  ------------
                 |  Dist. |                   |    P/L  |
...
                 -----------                  ------------
                     ^    LA,VT,CT,WPS           ^   ^  ^
                     |_____________________________|  | |
                     |    @ transfer cost          |  P/L
specific
                 -----------                       |
                 hrdwre/sftwre
                 |   LET  |                        |
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```
            -----------                       |
              ^     |_______________________________|
              |                    |
              v                    |
        -----------------    ------------------------
--
        | Other         |    |    OFIS Engineering |
        | engineering |      ------------------------
--
        | suppliers    |
        -----------------
```

RATIONALE BASED ON COMMON PRODUCTS

```
COMMON ENGINEERING           EXT.   CT   VT                 LA
printing, paper move, servo control
             x
video monitor design/use            x    x                  ?
general imaging and graphics             x                  x
             x
keyboards           x        x      x
modems, high speed modems    x??    xx   x                  x
mass storage  x     x        ?      ?
vlsi and special lsi         x      x    x                  x
packaging, FCC, noise, human factors                        x
             x
             x
terminal firmware, microprocessor logic x                   x
             x
terminal architecture for other systems x                   x
             x
PDP-11 programming & operating system    x                  x
languages, forms, files      x      x
word processing     x        x      x    x
applications, also ext to DEC       ?    x
```

(Fundamentally, all dumb terminals are becoming computing terminals for ALL applications, and we must print what we see on the screens!)

```
COMMON MANUFACTURING SKILLS & PRODUCT LOCATIONS
ALB                 x        x
WF                  x        x      x
Phoenix                      x      x
```

(Terminals and computing terminals are in three plants. They are fed by lsi, modem, board and mass storage plants.)

```
PRODUCT LINE COUPLING
TPG                 x        x      x
WPS                 x
Technical groups (especially graphics, rt)                  x
             x
```

?
Commercial groups (especially forms, graphics)? x

(TPG might be the highest volume channel, but with the change to Computing Terminals from VT's, all VT/LA selling product lines will end up selling CT's. Furthermore, applications programs will evolve to the terminal and be an alternative to current, shared systems.)

SERVICE COUPLING
The hardware service techniques are common. CT introduces software support not present in dumb terminals.

GB2.S6.44

****
* d i g i t a l *
****

TO: DICK CLAYTON   DATE: TUE 2 SEP 1980
7:20 PM EDT
    GRANT SAVIERS   FROM: GORDON BELL
cc: see "CC" DISTRIBUTION   DEPT: OOD
                                                        EXT: 223-2236
                                                        LOC/MAIL STOP: ML12-
1/A51

SUBJECT: I WANT HELP TOMORROW ON THE LOW END; ALSO SOFTWARE FOR IT

Pursuant of our discussion tonite, and considering where we are
on this critical project, I hope you can work on it tomorrow with me in lieu of going to the seminar. There are a number of issues relating to the disk availability, its interface, and getting the right resources on the project (ie not too many and not too few).

Will talk with you tomorrow.
gordon

ps

Dick,
You and I should go over the software options... cause there are really a lot we can go for in the short term. This entails getting together with BJ (but let's keep this outside
of the hardware project as there isn't a need to interact with
it!). To name a few of the options:
1. get Ollie Stone really working to acquire for the 11 low end on pdt
2. get Thissel to buyout and/or find a way to get oems helping
3. Jake and Dibol on the 11 which he is using on PDT-150
4. PDT as a down line load, that Gil Steil has done
5. Packaged RT things like Basic, or interactive Fortran
6 Word processing that is being done for the new terminal
7. other p/l specific stuff.

Somehow we have to focus this effort around collecting and then marketing. Maybe the store is the vehicle and we can do it now using our 7500 pdt150s we have in inventory! (Note our 20VT200 with t&e floppy is exactly equivalent to the PDT150
we have in inventory. We need some creative packaging and ways of distributing. Let's get these together and go see Stan about moving what we can demo.

"CC" DISTRIBUTION:

SHEL DAVIS BILL JOHNSON KEN OLSEN
STAN OLSEN LARRY PORTNER

GB1.S6.49

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| d | i | g | i | t | a | l |          i n t e r o f f i c e
|   |   |   |   |   |   |   |            m e m o r a n d u m
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SUBJ: **Low End Semicondutor Make/Buy Policy**

TO: Ed Paderson, ML3-2/E41 Date: 2/21/80 Thu
From: Gordon Bell
CC: Henry Crouse, ML1-5/B98 Dept: OOD
Brian Croxon, TW/C04 MS: ML12-1/A51 Ext: 223-2236
George Hoff, MR1-2/E78 EMS: @CORE
Roy Moffa, ML1-2/H26
Steve Teicher, ML4-3/T34 Follow Up: 3/7/80
Joe Zeh, WZ2
OOD
OPERATIONS COMMITTEE
PMC
Microprocessor Focus Group
(See Distribution)

Why not this policy for semiconductors? (Basically it's the Make vs. Buy issue)?

0. Overall, if we can buy it, do so. Only make (design and manufacturing) what we can sell, not what we can buy! See the attached.

We have far more needs and opportunities than we can build proprietarily, therefore, we must chose carefully, and leverage to get semiconductor and semicomputer companies to do as much as possible.

1. We want proprietary parts only where we must have them - in the CPU part mainly because they're to sell (e.g. Tiny, Fonz, LSI-11) and not available outside; or to get unique performance (MCA); or cost/performance (COMET). Get others to make our processor chips (e.g. Jaws, 6120) when we can.

2. We need to be competitive in several technologies or else it impairs competitiveness at the systems level. It would be nice to excel in one technology and acquire the smallest number of processes in

other technology areas.

3. We must use external parts from Semicomputer companies* whenever possible (e.g. Comm. options, floppy controllers).

4. We should get (build or buy) special interface chips so we can use standard peripheral parts as much as possible to get the lowest cost systems; and

5. We must get as many proprietary parts as possible to be

done externally (e.g. disk parts), giving up proprietariness (unless it's the 11 or VAX-11 Architecture) when necessary to get cost, availability and a good supply.

6. We must go to fast turn around design to get cost reductions only when 4 and 5 aren't available.

7. We must keep a good watch to determine our competitive position (cost, performance, or cost/performance). If we are clearly failing by falling further behind in an area, we must act. For example, in the low end we can consider: doing more, getting outside proprietary, or switching to a non-DEC ISP (especially when we don't rely on or need our software base).

*A Semicomputer company (e.g. Intel, Xilog, and TI?) is a company that predominately supplies semiconductor parts that are computers and computer options selling at chips, board, box and system level. They feed OEMS that often compete with us (e.g. Apple, Tandy, Olivetti).

GB:swh
GB1.S2.9
Attachment

Distribution

Keith Amundsen, ML1-2/E60
Don Dodson, ML1-3/E62
Don Gaubatz, ML3-2/E41
Jim grochmal, TW/B14
Glen Larson, MK1-1/M37
Roy Lomicka, ML5-3/E12
Jim McGuiness, ML5-3/E12
Tom McIntyre, ML5-5/E76
Russ Moore, ML1-2/E60
Tom Northrup, WZ
Rick Olsen, ML1-2/E65
Al Rainha, LM
Hapton Saler, ML1-2/H26
Joe Schmidt, MK1-1/M37
Ranjait Singh, ML5-5/E97
Norm Field, ML1-3/E58
Fred Zeraski, WZ2

00 BURT DECGRAM ACCEPTED S 20401 O 74 17-SEP-81 08:35:17

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION   DATE: THU 17 SEP 1981
8:27 EST

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

cc: LARRY PORTNER
    JACK SHIELDS

SUBJECT: AN AGGRESSIVE VT AND SET OF LOW COST CT PRODUCTS FAST!

We would like to meet Friday morning at 8:15 to begin to address how we are going to get an aggressive set of low end terminal and computing terminal products. Please come, together with no more than a couple other technical persons.

At the Operations Committee Woods on Tuesday and Wednesday, we looked at the Product Strategy and position in the Terminals and Computing Terminals. We are concerned with our competitive ability, and would like to go for an aggressive product introduction schedule to address ALL the competitive holes and issues surrounding the products we are building. The concerns:

1. A low cost VT100 replacement based on the computing terminal components (monitor and keyboard). This would be a VT100 and hopefully upgradeable to a VT125. It should have a modem as

an option. It would most likely not be based on a Tiny, nor would it be programmable.

2. A package with power supply for a small computer board, or perhaps 2 boards at the most, that would be used to build:

2a. The lowest cost and best 11 system to execute the OBM!

2b. CAT ... Z80 with option for 6120 or Tiny.

2c. A board for the 278 SW.

3. SW that will run OBM and CTAB competitively:

3a. OBM and CTAB files must be identical and OBM must be layerable on CTAB

3b. CTAB must provide a basis for layering PL SW, eg. COBOL.

3c. We must be able to use CT as a VT125

3d. We must show that the OBM/GOM development group is properly organized and motivated, given the seperation of the groups. We should address architecture, PM, the direction, etc.

The package for the CT25 will be reported on Oct. 5. The other items will be discussed at the Oct. 15 Woods. Item 3 will be discussed on Nov. 2.

The schedules for the products are:

VT100R	July 1, 1982
CT25	Nov. 1982 (concurrent with the Office software)
CT278	asap, negates need for RX50 repackage
CTCAT	no goal until ROBIN is introduced

ALL PREVIOUS PLANS ARE STILL IN PLACE! We are entering an intensive period of phase 0/1 to EXPLORE, DEFINE AND BREADBOARD
SEVERAL ALTERNATIVES FOR EACT OF THE ABOVE.

On Friday Morning, We would like to meet with you and several of
your technical designers to discuss the above 3 items. I expect
that items 1 and 2 will take until 11 am. Then I would like to
discuss items 3.

"TO" DISTRIBUTION:

BILL AVERY	GERALD V BUTLER	RON HAM
DON JENKINS	TED JOHNSON	AVRAM MILLER
KEN OLSEN	BRUCE STEWART	

GB2.S8.23

00 BURT DECGRAM ACCEPTED S 16973 O 779 03-SEP-81 22:12:54

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* d i g i t a l *
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TO: see "TO" DISTRIBUTION

DATE: THU 3 SEP 1981 22:02 EST

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: INTELLIGENT AND COMPUTING TERMINALS FOR OC WOODS

Ken wanted to go through the whole list of products in this low end space and conceivably add these:
vt 50/52, vt100, vt101...vt131/132 (feel like losers)

11/03, 11/23 rx and rl, Shoebox.

The object is to find out whether any of them made money. We should also understand why they have not made money as one could safely predict they haven't. Perhaps the only exceptions are the CSS products that have achieved low volume, but are priced high in a product price controlled environment.

The attached memo gives a listing of the various attempts, and while we might spend a great deal of effort precisely defining the failure, I don't think it is worth doing it on anything but a qualitative basis. In addition, we should be aware of the tremendous need for software and the perception that we are going to supply software forever when we put out a new system. This is clearly why we have trouble selling 8's... and why putting out a system that would also run 11 code might just make the system really saleable, independent of whether we ever supplied any software for the 11.

Potentially we have a new zoo of operating systems which we will be obliged to support and enhance:

PDP-8
- wps
- dibol for running business packages

PDP-11
- RT/Dibol
- RT/for programming environment
- CTAB based on M for CT ... which really looks competitive
- UCSD Pascal (recall that this was originally written for the 11)
- UNIX- also available for the 11 and we should make sure it will run on future hardware. While it runs on a Fonz, it really would prefer a J.

Z80
- CP/M ... can we confine our software to what we can just simply convert and run so that we do no programming, but merely publish what's available.

I would like to limit our exposure and have a pretty clear policy on the programming environments we support.
Specifically:
PDP-8
 all applications in DIBOL. Do enhancements if wps 278 can
 support them via sales. This will depend on the reception to
the product announcements of OFFICE.
PDP-11
 CTAB will be the main basis, and provide programming environments
  for BASIC, UCSD Pascal, FORTRAN, and DIBOL
 RT (support only)
 UNIX-make sure it runs well on all 11's now and forever
 UCSD Pascal- make sure it runs well, but try to encourage
  the support on CTAB instead
Z80
 Only convert (not program) available programs on a pay as you
  go, business basis.

Right now we're off inventing two new systems for the lower end below CT, in addition to the system we've been calling ROBIN, which uses the Z80 and runs CP/M. Both of these use the Tiny, and while I don't understand who would buy either of them yet, I'm more concerned about what base system they'd run. Perhaps the UCSD Pascal is the best alternative, since it is potentially the smallest and least general and therefore might run well there. One system is the VT200 and the other, called CAT, or TRIAD, capable of running all 3 environments of Z80, PDP-8 and PDP-11 (Tiny type). CP/M is the only general purpose environment... and since it's so poor, we would ensure that these systems wouldn't be used for anything but terminal and fixed applications. It's clearly not a system for the small business person (due to primary and secondary memory size).

All in all, I feel very, very bad about these later two products from a systems viewpoint. As a terminal, the VT200 is really vital! Somehow, I'd do anything to get it to also be a video option for CT! What's the chance of this?

"TO" DISTRIBUTION:

BILL AVERY RICK CORBEN BARRY JAMES
FOLSOM
TED JOHNSON BILL JOHNSON SI LYLE
AVRAM MILLER KEN OLSEN LARRY
PORTNER

ATTACHED: MEMO;66

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* d i g i t a l *
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TO: MARKETING COMM: DATE: SAT 21 FEB 1981
17:59 EST
FROM: GORDON BELL
cc: SI LYLE DEPT: ENG STAFF
AVRAM MILLER EXT: 223-2236
BILL PICOTT LOC/MAIL STOP: ML12-1/A51

SUBJECT: UURGENT PROBLEM: RESPONSIBILITY FOR LOW COST SYSTEMS

For our disussion at GVPC:

Independent of whether I have be able to help build better low
end personal computing terminals, historically we have tried and
generally have done poorly (market share,
profitability,quality).

PRODUCT HISTORY
The products arena, over the past 6 years and currently:
VT8/E (Reuters), VT14(originally GM for PDP-14)
VT30, 31, etc. by CSS for weaving, mimic diagrams, tv
VT15,GT40, GT60, Megatek (lab and engineering graphics)
VSV11 (Graphics and Image) LDP, now CSS
VT20,21,71,171, etc. for Typeset also Tektronix based
LA36/BSR, LA36/TU60, LA120/TU58 (AT&T), LA44, VT134

PDT130, PDT150 (for ADP)
Minc, Mini-Minc, TLC
Gigi, Gigi 1.5
VT103 (TPG)
DS315

WHY IT HAPPENS

Our structure and the basic P/L Bill of Rights (which I do not advocate changing), created the problem. Some of the forces:

- .Customers specialized need (Caused 6)
- .Perceived specialized market need (caused about 20)
- .Perceived general purpose, high volume opportunity (5)
- .The components are available, and it's about the only piece of hardware that a P/L can afford to engineer
- .They are fun to start. It is the one product that can be built according to the classic model: marketing specifies and engineering builds it
- .The market is perceived to be sufficiently different that no gp system can be built (Apple disproved this!) ... hence no common system was able to be defined
- .The engineering budget was not large enough to cover this evolving part ... for example, the whole WPS P/L had to be started up to start the eng. investment
- .Poor engineering leadership to recognize need, and propose it

SOLUTION

Now that we have recognized the problem, let's solve it.

- .Technology is changing making engineering cost higher, product costs lower, and unprofitabity clearer
- .We are doing a system to cover many of these areas
- .Near term, Engineering is taking responsibility for 278
- .Engineering will operate "modified Golden Rule":
  - .Will operate with Business Plan and Phase Review

.Will get an outside assessment of product viability

.Review the current terminal and PC's ... there are lots more lurking losers. Put the $'s in low end PC's!

GB2.S8.29

00 BURT DECGRAM ACCEPTED S 4441 O 100 21-SEP-81 09:22:04

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* d i g i t a l *
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TO: PEG: DATE: MON 21 SEP 1981 8:47 EST

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION

DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: OC WOODS DISCUSSION AND ACTION ITEMS

LOW END was the main topic. We want to continue winning with lower cost competitive terminals (and also getting the high functionality VT200) AND we want to get a lower cost CT for the OFFICE products that are coming. The goal is to have the strongest possible CT offering. There's a seperate memo on this.

We discussed the issues on the Office and CTAB software vis a vis compatibility and have to report back on our plan. In the review on Thursday evening with the developers, I think we may be ok. The critical issue now is make sure the goals are right and then support the plan! I think it is quite good and we can win, assuming a few of the details are reconciled. We have more

compatibility of languages, files and interfaces than any competitior. Furthermore, the OFFICE specs look great and we can
win there too! But we have to implement.

Personal Computing Clusters and various Servers are not yet moving fast enough. Why can't our hot M team to get into this?

PRODUCT RESPONSIBILITY AND PROFITABILITY IS TO BE IMPLEMENTED:
.one person must be responsible for a product, and
.Engineering has the profit responsibility for a product.

We must stop introducing products that have below average profit
... because we are responsible for product success (ie. profit)!
In the event products are planned (or have no plans) which violate the profit goals, we must ask the Operations Committee
for guidance as to whether to introduce. We must review:
.VT278, pending and ideas(278T, 278RL, 278 Mini floppy, CT278)
.11/23 RL package
.CTs in all the desired versions
.Robin

PRODUCT AND PRODUCT AREA REVIEWS. There is a proposal that there
be a major review of all products and product areas. Note that,
Jack Shields' staff reviews the service plan for the 50 majors.

Ward McKenzie agreed to co-sponsor a review of the 16-bit products from chips to systems.

Marcus was concerned about not being informed of the move to Reading of the Office Program. We screwed up and have to report
back to OC on this now regarding the status. BJ's plan is

ON!

We got the offer of support from Ken, Julius, Si, Win and Ted to
discuss the importance of CT and OFFICE with the development groups. Avram and Bruce, feel free to schedule any of us to talk
about the importance of these programs.

LOW END MASS STORAGE AND REMOVABILITY IS OF MUCH CONCERN! Grant
must lead us through the morass of possibilities. We have lost
the low end COEM business by high markups, but I'm still concerned about getting the straight story here about total cost
(including DEC storage and transshipment, FOB charges, handling,
portability, high cost of backing up with either floppies or RL's, etc.) of alternatives. How viable are the RL's? What are
we going to do on the CT?

"CC" DISTRIBUTION:

RICK CORBEN BRUCE DELAGI SAM FULLER
OPERATIONS COMMITTEE:

GB2.S8.21

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Subject: **LOW END DIRECTION DISCUSSION WITH STAN**

To: Dick Clayton, ML12-2/E71
Bruce Delagi, MR2-1/M64

Date: April 20, 1979
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

CC: Mike Gutman, ML3-6/E94
John Kevill, ML3-6/E94
Andy Knowles, ML10-2/A52
Stan Olsen, MK1-2/C36
Stan Pearson, ML12-2/E71

Stan would like us to be the volume, leader and build products for retail outlets. This would be >100K systems/year in 4 years and aiming at low, entry cost, with decreasing average selling price. He'll put the market plan in place, but he wants a clear statement of the products (entry, average and maximum) vs. time for the next 4 years. <u>Could you put together (plot) this set of systems (vs. time)?</u> Then we should get together.

This would be in terms of a table giving the (really part of Redbook) components (CRT, printer, processor, mass store, communications options, and software) versus time.

In our planning we need a better interconnect and packaging strategy so that each component can be evolved relatively independently so as to gradually decrease these system prices. Such a strategy would address: where the computer is packaged; boundness; keyboard on printer or not; how the pieces connect to each other; communications and modems; etc.

Some of the questions we discussed:

1. Will videotape/videodisk be a product in this time?

2. Can Gigi be made available in high volume to effect lower entry cost?

3. Will Pascal be a standard? Should we adopt it? How do we have propriety SW with it?

4. Transition from 8 to 11? Is it possible? Will the 11 go into the

store?

5. Is the VT100L useful at getting lower costs?

6. Can bubbles or CCD be used with tape (TU58 or successor) to lower entry cost?

7. Is it necessary to build low end hard disk?

8. Can RL02 be sold to add on to all low end systems to further get us in this market?

9. Will all these be CRT-based?

10. Should we have low cost printers without keyboards for these systems?

GB:swh

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Dick Clayton	ML12-2/E71	Bruce Delagi	MR2-4/M64
Mike Gutman	ML3-6/E94	John Kevill	ML3-6/E94
Andy Knowles	ML10-2/A52	Stan Olsen	MK1-2/C36
Stan Pearson	ML12-2/E71		

+---------------+ ID#0178

! d i g i t a l ! i n t e r o f f i c e m e m o r a n d u m

+---------------+

Subject: **Low Power Bipolar Gate Array**

To: Bob Armstrong, Jim Cudmore,
Bill Demmer, Bill Green,
George Hoff, Alan Kotok

Date: July 28, 1978
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

follow up 8/11/78

The Japanese did what seems like an incredibly clever thing in developing a low power gate array. They simply use only a fraction of their regular large gate array that has a heat sink. This means only one part, one design system etc. Can we learn from them? (Let's not develop the smaller bipolar gate array -- have everyone use the current one.)

Can the ECL array be used in a similar way?

Fujitsu has bipolar arrays. Can we use them? They also have 8ns RAMs.

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST: Bob Armstrong TW/D06 Jim Cudmore ML1-5/E30
Bill Demmer TW/D19 Bill Green ML1-4/B34
George Hoff MR1-2/E47 Alan Kotok MR1-2/E47

FROM: GORDON BELL DATE: SUN 20 JAN 1980 11:00 AM EST
DEPT: OOD
EXT: 223-2236
TO: DICK CLAYTON
GRANT SAVIERS
cc: HERB SHANZER
MIKE GUTMAN
STAN PEARSON
BOB JACK

SUBJECT: LOWER COST SYSTEMS ARE LIMITED BY DISK ELECTRONICS

It seems like the systems we are coming out with in CSD are above the 16K nu charter limit because they use the DEC traditional boxes within boxes, backplane and cabinet approach which organizations reinforce. Would it be better to partition the Low end to systems that are mounted in the terminal or in the disk? It bothers me to see the vt 278 use the same kludgy disk system package and electronics in this day and age. Part of the problem here is that there is no lsi work in the disk area, nor do we use standard chips because they are incompatible with our bus...hence, we are stuck with using msi just like we did about 5-7 years ago.

Would you guys get together and see what can be done here to get us in a more competitive position? (Even IBM's recent Intelligent terminal is smaller)

Let's not have the 278 in the current package.

Grant, would you look at what is being done to get us into the 4th generation as measured by our logic design capabilities?

GB1.S1.38

GB0004/30

| d | i | g | i | t | a | l | i n t e r o f f i c e   m e m o r a n d u m

Subject: **Morale at WX**

To: Jim Cudmore, ML1-5/E30
Dick Clayton, ML12-2/E71
Roy Moffa, ML1-2/H26
Steve Teicher, ML4-3/T34
Joe Zeh, WZ2

Date: 8/4/79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

Follow Up: 8/20/79

In talking to some of the troops in the mill doing LSI design, they suggested that we (management) get on the stick and help the morale at WX. Their concern was that we built a building in Hudson, yet the WX folks aren't going to get into it for quite some time and we keep delaying the day. Also, these designers are separated from the other designers on a chip who are in the mill. Also, there is no cafeteria, it has been a temporary facility, etc. Can we do anything to help out here besides being understanding and appreciative? Should we try to find a place in the mill until Hudson?

GB:swh

ID#395

| d | i | g | i | t | a | l | **i n t e r o f f i c e m e m o r a n d u m**

Subject: **Concerns on LSI Semiconductor Capacity Vs. Laboratory**

To: Jim Cudmore, ML1-5/E30
Bill Green, ML1-4/B34
Jack Smith, ML1-4/A54

Date: 19 DEC 78
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

CC: Dick Clayton, ML12-2/E71
Roy Moffa, ML5-2/E93
Mike Titelbaum, ML1-2/E65
Joe Zeh, WZ2

follow up 1/2/79

Jack asked me to note this prior to the January Operations Committee review. My concerns right at a time we're capacity-bound:

1. Will we have a problem moving from Worcester and Westboro to Hudson?

2. Why bother to do higher volume manufacturing for LSI-11 and Fonz inside? Let's get these manufactured outside.

3. Don't we need better (reasonable) engineering turn-around? Our profits in this area get made by short turn-around and time to market, not manufacturing cost.

4. Right now we need Fonz chips in numerous groups and this conflicts with manufacturing capacity. How can we get them?

5. Fonz is doubly (triply?) frustrating with a third (fourth?) pass on the design. Can we get reasonable tools to avoid two (three?) extra passes? The SQUID chip is expensive (outrageous) too. I see us going nowhere except out of business because we can't afford the designs.

Again, let me reiterate. The designs (and quick turn-around) are the big leverage on products and profit. I don't care if we make a single chip.

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST: Dick Clayton ML12-2/E71 Jim Cudmore ML1-5/E30
Bill Green ML1-4/B34 Roy Moffa ML5-2/E93
Jack Smith ML1-4/A54 Mike Titelbaum ML1-2/E65
Joe Zeh WZ2

EMS 16-NOV-78 22:00:44 510 1

To: Bill Johnson
CC: Bill Demmer, Ulf Fagerquist
From: Gordon Bell
Date: THU 16-NOV-78 22:00:44 EDT
Subject: LSI for VAX

(give to Kusik, Fuller, Bingham and green and strecker) I want to get on with it. I think we can save many months of needless hassle simply by deciding to use HMOs on an edict basis. Later on, we can change our mind if something lloooks better ow or if we nneed another technology to do the job.

This will let us focus on the architecture, circuits logic and design tools.
(also send to J Burness)

Command:

EMS 16-NOV-78 21:55:23 230 1

To: Dick Clayton
CC: Jim Cudmore
From: Gordon Bell
Date: THU 16-NOV-78 21:55:23 EDT
Subject: LSI for VAX

I want to get on with it. I think we can save many months of needless hassle by simply deciding to use HMOS on an edict basis. Later on, we can change our mind if something looks better or we can not do the job. This will let us focus on the architecture, circuits, logic and design tools.

Let's go!

Command:

LSI GENERATION

DIGITAL COMPUTER

VAX Computer Exhibit

- VAX SBI Memory Board, Digital Equipment Corp, 1976, (D164.80).
- VAX Star 64K MOS Memory Array, Digital Equipment Corp, 1976, (D165.80).
- VAX Proto-type UBA, Digital Equipment Corp, 1976, (D166.80).
- VAX Test Tapes, Digital Equipment Corp, 1976, (D167.80).
- VAX Logic Module, Digital Equipment Corp, 1976, (D170.80).

This board was an experiment in fine line routing (8 mil conductors and spacing). The logic is the 11780 UMD Module. It is significant in that it was the best routing solution that the top automated p/c vendors in the country (Algorex Data Corp) could achieve. (The production version of the module was done in-house, using 15 mil conductors and spaces.) It contributed toward influencing DEC to adopt fine line as a standard and was used extensively in developing the process which eventually came to be used for the 11750.

- VAX poster signed, Digital Equipment Corp, 1976, (D171.80).

MINC, (Modular Instrument Computer) Digital Equipment Corp, 1975, (D155.80).

Word length: 16 bits

Memory size: 32,768 words

Speed: Approximately 200,000 single instructions per second

Clock rate: 3 Mhz

Instruction set Processor: PDP-11(LSI-11)

Arithmetic element: Data path on an LSI chip, 8 general purpose registers

Instruction format: Double operand, multi-mode, 16 bit instructions

Power consumption: Approximately 500 watts

Size: Roll around cart (24"x30"x40")

Component Count: 4 LSI chips forming the LSI-11 processor, 300 MSI and LSI chips for memory and peripherals

Project start: August, 1975

Packaging model demonstrated: August, 1976

Running system demonstrated: August, 1977

Product announcement: October, 1978

First shipment: December, 1978

Number produced: 1500 annually

Input-Output: Real-time plug-in modules for analog, digital event processing and signal conditions. Graphics CRT. IEEE 488 and serial communications lines.

Software: Real-time and graphics BASIC. Optional languages and facilities available on PDP-11.

Use: Science-based discipline computation, including general purpose programming, mathematical modeling, graph plotting, laboratory management. Real-time use including data acquisition, signal processing or experiment control.

Achievements: Improved human interface as scientific and laboratory computer through software, modular hardware and documentation. Improved cost and performance per cost of ownership by portability, higher mean time between failures (MTBF), customer installation, built-in service and diagnostics, and direct phone link to factory for information.

- MINC Grip Strength Tester, Digital Equipment Corp, 1979, Gift of Laboratory Data Products Group, Digital Equipment Corp (D188.80).

<u>MPS 8008 Micro-processor</u> Computer Module, Intel, 1972, (D101.79).

<u>PDP-11/23 Micro-computer</u> Processor Module, Digital Equipment Corp, 1979, (D33.80).

<u>COMPONENTS</u>

LOGIC MODULES

<u>Altair 8800 CPU Board,</u> MITS, 1975, Loaned by Ed Luwish (X6.80).

<u>LSI-11 Computer Module</u>, Digital Equipment Corp, 1975, Gift of Steve Teicher (D35.80).

<u>Four Channel Asynchronous Serial Interface</u>, Digital Equipment Corp, (D36.80).

<u>Wafer of UART Die & Chip</u>, General Instrument, 1972, Gift of Vince Bastiani (D103.80).

<u>6120 IC CPU Diagram and Micro-photo</u>, Harris Corp, 1980, Gift of Don White (D105.80).

<u>S-100 CPU Board</u>, SDS-SD Sales, 1976, Gift of David Ramsberger (D236.81).

PRIMARY MEMORY

<u>64k Byte Memory Module</u>, Digital Equipment Corp, (D34.80).

<u>Altaire 4k Dynamic Ram Board,</u> MITS, 1975, 10 x 30 cm, Loaned by Ed Luwish (X7.80).

TERMINAL

<u>VT105</u>, Digital Equipment Corp, 1976, Gift of Laboratory Data Products Group, Digital Equipment Corp, (D157.80).

VT50-AA, Digital Equipment Corp, Gift of Dana May (D227.80).

DMCAT2.5

EMS 27-NOV-78 22:09:05 490 1

To: Dick Clayton
CC: Bill McBride, Stanton Pearson
From: Gordon Bell
Date: MON 27-NOV-78 22:09:05 EDT
Subject: Anothehr higher priority project

LSI VAX chip looks more important to me for two reasongs: 1. When I see the
MINC and the software it needs to/could use that will come from what else is
being done, the chip seems essential This sort of systems is really needed
to get rid of the limits that plague these single user systems like the HP
and IBM personal machines. VAX won't have he limits.

2. To build the really reliable systems, we do need chips so as to use
/build them in either checking or voting mode. Getiing a zero cost machie is
important. This would really change the approach we are having to go with in
HYDRA.

Command:

ID#320

| d | i | g | i | t | a | l | **interoffice memorandum**

Subject: **Getting LSI**

To: Dick Clayton, ML12-2/E71
Jim Cudmore, ML1-5/E30
Bill Demmer, TW/D19
Ulf Fagerquist, MR1-2/E78
Bill Green, ML1-2/E61
Bob Puffer, ML12-2/E38
Joe Zeh, WB

Date: 30 OCT 78
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

In order to get a start on our Wednesday meeting, here's my concerns:

1. The process looks out of control and I'm frightened. Bill has had to step in to manage this, and the former good guys are doing meanial work. Independent of their capabilities as managers, there is a major problem in recruiting in this area, and I worry about things that will guarantee an exodus of people. Similarly, I don't like the thought of overloading Bill this way. He has to be free to lead us out of the morass.

2. Comet chips. How are we going to get them? Need we bother? Why not just get the outside vendors such as TI to do it and we won't have to fool with them?

3. Overall, I can't see us as getting very good in the process domain because we don't sell MOS chips competitively. By buying from INTEL we're constrained to be several years behind. If you look at the channel width vs time and where our products sit, we're getting worse! There's no end in sight or no way to get back on the curve. This is the situation we were in with disks several years ago too (and aren't out of yet). Here, could you please bring a plot of this situation, to either allay or confirm my fears?

4. The design group and interface with the rest of the engineering users is poor and I think basically wrong. No successful semi manufacturer separates process, circuit, cad, logic, and architecture so organizationally and physically as we do.

5. The LSI engineering effort is busily building a collection of processes, some of which they believe in and want to do, and some of which they are merely coerced into doing (eg. gate arrays) and they feel beneath them. I think we have a large catalog of processes and no products for them (also because of the mystique we've managed to put up around the notion of LSI). Here I'd like a table which shows the processes versus time and the entries would be the products built with each of the processes. The entries would also contain how much we've spent for the processes and how much we spent to get each product, given the process. PLEASE BRING THIS ONE ON WEDNESDAY.

Mini-sermon: The way we make money in engineering and manufacturing is by selecting a process or a basic architecture and doing repeat designs.

6. Training and obtaining LSI designers is an important part of the group effort and I don't believe it has been recognized as such. We have been unsuccessful at getting, retaining and training people. This ought to be trivial as we have very bright people, and they can easily learn this kind of design, given the proper environment. Could you please bring a table of skills versus time, showing the people we've gained and lost by name in the various areas?

7. There was some clear disowning of the problems associated with the Motorola MECL array as being proposed for the Dolphin. Since the chip is to be second sourced internally, I don't understand the remoteness. The attitude is "see, Motorola is in trouble and will fail and they're having trouble just like us". The group had not communicated the concern with Ulf and the large systems group.

There are probably other issues, but I'd like to start with these as a means of really getting control of our destiny in this essential area. I want to help and everyone concerned with hardware does too. It is time to let some of us get involved in helping.

D I G I T A L INTEROFFICE MEMORANDUM

DIST: Dick Clayton ML12-2/E71 Jim Cudmore ML1-5/E30

Bill Demmer TW/D19 Ulf Fagerquist MR1-2/E78

Bill Green ML1-2/E61 Bob Puffer ML12-2/E38

Joe Zeh, WB

ID#0305

| d | i | g | i | t | a | l | i n t e r o f f i c e   m e m o r a n d u m

Subject: **LSI VAX: How, Where and When**

To: Distribution

Date: 18 OCT 78
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

follow up 11/1/78

Craig and I discussed the above last weekend. Now, I'm concerned with the possibility of milling inactivity. Frankly, it is pivotal to the strategy and I want us to settle a whole bunch of issues...quick!

The goal for the project should probably be:

> a small number of chips processor, permitting us to build small systems that can be embedded in terminals and be used at the same level as Fonz level systems we are now working on. (Such systems would become the terminus nodes in distributed processing systems and alternatively, powerful stand alone systems.)

Organizationally, I want something out of this project like we seem to be getting with both Comet and Dolphin, but with much better performance in the semiconductor area vis a vis the meeting of commitments. I note that in the case of Dolphin, the technology isn't even within DEC. To me this means a small, dedicated crew working together (geographically and in the same group) on:

1. selecting the technology, and then
2. getting the architecture
3. circuit design
4. CAD tools
5. logic design, and then when close to completion
6. working with customers to apply it.

For starters, this means to me the selection of a leader and the early exploration of 1 together with feasibility. Craig is already going on the architecture, and we need the focus now that a project would bring so that he can be more effective and really move! This also requires deciding who's going to be responsible for it within OOD.

I certainly have prejudices on things like moving quickly to CMOS, if necessary, in order to get the power down, speed up. Also, it need not be that small, as we are not competing at the chip level (i.e., cost isn't that important). It does have to have a small channel in order to get the density (and speed...which we should want). Using Intel technology worries me because that allows them to keep up exactly one generation behind them! Instead of doing the CMOS-11 at Harris, is VAX a better choice?

What are your thoughts on this project (see attached also)?

Bob, will you please frame the proposals so we can get moving in a "+" direction?

GB:ljp

Attachment

<u>Distribution</u>

Ron Bingham	MR1-2/E85	Andy Knowles	ML5-2/A53
Roger Cady	MK1-1	Bob Kusik	WZ-2
Dick Clayton	ML12-2/E71	Roy Moffa	MR2-1/M64
Brian Croxon	TW/C04	Craig Mudge	Cal Tech
Bill Demmer	TW/D19	Bob Puffer	ML12-2/E38
Ulf Fagerquist	MR1-2/E78	Mike Titelbaum	ML1-2/E65
Bill Green	ML1-4/B34	Joe Zeh	WB
Bill Johnson	ML21-3/E87		

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Ron Bingham	MR1-2/E85	Andy Knowles	ML5-2/A53
Roger Cady	MK1-1	Bob Kusik	WZ-2
Dick Clayton	ML12-2/E71	Roy Moffa	MR2-1/M64
Brian Croxon	TW/C04	Craig Mudge	Cal Tech
Bill Demmer	TW/D19	Bob Puffer	ML12-2/E38
Ulf Fagerquist	MR1-2/E78	Mike Titelbaum	ML1-2/E65
Bill Green	ML1-4/B34	Joe Zeh	WB
Bill Johnson	ML21-3/E87		

BOTTOM LINE

We're wasting our time (and much money) in the low cost timesharing systems like 23, 24 and NOW MICRO 11, as history has shown. The small (low cost) business computer market area will be the lossiest. I think the market has rejected them on a totally rational, economic basis. UNLESS we consider the total system economics, and get a complete market/product plan, we're going to lose again. Unfortunately, in the NEW Digital, no one will ever know that we're off a factor of 10 in a product plan, and we'll continue to invest.

Note that 11/23 and 11/24 were forecasted at 1.9 and 2.0 Billlion dollars. The actual appears to be something like 1/10 this amount! Being off by an order of magnitude is pretty poor.

Ken got a task force that gave a bit of insight, and other folks tried to analyze it too (including me). I suspect we'll forget the fact that this work was done and will be organizing another one in the near future to replicate the work or try and understand why Micro 11 ain't making its numbers. To me, the responsiblity for plans are clear: Gutman for Micro 11 sold alone, and any market group (eg. Small Business) when it's sold with applications software).

HERE'S WHY WE GOT A PROBLEM
While the "SuperMicro" is a possible computer structure of the 5th Generation, I believe it is far from obvious how it will be achieved and maybe even whether it will exist due to market infeasibility.

I'd suggested that we rename the Micro 11, SuperMicro 11 (especially when J's in it) to reflect the fact that it's Microprocessor based, but it behaves a Minicomputer of the previous generaton. Note the
price decline AND STYLE OF USE evolution versus generations (time):

```
1965-70        1972-75            1983

PDP-6/10 ---> 11/40...11/70 ---> Micro 11  (timesharing
decline)
(Central)      (distributed)     (now personal level)
400K            100K-250K          10K-20K

6600                 780           Scorpio   (6600 was Super
of '65)
(Central)      (distributed)      (operated at personal)
3 Million         250K               50K

LINC                 Apple
65 (40K)              78 (3K)
```

MY CURRENT PREMISE

1. There are several kinds of computing styles (and support economies):
 .super/mainframe- cared for by a staff
 .distributed mini- cared for by a staff or very knowledgeable person
 (requires several k$ to install a new piece of software)
 .personal- simple, user software installable. >100k units sold.

2. In the low end, boxes, busses, cables, etc. and vanity boxes are all irrelevant unless they impact a single individual's ability to buy, move and somehow get operational a given machine. Software costs dominate. We have 3 PC's to penetrate the market, IBM has one!

3. Micro 11 and supermicro 11 (the j) will be added to our list of marketing failures, because we have a general purpose system (derived historically via RSTS). It's unclear why anyone would want a low cost gpts except in a school where labor's free. Such a system is characterized:
 .can program it to do anything
 .low volume, (<5k per year)
 .lots of ad hoc softare written to take advantage of gpts, requires
 experts (fellow users ala Decus), or oems to install it.
 .typical installation is 1/2 day per package (like the tap), lots
 of training to use, lots of manuals (>1 foot of shelf for system)

4. Applications for micro11 are pretty much irrelevant for end user because the installation and use were designed for an economy based on 100K-400K. Application of such software is a major re-write.

USE OF SMALL COMPUTERS IN SMALL BUSINESSES

I don't think anyone's made any money serving this market so far for various reasons. Micro11 will be then next failure because:

1. economics are right (see above)
2. product ain't right (see above)
3. the range of tasks are too hard to do, and the users won't pay to learn to be computer people. This is similar to the

reason why home computers stay in the closet, and people ask what do you do with them?

HOW WILL THE SMALL BUSINESSES BE SERVED?
Personal computer clusters are the way to attack it because all these users will start with a simple computer that does NOT do their whole job, but does a few functions. It will be something they feel comfortable with, and they can learn with. Also, the human interfaceis better. It probably won't be centered on WPS because they don't have much correspondance, but it could use the list processing of WPS to do report writing and to send out bills and pay bills. (This would give them a simple accounts receivable/payable system.)

BUT WHY DOES IT SEEM TO BE WORKING IN EUROPE?
I think the price of the systems are just enough higher due to delays in introduction/use to allow the system work. The system will work for systems above 23's, but probably not below! Also, the market may not have all the clutter we have vis a vis personals, etc.

IS THERE ANYWAY TO GET DECENT VOLUME ON MICRO 11?
I still say get some FIXED application and flog the hell out of it. The only one I've seen is the bounded WORD 11 (Mary Jane and I tried this about a year ago). Also, the EDU folks might be able to bundle something useful.
.

<DATE>

<NAME>
<ADDRESS>

Dear Sir:

Would you please remove my name from your distribution list.

I no longer wish to receive this magazine. The mailing label to the magazine is attached below for your convenience. Thank you.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:swh
GB0004/8

July 12, 1979

Patricia Adelman
Locator of Used Machinery & Equipment
Machinery Dealers National Information Systems, Inc.
1110 Spring Street
Silver Spring, Maryland 20910

Dear Ms. Adelman:

Would you please remove my name from your distribution list. I no longer wish to receive this magazine. The mailing label to the magazine is attached below for you convenience. Thank you.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:swh
GB0004/9

<subj>CDC Meeting in Feb.
<from>William C. Norris
<to>OLSEN, KEN
<date>12/16/81
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<log#>1-2
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<subj>RESUME
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<to>BELL, GORDON
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<from>BRENT J. GARBACK
<to>BELL, GORDON
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<subj>NORMAN N. AXELROD ASSOCIATES
<from>NORMAN N. AXELROD
<to>BELL, GORDON
<date>12/18/81
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<from>CLARANCE E. HAGGLUND
<to>BELL, GORDON
<date>12/7/81
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<to>BELL, GORDON
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<from>ROBERT M. FANO
<to>BELL, GORDON
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<date rec>12/28/81
<log#>12-59

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<subj>N.V. PHILIPS
<from>R. WIJNHOVEN
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<message>Steve Teicher- HELP! would you please have someone take care of him? You might get him to give a seminar there on their FTA. They have a really neat system to do lots of designs per year. CC: Scholke, Cudmore
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<from>STEPHEN W. CAMP
<to>BELL, GORDON
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<subj>HARVARD UNIVERSITY
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<to>BELL, GORDON
<date>12/15/81
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<log#>12-49

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<subj>NORTH CAROLINA STATE UNIVERSTIY
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<to>MARCUS, JULIUS
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<subj>WARE, FLETCHER & FREIDENRICH
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<date>12/10/81
<date rec>12/14/81
<log#>12-36
<reply by>0
<dispo/date>

<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>COMP. SYS. LAB. - WASH. UNIV. IN ST. LOUIS
<from>CHARLES MOLNER
<to>BELL, GORDON
<date>12/1/81
<date rec>12/9/81
<log#>12-35
<reply by>0
<dispo/date>12/14/81
<message>SENT TO GWEN ORIGINALLY - GB SENT ON TO DICK CLAYTON - "WHEN CAN WE GET CHRLIE IN FOR AN INTERVIEW?
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>RESUME
<from>LEO J. SAROIAN
<to>BELL, GORDON
<date>
<date rec>12/14/81
<log#>12-34
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>SRC Board - Monterey Meeting mins.

<from>ERICH BLOCH
<to>BELL, GORDON
<date>12/8/81
<date rec>12/14/81
<log#>12-33
<reply by>0
<dispo/date>
<message>HOLD - SRC
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>RESUME - COVER LETTER
<from>VICTORIA LONELL
<to>BELL, GORDON
<date>12/6/81
<date rec>12/10/81
<log#>12-32
<reply by>0
<dispo/date>MEYER, LIPPERT, MEANY - 12/17/81
<message>LET'S LOOK AT HER
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>TWX
<from>KEVIN SULLIVAN
<to>BELL, GORDON
<date>12/10/81
<date rec>12/10/81
<log#>12-31
<reply by>0
<dispo/date>
<message>

<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>CAD/CAM
<from>E.J. CARROLL - PRES.
<to>BELL, GORDON
<date>12/1/81
<date rec>12/10/81
<log#>12-30
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>CENTER FOR RESEARCH IN COMPUTING TECHNOLOGY
<from>HARVARD U.
<to>BELL, GORDON
<date>
<date rec>12/9/81
<log#>12-29
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
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<subj>TWX
<from>DAVE WHITESIDE
<to>BELL, GORDON

<date>12/8/81
<date rec>12/9/81
<log#>12-28
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>REGIS MCKENNA PUBLIC RELATIONS
<from>REGIS MCKENNA
<to>BELL, GORDON
<date>12/8/81
<date rec>12/9/81
<log#>12-27
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>SEMICONDUCTOR INDUSTRY ASSOCIATION
<from>T.D. HINKELMAN
<to>BELL, GORDON
<date>12/4/81
<date rec>12/9/81
<log#>12-26
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y

<>

<subj>RAYTHEON SERVICE CO.
<from>JOHN MANZO
<to>BELL, GORDON
<date>12/2/81
<date rec>12/9/81
<log#>12-25
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>LIPCON FOR SENIOR CONSULTING ENGINEER
<from>FULLER
<to>BELL, GORDON
<date>12/8/81
<date rec>12/8/81
<log#>12-24
<reply by>0
<dispo/date>12/17/81
<message>signed and returned
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>XEROX
<from>PAUL STRASSMANN
<to>BELL, GORDON
<date>12/3/81
<date rec>12/8/81
<log#>12-23
<reply by>0

<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>ASSOCIATION SUISSE POUR L'AUTOMATIQUE
<from>KARL M. JAUCH
<to>BELL, GORDON
<date>11/28/81
<date rec>12/8/81
<log#>12-22
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>ALTOONA ENTERPRISES INC.
<from>ROBERT A. HALLORAN
<to>BELL, GORDON
<date>12/3/81
<date rec>12/8/81
<log#>12-21
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>UNIVERSITY OF ILLINOIS AT URBANA - CHAMPAIGN

<from>J. N. SNYDER
<to>BELL, GORDON
<date>12/3/81
<date rec>12/8/81
<log#>12-20
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>INDUSTRIAL RESEARCH INSTITUTE
<from>CHARLES F. LARSON
<to>BELL, GORDON
<date>12/3/81
<date rec>12/8/81
<log#>12-19
<reply by>0
<dispo/date>SAM FULLER - 12/16/81
<message>WANNNA JOIN? JIM BELL WAS A MEMBER
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>RESUME
<from>RAY ANDERSON
<to>BELL, GORDON
<date>
<date rec>
<log#>12-
<reply by>0
<dispo/date>MEYER - 12/8/81
<message>
<answer>
<f/u>mm/dd/yy

<filed>
<done>Y
<>

<subj>SANDIA NATIONAL LABORATORIES
<from>D.K. ROBBINS
<to>BELL, GORDON
<date>12/1/81
<date rec>12/7/81
<log#>12-18
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>RESUME
<from>DICK HORST
<to>BELL, GORDON
<date>11/28/81
<date rec>12/7/81
<log#>12-17
<reply by>0
<dispo/date>MEYER - 12/9/81
<message>PLS. HANDLE CAN HE MEET WITH OUR HUMAN FACTOR FEKS? ALSO EDN (SAY JOE MEANY) AND SAM
<answer>
<f/u>mm/dd/yy
<filed>12
<done>Y
<>

<subj>INDUSTRY/FOUNDER SOCIETIES FORUM ON ENGINEERING MANPOWER
<from>GORDON H. MILLAR
<to>BELL, GORDON

<date>11/30/81
<date rec>12/4/81
<log#>12-16
<reply by>0
<dispo/date>SAVIERS - 12/9/81
<message>WHO SHOULD GO
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>James Carpenter Whitney
<from>ERICH BLOCH
<to>BELL, GORDON
<date>12/1/81
<date rec>12/4/81
<log#>12-15
<reply by>0
<dispo/date>12/16/81
<message>John Meyer, Bil Avery, Sam - interested? Could we try him?
<answer>
<f/u>mm/dd/yy
<filed>Hold SRC
<done>Y
<>

<subj>ADDITIONAL TECHNICAL SUPPORT
<from>JOSEPH R. WHITE
<to>BELL, GORDON
<date>12/2/81
<date rec>12/4/81
<log#>12-14
<reply by>0
<dispo/date>FILE 12 - 12/8/81
<message>
<answer>
<f/u>mm/dd/yy

<filed>
<done>Y
<>

<subj>INTEL
<from>GARY RANCOURT
<to>BELL, GORDON - WAS ROUTED TO US; DON'T KNOW FROM WHO
<date>11/30/81
<date rec>12/3/81
<log#>12-13
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>NEW ENGLAND HOME FOR LITTLE WANDERERS
<from>CLIFFORD W. FALBY
<to>BELL, GORDON
<date>11/30/81
<date rec>12/3/81
<log#>12-12
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>SHELDAHL
<from>ROY L. HOLBEN
<to>BELL, GORDON
<date>11/30/81
<date rec>12/3/81

<log#>12-11
<reply by>0
<dispo/date>DICK GONZALES - 12/7/81
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>BOSTON RESEARCH DIRECTOR'S CLUB
<from>TERRENCE HENG
<to>BELL, GORDON
<date>
<date rec>12/2/81
<log#>12-10
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>FANNIE AND JOHN HERTZ FOUNDATION - 2 LETTERS
<from>WILSON K. TALLEY - PRES
<to>BELL, GORDON
<date>10/26/81
<date rec>NOVEMBER
<log#>12-9
<reply by>0
<dispo/date>SENT LETTERS TO TOM AND WILSON - BEFORE DEC.
<message>THANKS FOR WINNING PRIZE, YOU MADE A GREAT CHOICE
<answer>
<f/u>mm/dd/yy
<filed>12

<subj>RESUME
<from>JAMES D. COLLINS

<to>BELL, GORDON
<date>11/23/81
<date rec>12/1/81
<log#>12-8
<reply by>0
<dispo/date>SAVIERS/MEYER/HANNEMAN/BUNEICE- 12/10/81
<message>PLEASE ANSWER
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>PRODUCT DESIGN AND ENGINEERING SERVICES
<from>CHARLIE MIDDLETON
<to>OLSEN, KEN
<date>11/17/81
<date rec>12/1/81
<log#>12-7
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>resume
<from>JAC SIMENSEN
<to>BELL, GORDON
<date>
<date rec>12/1/81
<log#>12-6
<reply by>0
<dispo/date>FILE 12 - 12/1/81
<message>G INTERVIEWED IN MR 11/30 81
<answer>
<f/u>mm/dd/yy
<filed>12

<done>Y
<>

<subj>RESUME
<from>STUART K. KLEIN
<to>BELL, GORDON
<date>
<date rec>12/1/81
<log#>12-5
<reply by>0
<dispo/date>PEG, CLARKE, CLAYTON, MEYER -- DIPIETRO - 12/1/81
<message>HOW'D HE DO IN THE VT78? INTERST? JOHN PLEASE HANDLE, KEEP US POSTED.
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>LUDOLPHY & ASSOCIATES
<from>K.H. "SKIP" HAYNES - EXECUTIVE RECRUITER
<to>BELL, GORDON
<date>11/24/81
<date rec>12/1/81
<log#>12-4
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>DIEBOLD GROUP INC.
<from>N. RICHARD MILLER - VP BUSINESS PLANNING
<to>BELL, GORDON
<date>11/23/81
<date rec>12/1/81

<log#>12-3
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>SPEC INC.-- SPECIAL PROJECTS ENGINEERING CO. INC.
<from>PAUL B. SMITH
<to>BELL, GORDON
<date>
<date rec>12/1/81
<log#>12-2
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>LABORATORY FOR COMPUTER SCIENCE
<from>MICHAEL DERTOUZOUS
<to>OLSEN, KEN
<date>11/16/81
<date rec>12/1/81
<log#>12-1
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>ANDERSON-NICHOLS
<from>DONALD F. DARGIE
<to>BELL, GORDON
<date>11/25/81
<date rec>11/30/81
<log#>11-74
<reply by>0
<dispo/date>MIKE MULROY - 12/1/81
<message>YOURS
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>AFIPS
<from>BERNARD A GALLER
<to>BELL, GORDON
<date>11/19/81
<date rec>11/30/81
<log#>11-73
<reply by>0
<dispo/date>GWEN - 12/1/81
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>CARLETON UNIVERSITY
<from>J.S. RIORDON
<to>BELL, GORDON
<date>11/23/81
<date rec>11/30/81
<log#>11-72
<reply by>0
<dispo/date>LETTER TO RIORDON - 12/7/81
<message>

<answer>
<f/u>mm/dd/yy
<filed>12
<done>Y
<>

<subj>ADDISON-WESLEY PUBLISHING CO.
<from>CARL HESLER, JR. - VP AND GEN. MANAGER
<to>OLSEN, KEN
<date>11/16/81
<date rec>11/30/81
<log#>11-71
<reply by>0
<dispo/date>AVRAM - 12/1/81
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>IBM USERS
<from>IAN HUGO
<to>BELL, GORDON
<date>11/26/81
<date rec>11/30/81
<log#>11-70
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>BOOZ ALLEN & HAMILTON
<from>HARVEY L. POPPEL
<to>BELL, GORDON
<date>11/23/81

<date rec>11/30/81
<LOG#>11-69
<REPLY BY>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>POLITECHNIKA WARSZAWSKA - WARSAW TECHNICAL U
<from>STAN BUDKOWSKI
<to>BELL, GORDON
<date>11/15/81
<date rec>11/25/81
<log#>11-67
<reply by>0
<dispo/date>STAND - 12/7/81
<message>
<answer>
<f/u>mm/dd/yy
<filed>12
<done>Y
<>

<subj>MOTOROLA
<from>WILLIAM J. WEISZ
<to>BELL, GORDON
<date>11/20/81
<date rec>11/25/81
<log#>11-66
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>RENSSELAER POLYTECHNIC INSTITUTE
<from>GEORGE M. LOW - PRES
<to>OLSEN, KEN
<date>11/17/81
<date rec>11/25/81
<log#>11-65
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>FIRING AND ASSOCIATES
<from>MARTEL FIRING
<to>OLSEN KEN
<date>11/9/81
<date rec>11/25/81
<log#>11-64
<reply by>0
<dispo/date>PEG -- 12/1/81
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>RIXON
<from>LEE SCHANK
<to>BELL, GORDON
<date>10/26/81
<date rec>11/25/81
<log#>11-63
<reply by>0
<dispo/date>

<message>
<answer>
<f/u>mm/dd/yy
<filed>12
<done>Y
<>

<subj>IEEE
<from>DOUGLAS REUDINK
<to>OLSEN, KEN
<date>10/31/81
<date rec>11/25/81
<log#>11-62
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>MIT - MEDIA TECH. LAB
<from>JEROME WIESNER
<to>KEN OLSEN
<date>10/14/81
<date rec>11/24/81
<log#>11-61
<reply by>0
<dispo/date>KO 11/30/81 Mon 5:27
<message>G. BELL WHAT SHOULD I SAY (FROM KEN)
<answer>TO KO--HOW MUCH, THEY DO INTERESTING WORK
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>RESUME TYPE
<from>CARL H. RICE

<to>BELL, GORDON
<date>11/23/81
<date rec>11/24/81
<log#>11-60
<reply by>0
<dispo/date>DIPIETRO - 12/2/81
<message>ALSO TO SAVIERS, GONZALES, MEYER
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>U.S CHROME CORPORATION OF CONNECTICUT
<from>AL KERTESZ SALES MANAGER
<to>BELL, GORDON
<date>11/18/81
<date rec>11/24/81
<log#>11-59
<reply by>0
<dispo/date>GONZALES - 11/30/81
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>UNIVERSITY OF NORTH CAROLINA
<from>JOSEPH CAPOWSKI
<to>BELL, GORDON
<date>11/18/81
<date rec>11/24/81
<log#>11-58
<reply by>0
<dispo/date>LETTER TO CAPOWSKI - 12/1/81
<message>COPIES TO SCHWARZ, CHAMBERLAIN
<answer>
<f/u>mm/dd/yy
<filed>12

<done>Y
<>

<subj>TWX
<from>ROBB WILMOT
<to>BELL, GORDON
<date>11/24/81
<date rec>11/24/81
<log#>
11-57
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>Ethernet Hold folder
<done>Y
<>

<subj>STC MICROTECHNOLOGY CORP.
<from>LORI K. HIATT - MKT ADMIN.
<to>BELL, GORDON
<date>11/13/81
<date rec>11/23/81
<log#>11-56
<reply by>0
<dispo/date>ON CIRC-SAVIERS,BURNEICE, RIGGLE, KALB,TEICHER - 12/1/81
<message>HOW ABOUT TRYING THEM? HOW DO THEY PERFORM?
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>OMSI
<from>MICHAEL TEMPLETON
<to>BELL, GORDON
<date>11/20/81

<date rec>11/23/81
<log#>11-55
<reply by>0
<dispo/date>FILE 12 - 12/1/81
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>CARELTON UNIVERSITY - REFERENCE REQUEST
<from>L. ROBERT MORRIS
<to>BELL, GORDON
<date>11/16/81
<date rec>11/20/81
<log#>11-54
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>SH&G
<from>JAMES A. FOUNTAIN
<to>BELL, GORDON
<date>11/12/81
<date rec>11/20/81
<log#>11-53
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>LOS ALAMOS
<from>ROBERT H. EWALD - DIV. LEADER, JOHN E. RANELLETTI - DEPT. HEAD
<to>BELL, GORDON
<date>11/6/81
<date rec>11/20/81
<log#>11-52
<reply by>0
<dispo/date>STRECKER - 11/23/81
<message>I BELIEVE YOU'D CONTRIBUTE AND GETMORE OUT OF THIS. CAN YOU GO?   I'LL ARRANGE.
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>TWX
<from>BERNIE LACROUTE
<to>BELL, GORDON
<date>11/19/81
<date rec>11/20/81
<log#>11-51
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>LAB. FOR COMPUTER SCIENCE
<from>MICHAEL . DEERTOUZOS
<to>BELL, GORDON
<date>11/16/81
<date rec>11/19/81
<log#>11-50

<reply by>0
<dispo/date>OC/ENG STAFF - 11/25/81
<message>HOW DO I ANSWER THIS?
<answer>
<f/u>mm/dd/yy
<filed>RETURNED TO G

<subj>SRI INTERNATIONAL
<from>DANIEL D. SHEARER
<to>BELL, GORDON
<date>11/12/81
<date rec>11/19/81
<log#>11-49
<reply by>0
<dispo/date>AK - 11/25/81
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>WHO'S WHO IN TECHNOLOGY TODAY
<from>JOHN H. DICK - PRES.
<to>BELL, GORDON
<date>11/17/81
<date rec>11/19/81
<log#>11-48
<reply by>0
<dispo/date>NO - 11/25/81
<message>
<answer>
<f/u>mm/dd/yy
<filed>12
<done>Y
<>

<subj>RESUME
<from>GEORGE S. CROSBY
<to>BELL, GORDON

<date>11/16/81
<date rec>11/19/81
<log#>11-47
<reply by>0
<dispo/date>NO - 11/25/81
<message>
<answer>
<f/u>mm/dd/yy
<filed>12
<done>Y
<>

<subj>CORNUCOPIA CORPORATION
<from>PRINCE DUNCAN AYEMERE IDOKOGI
<to>BELL, GORDON
<date>11/14/81
<date rec>11/19/81
<log#>11-46
<reply by>0
<dispo/date>WIN HINDLE - 11/20/81
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
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<subj>EDP
<from>LINDA G. SPRAGUE
<to>BELL, GORDON
<date>11/16/81
<date rec>11/19/81
<log#>11-45
<reply by>0
<dispo/date>JOHN MEYER - 11/20/81
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y

<>

<subj>THE VICE PRESIDENT WAHSHINGTON
<from>GEORGE BUSH
<to>BELL, GORDON
<date>WEDNESDAY
<DATE REC>11/19/81
<log#>11-44
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>NATIONAL ACADEMY OF ENGINEERING
<from>COURTLAND D. PERKINS - PRES. - PLAQUE FOR SERVICE
<to>BELL, GORDON
<date>11/16/81
<date rec>11/19/81
<log#>11-43
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
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<subj>GASTON SNOW & ELY BARTLETT
<from>SUSAN H. NYCUM
<to>BELL, GORDON
<date>11/6/81
<date rec>11/19/81
<log#>11-42
<reply by>0

<dispo/date>STEVE LIPNER - 11/23/81
<message>WILL YOU GO? PLS. CONTACT IF APPROPIRATE
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>MECHANICAL CONSULTING SERVICE
<from>DAVID L. MAHER
<to>BELL, GORDON
<date>11/16/81
<date rec>11/18/81
<log#>11-41
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
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<subj>VAN NOSTRAND REINHOLD COMPANY
<from>TONY
<to>BELL, GORDON
<date>
<date rec>11/17/81
<log#>11-40
<reply by>0
<dispo/date>VAN NOSTRAND REINHOLD CO. - 11/20/81
<message>NOTE - THERE WERE SOME CHANGES
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>SEMICONDUCTOR INDUSTRY ASSOCIATION

<from>TOM HINKELMAN - EXECUTIVE DIRECTOR
<to>BELL, GORDON
<date>11/12/81
<date rec>11/17/81
<log#>11-39
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
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<subj>COMPUTER SYSTEMS LABORATORY
<from>JUD LEONARD
<to>BELL, GORDON
<date>
<date rec>11/16/81
<log#>11-38
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>BOARD OF OVERSEERS OF HARVARD COLLEGE
<from>ROBERT SHENTON - SEC.
<to>BELL, GORDON
<date>11/13/81
<date rec>11/16/81
<log#>11-37
<reply by>0
<dispo/date>FILED - HARVARD - 3/4/82
<message>
<answer>
<f/u>mm/dd/yy

<filed>HARVARD VISITING COMMITTEE - HARVARD UNIVERSITY
<done>Y
<>

<subj>DATA PROCESSIONG DESIGN, INC
<from>RICHARD MARINO
<to>BELL, GORDON
<date>11/9/81
<date rec>11/16/81
<log#>11-36
<reply by>0
<dispo/date>STEWARET, REYER,AK, JULIE, SI, TED WIN - 11/20/81
<message>I WROE A LETTER TO HIM IN ORDER TO OPENA DIALOGUE TO GET DECWORD FIXED. DON'T WE WANT TO OFFER DECWORD IMMEDIATELY ON VAX?
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>SUCCESSMOVE, INC.
<from>ED KOGLOWSKI
<to>BELL, GORDON
<date>11/12/81
<date rec>11/16/81
<log#>11-35
<reply by>WILL BE CALLING 11/19
<dispo/date>MEYER - 11/20/81
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>ADVANCED RESEARCH IN VLSI CONFERENCE
<from>MIT
<to>OLSEN, KEN

<date>
<date rec>11/16/81
<log#>11-34
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
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<subj>INSTITUTE FOR BASIC RESEARCH
<from>RUGGERO MARIA SANTILLI
<to>OLSEN, KEN
<date>11/6/81
<date rec>11/16/81
<log#>11-33
<reply by>0
<dispo/date>SAM - 11/20/81
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>TACTICAL EQUIPMENT CORP.
<from>PHILLIP A. KAUFMAN
<to>BELL, GORDON
<date>11/16/81
<date rec>11/16/81
<log#>11-32
<reply by>0
<dispo/date>NO INTEREST - 11/20/81
<message>
<answer>
<f/u>mm/dd/yy
<filed>12
<done>Y

<>

<subj>RESUME
<from>JOHN J. MCKENNA ASSOCIATES
<to>BELL, GORDON
<date>
<date rec>11/16/81
<log#>11-31
<reply by>0
<dispo/date>DIPIETRO - 11/16/81
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>BOSTON UNIVERSITY
<from>NICHOLAS WASHIENKO, PH.D
<to>BELL, GORDON
<date>
<date rec>11/13/81
<log#>11-30
<reply by>0
<dispo/date>LARRY - 11/17/81
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>AMERICAN MEN AND WOMEN OF SCIENCE
<from>MARTHA CARGILL, EDITOR
<to>BELL, GORDON
<date>
<date rec>11/13/81
<log#>11-29
<reply by>0

<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>UNIVERSITY OF WASHINGTON
<from>JEAN-LOUP BFAER
<to>BELL, GORDON
<date>11/9/81
<date rec>11/13/81
<log#>11-28
<reply by>0
<dispo/date>CIRC. FULLER,BJ,GLORIOS - 11/20/81
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>ANDRULIS RESEARCH CORPORATION
<from>ERWIN R. BRIGHAM
<to>BELL, GORDON
<date>11/10/81
<date rec>11/13/81
<log#>11-27
<reply by>0
<dispo/date>SORRY - 11/20/81
<message>
<answer>
<f/u>mm/dd/yy
<filed>12
<done>Y
<>

<subj>FORTUNE SYSTEMS CORPORATION

<from>GARY B. FRIEDMAN
<to>BELL, GORDON
<date>11/6/81
<date rec>11/13/81
<log#>11-27
<reply by>0
<dispo/date>THREW AWAY - 11/17/81
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>RITTA PERSONNEL - RESUME
<from>DANIEL F. MARTIN
<to>BELL, GORDON
<date>11/10/81
<date rec>11/12/81
<log#>11-26
<reply by>0
<dispo/date>JOHN DIPIETRO - 11/17/81
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>HARVARD UNIVERSITY
<from>PAUL C. MARTIN
<to>BELL, GORDON
<date>11/10/81
<date rec>11/12/81
<log#>11-25
<reply by>0
<dispo/date>FILED - HARVARD UNIVERSITY - 3/4/82
<message>
<answer>
<f/u>mm/dd/yy

<filed>HARVARD VISITING COMMITTEE - HARVARD UNIVERSITY
<done>Y
<>

<subj>UNIV. SOUTHERN CALIFORNIA
<from>ELLIS HOROWITZ
<to>BELL, GORDON
<date>11/9/81
<date rec>11/12/81
<log#>11-24
<reply by>0
<dispo/date>LETTER TO HOROWITZ - SENT BEFORE - 12/1/81
<message>I STILL FEEL THE SAME WAY, P.S. WOULD REALLY LIKE TO SEEHIS RECENT WORK.
<answer>
<f/u>mm/dd/yy
<filed>12
<done>Y
<>

<subj>BUTLER COX & PARTNERS LIMITED
<from>ROBERT MORETON - CONFERENCE MANAGER
<to>BELL, GORDON
<date>10/27/81
<date rec>11/12/81
<log#>11-23
<reply by>0
<dispo/date>LETTER IN GB'S AREA - 11/20/81
<message>
<answer>
<f/u>mm/dd/yy
<filed>12
<done>Y
<>

<subj>TWX
<FROM>OC
<to>BELL, GORDON
<date>11/10/81

<date rec>11/11/81
<log#>11-22
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>ENGINEERING COLLEGE MAGAZINES ASSOCIATED
<from>HOWARD J. SCHWEBKE - EXEC. SEC, ECMA
<to>BELL, GORDON
<date>11/81
<date rec>11/10/81
<log#>11-21
<reply by>0
<dispo/date>CORPORATE CONTRIBUTIONS GEORGE-CHAMBERLAIN - 11/17/81
<message>FYI
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>T. OWEN TRAINOR ASSOCIATES, INC.
<from>SALVATORE B. PELLITTERI - VP
<to>BELL, GORDON
<date>10/7/81
<date rec>11/10/81
<log#>11-20
<reply by>0
<dispo/date>DAVE BROWN - 11/11/81
<message>FYI
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y

<>

<subj>SIA
<from>T.D. HINKELMAN
<to>BELL, GORDON
<date>11/5/81
<date rec>11/10/81
<log#>11-19
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>TWX
<from>CARL HAWKINS
<to>BELL, GORDON
<date>11/6/81
<date rec>11/10/81
<log#>11-18
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>WESTINGHOUS ELECTRIC CORPORATION
<from>L.J. HUDSPETH, VP CORP. PROD. & QUALITY
<to>BELL, GORDON
<date>11/6/81
<date rec>11/10/81
<log#>11-17
<reply by>0

<dispo/date>DENNIS OCONNER, CLAYTON, FULLER, GLORIOSO, DIETER, WILLIAMS - 11/20/81
<message>WHO WILL ANSWER THIS?
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>NEW VERSION OF COMPUTER STRUCTURES
<from>RICHARD K. MICKEY
<to>BELL, GORDON
<date>11/5/81
<date rec>11/9/81
<log#>11-16
<reply by>0
<dispo/date>LETTER TO RICHARD - 11/23/81
<message>
<answer>
<f/u>mm/dd/yy
<filed>12
<done>Y
<>

<subj>J.D. FAIRCHILD & ASSOC.
<from>JOHN FAIRCHILD
<to>BELL, GORDON
<date>
<date rec>11/9/81
<log#>11-15
<reply by>0
<dispo/date>DIPIETRO - 11/10/81
<message>PLS HANDLE
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>FORTUNE SYSTEMS CORPORATION
<from>GARY B. FRIEDMAN - PRES
<to>BELL, GORDON
<date>11/6/81
<date rec>11/9/81
<log#>11-14
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>DEP. OF COMPUTING SCIENCE
<from>ERGONG HE, THE UIVERSITY OF ALBERTA, EDMONTON, ALBERTA, CANADA T6G 2H1, DEPT. OF COMP. SCIENCE
<to>BELL, GORDON
<date>10/31/81
<date rec>11/9/81
<log#>11-13
<reply by>0
<dispo/date>DIETER - 11/10/81
<message>PLS HANDLE
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>EXPERT WITNESS NETWORK
<from>GEORGE S. JENKINS, P.E. - PRES.
<to>BELL, GORDON
<date>11/2/81
<date rec>11/9/81
<log#>11-12
<reply by>0
<dispo/date>FILE 12 - 11/10/81
<message>

<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>EXPERT WITNESS NETWORK
<from>GEORGE S. JENKINS, P.E. - PRES.
<to>BELL, GORDON
<date>11/2/81
<date rec>11/9/81 Mon 13:32
<log#>11-12
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>REVIEWS
<from>STEVE TEICHER RE: DICKHUT/SUPNIK
<to>BELL, GORDON
<date>11/2/81
<date rec>11/5/81
<log#>11-11
<reply by>0
<dispo/date>11/6/81
<message>TO LARRY PORTNER- GB DID NOT SIGN AS "DID NOT FEEL RIGHT ON THIS NEBULOUS PROPOSAL"
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>RESUME
<FROM>FRANK E. HEART

<to>BELL, GORDON
<date>11/2/81
<date rec>11/6/81
<log#>11-10
<reply by>0
<dispo/date>WIN/KEN/SAM/JACK/MEYER/ - 11/25/81
<message>LET'S HAVE FRANK OUT FOR A CASUAL DISCUSSION
<answer>
<f/u>mm/dd/yy
<filed>RETURNED TO G
<done>Y
<>

<subj>GENERAL DEVICES, INC
<from>RICHARD W. CLARK - TECH. DIRECTOR
<to>BELL, GORDON
<date>11/2/81
<date rec>11/5/81
<log#>11-9
<reply by>0
<dispo/date>TEICHER - 11/6/81
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>SIA
<from>LINDA D. PICKERING - OFFICE MANAGER
<to>BELL, GORDON
<date>11/2/81
<date rec>11/5/81
<log#>11-8
<reply by>0
<dispo/date>JIM CUDMORE - 11/24/81
<message>TO JIM CUDMORE
<answer>
<f/u>mm/dd/yy
<filed>

<done>Y
<>

<subj>THE SENIOR MANAGEMENT PROGRAM
<from>WALTER J. DONOVAN - EXECUTIVE VP
<to>BELL, GORDON
<date>10/23/81
<date rec>11/4/81
<log#>11-7
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>UNITED STATES DEPARTMENT OF COMMERCE
<from>JUSDON C. FRENCH - DIRECTOR
<to>BELL, GORDON
<date>10/29/81
<date rec>11/4/81
<log#>11-6
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>BUSINESS WEEK INVITATION
<from>LEWIS H. YOUNG
<to>BELL, GORDON
<date>11/4/81
<date rec>10/28/81
<log#>11-5

<reply by>0
<dispo/date>11/4/81 Wed 10:29
<message>rsvp to sarah duffy-cannot attend
<answer>
<f/u>mm/dd/yy
<filed>12
<done>Y
<>

<subj>TWX
<from>BRIGITTE MARGER
<to>BELL, GORDON
<date>10/29/81
<date rec>11/3/81
<LOG#>11-4
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>COMMERCIAL COMPUTER SERVICES, INC
<from>STUART M. KATZ - PRESIDENT
<to>BELL, GORDON
<date>10/29/81
<date rec>11/3/81
<log#>11-3
<reply by>0
<dispo/date>LETTER TO STUART KATZ - 11/9/81
<message>
<answer>
<f/u>
<filed>LETTERBOOK
<done>Y
<>

<subj>PARAMIN, INC.
<from>JOHN B. MIKLE - PRES.
<to>BELL, GORDON
<date>10/30/81
<date rec>11/3/81
<log#>11-2
<reply by>0
<dispo/date>LACROUTE - 11/6/81
<message>PLEASE CALL HIM
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>BOSTON RESEARCH DIRECTORS' CLUB
<from>TERRENCE HENG - SECRETARY - TREASURER
<to>BELL, GORDON
<date>10/12/81
<date rec>11/3/81
<log#>11-1
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>RESUME
<from>TRAC, INC.
<to>BELL, GORDON
<date>
<date rec>11/2/81
<log#>10-73
<reply by>0
<dispo/date>11/4/81
<message>John DePietro please handle
<answer>

<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>AMK BERLIN
<from>I.A. BIRGIT VOSS - PROJEKT OFFICER IKD
<to>BELL, GORDON
<date>10/21/81
<date rec>11/2/81
<log#>10-72
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>IBM
<from>ERICH BLOCH
<to>BELL, GORDON
<date>10/23/81
<date rec>11/2/81
<log#>10-71
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>JOB OPENING REQUEST
<from>DAVID ZAIG
<to>BELL, GORDON
<date>10/29/81

<date rec>11/2/81
<log#>10-70
<reply by>0
<dispo/date>GWEN - 11/6/81
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>TWX
<from>DICK DAVIES
<to>BELL, GORDON
<date>10/30/81
<date rec>11/2/81
<log#>10-69
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>TWX
<from>DICK DAVIES
<to>BELL, GORDON
<date>10/30/81
<date rec>11/2/81
<log#>10-30-68
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>INMOS
<from>IANN M. BARRON - EXEC. DIRECTOR
<to>BELL, GORDON
<date>9/15/81
<date rec>11/2/81
<log#>10-67
<reply by>0
<dispo/date>11/3/81
<message>SENT TO RON REILING - HOW DO I DEAL WITH THIS?
<answer>
<f/u>11/6/81
<filed>
<done>Y
<>

<subj>RECEIPTS FROM MONTY
<from>MONTY - 1210 GALISTEO PARKWAY, SANTA FE, NM 87501
<to>BELL, GORDON
<date>10/28/81
<date rec>11/2/81
<log#>10-66
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>TEKTRONIX
<from>JOE POLHILL
<to>BELL, GORDON
<date>
<date rec>11/2/81
<log#>10-65
<reply by>0
<dispo/date>

<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>BATTELLE COLUMBUS LABORATORIES RE: RESEARCH PROGRAM ON KEY TECHNOLOGIES IN THE 1980'S
<from>ALVIN M. WHITE SENT TO AL BERTOCCHI
<to>BELL, GORDON
<date>10/12/81
<date rec>10/30/81
<log#>10-64
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>SIA (SEMICONDUCTOR INDUSTRY ASSO)
<from>TOM HINKELMAN
<to>BELL, GORDON
<date>10/13/81
<date rec>10/16/81
<log#>10-63
<reply by>0
<dispo/date>10/22/81 (SENT TO JEFF KALB)
<message>JEFF ARE YOU GOING?
<answer>
<f/u>10/30/81
<filed>
<done>Y
<>

<subj>FERMILAB INDUSTRIAL AFFILIATES

<from>LEON M. LEDERMAN - DIRECTOR
<to>BELL, GORDON
<date>10/28/81
<date rec>10/30/81
<log#>10-62
<reply by>0
<dispo/date>JOEL SCHWARTZ - 11/3/81
<message>CAN YOU ANSWER THIS? FYI - THIS WOULD PROBABLY HELP SELL.
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>CALIFORNIA INSTITUTE OF TECHNOLOGY
<from>DR. GEORGE LEWICKI
<to>DEL THORNDIKE
<date>10/13/81
<date rec>10/30/81
<log#>10-61
<reply by>0
<dispo/date>11/4/81
<message>
<answerunable to attend see 10-53
<f/u>mm/dd/yy
<filed>12
<done>Y
<>

<subj>UNIVERSITY OF CALIFORNIA
<from>HAROLD COHEN - PROFESSOR
<to>GEORGE CHAMPINE
<date>10/20/81
<date rec>10/30/81
<log#>10-60
<reply by>0
<dispo/date>
<message>
<answer>

<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>CORPORATE REALTY LTD.
<from>MICHAEL G. SNOWDEN - DIRECTOR
<to>BELL, GORDON
<date>10/20/81
<date rec>10/30/81
<log#>10-59
<reply by>0
<dispo/date>12/18/81
<message>
<answer>standard mill renovation letter from MJ + brochure + guidelines + cc Ken Olsen
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>RIXON INC.
<from>LEE H. SCHANK
<to>BELL, GORDON
<date>10/26/81
<date rec>10/30/81
<log#>10-58
<reply by>0
<dispo/date>11/13/81
<message>
<answer>
<f/u>mm/dd/yy
<filed>file 12
<done>Y
<>

<subj>INVITATION TO LUNCH W/COMP. PROD. DIV. OF MAXELL CORP.
<from>DAVID B. MONOSON
<to>BELL, GORDON

<date>10/15/81
<date rec>10/23/81 Fri 15:14
<log#>10-57
<reply by>0
<dispo/date>SAVIERS - 11/3/81
<message>TO INTRODUCE MAXELL LINE OF FLOPPY DISKS
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>RAY PETERSON - RESUME
<from>PETER CHRISTY
<to>BELL, GORDON
<date>10/22/81
<date rec>10/23/81
<log#>10-56
<reply by>0
<dispo/date>11/4/81
<message>ROUTED TO WILL, CLAYTON & JOE CHENAIL ALSO ASKED JOHN MEYER TO HANDLE AND ALSO CONTACT PETER CHRISTY - GB OUT OF THE LOOP
<answer>
<f/u>mm/dd/yy
<filed>12
<done>Y
<>

<subj>SRC INTERIM BOARD MTG AGENDA AND BACKUP MATERIAL
<from>ERICH ....BLOCH
<to>BELL, GORDON
<date>10/19/81
<date rec>10/23/81
<log#>10-55
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy

<filed>
<done>Y
<>

<subj>THRESHOLD TECHNOLOGY (THANK YOU LETTER + LIT)
<from>JOSEPH J. BOVE - VP MARKETING
<to>BELL, GORDON
<date>10/16/81
<date rec>10/23/81
<log#>10-55
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>THE ARCHITECTURE OF AN ELECTRONIC BOOK - TECHNICAL REPORT
<from>DR. JOHN M. MURRAY - PROF. - U OF COLO
<to>BELL, GORDON
<date>4/10/81 (ON PAPER)
<date rec>10/23/81
<log#>10-54
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>SILICON STRUCTURES PROJECT
<from>GEORGE LEWICKI - CALIFORNIA INSTITUTE OF TECHNOLOGY
<to>BELL, GORDON
<date>10/19/81

<date rec>10/23/81
<log#>10-53
<reply by>0
<dispo/date>
<message>unable to attend (with regrets)
<answer>
<f/u>mm/dd/yy
<filed>12
<done>Y
<>

<subj>ICPS
<from>ARTHUR BIENENSTOCK - STANFORD SYNCHROTRON RADIATION LAB
<to>BELL, GORDON
<date>10/19/81
<date rec>10/23/81
<log#>10-52
<reply by>0
<dispo/date>TEICHER - 11/3/81
<message>YOURS
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>RESEARCH INSTITUTE REPORT (2) 10/9 & 10/16)
<from>KEN O
<to>BELL, GORDON
<date>
<date rec>10/23/81
<log#>10-51
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>VIDEODISC DATA STORAGE
<from>KONRAD K. KALBA PRES., KALBA BOWEN ASSOCIATES
<to>BELL, GORDON
<date>OCTOBER 21, 1981
<date rec>10/23/81
<log#>10-50
<reply by>0
<dispo/date>SAVIERS - 11/3/81
<message>YOURS
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>SOFTWARE PIRACY
<from>LOYD D. GALLAHER - INFORMATION CONCEPTS, INC.
<to>BELL, GORDON
<date>10/16/81
<date rec>10/21/81
<log#>10-49
<reply by>0
<dispo/date>10/23/81
<message>sent to BJ "Please lead on this...or answer it"
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>STATUS OF SEMICONDUCTOR MEASUREMENT TECH PROGRAM
<from>JUDSON C. FRENCH - NAT BUREAU OF STANDARDS
<to>WARREN E. DAVIS
<Date>Oct 21, 81
<date rec>10/22/81 Thu 13:18
<log#>10-48
<reply by>0

<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>MATHEMATICAL ART-PRODUCING SYSTEM
<from>ROBERT GUARENTE
<to>BELL, GORDON
<date>10/21/81
<date rec>10/21/81
<log#>10-47
<reply by>0
<dispo/date>11/4/81
<message>contacted Rick Merrill re: obtaining a GiGi & a T/S account
<answer>
<f/u>11/13/81
<filed>f/u
<done>Y
<>

<subj>INFORMATION CONCEPTS, INC.
<from>LOYD GALLAHER - PRES.
<to>BELL, GORDON
<date>10/16/81
<date rec>10/21/81
<log#>10-46
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>AMERICAN ASSOCIATION OF ENIGNERING SOCIETIES, INC.
<from>CARL FREY
<to>BELL, GORDON
<date>10/10/81
<date rec>10/21/81
<log#>10-45
<reply by>0
<dispo/date>10/23/81
<message>ret to Who's Who in Eng (kept a copy)
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>RESUME
<from>JOHN J. MCKENNA ASSOCIATES
<to>BELL, GORDON
<date>
<date rec>10/21/81
<log#>10-44
<reply by>0
<dispo/date>DIPIETRO - 10/21/81
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>JET PROPULSION LABORATORY JPI
<from>R.L. WESSNER
<to>DIRECTOR, PRODUCT DEVELOPMENT
<date>10/9/81
<date rec>10/21/81
<log#>10-43
<reply by>0
<dispo/date>
<message>

<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>DAIICHI JITSUGYO CO., LTD.
<from>M YOSHIMURA, MANAGER
<to>BELL, GORDON
<date>9/26/81
<date rec>10/21/81
<log#>10-42
<reply by>0
<dispo/date>AVERY - 10/21/81
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>LIGHT SWITCHING ARRAY - PHILLIPS
<from>E. VAN DER WOUDE OF PHILLIPS, EINDHOVEN, NETHERLAND
<to>BELL, GORDON
<date>10/13/81
<date rec>10/20/81
<log#>10-41
<reply by>0
<dispo/date>10/23/81
<message>sent to Bill Avery "These guys are good - you or Stocky look at these?"
<answer>
<f/u>mm/dd/yy10/30/81
<filed>
<done>Y
<>

<subj>RESUME-FREDERICK R. RADCLIFFE
<from>MIKE BOYD MR1-2/E16

<to>BELL, GORDON
<date>10/20/81 Tue 13:32
<date rec>10/20/81
<log#>10-40
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>INVESTMENTS
<from>MERRILL LYNCH, PIERCE, FENNER & SMITH
<to>BELL, GORDON
<date>10/20/81 Tue 13:25
<date rec>10/20/81
<log#>10-39
<reply by>0
<dispo/date>
<message>NOT INTERESTED
<answer>
<f/u>mm/dd/yy
<filed>FILE 12
<done>Y
<>

<subj>ACM INVITATION
<from>SOPKA/LAMIA
<to>BELL, GORDON
<date>OCT 5, 81/NOV 6, 1981
<date rec>10/20/81/11/9/81
<log#>10-38
<reply by>0
<dispo/date>11/12/81
<message>CALLED LAMIA - PUT OFF FOR A YEAR
<answer>
<f/u>mm/dd/yy
<filed>12

<done>Y
<>

<subj>IBM
<from>RESEARCH REPORT
<to>BELL, GORDON
<date>
<date rec>10/19/81
<log#>10-37
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>DIAMOND SHAMROCK
<from>JAMES T. EASTON - MANAGER
<to>BELL, GORDON
<date>10/9/81
<date rec>10/19/81
<log#>10-36
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>OMSI
<from>MICHAEL TEMPLETON - EXECUTIVE DIRECTOR
<to>BELL, GORDON
<date>10/15/81
<date rec>10/19/81
<log#>10-35
<reply by>0

<dispo/date>LETTER TO MIKE TEMPLETON - 11/6/81
<message>LETTER FILED IN 12
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>ROCKWELL INTERNATIONAL
<from>ROBERT E. ANSLOW - DIRECTOR WW SALES
<to>BELL, GORDON
<date>10/2/81
<date rec>10/19/81
<log#>10-34
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>RESUME
<from>? RONALD SAVOY
<to>BELL, GORDON
<date>
<date rec>10/19/81
<log#>10-33
<reply by>0
<dispo/date>DIPIETRO - 10/19/81
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>SYSTONICS

<from>NINO CERNIGLIA - VP
<to>BELL, GORDON
<date>10/14/81
<date rec>10/19/81
<log#>10-32
<reply by>0
<dispo/date>JACK SMITH - 10/19/81
<message>FYI
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>ALPHA DATA
<from>D. CURTISS JOHNSON
<to>BELL, GORDON
<date>10/13/81
<date rec>10/19/81
<log#>10-31
<reply by>0
<dispo/date>SAVIERS - 10/21/81
<message>YOURS
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>USR/GROUP
<from>MARLEEN MARTIN - VP
<to>BELL, GORDON
<date>10/12/81
<date rec>10/19/81
<log#>10-30
<reply by>0
<dispo/date>CALLED TO APOLOGIZE - 11/20/81
<message>
<answer>
<f/u>mm/dd/yy

<filed>12
<done>Y
<>

<subj>FIELD STUDY
<from>LINDA MARKS
<to>BELL, GORDON
<date>10/13/81
<date rec>10/19/81
<log#>10-29
<reply by>0
<dispo/date>10/22/81
<message>sent to Win to handle and in turn she was put in touch with Mark Steinkrauss 10/27/81
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>DATAMATION
<from>
<to>BELL, GORDON
<date>
<date rec>10/9/81
<log#>10-28
<reply by>0
<dispo/date>TO DATAMATION - YES
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>SYRACUSE UNIVERSITY
<from>DANIEL J. PEASE - ASST. PROF.
<to>BELL, GORDON
<date>9/18/81

<date rec>10/15/81
<log#>10-27
<reply by>0
<dispo/date>LETTER SENT OT PROF. DAN PEASE -- MEANY - 11/3/81
<message>THE MUSEUM AIN'T GOT THE $.   THE SET OF MACHINES WOULD BE NICE TO HAVE, ESPECIALLY IN 50-100 YEARS IF WE COULD STORE THEM.
<answer>
<f/u>mm/dd/yy
<filed>12
<done>Y
<>

<subj>AMA
<from>CHARLES M JOHNSON
<to>BELL, GORDON
<date>9/25/81
<date rec>10/15/81
<log#>10-26
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>PHILIPS
<from>W. HOEKSTRA
<to>BELL, GORDON
<date>10/1/81
<date rec>10/14/81
<log#>10-25
<reply by>0
<dispo/date>SAVIERS - 10/16/81
<message>PLEASE HANDLE
<answer>
<f/u>mm/dd/yy
<filed>

<done>Y
<>

<subj>NATIONAL RESEARCH COUNCIL
<from>DONALD BURNHAM - CHAIRMAN
<to>BELL, GORDON
<date>10/2/81
<date rec>10/14/81
<log#>10-24
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>PRIME
<from>ROBERT S. SWARZ, PH.D
<to>BELL, GORDON
<date>10/6/81
<date rec>10/13/81
<log#>10-23
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>RESUME
<from>RUTH O. GUMPRT
<to>BELL, GORDON
<date>10/11/81
<date rec>10/13/81
<log#>10-22

<reply by>0
<dispo/date>JOHN DIPIETRO - 10/13/81
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>CAMBRIDGE RESEARCH INSTITUTE
<from>NEIL WASSERMAN
<to>BELL, GORDON
<date>10/8/81
<date rec>10/12/81
<log#>10-21
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>U OF CALIF. LOS ALAMOS SCIENTIFIC LAB.
<from>GLORIA LUJAN
<to>BELL, GORDON
<date>10/5/81
<date rec>10/9/81
<log#>10-20
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>THE DOWD GROUP
<from>ROLAND DOWD
<to>BELL, GORDON
<date>10/6/81
<date rec>10/9/81
<log#>10-19
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>MAIN LINE PERSONNEL SERVICES, INC.
<from>RALPH L. SCHIFFER, MANAGER OF RECRUITMENT
<to>BELL, GORDON
<date>9/1/81
<date rec>10/9/81
<log#>10-17
<reply by>0
<dispo/date>DIPIETRO - 10/12/81
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>IT&T
<from>MR. ARASKOG - REQUESTING ATTENDANCE TO PRIVATE DINNER
<to>BELL, GORDON
<date>
<date rec>10/8/81
<log#>10-16
<reply by>0
<dispo/date>
<message>
<answer>

<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>THE VOICE ELECTRONICS LABORATORY, INC.
<from>JOSEPH M. FOX - PRESIDENT
<to>BELL, GORDON
<date>9/30/81
<date rec>10/8/81
<log#>10-15
<reply by>0
<dispo/date>FULLER - 10/14/81
<message>I BELIEVE WE SHOULD SAY NO. AGREE?
<answer>no interest
<f/u>10/23
<filed>12
<done>Y
<>

<subj>ROCKWELL INTERNATIONAL
<from>ROBERT E. ANSLOW - DIRECTOR WORLDWIDE SALES
<to>BELL, GORDON
<date>10/2/81
<date rec>10/8/81
<log#>10-14
<reply by>0
<dispo/date>KALB - 10/14/81
<message>THIS REPORT IS BEING CIRCULATED
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>TEXAS INSTRUMENTS
<from>MARVIN CONRAD - SR. MEMBER OF TECH. STAFF
<to>BELL, GORDON
<date>10/6/81

<date rec>10/8/81
<log#>10-13
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>CMG ST. LOUIS CHAPTER
<from>T. LEO LO, PH.D
<to>TED JOHNSON
<date>9/28/81
<date rec>10/8/81
<log#>10-12
<reply by>0
<dispo/date>TED JOHNSON - 10/13/81
<message>YOU MIGHT CALL TERRY POLTER TO GET A SPEAKER OR TO SPEAK HERE. TERRY HEADS OUR PERF. ANALYSIS GROUP.
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>GNOSTIC CONCEPTS, INC.
<from>BILL WALSH - SENIOR ANALYST
<to>BELL, GORDON
<date>10/2/81
<date rec>10/6/81
<log#>10-11
<reply by>0
<dispo/date>DEMMER - 10/8/81
<message>YOUR DOING THIS
<answer>CALL FROM WALSH--REFERRED HIM TO DEMMER - 10/12/81
<f/u>mm/dd/yy
<filed>
<done>Y

<>

<subj>NATIONAL SCIENCE FOUNDATION
<from>BERNARD CHERN
<to>BELL, GORDON
<date>
<date rec>10/5/81
<log#>10-10
<reply by>0
<dispo/date>NSF 10/8/81 Thu 9:46
<message>
<answer>
<f/u>mm/dd/yy
<filed>NSF REVIEWS
<done>Y
<>

<subj>WU MAILGRAM
<from>SEMIOCNDUCTOR INDUSTRY
<to>BELL, GORDON
<date>10/5/81
<date rec>10/5/81
<log#>10-9
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>WU MAILGRAM
<from>IBM - BURDICK
<to>BELL, GORDON
<date>10/5/81
<date rec>10/5/81
<log#>10-8
<reply by>0

<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>TWX
<from>IRWIN FEDERAMN/ERICH BLOCH - 44 SOUTH BROADWAY, WHITE PLAINS, NY 10601
<to>BELL, GORDON
<date>10/2/81
<date rec>10/5/81
<log#>10-7
<reply by>0
<dispo/date>KALB - 10/14/81
<message>WHAT DO YOU SUGGEST?
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>RESUME
<from>MARTIN SCHULTZ
<to>BELL, GORDON
<date>9/29/81
<date rec>10/5/81
<log#>10-6
<reply by>0
<dispo/date>DIPIETRO - 10/8/81
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>RESUME - PETER DAVID HOWES
<from>GENE MONDONI
<to>BELL, GORDON

<date>9/30/81
<date rec>10/2/81
<log#>10-5
<reply by>0
<dispo/date>DIPIETRO - 10/13/81
<message>LET'S TALK TO HIM, NOT CLEAR WHERE HE COULD HELP
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>THE BROADMOOR
<from>SAME
<to>BELL, GORDON
<date>9/24/81
<date rec>10/2/81
<log#>10-4
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>OPTO LINE
<from>J. A. LAMONTAGNE
<to>BELL, GORDON
<date>9/30/81
<date rec>10/2/81
<log#>10-3
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>WILLIAM MCCULLOCH ASSOC.
<from>WILLIAM MCCULLOCH
<to>BELL, GORDON
<date>9/28/81
<date rec>10/1/81
<log#>10-2
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>HUXTABLE
<from>FULTON L. HUSTABLE - PRES.
<to>BELL, GORDON
<date>9/28/81
<date rec>10/1/81
<log#>10-1
<reply by>0
<dispo/date>DIPIETRO - 10/5/81
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>MICRO CYBERNETICS
<from>STUART KIRCHNER - PRES
<to>BELL, GORDON
<date>9/26/81
<date rec>9/30/81
<log#>9-31
<reply by>0
<dispo/date>FULLER - 10/5/81

<message>DO WE STILL HAVE A PLACE FOR EXT. CONSULTANTS?
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>ELEKTRO-PHYSIK, INC.
<from>KLAUS E. STEINGROEVER - PRES.
<to>BELL, GORDON
<date>9/25/81
<date rec>9/29/81
<log#>9-30
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>RESUME - P.S. CHIB
<from>P.S. CHIB
<to>BELL, GORDON
<date>9/25/81
<date rec>9/28/81
<log#>9-29
<reply by>0
<dispo/date>DIPIETRO - PLS HANDLE
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>AMER. BIOGRAPHICAL INST.
<from>J.S. MILLS
<to>BELL, GORDON

<date>9/22/81
<date rec>9/28/81
<log#>9-28
<reply by>0
<dispo/date>
<message>NO INTEREST
<answer>
<f/u>mm/dd/yy
<filed>NO
<done>Y
<>

<subj>RIXON INC.
<from>LEE H. SCHANK - VP GENERAL MANAGER
<to>BELL, GORDON
<date>9/22/81
<date rec>9/28/81
<log#>9-27
<reply by>0
<dispo/date>LACROUTE - 10/16/81
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>CARNEGIE-MELLON UNIVERSITY
<from>A.N. HABERMANN - PROFESSOR AND DEPARTMENT HEAD
<to>BELL, GORDON
<date>9/22/81
<date rec>9/25/81
<log#>9-26
<reply by>0
<dispo/date>HABERMANN - 10/14/81
<message>LETTER FILED GB3.S1.25
<answer>
<f/u>mm/dd/yy
<filed>GB3
<done>Y

<>

<subj>OKLAHOMA STATE UNIVERSTIY
<from>DANELL Q. MOHANTY, COORDINATOR
<to>BELL, GORDON
<date>9/18/81
<date rec>9/24/81
<log#>9-25
<reply by>0
<dispo/date>JANE GORING - 10/5/81
<message>FYI
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>TWX
<from>PIOTR KOWALSKI - MIT
<to>BELL, GORDON
<date>9/21/81
<date rec>9/24/81
<log#>9-24
<reply by>0
<dispo/date>MUSEUM & GEORGE CHAMBERLAIN - 10/8/81
<message>FYI, LET'S GET A FILM ON THIS WORK.
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>COMPUTER SCIENCE DEPARTMENT
<from>MARIO R. BARBACCI
<to>BELL, GORDON
<date>9/19/81
<date rec>9/24/81
<log#>9-23
<reply by>0

<dispo/date>HABERMANN - 10/14/81
<message>IN LETTERBOOK WITH LETTER TO HABERMANN
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>STEIGER-EGLI CALULATOR
<from>MARGARET W. KENNEDY, PHD
<to>BELL, GORDON
<date>9/22/81
<date rec>9/24/81
<log#>9-22
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>UNIVERSITY OF HOUSTON
<from>ANNE L. SIMPSON
<to>...KEN OLSEN
<date>9/10/81
<date rec>9/24/81
<log#>9-21
<reply by>0
<dispo/date>DIETER - 9/30/81
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>memo - RIKA BRADEMANN - GENEVA

<from>RIKA
<to>BELL, GORDON
<date>9/14/81
<date rec>9/24/81
<log#>9-20
<reply by>0
<dispo/date>GLORIOSO - 9/24/81
<message>CAN WE SENDSOMEONE WITH A PROGRAM?
<answer>Attached is a copy of paper Harry has submitted.
<message fm g>GLORIOSO - THIS SOUNDS GREAT
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>SHOWCASE FOR TECHNOLOGY
<from>H.M. WILLIS
<to>BELL, GORDON
<date>9/17/81
<date rec>9/21/81
<log#>9-19
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>INTERCONTINENTAL AIR FREIGHT, INC.
<from>NICHOLAS TZANNOS
<to>OLSEN, KEN
<date>7/6/81
<date rec>9/21/81
<log#>9-18
<reply by>0
<dispo/date>11/13/81
<message>DOUBT WE WILL PARTICIPATE BUT KEEP US POSTED
<answer>

<f/u>mm/dd/yy
<filed>12
<done>Y
<>

<subj>RESUME - HOSSEIN KERAMATY
<from>HOSSEIN
<to>BELL, GORDON
<date>9/16/81
<date rec>9/21/81
<log#>9-17
<reply by>0
<dispo/date>JOHN DIPIETRO - 9/24/81
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>MARTINDALE ASSOCIATES, INC.
<from>JIM DAVIS - SALES SUPPORT
<to>BELL, GORDON
<date>9/10/81
<date rec>9/21/81
<log#>9-16
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>TERADYNE
<from>ROBERT DUNHAM - NATIONAL ACCOUNT MANAGER
<to>BELL, GORDON
<date>9/18/81

<date rec>9/21/81
<log#>9-15
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>G.O. GRAPHICS
<from>THOMAS L. DOYLE - DIRECTOR, OPERATIONS AND PLANNING
<to>BELL, GORDON
<date>9/19/81
<date rec>9/21/81
<log#>9-14
<reply by>0
<dispo/date>LACROUTE - 10/5/81
<message>WHAT IF WE DID THIS? LET'S TALK TO THEM. MAYBE THE BEST PROTOCOL CONVERSION UNIT WOULD BE A VT103...IT GIVES US PKG & P/S AND CPU AND SPACE TO EXPAND.
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>IMAGE PROCESSING LABORATORY
<from>HERBERT FREEMAN - PROFESSOR OF COMPUTER ENIGNEERING
<to>BELL, GORDON
<date>9/15/81
<date rec>9/21/81
<log#>9-13
<reply by>0
<dispo/date>FILED IN 12 - 10/8/81
<message>
<answer>
<f/u>
<filed>12

<done>Y
<>

<subj>MACKINTOSH INTERNATIONAL
IAN MACKINTOSH INTERNATIONAL LIMITED
MACKINTOSH HOUSE, NAPIER ROAD, LUTON, LU1 1RG, ENGLAND
TEL. (0582)412716, (0582)417738, TELEX 826818
<from>IAN M MACKINTOSH - CHAIRMAN
<to>KEN OLSEN
<date>9/11/81
<date rec>9/18/81
<log#>9-12
<reply by>0
<dispo/date>CUDMORE - 10/5/81
<message>YOURS
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>THRESHOLD
<from>JOSEPH J. BOVE -- VP MARKETING
<to>BELL, GORDON
<date>9/9/81
<date rec>9/17/81
<log#>9-11
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed......>
<done>Y
<>

<subj>BOSTON FESTIVAL BALLET
<from>NEENYA OSTORM FUNDRAISING COMM. BOARD OF GOVERNORS

<to>BELL, GORDON
<date>9/2/81
<date rec>9/15/81
<log#>9-10
<reply by>0
<dispo/date>GEORGE CHAMBERLAIN
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>CRIMSON CAMERA TECHNICAL SALES, INC.
<from>PHIL AHERN
<to>BELL, GORDON
<date>9/11/81
<date rec>9/14/81
<log#>9-9
<reply by>0
<dispo/date>ARTHUR DEAN - 9/16/81
<message>KNOW ANYTHNG ABUT THIS CO?
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>MAIN LINE PERSONNEL SERVICES, INC.
<from>RALPH L. SCHIFFER
<to>BELL, GORDON
<date>8/25/81
<date rec>9/14/81
<log#>9-8
<reply by>0
<dispo/date>ULF FAGERQUIST - 9/17/81
<message>
<answer>
<f/u>mm/dd/yy
<filed>

<done>Y
<>

<subj>RESUME - JOHN E. BRENNAN
<from>JOHN BRENNAN
<to>BELL, GORDON
<date>9/10/81
<date rec>9/14/81
<log#>9-7
<reply by>0
<dispo/date>DIPIETRO - 9/15/81
<message>PLEASE HANDLE
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>IBM
<from>ERICH BLOCH
<to>BELL, GORDON
<date>9/8/81
<date rec>9/11/81
<log#>9-6
<reply by>0
<dispo/date>FILED SUBJ: SRC PROPOSAL
<message>
<answer>
<f/u>mm/dd/yy
<filed>SRC PROPOSAL
<done>Y
<>

<subj>UNIVERSITY OF NEW CASTLE UPON TYNE
<from>DR. PHILIP C. TRELEAVEN
<to>BELL, GORDON
<date>9/7/81
<date rec>9/11/81
<log#>9-5
<reply by>0

<dispo/date>DIETER, - 9/29/81
<message>CAN WE/SHOULD WE SUPPORT?
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>POLYTECHNIC
<from>EDWARD J. SMITH - PROFESSOR - COMP. SCI. DIV.
<TO>BELL, GORDON
<date>9/9/81
<date rec>9/11/81
<log#>9-4
<reply by>0
<dispo/date>CALLED SMITH WITH REGRETS, OVERCOMMITTED 9/30/81
Wed 16:46
<message>
<answer>
<f/u>mm/dd/yy
<filed>12
<done>Y
<>

<subj>MIT SUSTAINING FELLOWS
<FROM>MR. BREENE M. KERR, CHAIRMAN
<to>BELL, GORDON
<date>9/1/81
<date rec>9/10/81
<log#>9-3
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>L.F. ROTHSCHILD, UNTERBERG, TOWBIN
<from>WILLIAM H. CARNEY III
<to>BELL, GORDON
<date>9/4/81
<date rec>9/8/81
<log#>9-2
<reply by>0
<dispo/date>GEORGE CHAMPINE - 10/5/81
<message>SOUNDS LIKE YOUR JOB.
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>SECURITIES AND EXCHANGE COMMISSION
<from>CECILIA K. HILLMAN - CHIEF BRANCH OF OWNERSHIP & EXAMINATIONS
<to>BELL, GORDON
<date>8/28/81
<date rec>9/8/81
<log#>9-1
<reply by>0
<dispo/date>BOB DILL 9/8/81 Tue 11:43
<message>HELP
<answer>
<f/u>mm/dd/yy
<filed>13
<done>Y
<>

<subj>VT100 FOR NATIONAL MUSEUM OF MODERN ART, PARIS
<from>PIOTR KOWALSKI
<to>BELL, GORDON
<date>9/2/81
<date rec>9/3/81
<log#>8-70
<reply by>9/11/81
<dispo/date>CHAMBERLAIN 9/4/81 Fri 9:58
<message>LET'S GET HIM ONE. HE SHOULD SIGN AN AGREEMENT. IF OK, I'LL ARRANGE.

<answer>
<f/u>9/11/81
<filed>
<done>N
<>

<subj>UNITED TECHNOLOGIES
<from>PETER L. SCOTT
<to>BELL, GORDON
<date>8/28/81
<date rec>9/1/81
<log#>8-69
<reply by>0
<dispo/date>GWEN - 9/15/81
<message>THANK YOU, NO.
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>MONOSSON ON DEC - SENT CHECK $31.68 FOR REFUND OF UNUSED SUBSCRIPTION.
<from>ELVIS PINEYRO - CIRCULATION MANAGER
<to>BELL, GORDON
<date>8/25/81
<date rec>9/1/81
<log#>8-68
<reply by>0
<dispo/date>RENATE BAPTISTE - 9/1/81
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>

<from>
<to>BELL, GORDON
<date>
<date rec>
<log#>8-
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>SIGNETICS
<from>LEN UMINA - TECHNICAL PROGRAM MANAGER
<to>BELL, GORDON
<date>8/24/81
<date rec>8/31/81
<log#>8-67
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>KIDDER, PEABODY & CO.
<from>PETER F. RICCHIUTI
<to>BELL, GORDON
<date>
<date rec>8/31/81
<log#>8-66
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>

<done>Y
<>

<subj>RESUME - HARRISON S. CAMPBELL
<from>HARRISON S. CAMPBELL
<to>BELL, GORDON
<date>
<date rec>8/31/81
<log#>8-65
<reply by>0
<dispo/date>DIPIETRO - 9/1/81
<message>PLEASE HANDLE
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>THE CATHOLIC UNIVERSITY OF AMERICA
<from>KARL C. THOMAS - DIRECTOR, COMPUTER CENTER
<to>BELL, GORDON
<date>8/26/81
<date rec>8/31/81
<log#>8-64
<reply by>0
<dispo/date>GEORGE CHAMBERLAIN - 9/8/81
<message>SENT DEMAN SHUTTLE
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>TWX
<from>TOM KOBAYASHI
<to>BELL, GORDON
<date>8/28/81
<date rec>8/28/81
<log#>8-63

<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>13
<done>Y
<>

<subj>TWX
<from>ANDY REDDISH - AB
<to>BELL, GORDON
<date>8/28/81
<date rec>8/28/81
<log#>8-62
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>TWX
<from>TOM KOBAYASHI
<to>BELL, GORDON
<date>8/28/81
<date rec>8/28/81
<log#>8-61
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>UNIVERSITY OF WASHINGTON
<from>ROBERT W. RITCHIE - PROF. AND CHAIRMAN
<to>BELL, GORDON
<date>8/25/81
<date rec>8/27/81
<log#>8-60
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>ACCESS TECNOLOGY, INC.
<from>ALLEN Z. KLUCHMAN - PRESIDENT
<to>BELL, GORDON
<date>8/26/81
<date rec>8/27/81
<log#>8-59
<reply by>0
<dispo/date>GEORGE CHAMBERLAIN - 9/8/81
<message>SENT DEMAN SHUTTLE -- CC TO SI
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>AMERICAN BIOGRAPHICAL INSTITUTE
<from>J.S. MILLS - ADMINISTRATIVE EDITOR
<to>BELL, GORDON
<date>8/25/81
<date rec>8/27/81
<log#>8-58
<reply by>0
<dispo/date>
<message>
<answer>

<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>MCGRAW-HILL BOOK COMPANY
<from>JOHN F. CARLEO
<to>BELL, GORDON
<date>8/20/81
<date rec>8/27/81
<log#>8-57
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>ASQUITH & JACKSON ASSOICATES, INC.
<from>EDMUND J. WALSH - VP
<to>BELL, GORDON
<date>8/24/81
<date rec>8/26/81
<log#>8-56
<reply by>0
<dispo/date>JOHN DIPIETRO - 8/26/81
<message>PLEASE HANDLE
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>AMERICAN VACUUM SOCIETY
<from>re: dinner 9/16/81 5:00
<to>BELL, GORDON
<date>

<date rec>8/26/81
<log#>8-55
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>TOPAZ TRAVEL
<from>JAMES B. HOPPE
<to>BELL, GORDON
<date>8/18/81
<date rec>8/25/81
<log#>8-54
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>AMERICAN EXPRESS
<from>SCOTT P. MARKS JR. VICE PRESIDENT
<to>BELL, GORDON
<date>
<date rec>8/25/81
<log#>8-53
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>REQUEST FROM DR. HARRIET FEINBERG
<from>DR. HARRIET FEINBERG
<to>BELL, GORDON
<date>8/20/81
<date rec>8/25/81
<log#>8-52
<reply by>0
<dispo/date>CALLED FEINBERG 9/8/81 Tue 15:25
<message>SORRY, BUT CAN'T HELP YOU.
<answer>
<f/u>mm/dd/yy
<filed>13
<done>Y
<>

<subj>TEKNOWLEDGE
<from>EDWARD A. FEIGENBAUM
<to>BELL, GORDON
<date>8/14/81
<date rec>8/24/81
<log#>8-51
<reply by>0
<dispo/date>FULLER,KRAFT,PEEBLES,GLORIOSO - 9/10/81
<message>GOING?
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>MCGRAW-HILL BOOK COMPANY
<from>JAMES E. VASTYAN - EDITOR
<to>BELL, GORDON
<date>8/17/81
<date rec>8/21/81
<log#>8-50
<reply by>0
<dispo/date>

<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>COMPUTER SYSTEMS RES, GROUP
<from>SAME
<to>BELL, GORDON
<date>
<date rec>8/21/81
<log#>8-49
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>TWX
<from>KEN OLSEN
<to>BELL, GORDON
<date>8/18/81
<date rec>8/19/81
<log#>8-48
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>COMPUTER AIDED MANUFACTURING - INTERNATIONAL, INC.
<from>JOHN B. BELL

<to>OLSEN, KEN
<date>8/13/81
<date rec>8/19/81
<log#>8-47
<reply by>0
<dispo/date>WILL THOMPSON - 8/20/81
<message>FYI
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>MIT
<from>VERNON ALDEN - MASS BUSINESS DEVELOPMENT COUNCIL
<to>BELL, GORDON
<date>
<date rec>8/19/81
<log#>8-46
<reply by>0
<dispo/date>GLORIOSO/DIETER/AVERY - 8/19/81
<message>VERNON ALDEN GAVE THIS TO ME
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>RESUME - GEORGE E. LINDAMOOD
<from>GEORGE E. LINDAMOOD
<to>BELL, GORDON
<date>8/13/81
<date rec>8/18/81
<log#>8-45
<reply by>0
<dispo/date>FULLER/METZGER - 8/20/81
<message>CAN WE USE HERE?
<answer>
<f/u>8/28/81 - TO DIPIETRO -- WHAT IS STATUS ON LINDAMOOD - 9/16/81
<filed>

<done>Y
<>

<subj>LAKE CENTER INDUSTRIES
<from>C.E. HJERMSTAD - MGR. OF MARKETING
<to>BELL, GORDON
<date>8/12/81
<date rec>8/18/81
<log#>8-44
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>NATIONAL SCIENCE FOUNDATION
<from>C. WILLIAM KERN
<to>BELL, GORDON
<date>7/27/81
<date rec>8/17/81
<log#>8-43
<reply by>0
<dispo/date>KNOWLES/SHIELDS/MEANY/WEISS - 8/17/81
<message>CAN/SHOULD WE GO AFTER THIS BUSINESS? IT'D REALLY HELP OUR IMAGE AND INTERFACE WITH THE GOV'T. & UNIVERSITIES.
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>RESUME - LAMAR LEDBETTER
<from>SKIP GARVIN
<to>BELL, GORDON
<date>8/6/81
<date rec>8/17/81
<log#>8-42

<reply by>0
<dispo/date>DIPIETRO - 8/17/81
<message>NOTE: SIMULATION HO (???)
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>COPYRIGHT CLEARANCE CENTER, INC.
<from>R.O. STANTON - CHAIRMAN - ADVISORY COMMITTEE
<to>BELL, GORDON
<date>8/10/81
<DATE REC>8/17/81
<log#>8-41
<reply by>0
<dispo/date>ED SCHWARTZ - 8/18/81
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>NORTH AMERICAN TECHNOLOGY, INC.
<from>LAURA HANSON
<to>BELL, GORDON
<date>8/10/81
<date rec>8/17/81
<log#>8-40
<reply by>0
<dispo/date>AVERY - 8/18/81
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>TWX
<from>CAROLYN PELLOT - EDITORIAL ASSISTANT - MCGRAWHILL/NY
<to>BELL, GORDON
<date>8/14/81
<date rec>8/14/81
<log#>8-39
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>TWX
<from>TOM KOBAYASHI
<to>BELL, GORDON
<date>8/14/81
<date rec>8/14/81
<log#>8-38
<reply by>0
<dispo/date>FILED - JAPAN - 8/18/81
<message>
<answer>
<f/u>mm/dd/yy
<filed>JAPAN
<done>Y
<>

<subj>TWX
<from>TOM KOBAYASHI
<to>BELL, GORDON
<date>8/14/81
<date rec>8/14/81
<log#>8-37
<reply by>0
<dispo/date>
<message>
<answer>

<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>RESUME - JOHN R. ENGLAND
<from>JOHN ENGLAND
<to>BELL, GORDON
<date>8/4/81
<date rec>8/14/81
<log#>8-35
<reply by>0
<dispo/date>DIPIETRO - 8/14/81
<message>PLEASE HANDLE
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
<from>K. VENKATARAMAN - SPECIAL TECHNICAL ADVISER
<to>BELL, GORDON
<date>8/4/81
<date rec>8/14/81
<log#>8-34
<reply by>0
<dispo/date>CIRC: WITMORE, TED JOHNSON, RON SMART, LINDA SMITH AND RE. - 8/20/81
<message>
<answer>
<f/u>mm/dd/yy
<filed>COPY OF LETTER IN LETTERBOOK
<done>Y
<>

<subj>YOKO COMPANY LIMITED
<from>H. SUZUKI - VICE PRES.
<to>BELL, GORDON
<date>7/29/81

<date rec>8/14/81
<log#>8-33
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>NATIONAL RESEARCH COUNCIL
<from>JACOB F. BLACKBURN
<to>BELL, GORDON
<date>8/11/81
<date rec>8/14/81
<log#>8-32
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
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<subj>RESUMES - SOUTHERN ENGINEERING SERVICES
<from>BALLEGOOIJEN,RUSSEAU,ROBERTS,SCHMIDT,SCHAUSS,ASSADIFAR
<to>BELL, GORDON
<date>
<date rec>8/14/81
<log#>8-31
<reply by>0
<dispo/date>DIPIETRO - 8/14/81
<message>PLEASE HANDLE
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>TWX - WEST COAST HIRE
<from>DAVE CUTLER
<to>BELL, GORDON
<date>8/12/81
<date rec>8/14/81
<log#>8-30
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>MONOSSON ON DEC
<from>ELVIS PINEYRO - CIRCULATION MANAGER
<to>BELL, GORDON
<date>8/12/81
<date rec>8/13/81
<log#>8-29
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>EXXON ENTERPRISES
<from>E.G. CLARK - VP
<to>BELL, GORDON
<date>8/10/81
<date rec>8/13/81
<log#>8-28
<reply by>0
<dispo/date>
<message>
<answer>

<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>GENERAL DEVICES, INC.
<from>RICHARD W. CLARK - TECH. DIRECTOR I.C. MASK DESIGN GROUP
<to>BELL, GORDON
<date>8/10/81
<date rec>8/13/81
<log#>8-27
<reply by>0
<dispo/date>TEICHER - 8/17/81
<message>FYI
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>STANFORD UNIVERSITY
<from>JOHN MCCARTHY
<to>BELL, GORDON
<date>8/4/81
<date rec>8/13/81
<log#>8-26
<reply by>0
<dispo/date>JOHN MCCARTHY - 8/17/81
<message>SORRY RP-20 ISN'T AVAILABLE ON VAX. WE DON'T HAVE A PLAN TO HAVE AN IBM SELECTOR ON VAC. I CERTAINLY SYMPATHIZE WITH THE DILEMA, BUT DON'T KNOW OF AN ALTERNATIVE AT PRESENT.
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>TWX

<from>DAVID CUTLER
<to>BELL, GORDON
<date>8/12/81
<date rec>8/13/81
<log#>8-25
<reply by>0
<dispo/date>DIETER, GLORIOSO, FULLER - 8/17/81
<message><subj>KEN
<amount>$
<from>
<date rec>
<log no.>#
<dispo/date>
<note>
<>

FYI
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>REXNORD
<from>BERNARD HARRIS - PRODUCT MANGER
<to>BELL, GORDON
<date>8/10/81
<date rec>8/13/81
<log#>8-24
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>VERBEX
<from>WILLIAM A SMALL

<to>BELL, GORDON
<date>8/7/81
<date rec>8/12/81
<log#>8-23
<reply by>0
<dispo/date>FILE 12 - 8/17/81
<message>
<answer>
<f/u>mm/dd/yy
<filed>12
<done>Y
<>

<subj>SIGNETICS
<from>LEN UMINA - FIELD APPLICATIONS ENGINEER
<to>BELL, GORDON
<date>8/3/81
<date rec>8/11/81
<log#>8-22
<reply by>0
<dispo/date>ZIA/TEICHER/CROXON/MCINNIS/WALTON - 8/11/81
<message>ANY USE TO US?
<answer>
<f/u>8/28/81
<filed>FU 8/28
<done>Y
<>

<subj>RESUME
<from>RUSSELL PLUMB
<to>BELL, GORDON
<date>8/5/81
<date rec>8/11/81
<log#>8-21
<reply by>0
<dispo/date>DIPIETRO - 8/12/81
<message>PLEASE HANDLE
<answer>
<f/u>mm/dd/yy
<filed>

<done>Y
<>

<subj>COATING TECHNOLOGY INC.
<from>ROGER W. SPRING
<to>BELL, GORDON
<date>
<date rec>8/11/81
<log#>8-20
<reply by>0
<dispo/date>DICK GONZALES - 8/11/81
<message>FYI
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>HEWLETT-PACKARD COMPANY
<from>B.M. OLIVER
<to>BELL, GORDON
<date>8/7/81
<date rec>8/11/81
<log#>8-19
<reply by>0
<dispo/date>CC TO DICK TESTA/HZ--ORIGINAL RETURNED - 8/26/81
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>LABORATORY FOR COMPUTER SCIENCE
<from>ALBERT VEZZA
<to>BELL, GORDON
<date>8/6/81
<date rec>8/11/81
<log#>8-18
<reply by>0
<dispo/date>

<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
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<subj>SUBSCRIPTION - MONOSSON ON DEC
<from>MONOSSON ON DEC
<to>BELL, GORDON
<date>
<date rec>8/11/81
<log#>8-17
<reply by>0
<dispo/date>FILE 12 - 8/17/81
<message>
<answer>
<f/u>mm/dd/yy
<filed>12
<done>Y
<>

<subj>
<from>
<to>BELL, GORDON
<date>
<date rec>
<log#>8-
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>CURT DECKERT ASSOCIATES INCORPORATED
<from>CURT DECKERT
<to>BELL, GORDON - FIRST WENT TO LARRY THEN TO G
<date>7/30/81

<date rec>8/6/81
<log#>8-16
<reply by>0
<dispo/date>AVERY - 8/6/81
<message>WHAT THIS? YOURS
<answer>
<f/u>mm/dd/yy
<filed>FIRST PAGE - 12
<done>Y
<>

<subj>RESUME - SOUTHERN ENGINEERING SERVICES
<from>DEJAN NINKOVICH
<to>BELL, GORDON
<date>
<date rec>8/6/81
<log#>8-15
<reply by>0
<dispo/date>JOHN DIPIETRO 8/6/81
<message>PLEASE HANDLE
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>HARVARD UNIVERSITY
<from>HOWARD L. RESNIKOFF - ASSOC. VP FOR INFO. SERVICES AND TECH.
<to>BELL, GORDON
<date>8/4/81
<date rec>8/6/81
<log#>8-14
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>NSF-INFOR.TECH.WORKING GROUP
<done>Y

<>

<subj>MIT
<from>E. BARBARA LEWIS
<to>BELL, GORDON
<date>8/5/81
<date rec>8/6/81
<log#>8-13
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>SOUTH SHORE PERSONNEL
<from>ROBERT W. CARNE - ACCOUNT EXECUTIVE
<to>BELL, GORDON
<date>8/3/81
<date rec>8/6/81
<log#>8-12
<reply by>0
<dispo/date>DIPIETRO - 8/11/81
<message>PLEASE HANDLE
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>TWX
<from>CARL NOELCKE
<to>BELL, GORDON
<date>8/5/81
<date rec>8/5/81
<log#>8-11

<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>MECHMETALS CORPORATION
<from>W.R. ERIKSEN
<to>BELL, GORDON
<date>7/23/81
<date rec>8/5/81
<log#>8-10
<reply by>0
<dispo/date>RIGGLE - 8/5/81
<message>FYI
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>SOUTHERN ENGINEERING SERVICES
<from>SAME -- CHIN--TRINH--COMSTOCK--PILON--HOLE--LAUT--HOFACKER
<to>BELL, GORDON
<date>
<date rec>8/5/81
<log#>8-9
<reply by>0
<dispo/date>JOHN DIPIETRO - 8/5/81
<message>PLEASE HANDLE - I SENT
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>BRATTLE RESEARCH CORPORATION
<from>JOHN CLIPPINGER
<to>BELL, GORDON
<date>8/4/81
<date rec>8/5/81
<log#>8-8
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>NATIONAL BUREAU OF STANDARDS
<from>DAVID GLAZE
<to>BELL, GORDON
<date>
<date rec>8/4/81
<log#>8-7
<reply by>0
<dispo/date>DENVER OFFICE - ROY WICKLUND - 8/5/81
<message>THANKS - THIS IS A NICE LETTER TO GET
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>IBM
<from>ERICH BLOCH
<to>BELL, GORDON
<date>7/30/81
<date rec>8/4/81
<log#>8-6

s lqp5
s lqp5

n lqp5
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>VLSI COOPERATIVE RESEARCH PROEJCT
<from>JACK BARANSON/GERALD C. WERNER
<to>KEN OLSEN
<date>7/29/81
<date rec>8/4/81
<log#>8-5
<reply by>0
<dispo/date>JIM CUDMORE - 8/6/81
<message>YOURS
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>TWX
<from>MARK STEINKRAUSS - 7182
<to>BELL, GORDON
<date>8/4/81
<date rec>8/4/81
<log#>8-4
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>COMMERCIAL COMPUTER SERVICES, INC.
<from>STUART M. KATZ - PRESIDENT
<to>BELL, GORDON
<date>7/29/81
<date rec>8/4/81
<log#>8-3
<reply by>0
<dispo/date>CALLED KATZ--8/14/81 Fri 16:49
<message>SORRY, PRIOR COMMITMENT
<answer>
<f/u>mm/dd/yy
<filed>12
<done>Y
<>

<subj>PDP-1 FIXING PARTY
<from>R.C. CLEMENTS
<to>BELL, GORDON
<date>7/29/81
<date rec>8/3/81
<log#>8-2
<reply by>0
<dispo/date>GWEN - 8/3/81
<message>PLEASE ANSWER
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>VISIT OF DR. GEORGE DODD, DEPT. HEAD SCI. DEPT. GEN. MOTORS RESEARCH
<from>PETER ERIKSSON - SALES REP. - AUTOMOTIVE BRANCH
<to>BELL, GORDON
<date>7/28/81
<date rec>8/3/81
<log#>8-1
<reply by>0
<dispo/date>

<message>
<answer>
<f/u>mm/dd/yy
<filed>CALENDAR 8/25
<done>Y
<>

<subj>RESUME - DAVID J. TOMARAS
<from>DAVID TOMARAS
<to>BELL, GORDON
<date>7/28/81
<date rec>8/3/81
<log#>7-57
<reply by>0
<dispo/date>DIPIETRO - 8/3/81
<message>YOURS
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>BAUDEX
<from>ARTHUR MATSCHKE - PRESIDENT
<to>KEN OLSEN
<date>7/9/81
<date rec>7/30/81
<log#>7-56
<reply by>0
<dispo/date>AVERY - 8/3/81
<message>FYI
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>NATIONAL ACADEMY OF ENIGNEERING
<from>HAROLD LIEBOWITZ

<to>BELL, GORDON
<date>7/27/81
<date rec>7/29/81
<log#>7-55
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>12
<done>Y
<>

<subj>THRESHOLD
<from>JOSEPH J. BOVE - VP MARKETING
<to>BELL, GORDON
<date>7/20/81
<date rec>7/28/81
<log#>7-54
<reply by>0
<dispo/date>HOLD MJ CALL FOLDER--OK TO SET UP A MEETING
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>NATIONAL SEARCH AND RECRUITING
<from>JACK BOUR - VP TECHNICAL RECRUITING DIV.
<to>BELL, GORDON
<date>7/24/81
<date rec>7/28/81
<log#>7-53
<reply by>0
<dispo/date>DIPIETRO - 7/28/81
<message>PLEASE HANDLE
<answer>
<f/u>mm/dd/yy
<filed>

<done>Y
<>

<subj>NATIONAL PHYSICAL LABORATORY
<from>DONALD W. DAVIES - DIV. OF NUMERICAL ANALYSIS AND COMP. SCI.
<to>BELL, GORDON
<date>7/21/81
<date rec>7/27/81
<log#>7-52
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>IBM
<from>ERICH BLOCH
<to>BELL, GORDON
<date>7/21/81
<date rec>7/27/81
<log#>7-51
<reply by>0
<dispo/date>CUDMORE - 7/28/81
<message>THIS IS SOMETHING I THINK WE WANT. THIS PERSON SHOULD BE YOU, STEVE, JEF, I, SAME, BOB GLORIOSO. WHO??
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>AMERICAN SOFTWARE
<from>JAMES C. EDENFIELD - PRESIDENT
<to>BELL, GORDON
<date>7/13/81

<date rec>7/27/81
<log#>7-50
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>EFFLO POWER SUPPLIES
<from>SOL A. COHEN - VP MARKETING
<to>BELL, GORDON
<date>7/20/81
<date rec>7/27/81
<log#>7-49
<reply by>0
<dispo/date>HENK SCHALKE - 7/29/81
<message>WHAT IS THIS?
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>MONMOUTH PLASTICS,INC
<from>ALAN R. ZIMMERMAN - MGR. SALES AND SERVICE
<to>BELL, GORDON
<date>7/22/81
<date rec>7/24/81
<log#>7-48
<reply by>0
<dispo/date>JOHN HOLMAN - 8/11/81
<message>WHY IS HENK INVOLVED?
<answer>WILL HAS ASKED HENK TO BE RESPONSIBLE FOR HIS
MATERIALS GROUP.
<f/u>mm/dd/yy
<filed>
<done>Y

<>

<subj>PITMAN COHEN CHARTERED ACCOUNTANTS
<from>S. COHEN - JOINT LIQUIDATOR
<to>BELL, GORDON
<date>7/17/81
<date rec>7/24/81
<log#>7-46
<reply by>0
<dispo/date>JOE ZEH 8/4/81 Tue 9:23
<message>EMS--PLS SEND HANDBOOKS
<answer>
<f/u>8/14/81
<filed>
<done>Y
<>

<subj>WARSAW TECHNICAL UNIVERSITY
<from>STANISLAW BUDKOWSKI
<to>BELL, GORDON
<date>7/14/81
<date rec>7/23/81
<log#>7-46-A
<reply by>0
<dispo/date>ENG. STAFF/OC - 9/10/81
<message>SOMEONE LIKES US WELL ENOUGH TO COPY US. - SENT BOOKS TO WARSAW TECH. STANKSLAW BUDKOWSKI.
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>UNITED STATES GENERAL ACCOUNTING OFFICE
<from>ALLAN I. MENDELOWITZ--ASSOCIATE DIRECTOR
<to>BELL, GORDON
<date>7/17/81
<date rec>7/22/81
<log#>7-45

<reply by>0
<dispo/date>MEETING HELD AT DEC ON 7/28/81, WITH KATHRINE VUICICH AND PEGGY MCGREGOR
<message>
<answer>
<f/u>mm/dd/yy
<filed>JAPAN
<done>Y
<>

<subj>NATIONAL ACADEMY OF ENGINEERING
<from>COURTLAND PERKINS
<to>BELL, GORDON
<date>7/17/81
<date rec>7/22/81
<log#>7-44
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>NAE
<done>Y
<>

<subj>RESUMES
<from>SOUTHERN ENIGNEERING SERVICES
<to>BELL, GORDON
<date>
<date rec>7/22/81
<log#>7-43
<reply by>0
<dispo/date>DIPIETRO-7/22/81
<message>PLEASE HANDLE
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>
<from>
<to>BELL, GORDON
<date>
<date rec>
<log#>7-
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>XEROX
<from>ROGER A. MCINTYRE - XEROX NATIONAL ACCOUNT MANAGER
<to>BELL, GORDON
<date>7/14/81
<date rec>7/21/81
<log#>7-42
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>XEROX
<done>Y
<>

<subj>LABORATORY FOR COMPUTER SCIENCE
<from>CLEMENT K.C. LEUNG
<to>BELL, GORDON
<date>7/20/81
<date rec>7/21/81
<log#>7-41
<reply by>0
<dispo/date>STEVE,SAM,GLORIOSO 7/24/81 Fri 12:47
<message>STEVE WILL YOU HANDLE PLEASE? LET'S HIRE HIM AS A

CONSULTANT
<answer>
<f/u>8/28
<filed>12 COVER LETTER ONLY
<done>Y
<>

<subj>COMMUNICATIONS OF THE ACM
<from>LLOYD FOSDICK
<to>BELL, GORDON
<date>7/16/81
<date rec>7/21/81
<log#>7-40
<reply by>0
<dispo/date>SAM FULLER - 7/24/81
<message>KNOW ANYONE?
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>DEAN WITTER REYNOLDS INC.
<from>WALTER F. CURRAN
<to>BELL, GORDON
<date>
<date rec>7/20/81
<log#>7-39
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>RESUME
<from>JAMES I. MURRAY

<to>BELL, GORDON
<date>
<date rec>7/20/81
<log#>7-38
<reply by>0
<dispo/date>JOHN DIPIETRO/7/20/81
<message>PLEASE HANDLE
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>UNIVERSITY OF TEXAS AT AUSTIN
<from>PETER T. FLAWN
<to>BELL, GORDON
<date>7/14/81
<date rec>7/17/81
<log#>7-37
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>LABORATORY FOR COMPUTER SCIENCE
<from>MICHAEL L. DERTOUZOS
<to>BELL, GORDON
<date>7/13/81
<date rec>7/17/81
<log#>7-36
<reply by>0
<dispo/date>DERTOUZOS/7/21/81
<message>Sorry for being so tonely here. Probably the best policy for LCS <u>overall</u> would be to not pass on rumours of any kind.
<answer>

<f/u>mm/dd/yy
<filed>MIT GENERAL
<done>Y
<>

<subj>WESLEYAN UNIVERSITY
<from>H. DAVID TODD
<to>KEN OLSEN
<date>7/13/81
<date rec>7/17/81
<log#>7-35
<reply by>0
<dispo/date>ECKHOUSE/7/17/81
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>RESUME - ARKADY SHAPIRO
<from>BUZZ BROOKS
<to>BELL, GORDON
<date>7/15/81
<date rec>7/17/81
<log#>7-34
<reply by>0
<dispo/date>DIPIETRO/7/21/81
<message>PLS HANDLE
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>MIT
<from>FRANCIS F. LEE - PROF. DEPT. OF EE AND COMP. SCI.
<to>BELL, GORDON
<date>7/13/81

<date rec>7/16/81
<log#>7-33
<reply by>0
<dispo/date>GLORIOSO 7/21/81 Tue 11:22
<message>COULD WE USE HIM? LET'S DECIDE & WRITE TO FRANCIS
<answer>
<f/u>7/31/81
<filed>FU 7/31
<done>N
<>

<subj>IBM
<from>B.O. EVANS
<to>BELL, GORDON
<date>7/9/81
<date rec>7/16/81
<log#>7-32
<reply by>0
<dispo/date>CC TO KEN RET. ORIG -- CC TO DICK TESTA RET. ORIG - 8/26/81
<message>
<answer>
<f/u>mm/dd/yy
<filed>MCF
<done>Y
<>

<subj>DESIGN MANUFACTURING & TEST AUTOMATION
<from>RICHARD M. JENNINGS
<to>BELL, GORDON
<date>7/14/81
<date rec>7/15/81
<log#>7-31
<reply by>0
<dispo/date>TEICHER/7/21/81
<message>YOURS
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y

<>

<subj>RESUME - HON-YUEN ISAAC CHIN
<from>TECH-SEARCH CONSULTANTS
<to>BELL, GORDON
<date>
<date rec>7/15/81
<log#>7-30
<reply by>0
<dispo/date>DIPIETRO/7/21/81
<message>PLS HANDLE
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>COMPUGRAPHIC
<from>PATRICIA HUGHES
<to>BELL, GORDON
<date>7/14/81
<date rec>7/15/81
<log#>7-29
<reply by>0
<dispo/date>FILE 13 - 7/22/81
<message>NO INTEREST
<answer>
<f/u>mm/dd/yy
<filed>13
<done>Y
<>

<subj>DYNATECH R/D COMPANY
<from>MICHAEL G. O'CALLAGHAN
<to>BELL, GORDON
<date>7/10/81
<date rec>7/14/81

<log#>7-28
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
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<subj>WESTINGHOUSE ELECTRIC CORPORATION
<from>JILL KAPNER/DALE FOWLER
<to>BELL, GORDON
<date>7/10/81
<date rec>7/13/81
<log#>7-27
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>DANA CHASE PUBLICATIONS - APPLIANCE
<from>JAMES R. STEVENS
<to>BELL, GORDON
<date>7/8/81
<date rec>7/10/81
<log#>7-26
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
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<subj>CARNEGIE MELLON/MCGRAW HILL
<from>DONALD W. BURDEN
<to>BELL, GORDON
<date>6/22/81
<date rec>7/10/81
<log#>7-25
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>IBM
<from>J.V. WIRTS, VP
<to>BELL, GORDON
<date>
<date rec>7/10/81
<log#>7-24
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>PRESIDENT - MIT
<from>PAUL E. GRAY
<to>BELL, GORDON
<date>7/8/81
<date rec>7/10/81
<log#>7-23
<reply by>0
<dispo/date>
<message>
<answer>

<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>TWX
<from>PETER HERKE
<to>BELL, GORDON
<date>7/9/81
<date rec>7/9/81
<log#>7-22
<reply by>0
<dispo/date>DEMMER/7/15/81
<message>GOOD POINT, WHY CANT NAUTILIS BE EUROCARD?
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>ROHM AND HAAS CO.
<from>J.E. VOIT
<to>BELL, GORDON
<date>7/6/81
<date rec>7/9/81
<log#>7-21
<reply by>0
<dispo/date>JOHN HOLMAN - 7/27/81
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>UNIVERSITY OF MASSACHUSETTS
<from>ROBERT MALLARY
<to>BELL, GORDON
<date>7/5/81

<date rec>7/8/81
<log#>7-20
<reply by>0
<dispo/date>ECKHOUSE 7/14/81 Tue 12:11
<message>PLEASE HANDLE THIS FOR MALLARY
<answer>
<f/u>mm/dd/yy
<filed>12 7/14/81 Tue 12:15
<done>Y
<>

<subj>RESUMES
<from>SOUTHERN ENGINEERING SERVICES
<to>BELL, GORDON
<date>
<date rec>7/8/81
<log#>7-19
<reply by>0
<dispo/date>DIPIETRO 7/9/81
<message>PLEASE HANDLE
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>RESUME - ZAKHAR G. MAYMIN
<from>SCIENTIFIC TECHNOLOGY INC.
<to>BELL, GORDON
<date>
<date rec>7/8/81
<log#>........7-18
<reply by>0
<dispo/date>DIPIETRO 7/9/81
<message>PLEASE HANDLE
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>TWX
<from>MARCIA KENAH
<to>BELL, GORDON
<date>7/2/81
<date rec>7/8/81
<log#>7-17
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>RESUME
<from>STEVEN A SPURA
<to>BELL, GORDON
<date>7/3/81
<date rec>7/8/81
<log#>7-16
<reply by>0
<dispo/date>DIPIETRO 7/9/81
<message>PLEASE HANDLE
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>BERKELEY NUCLEONICS CORPORATION
<from>EDGAR BUCHS
<to>BELL, GORDON
<date>JUNE 81
<date rec>7/7/81
<log#>7-15
<reply by>0
<dispo/date>

<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>WORCESTER POLYTECHNIC INSTITUTE
<from>ROBERT J. HALL
<to>BELL, GORDON
<date>
<date rec>7/7/81
<log#>7-14
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>MEDICAL PRODUCTS MARKETING SERVICES
<from>GRAIG E. CAPEHART
<to>BELL, GORDON
<date>Summer 1981
<date rec>7/6/81
<log#>7-13
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>PREDICASTS, INC.

<FROM>STEVEN R. KAPLAN
<to>BELL, GORDON
<date>6/29/81
<date rec>7/6/81
<log#>7-12
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>COLUMBIA-GREAT LAKES CORP.
<from>RAY KEENAN
<to>BELL, GORDON
<date>6/30/81
<date rec>7/6/81
<log#>7-11
<reply by>0
<dispo/date>PICOTT 7/9/81
<message>YOURS
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>HEWLETT-PACKARD CO.
<from>DAVID PACKARD
<to>BELL, GORDON
<date>6/29/81
<date rec>7/6/81
<log#>7-10
<reply by>0
<dispo/date>COPY TO KEN 7/7
<message>
<answer>
<f/u>mm/dd/yy

<filed>MCF FOLDER
<done>Y
<>

<subj>KONRAD ZUSE - HIS PAINTINGS
<from>KONRAD ZUSE
<to>BELL, GORDON
<date>6/26/81
<date rec>7/6/81
<log#>7-9
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>RESUME
<from>RONALD P. CREVIER
<to>BELL, GORDON
<date>6/30/81
<date rec>7/6/81
<log#>7-8
<reply by>0
<dispo/date>DIPIETRO/7/9/81
<message>PLEASE HANDLE
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>BELMONT HILL SCHOOL
<from>GLENN W. BOYNTON
<to>BELL, GORDON
<date>7/2/81
<date rec>7/6/81

<log#>7-7
<reply by>0
<dispo/date>MJ CALLED BOYNTON OFFICE--LOOKS IMPRESSIVE, YOU ARE ON THE RIGHT TRACK, NO NEED TO MEET - 7/7/81
<message>
<answer>
<f/u>mm/dd/yy
<filed>12
<done>Y
<>

<subj>BALLINGER - PLANNING, ARCHITECTURE & ENGINEERING
<from>JOHN D. DEMOLL
<to>BELL, GORDON
<date>7/6/81
<date rec>7/6/81
<log#>7-6
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>STANFORD UNIVERSITY
<from>DONALD KENNEDY
<to>BELL, GORDON
<date>7/1/81
<date>7/6/81
<log#>7-5
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>MICRO-BAUD SYSTEMS, INC.
<from>KAY E. BANK
<to>BELL, GORDON
<date>
<date>
<log#>7-4
<reply by>0
<dispo/date>PICOTT, SAVELL 7/9/81
<message>BUT CAN IT COMPETE WITH A DF02
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>RESUMES -- SOUTHERN ENGINEERING SERVICES
<from>GREENBERG, SHRAGA, NAJM, HEUFELD, FUNG, SHAH, SPAIN
<to>BELL, GORDON
<date>
<date rec>7/2/81
<log#>7-3
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>BARRINGTON INC.
<from>W. LEE SHEVEL - PRESIDENT
<to>BELL, GORDON
<date>6/29/81
<DATE REC>7/2/81
<log#>7-2
<reply by>0
<dispo/date>

<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>IBM
<from>GUY RABBAT
<to>BELL, GORDON
<date>6/24
<date rec>7/2/81
<log#>7-1
<reply by>0
<dispo/date>TEICHER 7/10/81
<message>STEVE - WHO COULD DO THIS SO I CAN GET OFF? F/U 7/17
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>FRENCH-AMERICAN CHAMBER OF COMMERS IN THE UNITED STATES, INC.
<from>THEODORE MANDER
<to>BELL, GORDON
<date>6/22
<date rec>7/1/81
<log#>6-60
<reply by>0
<dispo/date>CHAMBERLAIN 7/9/81
<message>FYI
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>DEAN WITTER REYNOLDS, INC.

<from>FRANK MCGARRY
<to>BELL, GORDON
<date>6/25/81
<date rec>6/30/81
<log#>6-59
<reply by>0
<dispo/date>
<message>
answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>BUSINESS INTERNATIONAL ASIA/PACIFIC LTD
<from>WINNIE WONG
<to>BELL, GORDON
<date>
<date rec>6/29/81
<log#>6-58
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>LAKE CENTER INDUSTRIES
<from>C.E. HJERMSTAD
<to>BELL, GORDON
<date>6/24/81
<date rec>6/29/81
<log#>6-57
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy

<filed>
<done>Y
<>

<subj>UNIVERSITY OF NORTH CAROLINA
<from>FREDRICK P. BROOKS, JR.
<to>BELL, GORDON
<date>6/24/81
<date rec>6/29/81
<log#>6-56
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>YORK TAPE AND LABEL CORPORATION
<from>BRUCE COUTURE
<to>BELL, GORDON
<date>6/29/81
<date rec>6/29/81
<log#>6-55
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>SEMICONDUCTOR INDUSTRY ASSOCIATION
<from>ROBERT NOYCE
<to>BELL, GORDON
<date>6/23/81
<date rec>6/26/81

<log#>6-54
<reply by>0
<dispo/date>CUDMORE/6/29/81
<message>HOW ARE WE DOING REJOINING? F/U 7/10
<answer>
<f/u>7/10
<filed>
<done>Y
<>

<subj>INSTITUTE FOR THE FUTURE
<from>ROY AMARA
<to>BELL, GORDON
<date>6/23/81
<date rec>6/26/81
<log#>6-53
<reply by>0
<dispo/date>CIRC-JOHNSON/GLORIOSO/LACROUTE/6/29/81
<message>Let's Not Participate... an idea exchange! **ANY CALLS - NOT INTERESTED IN PARTICIPATING**
<answer>
<f/u>mm/dd/yy
<filed>12 - FIRST PAGE
<done>Y
<>

<subj>CALTECH
<from>F.E.C. CULICK
<to>BELL, GORDON
<date>6/22/81
date rec>6/26/81
<log#>6-52
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>TWX
<from>ELLI FASSETTA -- P.R.
<to>BELL, GORDON
<date>6/23/81
<date rec>6/25/81
<log#>6-51
<reply by>0
<dispo/date>Marci Kenah/6/29/81
<message>Yours
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>RESUME/D. GLUNTZ--DUNHILL OF PHOENIX INC.
<from>CHUCK PEARSON
<to>BELL, GORDON
<date>
<date rec>6/25/81
<log#>6-50
<reply by>0
<dispo/date>DIPIETRO/6/26/81
<message>PLEASE HANDLE
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>POOR'S REGISTER
<from>C.J. ASSENNATO
<to>BELL, GORDON
<date>
<date rec>6/25/81
<log#>6-49
<reply by>0
<dispo/date>NO INTEREST

<message>
<answer>
<f/u>mm/dd/yy
<filed>N
<done>Y
<>

<subj>ENGINEERING FOUNDATION CONFERENCES
<from>WILLIAM H. CORCORAN
<to>BELL, GORDON
<date>5/14/81
<date rec>6/24/81
<log#>6-48
<reply by>0
<dispo/date>JOHN MEYER/6/25/81
<message>FYI
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>WORKSHOP ON INSTRUCTION SET DESIGN AND CODE GENERATION
<from>CLEMENT LEUNG
<to>BELL, GORDON
<date>6/8/81
<date rec>6/24/81
<log#>6-47
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>UNIVERSITY OF WASHINGTON

<from>ROBERT GILLESPIE
<to>BELL, GORDON
<date>6/16/81
<date rec>6/24/81
<log#>6-46
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>JOSEPH F. DE PAZ, PH.D.
<from>Joseph de PAZ, Ph.D.
<to>BELL, GORDON
<date>6/16/81
<date rec>6/24/81
<log#>6-45
<reply by>0
<dispo/date>JOHN DIPIETRO/6/25/81

<message>PLEASE HANDLE
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>RESUME - DENNIS D'ANTONA
<from>DENNIS D'ANTONA
<to>BELL, GORDON
<date>6/19/81
<date rec>6/23/81
<log#>6-44
<reply by>0
<dispo/date>JOHN DIPIETRO/6/24/81
<message>PLEASE HANDLE
<answer>

<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>UNIVERSITY OF TEXAS AT AUSTIN
<from>EARNEST F. GLOYNA, DEAN
<to>BELL, GORDON
<date>6/17/81
<date rec>6/23/81
<log#>6-43
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>K. ZUSE VISIT TO STATES 3-3 THRU 3-8
<from>KONRAD ZUSE
<to>BELL, GORDON
<date>6/9/81
<date rec>7/22/81
<log#>6-42
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>AT&T
<from>JOE D. WETHERINGTON
<to>BELL, GORDON
<date>6/16/81

<date rec>7/22/81
<log#>6-41
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>CROWN PACIFIC MAXIM--MANAGEMENT CONSULTANTS
<from>H.H. HARBERTS
<to>BELL, GORDON
<date>6/19/81
<date rec>7/22/81
<log#>6-40
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>BALLINGER PLANNING, ARCHITECTURE & ENGINEERING
<from>JOHN J. GIRARD, III
<to>BELL, GORDON
<date>6/17/81
<date rec>7/22/81
<log#>6-39
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>NATIONAL ACADEMY OF ENGINEERING
<from>HAROLD LIEBOWITZ
<to>BELL, GORDON
<date>6/15/81
<date rec>7/22/81
<log#>6-38
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>ARTHUR D. LITTLE MANAGEMENT EDUCATION INSTITUTE, INC.
<from>JEAN FORD WEBB
<to>BELL, GORDON
<date>6/19/81
<date rec>6/19/81
<log#>6-37
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>PHOENIX
<from>ROBIN P. WARREN
<to>BELL, GORDON
<date>6/11/81
<date rec>6/19/81
<log#>6-36
<reply by>0
<dispo/date>

<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>HARVARD--PROGRAM ON INFO. RESOURCES POLICY
<from>ANTHONY G. OETTINGER
<to>BELL, GORDON
<date>6/17/81
<date rec>6/18/81
<log#>6-35
<reply by>07/17/81
<dispo/date>CIRC:SCHMITT,COURTIN,LACROUTE,KO 7/22/81
<message>
<answer>PATRICK & BOB SCHMITT WILL CONTRIBUTE AND ATTEND AND KEEP US POSTED. 8/14/81 Fri 15:16
<f/u>
<filed>12
<done>Y
RECEIVED FROM CIRCULATION - 8/6/81
<>

<subj>NATIONAL ASSOCIATION OF MANUFACTURERS
<from>RICHARD SEIBERT
<to>BELL, GORDON
<date>6/9/81
<date rec>6/17/81
<log#>6-34
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>HERMAN MILLER INC.
<from>ANDREW C. MCGREGOR
<to>BELL, GORDON
<date>6/11/81
<date rec>6/17/81
<log#>6-33
<reply by>0
<dispo/date>SCHNEIDER--6/19/81
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>R.J. SICKLES ASSOCIATES
<from>MARK E. DEVANE
<to>BELL, GORDON
<date>6/16/81
<date rec>6/17/81
<log#>6-32
<reply by>0
<dispo/date>HOLMAN--6/19/81
<message>YOURS
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>TWX - QUOTATION FOR RX02 EQUIVALENT
<from>TOM KOBAYASHI
<to>BELL, GORDON
<date>6/17/81
<date rec>6/17/81
<log#>6-31
<reply by>0
<dispo/date>METZGER--6/19/81
<message>THIS SOUNDS GREAT. GIVEN THE CAPITAL COST, TOOL-UP,

ETC. WHY ISN'T THIS THE RIGHT WAY? LET'S DO IT. CAN WE COMPARE THIS WITH OUR PROPOSAL? LET'S GET ENGINEERNG GOING IN JAPAN.
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>THUNDER SYSTEMS INC
<from>JIM GREENWOOD
<to>BELL, GORDON
<date>6/10/81
<date rec>6/16/81
<log#>6-30
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>HARVARD UNIVERSITY
<from>HOWARD L. RESNIKOFF
<to>BELL, GORDON
<date>6/11/81
<date rec>6/16/81
<log#>6-29
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>DECUS
<from>MARTHA SALINGER
<to>BELL, GORDON
<date>6/8/81
<date rec>6/12/81
<log#>6-28
<reply by>0
<dispo date>SALINGER 6/15/81
<message>"Generating Computer Generations" -- abstract only.
I sent form back to DECUS, retained copy in File 12.
<answer>
<f/u>mm/dd/yy
<filed>12
<done>Y
<>

<subj>THE YANKEE GROUP
<from>ALISON J. MCGRATH
<to>BELL, GORDON
<date>6/10/81
<date rec>6/12/81
<log#>6-27
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>NAVAL RESEARCH LABORATORY
<from>WALD, BRUCE
<to>BELL, GORDON
<date>6/9/81
<date rec>6/11/81
<log#>6-26
<reply by>0
<dispo/date>
<message>

<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>SIEMENS PARTS FOR COMPUTER MUSEUM
<from>JESSE, GERD
<to>BELL, GORDON
<date>6/11/81
<date rec>6/11/81
<log#>6-25
<reply by>0
<dispo/date>7/20/81--filed
<message>
<answer>
<f/u>mm/dd/yy
<filed>SIEMENS
<done>Y
<>

<subj>ANALOG DEVICES
<from>STATA, RAY
<to>BELL, GORDON
<date>6/9/81
<date rec>6/10/81
<log#>6-24
<reply by>0
<dispo/date>TEICHER 6/11/81 Thu 10:50
<message>GOING? LOOKS LIKE WE ARE FAR AHEAD
<answer>
<f/u>mm/dd/yy
<filed>N
<done>Y
<>

<subj>RESUME - ALEXANDER D. ROTH
<from>ALEXANDER D. ROTH
<to>BELL, GORDON

<date>81/6/8
<date rec>6/10/81
<log#>6-23
<reply by>0
<dispo/date>JOHN DIPIETRO 6/11/81 Thu 11:06
<message>PLS FORWARD TO PROPER PERSON
<answer>
<f/u>mm/dd/yy
<filed>N
<done>Y
<>

<subj>CHARLES RIVER HISTORIC INDUSTRIES, INC.
<from>STEVEN LUBAR
<to>BELL, GORDON
<date>81/6/8
<date rec>6/10/81
<log#>6-22
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>POIRIER, HOEVEL & CO.
<from>ROLAND L. POIRIER
<to>BELL, GORDON
<date>81/6/10
<date rec>6/10/81
<log#>6-21
<reply by>0
<dispo/date>
<message>NO INTEREST
<answer>
<f/u>13/13/81
<filed>13
<done>Y

<>

<subj>HODGE COMPUTER RESEARCH CORPORATION
<from>WINSTON W. HODGE
<to>BELL, GORDON
<date>81/6/8
<date rec>6/8/81
<log#>6-20
<reply by>0
<dispo/date>6/10/81 Wed 13:12
<message>LACROUTE, SAVELL, RODGERS, GLORIOSO - FYI
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>FLOATING POINT SYSTEMS, INC.
<from>FEDERAL MARKETING MANAGER
<to>BELL, GORDON
<date>81/6/8
<date rec>6/8/81
<log#>6-19
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>DEAN WITTER REYNOLDS INC.
<from>HERKNESS, LINDSAY
<to>BELL, GORDON
<DATE>81/6/8
<date rec>6/8/81
<log#>6-18
<reply by>0

<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>Y
<done>Y
<>

<subj>RESUME - SALZBERG, BETTY
<from>NORTHEASTERN UNIVERSITY
<to>BELL, GORDON
<date>81/6/8
<date rec>6/8/81
<log#>6-17
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>TWX - DEC JAPAN NEWSLETTERS
<from>KOBAYASHI, TOM
<to>BELL, GORDON
<date>81/6/8
<date rec>6/8/81
<log#>6-16
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>TEXAS INSTRUMENTS

<from>HEILMEIR, GEORGE
<to>BELL, GORDON
<date>81/6/5
<date rec>6/5/81
<log#>6-15
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>TWX - TLX SENT TODAY 6/5/81
<from>R. GOODMAN
<to>BELL, GORDON
<date>81/6/5
<date rec>6/5/81
<log#>6-14
<reply by>0
<dispo/date>SEE 6-12 -6/11/81
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>RESUME - PATRICK, ROBERT E.
<from>VICKI ROSE
<to>BELL, GORDON
<date>81/6/5
<date rec>6/5/81
<log#>6-13
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy

<filed>
<done>Y
<>

<subj>TWX - PERSONAL 15 MIN. CRYSTAL BALL-GAZE INTO 1984 AND 30 MIN. FIELD-THE-QUESTIONS-RAISED.
<from>GOODMAN, ROY
<to>BELL, GORDON
<date>81/6/5
<date rec>6/5/81
<log#>6-12
<reply by>0
<dispo/date>GOODMAN, ROY 6/9/81
<message>SORRY I AM NOT AVAILABLE. WOULD STILL LIKE TO RECOVER OUT OF POCKET EXPENSE FOR THE LAST INFOTECH VENTURE.
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>TWX - RX02 EQUIVALENT AND PORTABLE COMPUTER
<from>TOM KOBAYASHI
<to>BELL, GORDON
<date>81/6/5
<date rec>6/5/81
<log#>6-11
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>GENERATION OF COMPUTER GENERATIONS
<from>BANKERS TRUST COMPANY
<to>BELL, GORDON

<date>81/6/4
<date rec>6/4/81
<log#>6-10
<reply by>0
<dispo/date>ORIG. - TO G.B. CC: CIRC. ENG. STAFF-6/9/81
<message>A GIANT PUT ON?!
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>RESUMES
<from>SOUTHERN ENGINEERING SERVICES
<to>BELL, GORDON
<date>81/6/4
<date rec>6/4/81
<log#>6-9
<reply by>0
<dispo/date>DIPIETRO, JOHN - 6/4/81
<message>PLS. HANDLE
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>WORKSHOP - INSTRUCTION SET DESIGN AND CODE GENERATION FOR DATA DRIVEN COMPUTING SYSTEMS
<from>LEUNG, CLEMENT - MIT LAB FOR COMP. SCI.
<to>BELL, GORDON
<date>81/6/4
<date rec>6/4/81
<log#>6-8
<reply by>0
<dispo/date>FULLER, CALRK, DOUG - 6/16/81
<message>DO YOU WANT TO ATTEND WORKSHOP ON INSTRUCTION SET DEISGNAND CODE GENERATION FOR DATA-DRIVEN COMPUTING SYSTEMS. G.B. IS SCHEDULED TO ATTEND.
<answer>

<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>IEEE COMPUTER SOCIETY
<from>PREISS, RALPH
<to>BELL, GORDON
<date>81/6/3
<date rec>6/3/81
<log#>6-7
<reply by>0
<dispo/date>PREISS 6/8/81 Mon 13:08
<message>NOMINATED: #1-ATANASOFF, #2-WESLEY CLARK
<answer>
<f/u>mm/dd/yy
<filed>IEEE
<done>Y
<>

<subj>EARTHQUAKE ENGINEERING SYSTEMS INC.
<from>DAVE FAFARMAN
<to>BELL, GORDON
<date>81/6/3
<date rec>6/3/81
<log#>6-6
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>IBM
<from>EVANS, B.O.
<to>OLSEN, KEN
<date>81/5/19

<date rec>6/2/81
<log#>6-5
<reply by>0
<dispo/date>BOB GLORIOSO 6/8/81 Mon 14:46
<message>PLS RETURN GEORGE LOWE'S CALL: 518-270-6211
<answer>
<f/u>mm/dd/yy
<filed>12
<done>Y
<>

<subj>KIDDER PEABODY & CO.
<from>PEGRAM, SANDY
<to>BELL, GORDON
<date>81/6/?
<date rec>6/2/81
<log#>6-4
<reply by>0
<dispo/date>CALLED SANDY PEGRAM 6/8/81 Mon 14:07
<message>PLEASE TAKE GB OFF ALL YOUR MAILING LISTS
<answer>
<f/u>mm/dd/yy
<filed>N
<done>Y
<>

<subj>RESUME - BERKLING, KLAUS, DR.
<from>BERKLING, KLAUS, DR.
<to>BELL, GORDON
<date>81/5/27
<date rec>6/2/81
<log#>6-3
<reply by>0
<dispo/date>STEVE TEICHER - 6/4/81
<message>LET'S GET HIM HERE FOR INTERVIEW, WILL YOU PLEASE ANSWER AND HANDLE?
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y

<>

<subj>RESUME -- DIAMON, MARK S.
<from>JON HARVEY ASSOCIATES
<to>BELL, GORDON
<date>81/6/?
<date rec>6/2/81
<log#>6-2
<reply by>0
<dispo/date>JOHN DIPIETRO - 6/2/81
<message>PLEASE HANDLE
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>GENERAL RESEARCH CORP.
<from>STONE, RL
<to>BELL, GORDON
<date>81/5/26
<date rec>6/1/81
<log#>6-1
<reply by>0
<dispo/date>RAY STONE - 6/4/81
<message>ATTACHED IS A COPY OF THE DIST. PROCESS PAPER.
THERE ARE NO MORE POSTERS. THE OTHER TALK ISN'T AVAILABLE.
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>NSF - WAYNE STATE UNIV
<from>BERNARD CHERN
<to>BELL, GORDON
<date>81/?
<date rec>5/26/81
<log#>5-69
<reply by>0

<dispo/date>NSF 6/8/81 Mon 16:53
<message>
<answer>
<f/u>mm/dd/yy
<filed>NSF
<done>Y
<>

<subj>RESUME' -- HENRY L. SCHMIDT
<from>BROOKS, BUZZ
<to>BELL, GORDON
<date>81/5/?
<date rec>5/29/81
<log#>5-68
<dispo/date>JOHN DIPIETRO - 5/29/81
<message>PLEASE HANDLE.
<answer>
<f/u>mm/dd/yy
<filed>
<ret-gb>
<>

<subj>UNITED STATES DEPARTMENT OF COMMERCE
<from>SHONYO, DAVID B.
<to>BELL, GORDON
<date>81/5/22
<date rec>5/28/81
<log#>5-67
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<ret-gb>
<>

<subj>KIDDER, PEABODY & CO.
<from>PIKI, GEROLF M.
<to>BELL, GORDON
<date>81/5/?

<date rec>5/28/81
<log#>5-66
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<ret-gb>
<>

<subj>TWX--LOGO COMPUTER SYSTEMS INC.
<from>MONTPETIT, GUY
<to>BELL, GORDON
<date>81/5/28
<date rec>5/28/81
<log#>5-65
<dispo/date>
<message>CALLED TONY DICENZO (DTN 272-3651). HE IS WORKING WITH LOGO AS IS BILL KOHLBRENNER, A CONSULTANT FOR THE CT GROUP. TWX SENT AS INFO. NO FURTHER ACTION REQUIRED FROM GB AT THIS TIME.
<answer>
<f/u>mm/dd/yy
<filed>13
<ret-gb>
<>

<subj>BELL LABORATORIES
<from>HANNAY, N. B.
<to>OLSEN, KENNETH H.
<date>81/5/20
<date rec>5/28/81
<log#>5-64
<reply by>06/12/81
<dispo/date>AMES 5/29/81 Fri 14:52
<message>CAN WE PARTICIPATE?
<answer>BOB GLORIOSO, YOU SHOULD SEND THIS OUT AS HEAD OF RESEARCH, REFERING TO THE OLSEN LETTER...TO CLOSE PLUS STOP THE LOOP. FROM GB 7/28/81 Tue 16:01
<f/u>7/17;06/05/81--GLORIOSO CHECKING ON MORE QUALIFIED

CANDIDATES; SHOULD KNOW SOMETHING BY NEXT WEEK 7/8/81 Wed 14:39
<filed>12
<ret-gb>
<done>Y
<>

<subj>CARNEGIE-MELLON UNIVERSITY
<from>HABERMANN, A. N.
<to>BELL, GORDON
<date>81/5/15
<date rec>5/26/81
<log#>5-63
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<ret-gb>
<>

<subj>AGENCE DE L'INFORMATIQUE
<from>BOETTCHER, COLIN
<to>BELL, GORDON
<date>81/5/15
<date rec>5/26/81
<log#>5-62
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<ret-gb>
<>

<subj>RESUME' -- DR. LIYU CHEN
<from>CHEN, DR. LIYU
<to>BELL, GORDON
<date>81/5/?

<date rec>5/26/81
<log#>5-61
<dispo/date>JOHN DIPIETRO, CC:JEFF KALB, CUDMORE, TEICHER
<message>PLEASE HANDLE.
<answer>
<f/u>mm/dd/yy
<filed>
<ret-gb>
<>

<subj>AMERICAN TECHNOLOGY INC.
<from>BOEHM, MAX G.
<to>BELL, GORDON
<date>81/5/19
<date rec>5/26/81
<log#>5-60
<dispo/date>JOHN DIPIETRO - 5/27/81
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<ret-gb>
<>

<subj>MARCEL BREUER ASSOCIATES
<from>PAPACHRISTOU, TICIAN
<to>BELL, GORDON
<date>81/5/18
<date rec>5/26/81
<log#>5-59
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<ret-gb>
<>

<subj>TWX--RE:MY VISIT ON 22-26 JUNE

<from>RANDELL, BRIAN
<to>BELL, GORDON
<date>81/5/26
<date rec>5/26/81
<log#>5-58
<dispo/date>TWX SENT BACK TO BRAIN - 5/27/81
<message>BRIAN, WE ARE FREE 20-21 AND 26, 27, 28 JUNE. ADVISE WHEN YOU WILL ARRIVE. BED AWAITS. BRAINERD SPEAKS ON ENIAC ON JUNE 25 AT THE MUSEUM.
<answer>
<f/u>mm/dd/yy
<filed>TWX FILE (SUE'S DESK DRAWER) - 5/27/81
<ret-gb>
<>

<subj>RESUMES--EXECUTIVE SEARCH
<from>WAHLS, GORDON
<to>BELL, GORDON
<date>81/5/13
<date rec>5/21/81
<log#>5-57
<dispo/date>JOHN DIPIETRO - 5/21/81
<message>PLEASE HANDLE.
<answer>
<f/u>mm/dd/yy
<filed>
<ret-gb>
<>

<subj>MIT ARTIFICIAL INTELLIGENCE LABORATORY
<from>HILLIS, DANNY
<to>BELL, GORDON
<date>81/5/?
<date rec>5/21/81
<log#>5-56
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>

<ret-gb>
<>

<subj>TWX--11/70 IS DYING FAST IN EUROPE
<from>MULLIGAN, CHARLIE
<to>BELL, GORDON
<date>81/5/21
<date rec>5/21/81
<log#>5-55
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<ret-gb>
<>

<subj>FLOATING POINT SYSTEMS INC
<from>JOHNSTON, ROBERT F.
<to>BELL, GORDON
<date>81/5/18
<date rec>5/20/81
<log#>5-54
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<ret-gb>
<>

<subj
>INTEL
<from>RANCOURT, GARY
<to>BELL, GORDON
<date>81/5/20
<date rec>5/20/81
<log#>5-53
<dispo/date>

<message>
<answer>
<f/u>mm/dd/yy
<filed>
<ret-gb>
<>

<subj>RESUME' -- DR. M. SELIM CETINER
<from>CETINER, DR. M. SELIM
<to>BELL, GORDON
<date>81/4/12
<date rec>5/20/81
<log#>5-52
<dispo/date>JOHN DIPIETRO, CC:DICK CLATYON, TOM WILLIAMS - 5/20/81
<message>PLEASE TALK TO EACH OTHER AND SEE HOW YOU WISH TO PROCEED IN THIS AREA. JOHN, PLEASE HANDLE THIS LETTER.
<answer>TALKED WITH CETINER--NOT FOR DEC, JOHN D. 6/11/81 Thu 10:55
<f/u>mm/dd/yy
<filed>12
<ret-gb>
<>

<subj>JON M FRENCH
<from>FRENCH, JON M.
<to>BELL, GORDON
<date>81/5/15
<date rec>5/20/81
<log#>5-51
<dispo/date>NAME NOTED IN GB DIRECTORY
<message>
<answer>
<f/u>mm/dd/yy
<filed>N
<ret-gb>
<>

<subj>UNIVERSITY OF SASKATCHEWAN

<from>KAVANAGH, R. N.
<to>BELL, GORDON
<date>81/4/20
<date rec>5/20/81
<log#>5-50
<dispo/date>TO LETTERBOOK (GB2.S6.18) - 5/28/81
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<ret-gb>
<>

<subj>ANDREW ALLISON CONSULTANT
<from>ALLISON, ANDREW
<to>BELL, GORDON
<date>81/5/13
<date rec>5/19/81
<log#>5-49
<dispo/date>SAM FULLER, CC:STRECKER, WHITE, DEMMER - 5/21/81
<message>LET'S BE **ACTIVE** NOT WANT TO BE HAD, HERE.
<answer>
<f/u>mm/dd/yy
<filed>
<ret-gb>
<>

<subj>NORTHEASTERN UNIVERSITY
<from>WEISS, KARL
<to>BELL, GORDON
<date>81/5/14
<date rec>5/19/81
<log#>5-48
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>NORTHEASTERN - 5/20/81
<ret-gb>
<>

<subj>MALCO ELECTRONICS
<from>ROBERTS, JAMES B.
<to>BELL, GORDON
<date>81/5/15
<date rec>5/19/81
<log#>5-47
<dispo/date>JACK SMITH - 5/20/81
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<ret-gb>
<>

<subj>TECHNISCHE HOGESCHOOL TWENTE (MILITARY COMPUTER FAMILY--NO I WILL NOT SIGN, BECAUSE I AM NOT LOCATED IN THE U.S.)
<from>BLAAUW, PROF. DR. G.A.
<to>BELL, GORDON
<date>81/5/11
<date rec>5/19/81
<log#>5-46
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<ret-gb>
<>

<subj>WHITEHALL GROUP
<from>SHEVEL, W. LEE
<to>BELL, GORDON
<date>81/5/11
<date rec>5/19/81
<log#>5-45
<dispo/date>
<message>
<answer>

<f/u>mm/dd/yy
<filed>
<ret-gb>
<>

<subj>POIRIER, HOEVEL & CO.
<from>POIRIER, ROLAND L.
<to>BELL, GORDON
<date>81/5/11
<date rec>5/18/81
<log#>5-44
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<ret-gb>
<>

<subj>LAWRENCE LIVERMORE LABORATORY
<from>WOOD, LOWELL
<to>BELL, GORDON
<date>81/5/8
<date rec>5/18/81
<log#>5-43
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<ret-gb>
<>

<subj>TWX -- UNIDO RE:VIENNA MEETING
<from>SENIOR, GOWRI
<to>BELL, GORDON
<date>81/5/11
<date rec>5/18/81
<log#>5-42

<dispo/date>FILE #12 - 5/18/81
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<ret-gb>
<>

<subj>UNIVERSITY OF SOUTHERN CALIFORNIA
<from>KAPRIELIAN, Z.A.
<to>BELL, GORDON
<date>81/5/7
<date rec>5/18/81
<log#>5-41
<dispo/date>DICK ECKHOUSE - 5/21/81
<message>CAN WE DO ANYTHING?
<answer>TO GORDON & JANE GORING--I'M SURE A FEW HUNDRED DOLLARS COULD BE FOUND. MY QUESTION IS WHAT WILL WE GAIN FROM THIS? IN THE PAST WE'VE SUPPORT ORGANIZATIONS WHERE WE PARTICIPATE (SUCH AS TECHNICAL MEETINGS) AND WANT TO SEE THEM CONTINUE. MY FEW YEARS AS ASEE MEMBER DIDN'T LEAVE ME TOO IMPRESSED. JANE, DO WE RECRUIT STUDENTS FROM USC?
<f/u>mm/dd/yy
<filed>N
<ret-gb>sent to ECKHOUSE 6/9/81 Tue 9:15 PLEASE HANDLE/REPLY
<>

<subj>ADVANCED MICRO DEVICES INC.
<from>SIMONSEN, SVEN E.
<to>BELL, GORDON
<date>81/5/7
<date rec>5/18/81
<log#>5-40
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>12
<ret-gb>

<>

<subj>POLYTECHNIC
<from>LURIE, HAROLD
<to>BELL, GORDON
<date>81/5/7
<date rec>5/15/81
<log#>5-39
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<ret-gb>
<>

<subj>PAINE WEBBER JACKSON & CURTIS
<from>GAVEGNANO, RICHARD J.
<to>BELL, GORDON
<date>81/5/13
<date rec>5/15/81
<log#>5-38
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<ret-gb>
<>

<subj>TWX--DR. BAURS VISIT
<from>KISTER, WILLI
<to>BELL, GORDON
<date>81/5/15
<date rec>5/15/81
<log#>5-37
<dispo/date>
<message>
<answer>

<f/u>mm/dd/yy
<filed>
<ret-gb>
<>

<subj>BATTELLE COLUMBUS LAB.
<from>MINSHALL, CHARLES W.
<to>BELL, GORDON
<date>81/4/10
<date rec>5/13/81
<log#>5-36
<dispo/date>BOB GLORIOSO - 5/14/81
<message>FYI.
<answer>
<f/u>mm/dd/yy
<filed>
<ret-gb>
<>

<subj>AMERICAN SOFTWARE
<from>EDENFIELD, JAMES C.
<to>BELL, GORDON
<date>81/4/17
<date rec>5/13/81
<log#>5-35
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<ret-gb>
<>

<subj>TWX--RE:NORTHEASTERN UNIVERSITY
<from>ROCHE, JIM
<to>BELL, GORDON
<date>81/5/12
<date rec>5/13/81
<log#>5-34

<dispo/date>TWX SENT TO JIM (NERR) - 5/14/81
<message>THIS SHOULD BE WORKED WITH ANDY KNOWLES AND JOE MEANY. WHAT ABOUT GIVING THEM SOME PDT'S WITH GIGI'S **QUICK** TO GET THE WORK STARTED ON INTELLIGENT TERMINALS?
<answer>
<f/u>mm/dd/yy
<filed>
<ret-gb>
<>

<subj>INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS INC.
<from>GETTING, IVAN A.
<to>BELL, GORDON
<date>81/5/8
<date rec>5/13/81
<log#>5-33
<dispo/date>IVAN GETTING - 5/14/81
<message>I THINK THERE MAY BE BETTER CANDIDATES ON THE LIST.
<answer>
<f/u>mm/dd/yy
<filed>
<ret-gb>
<>

<subj>BELL LABORATORIES
<from>MATHEWS, MAX V.
<to>BELL, GORDON
<date>81/5/7
<date rec>5/13/81
<log#>5-32
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<ret-gb>
<>

<subj>RESUME' -- RUSS COLES, III

<from>COLES, RUSS III
<to>BELL, GORDON
<date>81/5/1
<date rec>5/12/81
<log#>5-31
<dispo/date>JOHN DIPIETRO - 5/13/81
<message>PLEASE HANDLE.
<answer>
<f/u>mm/dd/yy
<filed>
<ret-gb>
<>

<subj>NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
<from>YOUNG, A. THOMAS
<to>BELL, GORDON
<date>81/5/8
<date rec>5/12/81
<log#>5-30
<dispo/date>CALLED REGRETS 5/20/81 Wed 10:10
<message>MR. PAUL SCHNECK 301-344-8834
<answer>
<f/u>mm/dd/yy
<filed>12
<ret-gb>
<>

<subj>WHITEHALL GROUP
<from>SHEVEL, W. LEE
<to>CUDMORE, JAMES & METZGER, DON
<date>81/5/5
<date rec>5/12/81
<log#>5-29
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<ret-gb>
<>

<subj>INFORMATION DIALOGUES INC.
<from>GOETZ, JAMES B.
<to>OLSEN, KENNETH H.
<date>81/5/4
<date rec>5/11/81
<log#>5-28
<dispo/date>BILL PICOTT - 5/19/81
<message>CAN WE GET ONE?
<answer>
<f/u>mm/dd/yy
<filed>
<ret-gb>
<>

<subj>SCAN-OPTICS INC.
<from>BELHUMEUR, JEAN M JR.
<to>OLSEN, KENNETH H.
<date>81/4/30
<date rec>5/11/81
<log#>5-27
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<ret-gb>
<>

<subj>BUSINESS INTERNATIONAL CORP.
<from>FUNG, SHING K.
<to>BELL, GORDON
<date>81/5/5
<date rec>5/11/81
<log#>5-26
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy

<filed>
<ret-gb>
<>

<subj>GNOSTIC CONCEPTS INC.
<from>DAVIES, JANET
<to>BELL, GORDON
<date>81/5/7
<date rec>5/11/81
<log#>5-25
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<ret-gb>
<>

<subj>ROBERTSON & ASSOCIATES INC.
<from>ROBERTSON, RICHARD B.
<to>BELL, GORDON
<date>81/5/5
<date rec>5/11/81
<log#>5-24
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<ret-gb>
<>

<subj>
<from>
<to>BELL, GORDON
<date>81/
<date rec>
<log#>5-
<dispo/date>

<message>
<answer>
<f/u>mm/dd/yy
<filed>
<ret-gb>
<>

<subj>BUCKMINSTER CORPORATION
<from>SILVER, DAVID
<to>BELL, GORDON
<date>81/5/5
<date rec>5/11/81
<log#>5-23
<dispo/date>TOM WILLIAMS - 5/11/81
<message>FYI.
<answer>
<f/u>mm/dd/yy
<filed>
<ret-gb>
<>

<subj>NEVADA POWER COMPANY
<from>SUTTON, MELVIN C.
<to>BELL, GORDON
<date>81/4/29
<date rec>5/11/81
<log#>5-22
<dispo/date>PAUL REY - 5/11/81
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<ret-gb>
<>

<subj>INTEL
<from>NOYCE, ROBERT. N.
<to>BELL, GORDON
<date>81/5/1

<date rec>5/8/81
<log#>5-21
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<ret-gb>
<>

<subj>BUSINESS INTERNATIONAL CORPORATION
<from>FUNG, SHING K.
<to>BELL, GORDON
<date>81/5/5
<date rec>5/8/81
<log#>5-20
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<ret-gb>
<>

<subj>DUNHILL OF FORT COLLINS INC. (ELECTRONICS ENGINEERS OPENINGS)
<from>HICK, JACK
<to>BELL, GORDON
<date>81/5/1
<date rec>5/6/81
<log#>5-19
<dispo/date>JOHN DIPIETRO - 5/6/81
<message>FYI
<answer>
<f/u>mm/dd/yy
<filed>
<ret-gb>
<>

<subj>BUTCHER & SINGER INC.
<from>LEOPOLD, HARRY

<to>BELL, GORDON
<date>81/4/30
<date rec>5/6/81
<log#>5-18
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<ret-gb>
<>

<subj>NATIONAL SCIENCE FOUNDATION
<from>WEISS, EDWARD C.
<to>BELL, GORDON
<date>81/5/1
<date rec>5/6/81
<log#>5-17
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>NSF-ADVISORY COMMITTEE ON INFORMATION SCIENCE AND TECHNOLOGY
<ret-gb>
<>

<subj>TWX--RX01/RX02 FOR 278 -- TKYD
<from>KOBAYASHI, TOM
<to>BELL, GORDON
<date>81/5/6
<date rec>5/6/81
<log#>5-16
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<ret-gb>
<>

<subj>WHITEHALL GROUP
<from>SHEVEL, W. LEE
<to>BELL, GORDON
<date>81/5/4
<date rec>5/5/81
<log#>5-15
<dispo/date>ORIGINAL -- GORDON, CC:OC, ENG STAFF, RICH CASE, BOB GLORIOSO, MFG STAFF, METZGER - 5/8/81
<message>LET ME URGE YO TO READ THIS. (LEE WAS HIRED BY DON METZGER TO REVIEW OUR SEMI5-7S & HE'LL ALSO BE WORKING ON AN OVERALL ENG. REVIEW.) THE BIG SURPRISE IS THAT IBM SPENDS OVER 10 PERCENT ON R&D!
<answer>
<f/u>mm/dd/yy
<filed>
<ret-gb>
<>

<subj>WEATHERBY ASSOCIATES INC.
<from>GREY, LISA
<to>BELL, GORDON
<date>81/5/1
<date rec>5/5/81
<log#>5-14
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<ret-gb>
<>

<subj>IRCAM
<from>MARGER, BRIGITTE
<to>BELL, GORDON
<date>81/4/24
<date rec>5/5/81
<log#>5-13

<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>IRCAM
<ret-gb>
<>

<subj>DEAN WITTER REYNOLDS INC.
<from>REPPER, GEORGE
<to>BELL, GORDON
<date>81/5/?
<date rec>5/5/81
<log#>5-12
<dispo/date>GRANT SAVIERS - 5/8/81
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<ret-gb>
<>

<subj>CARNEGIE-MELLON UNIVERSITY
<from>SIEWIOREK, DANIEL P.
<to>BELL, GORDON
<date>81/4/30
<date rec>5/4/81
<log#>5-11
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<ret-gb>
<>

<subj>RESUME' -- DAVID DEAN LEWIS
<from>LEWIS, DAVID DEAN
<to>BELL, GORDON

<date>81/4/28
<date rec>5/4/81
<log#>5-10
<dispo/date>JOHN DIPIETRO - 5/5/81
<message>PLEASE HANDLE.
<answer>
<f/u>mm/dd/yy
<filed>
<ret-gb>
<>

<subj>TWX--DR. BAUR VISIT (6/9/81)
<from>KISTER, WILLI
<to>BELL, GORDON
<date>81/5/4
<date rec>5/4/81
<log#>5-9
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<ret-gb>
<>

<subj>HUXTABLE ASSOCIATES INC.
<from>HUXTABLE, FULTON L.
<to>BELL, GORDON
<date>81/4/27
<date rec>5/4/81
<log#>5-8
<dispo/date>JOHN DIPIETRO - 5/4/81
<message>FYI.
<answer>
<f/u>mm/dd/yy
<filed>
<ret-gb>
<>

<subj>JRS INDUSTRIES INC.
<from>WARSHAWSKY, ERWIN H.
<to>GUILBAULT, PAUL
<date>81/4/7
<date rec>5/4/81
<log#>5-7
<dispo/date>SAM, CC:PAUL GUILBAULT - 5/11/81
<message>THIS LOOKS USELESS FOR **OUR** PURPOSE. WHAT DO YOU THINK? I SEE **NO** PROPOSAL.
<answer>GORDON, YOUARE RIGHT IN THAT THERE IS NO SPECIFIC PROPOSAL **NOR** ANY DATA TO INDICATE QUALITY IF MCODE COMPLICE. THIS IS CLEARLY A LONG SHOT. IF PAUL IS INTERESTED I'D PROPOSE HE:
1) GET SO PERFORMANCE DATA ON GENERATED MCODE.
2) SEE IF JRS PLANS TO DEVELOP CODE GENERATIONFOR 750 & 730 TOO. THIS **COULD BE OF INTEREST TO DEC** IF THEY COULD TARGET CODE TO 730, 750, & 780. - 5/19/81
Sent back to Guilbault 6/15/81 Mon 15:28
<f/u>5/22/81
<filed>
<ret-gb>
<>

<subj>SIEMENS
<from>GUMIN, PROFESSOR HEINZ
<to>BELL, GORDON
<date>81/4/28
<date rec>5/4/81
<log#>5-6
<dispo/date>TO LETTERBOOK (GB2.S5.53) - 5/14/81
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<ret-gb>
<>

<subj>NATIONAL ACADEMY OF ENGINEERING -- AD HOC AGENDA 5/19/81
<from>HARRISON, VIRGINIA A.

<to>BELL, GORDON
<date>81/5/?
<date rec>5/4/81
<log#>5-5
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<ret-gb>
<>

<subj>TDK ELECTRONICS CO. LTD.
<from>OHTOSHI, Y.
<to>BELL, GORDON
<date>81/4/1
<date rec>5/4/81
<log#>5-4
<dispo/date>GRANT SAVIERS - 5/8/81
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<ret-gb>
<>

<subj>HARVARD UNIVERSITY
<from>OETTINGER, ANTHONY G.
<to>BELL, GORDON
<date>81/4/30
<date rec>5/4/81
<log#>5-3
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>no
<ret-gb>
<>

<subj>INTEL (MCF LETTER SIGNATURE)
<from>NOYCE, ROBERT N.
<to>BELL, GORDON
<date>81/4/?
<date rec>5/4/81
<log#>5-2
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<ret-gb>
<>

<subj>WESTERN DIGITAL CORP. (MCF LETTER SIGNATURE)
<from>FISHER, DAVID A.
<to>BELL, GORDON
<date>81/4/28
<date rec>5/4/81
<log#>5-1
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<ret-gb>
<>

<subj>MASSACHUSETTS INSTITUTE OF TECHNOLOGY (MIT)
<from>SEAMANS, ROBERT C. JR.
<to>BELL, GORDON
<date>81/4/27
<date rec>4/30/81
<log#>4-54
<dispo/date>
<message>
<answer>
<f/u>
<filed>

<ret-gb>
<>

<subj>UNIVERSITY OF NORTH CAROLINA AT CHAPEL HILL
<from>BROOKS, FREDERICK P. JR.
<to>BELL, GORDON
<date>81/4/24
<date rec>4/30/81
<log#>4-53
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<>

<subj>HOUSATONIC COMMUNITY COLLEGE (STATE OF CONNECTICUT)
<from>DARNOWSI, VINCENT S.
<to>BELL, GORDON
<date>81/4/21
<date rec>4/29/81
<log#>4-52
<dispo/date>GEORGE CHAMBERLAIN - 5/4/81
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<>

<subj>TWX-- GARY COLE MEETING WITH GORDON
<from>COLE, GARY
<to>BELL, GORDON
<date>81/4/28
<date rec>4/29/81
<log#>4-51
<dispo/date>
<message>

<answer>
<f/u>
<filed>
<ret-gb>
<>

<subj>HAMMOND SOFTWARE
<from>HAMMOND, IAN
<to>BELL, GORDON
<date>81/4/12
<date rec>4/28/81
<log#>4-50
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<>

<subj>UNIVERSITY OF WASHINGTON -- COMPUTING AND HIGHER EDUCATION: AN ACCIDENTAL REVOLUTION
<from>GILLESPIE, ROBERT G.
<to>BELL, GORDON
<date>81/4/24
<date rec>4/28/81
<log#>4-49
<dispo/date>ANDY KNOWLES - 5/4/81
<message>PLEASE REVIEW WITH JOE MEANY. PLEASE COMMENT. NOTE THE SURPRISING STATEMENT, PAGE 2! (WE'RE IN THE WRONG MARKET.) WE CAN STILL INPUT TO THIS.
<answer>
<f/u>5/15/81
<filed>
<ret-gb>
<>

<subj>UNIVERSITY OF WASHINGTON
<from>GILLESPIE, ROBERT G.

<to>BELL, GORDON
<date>81/4/14
<date rec>4/28/81
<log#>4-48
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<>

<subj>RESUME' -- JAMES M. DEVITT (IRELAND STUDENT)
<from>DEVITT, JAMES M.
<to>BELL, GORDON
<date>81/4/14
<date rec>4/27/81
<log#>4-47
<dispo/date>JANE GORING - 4/28/81
<message>PLEASE HANDLE.
<answer>
<f/u>
<filed>
<ret-gb>
<>

<subj>ETA KAPPA NU -- AWARD ORGANIZATION COMMITTEE
<from>D'ARCY, JAMES A.
<to>BELL, GORDON
<date>81/4/15
<date rec>4/27/81
<log#>4-46
<dispo/date>SAM - 4/30/81
<message>WHO?
<answer>I THINK OUR BEST CANDIDATE IS IKE NASSI - 5/12/81
<f/u>5/15/81
<filed>
<ret-gb>
<>

<subj>DIGITAL--GERMANY RE:SIEMENS MUSEUM
<from>JESSE, GERD
<to>BELL, GORDON
<date>81/4/15
<date rec>4/27/81
<log#>4-45
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<>

<subj>SIEMENS - MUSEUM
<from>SCHOEN, DR.
<to>BELL, GORDON
<date>81/4/14
<date rec>4/27/81
<log#>4-44
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<>

<subj>TEXAS INSTRUMENTS
<from>HEILMEIER, GEORGE H.
<to>BELL, GORDON
<date>81/4/23
<date rec>4/27/81
<log#>4-43
<dispo/date>
<message>
<answer>
<f/u>
<filed>

<ret-gb>
<>

<subj>P896 DESIGN COURSE (IEEE)
<from>NICOUD, PROF. J. D.
<to>BELL, GORDON
<date>81/4/13
<date rec>4/27/81
<log#>4-42
<dispo/date>SAM, CC:BILL STRECKER, BILL DEMMER, JACK MACKEEN - 4/27/81
<message>WHAT'S THIS?
<answer>
<f/u>5/6/81
<filed>
<ret-gb>
<>

<subj>HEWLETT-PACKARD COMPANY
<from>YOUNG, JOHN
<to>OLSEN, KENNETH H.
<date>81/4/15
<date rec>4/27/81
<log#>4-41
<dispo/date>KEN, CC:STEVE TEICHER, CUDMORE, LARRY, DICK HOUGH - 4/27/81
<message>WE HAD TO DO THIS TO GET SOME RESULTS. MIT FUNDING IS FOR NICE GUYS.
<answer>
<f/u>
<filed>
<ret-gb>
<>

<subj>UNIVERSITY OF CALIFORNIA--LAWRENCE LIVERMORE LABS
<from>GREENWOOD, JAMES R.
<to>BELL, GORDON
<date>81/4/22
<date rec>4/27/81

<log#>4-40
<dispo/date>ORIGINAL TO GORDON, CC:WIN, BILL JOHNSON - 4/28/81
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<>

<subj>TWX--VIENNA (UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION (UNIDO) RE: TECHNICAL MEETING IN VIENNA
<from>SENIOR, GOURI
<to>BELL, GORDON
<date>81/4/23
<date rec>4/27/81
<log#>4-39
<dispo/date>TWX SENT IN REPLY - 4/27/81
<message>SORRY I HAVE PREVIOUS COMMITMENTS AND CANNOT PARTICIPATE IN YOUR VIENNA MEETING ON MICROELECTRONICS.
<answer>
<f/u>
<filed>12
<ret-gb>
<>

<subj>MIDDLESEX COMMUNITY COLLEGE
<from>KERAMAS, JAMES G.
<to>BELL, GORDON
<date>81/4/15
<date rec>4/24/81
<log#>4-38
<dispo/date>JANE GORING - 4/24/81
<message>DO YOU WANT TO GO?
<answer>
<f/u>
<filed>
<ret-gb>
<>

<subj>NORTON-MURPHY SALES CORP.
<from>MURPHY, THOMAS A.
<to>BELL, GORDON
<date>81/4/20
<date rec>4/23/81
<log#>4-37
<dispo/date>TO FILE #13 - 4/23/81
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<>

<subj>MASSACHUSETTS INSTITUTE OF TECHNOLOGY (MIT) --
SIGNATURE ON CARDBOARD
<from>KALAUSKAS, CAROL (FORRESTER'S OFFICE)
<to>BELL, GORDON
<date>81/4/22
<date rec>4/23/81
<log#>4-36
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<>

<subj>NORTHEASTERN UNIVERSITY
<from>WEISS, KARL
<to>BELL, GORDON
<date>81/4/22
<date rec>4/23/81
<log#>4-35
<dispo/date>
<message>
<answer>
<f/u>

<filed>
<ret-gb>
<>

<subj>MOTOROLA INC.
<from>WEISZ, WILLIAM J.
<to>BELL, GORDON
<date>81/4/16
<date rec>4/22/81
<log#>4-34
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<>

<subj>CARNEGIE-MELLON UNIVERSITY
<from>BURKS, SHARON R.
<to>BELL, GORDON
<date>81/4/16
<date rec>4/22/81
<log#>4-33
<dispo/date>TO LETTERBOOK (GB2.S5.42) - 4/28/81
<message>
<answer>
<f/u>
<filed>
<ret-gb>
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<subj>STATE UNIVERSITY OF NY -- PERSONAL REQUEST
<from>HOROWITZ, BRUCE
<to>BELL, GORDON
<date>81/4/15
<date rec>4/22/81
<log#>4-32
<dispo/date>PETER CONNELL - 4/23/81

<message>PLEASE HELP.
<answer>
<f/u>
<filed>
<ret-gb>
<>

<subj>UNIVERSITY OF MICHIGAN
<from>BURKS, ARTHUR W.
<to>BELL, GORDON
<date>81/4/13
<date rec>4/22/81
<log#>4-31
<dispo/date>TO GWEN'S CORRESPONDENCE (MUDEC5.48) - 5/15/81
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<>

<subj>UNIVERSITY OF PENNSYLVANIA -- MUSEUM LECTURER
<from>BRAINERD, JOHN G.
<to>BELL, GORDON
<date>81/4/14
<date rec>4/21/81
<log#>4-30
<dispo/date>TO GWEN CORRESPONDENCE FILE (MUDEC5/30) - 4/24/81
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<>

<subj>CULLINANE DATABASE SYSTEMS
<from>CULLINANE, JOHN J.
<to>BELL, GORDON
<date>81/4/16

<date rec>4/21/81
<log#>4-29
<dispo/date>TO GWEN'S CORRESPONDENCE FILE (MUDEC5/28) - 4/27/81
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<>

<subj>UNIVERSITY OF WASHINGTON
<from>GILLESPIE, ROBERT G.
<to>BELL, GORDON
<date>81/4/15
<date rec>4/21/81
<log#>4-28
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>UNIVERSITY OF CALIFORNIA, LOS ANGELES
<from>POPEK, GERALD J.
<to>BELL, GORDON
<date>81/4/14
<date rec>4/21/81
<log#>4-27
<dispo/date>TO LETTERBOOK (GB2.S5.40) - 4/22/81 CC: OF POPEK'S LETTER TO AL AVERY, BILL DEMMER, ANDY KNOWLES, JOE MEANY, BILL MUNSON, GEORGE NEWTON, JACK SHIELDS.
<message>
<answer>
<f/u>
<filed>
<ret-gb>

<roll>
<>

<subj>CROWN PACIFIC MAXIM (MANAGEMENT CONSULTANTS)
<from>HARBERTS, H. H.
<to>BELL, GORDON
<date>81/4/20
<date rec>4/21/81
<log#>4-26
<dispo/date>JOHN DIPIETRO - 4/22/81
<message>PLEASE HANDLE.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>RESUME' -- JAMES E. BORCHERT
<from>BORCHERT, JAMES E.
<to>BELL, GORDON
<date>81/4/14
<date rec>4/17/81
<log#>4-25
<dispo/date>BILL JOHNSON, CC:DALEY, SCHROEDER, STONE - 4/21/81
<message>PLEASE ANSWER. LOOKS GOOD.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>TEXAS INSTRUMENTS
<from>HEILMEIER, GEORGE H.
<to>BELL, GORDON
<date>81/4/14

<date rec>4/17/81
<log#>4-24
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>MASSACHUSETTS INSTITUTE OF TECHNOLOGY (MIT)
<from>MOSES, JOEL
<to>BELL, GORDON
<date>81/4/13
<date rec>4/17/81
<log#>4-23
<dispo/date>CC: BOB GLORIOSO - 4/21/81
<message>PLEASE GIVE ME YOUR COMMENTS ON MAURICE WILKES BY THURS.
<dispo/date>TO LETTERBOOK (GB2.S5.36) - 4/24/81
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>NORTH AMERICAN TECHNOLOGY INC.
<from>ROSOV, GENE
<to>BELL, GORDON
<date>81/4/9
<date rec>4/15/81
<log#>4-22
<dispo/date>
<message>
<answer>
<f/u>
<filed>

<ret-gb>
<roll>
<>

<subj>WESTERN I/O INC.
<from>MUELLER, DAVID L.
<to>BELL, GORDON
<date>81/4/8
<date rec>4/15/81
<log#>4-21
<dispo/date>BERNIE LACROUTE, CC:BOB SAVELL, DAVE RODGERS, JERRY BUTLER - 4/21/81 **(NOTE: DO NOT READ THIS MESSAGE TO MUELLER!)** JUST RECEIVED TED JOHNSON'S COPY OF THIS LETTER FROM CUSTOMER ASSISTANCE. WE HAVE FILED IT IN FILE #12. -- 4/21/81
<message>SHOULDN'T WE MAKE THESE TO REDUCE INTERFACE COSTS?
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>BANASHEK AND ASSOCIATES INC. -- CUSTOMER PROBLEM "BREAK KEY"
<from>BANASHEK, ROBERT A.
<to>OLSEN, KENNETH H.
<date>81/4/7
<date rec>4/15/81
<log#>4-20
<dispo/date>HERB SHANZER - 4/21/81
<message>ANYWAY TO FIX THIS? OUR BREAKS AREN'T BREAKS??
<answer>
<f/u>5/1/81
<filed>
<ret-gb>
<roll>
<>

<subj>INFOTECH LIMITED
<from>PITMAN COHEN & CO. -- FLOYD, NASH & CO.
<to>BELL, GORDON
<date>81/3/23
<date rec>4/15/81
<log#>4-19
<dispo/date>TO LETTERBOOK (GB2.S5.16) - 4/17/81
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>LOUIS DELHAIZE
<from>AERTS, L. & STAES, J. L.
<to>BELL, GORDON
<date>81/4/1
<date rec>4/15/81
<log#>4-18
<dispo/date>NANCY BALLANTYNE, CC: MJ - 4/21/81
<message>HELP. A SPEAKER FOR DISTRIBUTED PROCESSING FROM ENGINEERING WOULD BE BERNIE LACROUTE (TW) R&D--BOB GLORIOSO. PLEASE CALL WITH PERSON WHO WILL HEAD MEETING SO I CAN TWX STAES AND GET GORDON OUT OF THE LOOP. THANKS.
<answer>
<f/u>
<filed>12
<ret-gb>
<roll>
<>

<subj>RESUME' -- PETER CULLEN
<from>CULLEN, PETER
<to>BELL, GORDON
<date>81/4/6
<date rec>4/14/81
<log#>4-17
<dispo/date>JANE GORING - 4/15/81

<message>PLEASE HANDLE.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>NORTHEASTERN UNIVERSITY
<from>ARNOWITT, YOUNG IN
<to>BELL, GORDON
<date>81/4/9
<date rec>4/13/81
<log#>4-16
<dispo/date>JOHN DIPIETRO - 4/21/81
<message>PLEASE ANSWER.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>OREGON SOFTWARE
<from>WHITNEY, RUSTY
<to>BELL, GORDON
<date>81/4/8
<date rec>4/13/81
<log#>4-15
<dispo/date>CC: JOE FORD, DICK SNYDER, STEVE HYDE - 4/21/81
<message>FYI
<answer>
<f/u>
<filed>ORIGINAL TO OREGON SOFTWARE - 4/21/81
<ret-gb>
<roll>
<>

<subj>UNIVERSITY OF PENN. -- PICTURES FOR LECTURE ON 6/25

<from>BRAINERD, JOHN C.
<to>BELL, GORDON
<date>81/4/9
<date rec>4/13/81
<log#>4-14
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>RESUME' -- ANTHONY PETRELLA
<from>DEANGELO, LARRY (DEC--MARKETING)
<to>BELL, GORDON
<date>81/4/8
<date rec>4/10/81
<log#>4-13
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>INTERMETRICS
<from>RYER, MICHAEL J.
<to>BELL, GORDON
<date>81/4/8
<date rec>4/10/81
<log#>4-12
<dispo/date>BILL JOHNSON - 4/13/81
<message>WHY DO WE WANT TO ANSWER? PROBABLY WE SHOULD.
LET'S KEE THEM AT ARM'S LENGTH.
<answer>
<f/u>

<filed>
<ret-gb>
<roll>
<>

<subj>CO-OP POSITION FOR SUMMER
<from>GAZIANO, CHARLES F.
<to>BELL, GORDON
<date>81/4/5
<date rec>4/10/81
<log#>4-11
<dispo/date>JANE GORING - 4/10/81
<message>PLEASE HANDLE.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>RESUME' -- PAUL WILLIS
<from>WILLIS, PAUL
<to>BELL, GORDON
<date>81/4/?
<date rec>4/8/81
<log#>4-10
<dispo/date>JOHN DIPIETRO - 4/8/81
<message>PLEASE HANDLE.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>MIT -- WORKSHOP ON INSTRUCTION SET DESIGN AND CODE GENERATION FOR DATA-DRIVEN COMPUTING SYSTEMS
<from>LEUNG, CLEMENT K. C.
<to>BELL, GORDON

<date>81/4/?
<date rec>4/8/81
<log#>4-9
<dispo/date>SENT ORIGINAL BACK TO LEUNG LISTING BILL STRECKER, AND IVAN DOBES. - 4/10/81
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>BIRD-JOHNSON COMPANY
<from>PINGREE, C. H.
<to>BELL, GORDON
<date>81/4/1
<date rec>4/7/81
<log#>4-8
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>RICHCO PLASTIC COMPANY
<from>GARAY, MARY
<to>BELL, GORDON
<date>81/3/26
<date rec>4/6/81
<log#>4-7
<dispo/date>DICK GONZALES - 4/6/81
<message>YOURS.
<answer>
<f/u>
<filed>
<ret-gb>

<roll>
<>

<subj>UNIVERSITY OF CALIFORNIA, BERKELEY
<from>PATTERSON, DAVID A.
<to>BELL, GORDON
<date>81/3/21
<date rec>4/6/81
<log#>4-6
<dispo/date>ORIGINAL TO GB--CC: TO LETTERBOOK (GB2.S5.14) - 4/13/81 CC: STRECKER, FULLER, TEICHER, DOUG CLARKE - 4/13/81
<message>I DOUBT IF THERE ARE REALLY ANY SURPRISES. IF WE FIND THEM, LET'S UTILIZE THEM. WHAT DO YOU THINK THE SURPRISE IS? IT'S PROBABLY TIME TO STOP EDUCATING THE EDUCATORS HERE.
<answer>FROM BILL STRECKER:I THINK THEIR WORK IS INTERESTING BUT NOT SURPRISING. THE REDUCTION IN MEMORY TRAFFIC DUE TO THEIR PROCEDURE CALL/REGISTER MECHANISM IS IMPRESSIVE - BUT IS A MULTIPROGRAMMED SYSTEMS WOULD RESULT IN THE SAVE/RESTORE OF 140 REGISTERS ON 2 CONTEXT SWITCHES. THEIR RESULTS SHOULD BE GENERALIZED TO MORE GENERAL PROGRAMMING ENVIRONMENTS WITH SOME CARE: THEY HAVE LOOKED AT SMALL PROGRAMS USING ONLY A LIMITED NUMBER OF DATA TYPES. INVESTING IN A MORE COMPLEX ARCHITECTURE TO SAVE 50 PERCENT IN PROGRAM SIZE MAY BE A BIG WIN IN ALL BUT THE SMALLEST SYSTEMS. - 4/21/81
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>TWX--OKI
<from>KOBAYASHI, TOM
<to>BELL, GORDON
<date>81/4/3
<date rec>4/3/81
<log#>4-5
<dispo/date>
<message>
<answer>

<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>UNIVERSITY OF TEXAS AT AUSTIN
<from>BROWNE, J. C.
<to>BELL, GORDON
<date>81/3/31
<date rec>4/3/81
<log#>4-4
<dispo/date>
<message>
<answer>
<f/u>
<filed>U OF TEXAS
<>

<subj>NORTHEASTERN UNIVERSITY
<from>WEISS, KARL
<to>BELL, GORDON
<date>81/4/1
<date rec>4/3/81
<log#>4-3
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>XEROX
<from>SUTHERLAND W.R.
<to>BELL, GORDON
<date>81/3/23
<date rec>4/1/81

<log#>4-2
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>TWX -- TERRY CULLEN'S EUROPEAN VISIT
<from>SCHERPENHUIZEN, JAN
<to>BELL, GORDON
<date>81/3/31
<date rec>4/1/81
<log#>4-1
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>RESUME' -- ROBERT F. MORROW
<from>MORROW, ROBERT F.
<to>BELL, GORDON
<date>81/3/28
<date rec>3/31/81
<log#>3-64
<dispo/date>JOHN DIPIETRO - 4/2/81
<message>PLEASE HANDLE.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>

<>

<subj>UNIVERSITY OF TEXAS AT AUSTIN
<from>HUMBLE, MS. CHARLIE
<to>BELL, GORDON
<date>81/3/24
<date rec>3/30/81
<log#>3-63
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>IEEE
<from>GETTING, IVAN A.
<to>BELL, GORDON
<date>81/2/19
<date rec>3/30/81
<log#>3-62
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>UNIVERSITY OF COLORADO--THANK YOU FOR TEACHING VLSI COURSE
<from>MURRAY, JOHN
<to>BELL, GORDON
<date>81/3/27
<date rec>3/30/81

<log#>3-61
<dispo/date>STEVE TEICHER - 4/13/81
<message>LOOKS GOOD.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>RESUME' -- ROBERT J. ROBINSON
<from>ROBINSON, ROBERT J.
<to>BELL, GORDON
<date>81/3/24
<date rec>3/30/81
<log#>3-60
<dispo/date>CC:TO LETTERBOOK (GB2.S5.13) - 4/13/81 CC: PETE JANSEN, DON AMES, AL CRAWFORD, JOHN ROSE. - 4/13/81
<message>ANY INTEREST? LOOKS LIKE HE HAS LOTS OF EXPERIENCE...WHERE COULD HE BE EFFECTIVE?
<dispo/date>JOHN DIPIETRO - 4/24/81
<message>WE HAVE HAD NO RESPONSE.
<answer>
<f/u>ORIGINAL - 4/24/81
<filed>
<ret-gb>
<roll>
<>

<subj>TUCKER R.H. ASSOCIATES INC.
<from>PLOURDE, DAVID R.
<to>LENG, JOHN
<date>81/3/20
<date rec>3/27/81
<log#>3-59
<dispo/date>JOHN HOLMAN - 3/30/81
<message>
<answer>
<f/u>
<filed>

<ret-gb>
<roll>
<>

<subj>RAGEN PRECISION INDUSTRIES INC.
<from>LOPATA, E.E.
<to>BELL, GORDON
<date>81/3/24
<date rec>3/27/81
<log#>3-58
<dispo/date>CIRC. ART CAMPBELL, STAN OLSEN, BILL PICOTT, WALT TETSCHNER - 4/2/81 LOPATA CALLED AND WE REFERRED HIM TO STAN.
<message>ANY INTEREST?
<answer>
<f/u>4/17/81
<filed>
<ret-gb>
<roll>
<>

<subj>NORTHEASTERN UNIVERSITY
<from>HOWARD, HELEN B.
<to>BELL, GORDON
<date>81/3/23
<date rec>3/25/81
<log#>3-57
<dispo/date>
<message>
<answer>
<f/u>
<filed>NORTHEASTERN - 5/4/81
<ret-gb>
<roll>
<>

<subj>RESUME' -- H. WILLIAM PAULSEN
<from>PAULSEN, H. WILLIAM
<to>BELL, GORDON

<date>81/3/?
<date rec>3/25/81
<log#>3-56
<dispo/date>JOHN DIPIETRO - 3/27/81
<message>PLEASE HANDLE.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>FOUNDRY CENTER INC.
<from>HENSEL, CHUCK
<to>BELL, GORDON
<date>81/3/?
<date rec>3/24/81
<log#>3-55
<dispo/date>JOHN DIPIETRO - 3/24/81
<message>PLEASE HANDLE.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>UNIVERSITY OF CALIFORNIA, LOS ANGELES
<from>SCHOLLHAMMER, HANS
<to>LONG, WILLIAM H.
<date>81/3/3
<date rec>3/24/81
<log#>3-54
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>

<roll>
<>

<subj>PERGAMON INFOTECH (TOOK OVER INFOTECH)
<from>BOON, C.
<to>BELL, GORDON
<date>81/3/12
<date rec>3/23/81
<log#>3-53
<dispo/date>TO LETTERBOOK (GB2.S5.16) - 4/15/81
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>ASSOCIATION FOR COMPUTING MACHINERY (REFUND FOR EXPENSES)
<from>HUANG, IAN Y.
<to>BELL, GORDON
<date>81/3/18
<date rec>3/23/81
<log#>3-52
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>RESUME' -- ANDREW D. VARANELLI
<from>VARANELLI, ANDREW D.
<to>BELL, GORDON
<date>81/3/20
<date rec>3/23/81

<log#>3-51
<dispo/date>JOHN DIPIETRO - 3/24/81
<message>PLEASE HANDLE.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>ARTHUR D. LITTLE MANAGEMENT EDUCATION INSTITUTE INC.
<from>WEBB, JEAN FORD
<to>BELL, GORDON
<date>81/3/18
<date rec>3/23/81
<log#>3-50
<dispo/date>JOHN MEYER - 3/24/81
<message>ANY INTEREST?
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>RESUME' -- MARCIA H. BALLEN
<from>O'CONNELL, MICHAEL
<to>BELL, GORDON
<date>81/3/?
<date rec>3/20/81
<log#>3-49
<dispo/date>JOHN DIPIETRO - 3/20/81
<message>LET'S GET HER IN ENGINEERING...FOR AN INTERVIEW.
HER EDUCATION BACGROUND LOOKS VERY POOR, JOBS, OK.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>RESUME' -- CLAUS DIETER MAKOWKA
<from>SLITCHTER, DR. C.P.
<to>BELL, GORDON
<date>81/3/?
<date rec>3/20/81
<log#>3-48
<dispo/date>JOHN DIPIETRO, PLEASE HANDLE. CC: DON AMES, JOHN MEYER, SAM, BOB GLORIOSO, BILL AVERY, STEVE TEICHER - 3/20/81
<message>LET'S GET HIM FOR AN INTERVIEW WITH THESE AREA: LDP, SEMIS, RESEARCH
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>SANTA MONICA PUBLISHING COMPANY
<from>PHISTER, MONTY
<to>BELL, GORDON
<date>81/3/16
<date rec>3/20/81
<log#>3-47
<dispo/date>
<message>
<answer>
<f/u>
<filed>N
<ret-gb>
<roll>
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<subj>ZUSE, KONRAD
<from>ZUSE, KONRAD
<to>BELL, GORDON
<date>81/3/10
<date rec>3/20/81
<log#>3-46

<dispo/date>CC: RON SMART, BILL HEFFNER - 3/31/81
<message>FYI
<answer>
<f/u>
<filed>GWEN CORRESPONDENCE (INCOMING) - 3/31/81
<ret-gb>
<roll>
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<subj>IMI INC.
<from>WEBB, RALPH L.
<to>BELL, GORDON
<date>81/3/9
<date rec>3/19/81
<log#>3-45
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>SIEMENS -- PHOTOS FOR MUSEUM
<from>GOETZELER, DR.
<to>BELL, GORDON
<date>81/3/13
<date rec>3/19/81
<log#>3-44
<dispo/date>TO GWEN'S CORRESPONDENCE (MUDEC5.45) - 5/15/81
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>DESIGN TECHNOLOGY CORPORATION
<from>MENZIN, MARVIN
<to>OLSEN, KENNETH H.
<date>81/3/9
<date rec>3/19/81
<log#>3-43
<dispo/date>DICK CLAYTON, CC:TOM WILLIAMS, BOB GLORIOSO, ROGER CADY, KEN OLSEN - 3/24/81
<message>ROGER, PLEASE ANSWER.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>AUGAT
<from>WELLINGTON, ROGER D.
<to>BELL, GORDON
<date>81/3/13
<date rec>3/18/81
<log#>3-42
<dispo/date>WILL THOMPSON, CC: DICK CLAYTON - 3/18/81
<message>LOOKS INTERESTING.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>DUNHILL OF LINCOLN INC. -- RESUME' (#DB-311812)
<from>BERCEY, DONALD A.
<to>BELL, GORDON
<date>81/3/11
<date rec>3/17/81
<log#>3-41
<dispo/date>JOHN DIPIETRO - 3/18/81
<message>PLEASE HANDLE.
<answer>
<f/u>

<filed>
<ret-gb>
<roll>
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<subj>MIDVALE-HEPPENSTALL COMPANY
<from>ROSENWALD, COOK
<to>BELL, GORDON
<date>81/3/12
<date rec>3/16/81
<log#>3-40
<dispo/date>
<message>
<answer>
<f/u>
<filed>
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<subj>ESRC
<from>HECHT, LEE
<to>OLSEN, KENNETH H.
<date>81/2/25
<date rec>3/16/81
<log#>3-39
<dispo/date>JIM CUDMORE - 3/18/81
<message>YOURS.
<answer>
<f/u>
<filed>
<ret-gb>
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<subj>NATIONAL ACADEMY OF ENGINEERING
<from>PERKINS, COURTLAND D.
<to>BELL, GORDON
<date>81/3/10
<date rec>3/12/81
<log#>3-38

<dispo/date>
<message>
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<subj>UNIVERSITY OF MICHIGAN
<from>BURKS, ARTHUR W.
<to>BELL, GORDON
<date>81/3/6
<date rec>3/12/81
<log#>3-37
<dispo/date>TO LETTERBOOK (GB2.S4.7) - 3/26/81
<message>
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<f/u>
<filed>
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<subj>HISTORICAL TECHNOLOGY INC.
<from>MOSKOWITZ, SAUL
<to>BELL, GORDON
<date>81/3/9
<date rec>3/11/81
<log#>3-36
<dispo/date>
<message>
<answer>
<f/u>
<filed>
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<roll>
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<subj>UNIVERSITY OF MASSACHUSETTS
<from>STONE, HAROLD
<to>BELL, GORDON
<date>81/3/5
<date rec>3/10/81
<log#>3-35
<dispo/date>
<message>
<answer>
<f/u>
<filed>
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<subj>AIR PRODUCTS AND CHEMICALS INC.
<from>BRIAN, P.L THIBAUT
<to>LANDAUER, DR. ROLF
<date>81/3/6
<date rec>3/10/81
<log#>3-34
<dispo/date>
<message>
<answer>
<f/u>
<filed>
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<subj>EXCEL PERSONNEL (RESUME OF #E-205)
<from>KELSEY, RICH
<to>BELL, GORDON
<date>81/2/19
<date rec>3/10/81
<log#>3-33
<dispo/date>JOHN DIPIETRO - 3/12/81
<message>PLEASE HANDLE.
<answer>
<f/u>

<filed>
<ret-gb>
<roll>
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<subj>INTERNATIONAL MATHEMATICAL & STATISTICAL LIBRARIES INC.
<from>BENNER, THOMAS J.
<to>BELL, GORDON
<date>81/3/6
<date rec>3/10/81
<log#>3-22
<dispo/date>RALPH COFFMAN - 3/18/81
<message>
<answer>
<f/u>
<filed>
<ret-gb>
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<subj>GYROMAT CORPORATION
<from>WIGGINS, R.F.
<to>BELL, GORDON
<date>81/3/5
<date rec>3/9/81
<log#>3-21
<dispo/date>
<message>
<answer>
<f/u>
<filed>
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<subj>JON HARVEY PERSONNEL (RESUME' MARTIN POLLOCK)
<from>KAPLAN, JACK H.
<to>BELL, GORDON
<date>81/3/4

<date rec>3/9/81
<log#>3-20
<dispo/date>JOHN DIPIETRO - 3/10/81
<message>PLEASE HANDLE.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>SIEMENS AG
<from>GUMIN, HEINZ
<to>BELL, GORDON
<date>81/2/27
<date rec>3/9/81
<log#>3-19
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>IBM
<from>LANDAUER, ROLF
<to>BRIAN, P.L. THIBAUT
<date>81/3/3
<date rec>3/9/81
<log#>3-18
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>UNIVERSITY OF WASHINGTON
<from>GILLESPIE, ROBERT G.
<to>PANEL MEMBERS (BELL, GORDON)
<date>81/3/2
<date rec>3/6/81
<log#>3-17
<dispo/date>
<message>
<answer>
<f/u>
<filed>GILLESPIE
<ret-gb>
<roll>
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<subj>INFORMATION INDUSTRIES INC.
<from>FAUPEL, FRED. C.
<to>BELL, GORDON
<date>81/2/27
<date rec>3/6/81
<log#>3-16
<dispo/date>JOHN DIPIETRO - 3/9/81
<message>PLEASE HANDLE.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>MASSACHUSETTS INSTITUTE OF TECHNOLOGY
<from>FORRESTER, JAY W.
<to>OLSEN, KEN
<date>81/2/20
<date rec>3/6/81
<log#>3-15
<dispo/date>DAVE PACKARD, CC: KEN - 3/6/81
<message>YOURS!

<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>STANFORD UNIVERSITY
<from>ULLMAN, JEFFREY D.
<to>BELL, GORDON
<date>81/3/?
<date rec>3/6/81
<log#>3-14
<dispo/date>ASKED ULLMAN FOR VITAE--COMING IN 2 WEEKS 3/10/81 Tue 13:08
<dispo/date>DAVE BROWN (DISK ENG.), CC:BILL DEMMER, ULF, GRANT, BILL PICOTT, SI - 3/9/81
<message>FYI
<answer>
<f/u>12
<filed>HOLD FOR INFO FOLDER
<ret-gb>
<roll>
<>

<subj>DESIGN AUTOMATION INC. (RESUME'S-- ED RAWSON, & HARRY ROSENSTEIN)
<from>SOKAL, NATHAN O.
<to>BELL, GORDON
<date>81/3/3
<date rec>3/6/81
<log#>3-13
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>WORCESTER POLYTECHNIC INSTITUTE (WPI)
<from>HALL, ROBERT J.
<to>PARTICIPANTS
<date>81/2/25
<date rec>3/3/81
<log#>3-12
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>MIT
<from>STALLMAN, RICHARD
<to>BELL, GORDON
<date>81/3/?
<date rec>3/3/81
<log#>3-11
<dispo/date>ORIGINAL TO GB, CC:DEMMER, HUSTVEDT, CARCHIDI, HEFFNER, BJ, FULLER, LACROUTE, CUTLER, GLORIOSO - 3/11/81
<message>I'D LIKE TO SEE US FUND EXTERNAL A/D ON VMS. WHAT'S THE CHANCE, IF I COULD FIND THE MONEY, THAT YOU WOULD EITHER DO THIS WORK OR HIRE STAHLMAN TO DO IT AND MEASURE IT?
<dispo/date>GAVE RICHARD STALLMAN A CALL AND LEFT A MESSAGE FOR HIM TO CALL SAM FULLER. - 4/23/81
<answer>SPOKE TO IRIS AND SHE SAID STALLMAN AND SAM HAVE BEEN TALKING WITH EACH OTHER. - 4/30/81
<f/u>3/27
<filed>
<ret-gb>
<roll>
<>

<subj>HENDERSON CORPORATION

<from>MANN, ROBERT L.
<to>BELL, GORDON
<date>81/2/27
<date rec>3/3/81
<log#>3-10
<dispo/date>MIKE MULROY - 3/4/81
<message>PLEASE HANDLE.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>CAPITAL CHILDREN'S MUSEUM
<from>LEWIN, ANN W.
<to>ASTON, MR. CHARLES A.
<date>81/2/28
<date rec>3/3/81
<log#>3-9
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>JON HARVEY PERSONNEL (RESUME' FOR JOHN L. CONNIN)
<from>KAPLAN, JACK H.
<to>BELL, GORDON
<date>81/2/26
<date rec>3/2/81
<log#>3-8
<dispo/date>JOHN DIPIETRO, CC:SI - 3/4/81
<message>PLEASE HANDLE.
<answer>
<f/u>
<filed>
<ret-gb>

<roll>
<>

<subj>ADVANCED ENGINEERING SERVICES
<from>SHATZ, SOL
<to>BELL, GORDON
<date>81/2/25
<date rec>3/2/81
<log#>3-7
<dispo/date>JIM CUDMORE, CC:WILL THOMPSON, HENK SCHALKE - 3/4/81
<message>YOURS.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>TEXAS INSTRUMENTS FOUNDATION
<from>HARRIS, S.T.
<to>BELL, GORDON
<date>81/3/2
<date rec>3/2/81
<log#>3-6
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>TEXAS INSTRUMENTS FOUNDATION
<from>HARRIS, S.T.
<to>BELL, GORDON
<date>81/3/2
<date rec>3/2/81

<log#>3-5
<dispo/date>
<message>
<answer>
<f/u>
<filed>
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<roll>
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<subj>NATIONAL RESEARCH COUNCIL
<from>BLACKBURN, JACOB F.
<to>MEMBERS
<date>81/2/25
<date rec>3/2/81
<log#>3-4
<dispo/date>postcard returned--can't attend 6/4-5
<message>
<answer>
<f/u>
<filed>CS&TB
<ret-gb>
<roll>
<>

<subj>UNITED STATES DEPARTMENT OF COMMERCE
<from>ELLERT, ROBERT B.
<to>BELL, GORDON
<date>81/2/26
<date rec>3/2/81
<log#>3-3
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>BRIGHAM YOUNG UNIVERSITY
<from>ROBISON, PARLEY P.
<to>BELL, GWEN
<date>81/2/24
<date rec>3/2/81
<log#>3-2
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>AIR PRODUCTS AND CHEMICALS INC.
<from>BRIAN, P.L. THIBAUT
<to>LANDAUER, DR. ROLF (IBM)
<date>81/2/25
<date rec>3/2/81
<log#>3-1
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>MIT VISITING COMMITTEE--DRAFT COPY OF REPORT FROM FEB. MEETING
<from>WEISZ, BILL
<to>BELL, GORDON
<date>81/2/18
<date rec>2/20/81
<log#>2-71
<dispo/date>
<message>
<answer>

<f/u>
<filed>MIT VISITING COMMITTEE--GB HAD NO COMMENTS 3/4/81 Wed 11:06
<ret-gb>
<roll>
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<subj>INFOTECH LIMITED (IN THE MATTER OF THE COMPANIES ACT, 1948)
<from>BOON, C.
<to>BELL, GORDON
<date>81/2/?
<date rec>2/27/81
<log#>2-70
<dispo/date>SEE LETTERBOOK (GB2.S3.17) - 3/4/81 LETTER SENT TO FLOYD NASH AND COMPANY (RE: GORDON'S $919.20 EXPENSE FROM INFOTECH TRIP.)
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>MONTGORMERY PHISTER SYSTEMS CONSULTING
<from>PHISTER, MONTY
<to>BELL, GORDON
<date>81/2/21
<date rec>2/27/81
<log#>2-69
<dispo/date>
<message>
<answer>
<f/u>
<filed>PHISTER
<ret-gb>
<roll>
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<subj>BECKER AND HAYES INC.
<from>BECKER, JOSEPH
<to>BELL, GORDON
<date>81/2/20
<date rec>2/27/81
<log#>2-68
<dispo/date>TO LETTERBOOK (GB2.S3.16) - 3/9/81
<message>
<answer>
<f/u>
<filed>
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<subj>PANASONIC COMPANY
<from>SPATER, ELIAS D.
<to>BELL, GORDON
<date>81/2/24
<date rec>2/27/81
<log#>2-67
<dispo/date>BILL PICOTT - 3/2/81
<message>YOURS.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>ICON ELECTRONICS INC.
<from>RAVENSCROFT, JERRY
<to>BELL, GORDON
<date>81/2/?
<date rec>2/25/81
<log#>2-66
<dispo/date>DICK GONZALES 2/26/81 Thu 12:46
<message>
<answer>

<f/u>
<filed>
<ret-gb>
<roll>
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<subj>SIEMENS AG
<from>GUMIN, PROF. HEINZ
<to>BELL, GORDON
<date>81/2/17
<date rec>2/25/81
<log#>2-65
<dispo/date>
<message>
<answer>
<f/u>
<filed>SIEMENS - HOLD
<ret-gb>
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<subj>COMPUTER SCIENCE REVIEW
<from>DODD, GEORGE G.
<to>BELL, GORDON
<date>81/1/12
<date rec>2/25/81
<log#>2-64
<dispo/date>
<message>
<answer>
<f/u>
<filed>GB'S "CALLS TO MAKE" FOLDER - 2/25/81
<ret-gb>
<roll>
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<subj>CHARGES BABBAGE INSTITUTE
<from>PAUL ARMER
<to>MICHAEL LINDGREN, CC:BELL, GORDON

<date>81/2/20
<date rec>2/24/81
<log#>2-63
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>ZUSE RE HIS LECTURE
<from>ZUSE
<to>BELL, GORDON
<date>81/2/15
<date rec>2/24/81
<log#>2-62
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>U OF ILLINOIS RE GILLIES LECTURER
<from>SNYDER
<to>BELL, GORDON
<date>81/2/19
<date rec>2/24/81
<log#>2-61
<dispo/date>
<message>
<answer>SORRY, OVER COMMITTED REF: GB2.S3.5
<f/u>
<filed>U OF ILLINOIS
<ret-gb>
<roll>

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<subj>IBM--RE NAE MEMBERSHIP CRITIQUE
<from>LANDAUER, ROLF
<to>BELL, GORDON
<date>81/2/18
<date rec>2/24/81
<log#>2-60
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>IEEE MEMBERS TO BE NOMINATED TO NAE
<from>GETTING, IVAN
<to>BELL, GORDON
<date>81/19/2
<date rec>2/24/81 Tue
<log#>2-59
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>TWX -- FUJITSU R AND D EXPENDITURE, ETC.
<from>KOBAYSHI, TOM
<to>BELL, GORDON
<date>81/2/24
<date rec>2/24/81
<log#>2-58
<dispo/date>

<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>S SHIMADA
<from>SHIMADA, SHOICHI
<to>BELL, GORDON
<date>81/2/13
<date rec>2/23/81
<log#>2-57
<dispo/date>GRANT SAVIERS - 2/25/81
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>NATIONAL SCIENCE FOUNDATION
<from>RESNIKOFF, HOWARD L.
<to>BELL, GORDON
<date>81/2/19
<date rec>2/23/81
<log#>2-56
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>HONEYWELL

<from>BACHMAN, CHARLES
<to>BELL, GORDON
<date>81/2/18
<date rec>2/20/81
<log#>2-55
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>DEAN WITTER REYNOLDS INC.
<from>REPPER, GEORGE
<to>BELL, GORDON
<date>81/2/?
<date rec>2/20/81
<log#>2-54
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>OLYMPIA USA INC
<from>KOCH, EUGEN P.
<to>OLSEN, KENNETH
<date>81/1/20
<date rec>2/20/81
<log#>2-53
<dispo/date>ORIGINAL TO F/U, CC: PICOTT, LYLE, LAZAR, KEN OLSEN, BOB GRAY - 2/25/81
<message>WON'T THE NEW ELECTRIC TYPEWRITERS BY OLD FIRMS (EG. OLYMPIA, BROTHER, OLIVETTI, ROYAL, SCM ETC. KILL US IN THE HARDCOPY DUMB TERMINAL. LET'S TALK TO THEM?

<answer>
<f/u>3/13/81
<filed>
<ret-gb>
<roll>
<>

<subj>BLACK DOT (PROOFS OF COMPUTER STRUCTURES BOOK)
<from>STRUCK, DEBBIE
<to>BELL, GORDON
<date>81/2/18
<date rec>2/20/81
<log#>2-52
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>SECURITY PLASTICS INC.
<from>GOMEZ, AL
<to>BELL, GORDON
<date>81/2/17
<date rec>2/20/81
<log#>2-51
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>ZUSE, KONRAD (SLIDE)
<from>ZUSE, KONRAD

<to>BELL, GORDON
<date>81/2/13
<date rec>2/20/81
<log#>2-50
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>ANDWARE PUBLISHING INC.
<from>REED, JACK C.
<to>BELL, GORDON
<date>81/2/13
<date rec>2/19/81
<log#>2-49
<dispo/date>BILL JOHNSON - 2/24/81
<message>SHOULD WE CONTACT? CAN WE USE?
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>STATE UNIVERSITY OF NEW YORK AT BUFFALO
<from>FRIEDER, GIDEON
<to>BELL, GORDON
<date>81/2/10
<date rec>2/18/81
<log#>2-48
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>

<roll>
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<subj>NATIONAL RESEARCH COUNCIL
<from>MROZINSKI, R.V.
<to>BELL, GORDON
<date>81/2/10
<date rec>2/18/81
<log#>2-47
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>INTEL
<from>RANCOURT, GARY
<to>BELL, GORDON
<date>81/2/6
<date rec>2/18/81
<log#>2-46
<dispo/date>ORIGINAL TO GARY - 2/18/81
<message>PLEASE CONTACT NAT PARKE, TEWKSBURY; PAUL THORDARSON, MILL RE: SPEECH PROCESSING
<answer>
<f/u>
<filed>CC: INTEL
<ret-gb>
<roll>
<>

<subj>CARNEGIE-MELLON UNIVERSITY
<from>SIEWIOREK, DANIEL P.
<to>BELL, GORDON
<date>81/2/12
<date rec>2/17/81
<log#>2-45
<dispo/date>KEN, CC: OC, ENG STAFF, DICK CLAYTON, JOEL SCHWARTZ, JOE MEANY, ED KRAMER - 2/19/81

<message>REALLY NICE TO GET. DAN'S A CONSULTANT (AND CRITIC/CONSCIOUS) OF OURS IN RELIABILITY.
<answer>
<f/u>
<filed>N
<ret-gb>
<roll>
<>

<subj>GLOBAL INTEGRATION TECHNOLOGIES INC.
<from>GREEN, ALEX C.
<to>BELL, GORDON
<date>81/2/13
<date rec>2/17/81
<log#>2-44
<dispo/date>BILL PICOTT, CC:GERRY WITMORE, TOM KOBAYASHI - 2/19/81
<message>YOURS. HOW ARE WE DOING HERE? ANY MKT. NEED?
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>SECURITY PLASTICS INC.
<from>GOMEZ, AL
<to>BELL, GORDON
<date>81/2/13
<date rec>2/17/81
<log#>2-43
<dispo/date>DICK GONZALES - 2/19/81
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>RAGEN PRECISION INDUSTRIES INC. (201-997-1000)
<from>LOPATA, E.E.
<to>BELL, GORDON
<date>81/2/13
<date rec>2/17/81
<log#>2-42
<dispo/date>CIRC. KALIN, PARKE, DUNDON, PICOTT, GLORIOSO - 2/19/81
<message>SHOULDN'T WE GET A OOD CAMERA & TRY GETTING IMAGES IN (AND READING THEM IF TEXT)?
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>SEMICONDUCTOR INDUSTRY ASSOCIATION (SIA)
<from>HINKELMAN, T.D.
<to>BELL, GORDON
<date>81/2/11
<date rec>2/17/81
<log#>2-41
<dispo/date>CUDMORE
<message>JIM WROTE TO HINKELMAN (2/23/81)--"NEITHER GB NOR I CAN ATTEND CONFERENCE, BUT I AM INTERESTED IN ATTENDING ONE OR TWO FUTURE MEETINGS."
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>NATIONAL ACADEMY OF ENGINEERING
<from>LIEBOWITZ, HAROLD
<to>BELL, GORDON
<date>81/2/13
<date rec>2/17/81

<log#>2-40
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>INTERSIL INSIGHT
<from>PHELPS, MEL
<to>BELL, GORDON
<date>81/2/?
<date rec>2/17/81
<log#>2-39
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>COLUMBIA UNIVERSITY (MILL RENOVATION)
<from>CARNEY, DONNA J.
<to>BELL, GORDON
<date>81/2/?
<date rec>2/17/81
<log#>2-38
<dispo/date>MJ - 2/18/81
<message>LETTER TO CARNEY3/12/81 Thu 15:28 MJGB12.55 & 53
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>T.H. FLOWERS (MUSEUM LECTURER)
<from>FLOWERS, T.H.
<to>BELL, GORDON
<date>81/2/9
<date rec>2/17/81
<log#>2-37
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>POLYTECHNIC INSTITUTE OF N.Y.
<from>LURIE, HAROLD
<to>BELL, GORDON
<date>81/2/11
<date rec>2/16/81
<log#>2-36
<dispo/date>
<message>
<answer>
<f/u>
<filed>calendar 5/1/81
<ret-gb>
<roll>
<>

<subj>CAPITAL CHILDREN'S MUSEUM
<from>LEWIN, ANN W.
<to>DUBE, NANCY
<date>81/2/6
<date rec>2/16/81
<log#>2-35
<dispo/date>
<message>
<answer>

<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>MOTOROLA CENTER
<from>WEISZ, WILLIAM J.
<to>MIT VISITING COMMITTEE
<date>81/2/9
<date rec>2/16/81
<log#>2-34
<dispo/date>
<message>
<answer>
<f/u>
<filed>MIT VISITING COMMITTEE - 2/17/81
<ret-gb>
<roll>
<>

<subj>INTEL (REFRESH HIGHLIGHTS ON INTEL PRODUCTS -- REPORT)
<from>RANCOURT, GARY
<to>BELL, GORDON
<date>81/FEB. AND MARCH
<date rec>2/16/81
<log#>2-33
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>UNIVERSITY OF TEXAS AT AUSTIN
<from>WOODSON, H.H.
<to>BELL, GORDON

<date>81/2/6
<date rec>2/13/81
<log#>2-32
<dispo/date>
<message>
<answer>
<f/u>
<filed>N
<ret-gb>
<roll>
<>

<subj>UNIVERSITY OF TEXAS AT AUSTIN
<from>COGDELL, J.R.
<to>BELL, GORDON
<date>81/2/?
<date rec>2/13/81
<log#>2-31
<dispo/date>ORIGINAL LETTER TO COGDELL - 2/16/81
<message>MIES VAN DER ROHE
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>STANFORD UNIVERSITY
<from>WHITE, ROBERT L.
<to>BELL, GORDON
<date>81/2/10
<date rec>2/13/81
<log#>2-30
<dispo/date>ORIGINAL TO LETTERBOOK (GB2.S2.37)CC:HERB SHANZER,BOB SUPNIK, SI, JACK MACKEEN, PAUL THORARSON, BOB GLORIOSO - 2/16/81
<message>WHAT YOU SAY? NOTE, WHY NOT MAKE J-11 "TH HOT", COOL MACHINE?? (IMAGE) USE FOR IMAGE & VOICE.
3/10/81 Tue 13:26 --HERB, PLEASE RESPOND TO WHITE WITH CC TO GB

3/27/81 Fri 13:12 SENT TO DEL THORNDIKE--PLEASE CALL WHITE AND KEEP US POSTED
<answer>
<f/u>3/20
<filed>
<ret-gb>
<roll>
<>

<subj>AFIPS
<from>GALLER, BERNARD A.
<to>CRAGON, HARVEY
<date>81/2/5
<date rec>2/12/81
<log#>2-29
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>CREATIVE SYSTEM DESIGN
<from>DENNY, ROBERT B.
<to>BELL, GORDON
<date>81/2/3
<date rec>2/12/81
<log#>2-28
<dispo/date>BILL JOHNSON, CC:HEFFNER, GIL STEIL, ERIC BATES, SI, ARMEN VARTERSSIAN - 2/16/81
<message>PLEASE CONVEY MY CONGRATULATIONS TO THE RT DESIGN TEAM. A FANTASTIC ENDORSEMENT. IT LOOKS LIKE THE RT WRITER(S) CAN TEACH US SOMETHING. CAN I RECOMMEND THEY PRESENT THEIR MANUALS TO TEAM IN SPITBROOK RD? (COULD I ALSO BE PRESENT AT THIS?) (COULD I HAVE THE LATEST SET?)
<answer>
<f/u>
<filed>

<ret-gb>
<roll>
<>

<subj>DSIR (DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH)
<from>KIBBLEWHITE, L.R.
<to>BELL, GORDON
<date>81/2/3
<date rec>2/12/81
<log#>2-27
<dispo/date>TO LETTERBOOK (GB2.S2.36) - 2/19/81
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>RESUME' ROSS M. KUDWITT
<from>KUDWITT, ROSS M.
<to>BELL, GORDON
<date>81/2/9
<date rec>2/11/81
<log#>2-26
<dispo/date>JOHN DIPIETRO - 2/23/81
<message>PLEASE HANDLE.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>RESUME' ALEXANDER DRUKAREV
<from>DRUKAREV, ALEXANDER
<to>BELL, GORDON
<date>81/2/7
<date rec>2/11/81

<log#>2-25
<dispo/date>JOHN DIPIETRO - 2/12/81
<message>PLEASE HANDLE.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>RON CAMPANELL DESIGN ASSOCIATES
<from>CAMPANELL, RON
<to>BELL, GORDON
<date>81/2/5
<date rec>2/10/81
<log#>2-24
<dispo/date>
<message>NO INTEREST 2/11/81 Wed 10:13
<answer>
<f/u>
<filed>12
<ret-gb>
<roll>
<>

<subj>HEALY REALTY COMPANY
<from>HEALY G.F.
<to>BELL, GORDON
<date>81/2/6
<date rec>2/10/81
<log#>2-23
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>EXCEL PERSONNEL -- RESUME' E-114
<from>KELSEY, RICH
<to>BELL, GORDON
<date>81/1/23
<date rec>2/10/81
<log#>2-22
<dispo/date>JOHN DIPIETRO - 2/11/81
<message>PLEASE HANDLE.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>CARNEGIE CORPORATION OF NEW YORK
<from>PIFER, ALAN
<to>OLSEN, KENNETH H.
<date>81/2/4
<date rec>2/10/81
<log#>2-21
<dispo/date>RALPH COFFMAN - 2/11/81
<message>YOURS.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>UNIVERSITY OF TEXAS AT AUSTIN
<from>MALEK, MIROSLAW
<to>BELL, GORDON
<date>81/2/4
<date rec>2/10/81
<log#>2-20
<dispo/date>TO LETTERBOOK (GB2.S2.24) - 2/11/81
<message>
<answer>

<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>HERTRICH DEVELOPMENT INC.
<from>HERTRICH, FRED
<to>BELL, GORDON
<date>81/2/4
<date rec>2/10/81
<log#>2-19
<dispo/date>
<message>
<answer>
<f/u>
<filed>HERTRICH DEVELOPMENT INC. - 3/9/81
<ret-gb>
<roll>
<>

<subj>NATIONAL SCIENCE FOUNDATION
<from>RESNIKOFF, HOWARD L.
<to>BELL, GORDON
<date>81/2/3
<date rec>2/9/81
<log#>2-18
<dispo/date>TO LETTERBOOK (GB2.S2.39) - 2/19/81
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>SECURITY PLASTICS INC.
<from>GOMEZ, AL
<to>BELL, GORDON

<date>81/2/5
<date rec>2/9/81
<log#>2-17
<dispo/date>DICK GONZALES - 2/11/81
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>JOSEPH CHRIS PERSONNEL SERVICES INC. -- RESUMES' (5685-5704,5198)
<from>JOSEPH CHRIS PERSONNEL SERVIES INC.
<to>BELL, GORDON
<date>81/2/?
<date rec>2/9/81
<log#>2-16
<dispo/date>JOHN DIPIETRO - 2/10/81
<message>FYI
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>UNIVERSITY OF CALIFORNIA
<from>DICKMAN, LLOYD
<to>BELL, GORDON
<date>81/2/?
<date rec>2/9/81
<log#>2-15
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>

<roll>
<>

<subj>BUSINESS & SOCIAL RESEARCH INSTITUTE--(CORPORATE CULTURE FOR INNOVATION)
<from>VEDIN, BENGT-ARNE
<to>BELL, GORDON
<date>81/1/?
<date rec>2/6/81
<log#>2-14
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>TEXAS A&M UNIVERSITY
<from>PAINTER, JOHN H.
<to>BELL, GORDON
<date>81/2/2
<date rec>2/6/81
<log#>2-13
<dispo/date>ORIGINAL TO MJ, COPY OF LETTER TO PAINTER IN LETTERBOOK (GB2.S2.25) - 2/11/81
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>UNIVERSITY OF TEXAS AT AUSTIN
<from>FRIEDRICH, DR. OTTO M. JR.
<to>BELL, GORDON
<date>81/1/31

<date rec>2/6/81
<log#>2-12
<dispo/date>TO LETTERBOOK (GB2.S2.24) - 2/11/81
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>IBM
<from>RABBAT, GUY
<to>BELL, GORDON
<date>81/1/26
<date rec>2/6/81
<log#>2-11
<dispo/date>TO LETTERBOOK (GB2.S3.4) - 2/19/81
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>IBM
<from>BLOCH, ERICH
<to>BELL, GORDON
<date>81/2/3
<date rec>2/6/81
<log#>2-10
<dispo/date>ORIGINAL RETURNED, CC:OC, AL MULLIN, ED SCHWARTZ, ENG STAFF, MOFFA, TEICHER, ZEH, MACKEEN, CROUSE - 3/3/81
<message>REALLY GOOD PAPER ON JAPAN OND OTHER COMPETITORS WITH SOME RECOMMNEDATIONS.
<answer>
<f/u>
<filed>
<ret-gb>YES - 3/3/81

<roll>
<>

<subj>WORCESTER POLYTECHNIC INSTITUTE
<from>CRANCH, EDMUND T.
<to>BELL, GORDON
<date>81/2/2
<date rec>2/4/81
<log#>2-9
<dispo/date>ORIGINAL TO F/U, CC:LEE WILLIAMS, BILL BAILEY, JOHN MEYER, GLORIOSO, FULLER, TEICHER, ANDY KNOWLES - 2/10/81
<message>WHAT'S HAPPENING HERE? IS THERE SOMEONE WHO SHOULD MANAGE THIS FROM OUR END? WHO'S FOLLOWING UP? WHO'S DOCUMENTING OUR COMMENTS?
<answer>SPOKE TO LEE WILLIAMS -- SHE HAS BEEN WORKING ON THE FOLLOWING THREE ITEMS: 1) PROF. SHASHI MEHRA, WPI IS ENROLLED IN THE COURSE AND IS NOW WORKING ON A CHIP. 2) BOB GLORIOSO + SAM ARE REVIEWING THE CURRICULUM. 3) LEE WILLIAMS THINKS IT WOULD BE WISE TO HAVE A FORMAL RELEASE TIME SET UP TO ENABLE ENGINEERS AT DEC TO ATTEND COURSES AT WPI OR ANYWHERE ELSE. NOTE: SHE SAID THAT NOBODY IS REALY MANAGING THIS RIGHT NOW. SHE IS TO BUSY WITH HER OWN PRIORITIES AND SAID IF WE DON'T GET SOMEONE TO MANAGE NOW, WE COULD LOSE JOINT UNDERSTANDING WITH WPI. - 3/3/81
<f/u>2/27/81
<filed>
<ret-gb>
<roll>
<>

<subj>MIT--DOCTORAL THESIS "FAULT TOLERANCE IN PACKET COMMUNICATION COMPUTER ARCHITECTURES
<from>LEUNG, CLEMENT K.C.
<to>BELL, GORDON
<date>81/1/27
<date rec>2/4/81
<log#>2-8
<dispo/date>
<message>
<answer>
<f/u>

<filed>
<ret-gb>
<roll>
<>

<subj>BLACK DOT (PROOFS FOR COMPUTER STRUCTURES BOOK)
<from>STRUCK, DEBBIE
<to>BELL, GORDON
<date>81/2/2
<date rec>2/4/81
<log#>2-7
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>HARVARD UNIVERSITY (REGISTRATION--WORKSHOP,COMMUNICATIONS NEWTWORK MANAGEMENT POLICY)
<from>OETTINGER, ANTHONY G.
<to>BELL, GORDON
<date>81/2/2
<date rec>2/3/81
<log#>2-6
<dispo/date>ORIGINAL TO F/U, CC:PATRICK COURTIN, STAN PEARSON, TED JOHNSON, BRUCE DELAGI - 2/9/81
<message>COULD EACH OF YOU RECOMMEND SOMEONE TO ATTEND...I.E. IF YOU'RE INTERESTED & BELIEVE WE SHOULD ATTEND.
<answer>SPOKE TO JANET SCHWARTZ (STAN PEARSON'S OFFICE), SHE WILL BE CONTACTING CLAIRE BISHOP DIRECTLY. DAVE RODGERS WILL BE ATTENDING. ALSO SPOKE TO ELAINE (PATRICK COURTIN'S OFFICE), SHE WILL BE CONTACTING CLAIRE BISHOP DIRECTLY. EITHER PATRICK OR BOB SCHMITT WILL BE ATTENDING. - 2/17/81
<f/u>
<filed>
<ret-gb>
<roll>

<>

<subj>MONTGOMERY PHISTER JR.
<from>PHISTER, MONTGOMERY JR.
<to>BELL, GORDON
<date>81/1/30
<date rec>2/3/81
<log#>2-5
<dispo/date>ORIGINAL TO LETTERBOOK (GB2.S2.29) - 2/19/81 CC: TO MARCY - 2/11/81
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>PANASONIC COMPANY
<from>SPATER, ELIAS D.
<to>BELL, GORDON
<date>81/1/29
<date rec>2/3/81
<log#>2-4
<dispo/date>I CALLED MR. SPATER'S OFFICE REGARDING SOME LITERATURE THAT SHOULD HAVE BEEN ENCLOSED WITH THE LETTER. THEY ARE WAITING TO RECEIVE THIS LITERATURE FROM JAPAN AND IT WILL BE ANOTHER MONTH AND THEN THEY WILL RE-SEND THE LETTER AND LITERATURE. - 2/4/81
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>TWX--T-11 ON OKI IF-800
<from>KOBAYASHI, TOM

<to>BELL, GORDON
<date>81/2/3
<date rec>2/3/81
<log#>2-3
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>UNIVERSITY OF TORONTO
<from>WORTMAN, D.B.
<to>BELL, GORDON
<date>81/1/27
<date rec>2/2/81
<log#>2-2
<dispo/date>DICK ECKHOUSE, CC:DAVE RODGERS - 2/10/81
<message>PLEASE SEND BOTH.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>TWX--VT103 AS CT-JR
<from>KOBAYASHI, TOM
<to>BELL, GORDON
<date>81/2/1
<date rec>2/2/81
<log#>2-1
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>

<roll>
<>

<subj>MIT SUSTAINING FELLOWS (CARD, & CERTIFICATE)
<from>MIT
<to>BELL, GORDON
<date>81/1/?
<date rec>1/30/81
<log#>1-87
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<>

<subj>DIEBOLD GROUP INC.
<from>MILLER, N. RICHARD
<to>BELL, GORDON
<date>81/1/23
<date rec>1/30/81
<log#>1-86
<dispo/date>JERRY TODD - 2/16/81
<message>YOURS. PLS. ANSWER.
<answer>
<f/u>
<filed>
<>

<subj>COMPUTER MARKETING
<from>BREEN, WILLIAM A.
<to>BELL, GORDON
<date>81/1/29
<date rec>1/30/81
<log#>1-85
<dispo/date>BILL PICOTT - 2/16/81
<message>WILL YOU PLEASE GET THIS DEMO?
<answer>
<f/u>
<filed>

<>

<subj>HOFFMANN ASSOCIATES
<from>HOFFMANN, NORMAN C.
<to>BELL, GORDON
<date>81/1/28
<date rec>1/30/81
<log#>1-84
<dispo/date>JOHN ROSE - 2/10/81
<message>YOURS! PLEASE HANDLE.
<answer>
<f/u>
<filed>
<>

<subj>UNIVERSITY OF WASHINGTON
<from>GILLESPIE, ROBERT G.
<to>BELL, GORDON (PANEL MEMBERS)
<date>81/1/27
<date rec>1/30/81
<log#>1-83
<dispo/date>
<message>
<answer>
<f/u>
<filed>GILLESPIE
<>

<subj>BLACK DOT (PROOFS, COMPUTER STRUCTURES)
<from>STRUCK, DEBBIE
<to>BELL, GORDON
<date>81/1/28
<date rec>1/30/81
<log#>1-82
<dispo/date>
<message>
<answer>
<f/u>
<filed>

<>

<subj>BLACK DOT (PROOFS, COMPUTER STRUCTURES BOOK)
<from>STRUCK, DEBBIE
<to>BELL, GORDON
<date>81/1/27
<date rec>1/30/81
<log#>1-81
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<>

<subj>RESUME' -- GERALD JOHN LIPOVSKI
<from>LIPOVSKI, GERALD JOHN
<to>BELL, GORDON
<date>81/1/?
<date rec>1/30/81
<log#>1-80
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<>

<subj>UNIVERSITY OF PENNSYLVANIA
<from>DIGASBARRO, P. PETER
<to>BELL, GORDON
<date>81/1/?
<date rec>1/30/81
<log#>1-79
<dispo/date>JANE GORING - 2/2/81
<message>PLEASE HANDLE.
<answer>
<f/u>
<filed>

<>

<subj>ZHEJIANG UNIVERSITY, HANGZHOU CHINA (RESUME')
<from>YEH, CHENG-CHING
<to>BELL, GORDON
<date>81/1/11
<date rec>1/29/81
<log#>1-78
<dispo/date>JOHN DIPIETRO - 1/30/81
<message>PLEASE HANDLE.
<answer>
<f/u>
<filed>
<>

<subj>DEAN WITTER REYNOLDS INC. (ARTICLE "THE EC GOES AFTER IBM")
<from>REPPER, GEORGE
<to>BELL, GORDON
<date>81/1/?
<date rec>1/29/81
<log#>1-77
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<>

<subj>TWX--T-11 ON OKI IF-800
<from>KOBAYASHI, TOM
<to>BELL, GORDON
<date>81/1/29
<date rec>1/29/81
<log#>1-76
<dispo/date>
<message>
<answer>
<f/u>

<filed>
<>

<subj>INTEL
<from>O'NEIL, RUSS
<to>BELL, GORDON
<date>81/1/26
<date rec>1/28/81
<log#>1-75
<dispo/date>HIS REPLACEMENT: GARY RANCOURT 617-667-8126
<message>
<answer>
<f/u>
<filed>N
<>

<subj>TECHNICAL CAREERS EXCHANGE
<from>FIENBERG, ELLIOT
<to>BELL, GORDON
<date>81/1/27
<date rec>1/28/81
<log#>1-74
<dispo/date>STEVE TEICHER - 2/10/81
<message>SOUNDS INTERESTING?
<answer>
<f/u>
<filed>
<>

<subj>SMITH, HINCHMAN & GRYLLS ASSOCIATES INC.
<from>FOUNTAIN, JAMES A. (313-964-3000)
<to>BELL, GORDON
<date>81/1/23
<date rec>1/28/81
<log#>1-73
<dispo/date>JOHN ROSE - 2/16/81
<message>YOURS.
<answer>
<f/u>

<filed>
<>

<subj>HOUGHTON MIFFLIN COMPANY
<from>REPLOGLE, DAVID R.
<to>OLSEN, KENNETH H.
<date>81/1/16
<date rec>1/27/81
<log#>1-72
<dispo/date>BRUCE STEWART - 2/16/81
<message>YOURS.
<answer>
<f/u>
<filed>
<>

<subj>OKLAHOMA STATE UNIVERSITY
<from>YEAGER, DEWEY A.
<to>OLSEN, KENNETH
<date>81/1/14
<date rec>1/27/81
<log#>1-71
<dispo/date>JACK MACKEEN - 1/28/81
<message>JACK, WHAT WOULD YOU LIKE US TO SAY?
<answer>JACK WROTE A REPLY TO DEWEY YEAGER (dated 2/10/81).
A ROGER WOLFE (SALES REP) IN TULSA, OKLA. WILL BE CONTACTING
YOU IN THE NEAR FUTURE.
<f/u>
<filed>N
<>

<subj>UNIVERSITY OF MASSACHUSETTS
<from>STONE, HAROLD S.
<to>BELL, GORDON
<date>81/1/20
<date rec>1/27/81
<log#>1-70
<dispo/date>
<message>

<answer>
<f/u>
<filed>
<>

<subj>TWX--GENERAL INFO (TOKYO OFFICE)
<from>KOBAYASHI, TOM
<to>BELL, GORDON
<date>81/1/27
<date rec>1/27/81
<log#>1-69
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<>

<subj>PURDUE UNIVERSITY
<from>SCHALLIOL, W.L.
<to>BELL, GORDON
<date>81/1/21
<date rec>1/26/81
<log#>1-68
<dispo/date>ORIGINAL TO F/U, CC:DICK ECKHOUSE, JOHN MEYER, BILL BAILEY - 1/27/81
<message>HELP! PLEASE GET TOGETHER & ANSWER. SHOULD WE DO THIS OUT OF THE COLLEGE RELATIONS PROGRAM?
<answer>DICK ECKHOUSE HAS SENT A MEMO TO BILL BAILEY, JOHN MEYER TO SET UP A MEETING TO GET A DRAFT TOGETHER FOR GORDON. - 2/4/81
<f/u>2/5
<filed>
<>

<subj>UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN (LETTER & MANUAL)
<from>SNYDER, J.N.
<to>BELL, GORDON

<date>81/1/20
<date rec>1/26/81
<log#>1-67
<dispo/date>TO LETTERBOOK (GB2.S3.5) - 2/19/81
<message>
<answer>
<f/u>
<filed>
<>

<subj>NATIONAL ACADEMY OF ENGINEERING
<from>LIEBOWITZ, HAROLD
<to>BELL, GORDON
<date>81/1/22
<date rec>1/26/81
<log#>1-66
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<>

<subj>RESUME' (WILLIAM S. NACEY)
<from>NACEY, WILLIAM S.
<to>BELL, GORDON
<date>81/1/21
<date rec>1/26/81
<log#>1-65
<dispo/date>JANE GORING, CC:GWEN BELL - 1/26/81
<message>
<answer>
<f/u>
<filed>
<>

<subj>JOSEPH CHRIS PERSONNEL SERVICE INC. (5719-GB-35)
<from>BEYERS, MR. GEORGE
<to>BELL, GORDON

<date>81/1
<date rec>1/26/81
<log#>1-64
<dispo/date>JOHN DIPIETRO - 1/26/81
<message>
<answer>
<f/u>
<filed>
<>

<subj>BLACK DOT -- PROOFS FOR BOOK
<from>STRUCK, DEBBIE
<to>BELL, GORDON
<date>81/1/23
<date rec>1/26/81
<log#>1-63
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<>

<subj>SIEMENS--RE OUR DISCUSSIONS
<from>HELMUT SCHWAB
<to>BELL, GORDON
<date>81/1/16
<date rec>1/23/81
<log#>1-62
<dispo/date>ORIGINAL TO MJ, CC:SI, HENRY CROUSE, BILL PICOTT, PAUL BAUER - 1/27/81 (CC OF LETTER TO LETTERBOOK (GB2.S1.32) - 1/28/81
<message>
<answer>
<f/u>
<filed>
<>

<subj>RESUME
<from>CHARLES J. JACOBUS

<to>BELL, GORDON
<date>81/1/18
<date rec>1/23/81
<log#>1-61
<dispo/date>ORIGINAL - F/U, CC:WILL THOMPSON, SAM, BOB GLORIOSO, DICK CLAYTON, JOHN MEYER, JOHN DIPIETRO - 1/26/81
<message>LET'S GET HIM HERE AND TALK TO HIM. (SPEECH, ROBOTICS, VISION, MFG. AUTOMATION). JOHN DIPIETRO, PLS HANDLE. (NOTE--THIS SAME LETTER WAS SENT TO LARRY AND FOWARDED ON 1/22. SEE 1-57)
<answer>JOHN DIPIETRO TOLD ME THAT ED BARON FROM MFG. WILL BE SEEING CHUCK ON 2/23. - 2/18/81
<f/u>2/13
<filed>ORIGINAL LETTER BACK TO GORDON - 2/18/81
<>

<subj>U OF WISCONSIN RE ATANASOFF
<from>THOMPSON, MURRAY
<to>BELL, GORDON
<date>81/1/19
<date rec>1/23/81
<log#>1-60
<dispo/date>TO LETTERBOOK (GB2.S1.30) - 1/28/81
<message>
<answer>
<f/u>
<filed>
<>

<subj>WESLEY CLARK NOMINATION-SECONDED FOR ECKERT-MAUCHLY AWARD
<from>FRANK E. HEART
<to>BELL, GORDON
<date>81/1/21
<date rec>1/23/81
<log#>1-59
<dispo/date>
<message>
<answer>
<f/u>
<filed>

<>

<subj>HIGH SPEED COMPUTING (CONFERNCE INFORMATION) LAWRENCE LIVERMORE LABS.
<from>CONFERENCE COMMITTEE (SHARONLEE DANIELSON) 415-422-4306)
<to>BELL, GORDON
<date>80/12/9
<date rec>1/22/81
<log#>1-58
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<>

<subj>RESUME' -- CHARLES J. JACOBUS (CHUCK)
<from>JACOBUS, CHARLES J.
<to>PORTNER, LARRY
<date>81/1/18
<date rec>1/22/81
<log#>1-57
<dispo/date>JOHN DIPIETRO, CC:JOHN MEYER, BOB GLORIOSO, DICK CLAYTON - 1/22/81
<message>DICK, HOW ABOUT GETTING HIM HERE? JOHN DIPIETRO, PLS. COORDINATE.
<answer>
<f/u>
<filed>
<>

<subj>NATIONAL RESEARCH COUNCIL
<from>BLACKBURN, JACK F.
<to>BELL, GORDON
<date>81/1/19
<date rec>1/21/81
<log#>1-56
<dispo/date>REGRETS RE 2/19&20 MEETING 1/22/81 Thu 14:08

<message>
<answer>
<f/u>
<filed>12
<>

<subj>E.L. CROW INC./CONSULTANTS
<from>CROW, EDWARD L.
<to>BELL, GORDON
<date>81/1/15
<date rec>1/21/81
<log#>1-55
<dispo/date>MJ CALL FOLDER 1/22/81 Thu 14:28
<dispo/date>JOHN ROSE - 2/16/81
<message>YOURS.
<answer>
<f/u>
<filed>
<>

<subj>SECURITIES AND EXCHANGE COMMISSION
<from>MORGAN, LAURA J.
<to>BELL, GORDON
<date>81/1/16
<date rec>1/21/81
<log#>1-54
<dispo/date>BOB DILL 1/22/81 Thu 14:31
<message>HELP
<answer>
<f/u>1/26
<filed>
<>

<subj>RESUME' -- JOHN COGHLAN (DEC EMPLOYEE IN AUSTRALIA)
<from>COGHLAN, JOHN
<to>BELL, GORDON
<date>81/1/12
<date rec>1/20/81
<log#>1-53

<dispo/date>MAUREEN CULLITON, CC:SAM - 1/22/81
<message>HELP! MAUREEN PLEASE HANDLE.
<answer>
<f/u>
<filed>
<>

<subj>DIEBOLD GROUP INC., THE
<from>MILLER, N. RICHARD
<to>BELL, GORDON
<date>81/1/14
<date rec>1/20/81
<log#>1-52
<dispo/date>REGRETS SENT 1/22/81 Thu 14:02
<message>
<answer>
<f/u>
<filed>
<>

<subj>UNIVERSITY OF WASHINGTON
<from>GILLESPIE, ROBERT G.
<to>BELL, GORDON
<date>81/1/16
<date rec>1/20/81
<log#>1-51
<dispo/date>
<message>
<answer>
<f/u>
<filed>GILLESPIE
<>

<subj>HARTFORDGRADUATE CENTER, THE
<from>DANCHAK, MICHAEL M.
<to>OLSEN, KENNETH H.
<date>81/1/9
<date rec>1/20/81
<log#>1-50

<dispo/date>REGRETS SENT 1/22/81 Thu 14:04
<message>
<answer>
<f/u>
<filed>
<>

<subj>GENERAL DEVICES INC.
<from>STEWART, CHARLES E.
<to>BELL, GORDON
<date>81/1/19
<date rec>1/19/81
<log#>1-49
<dispo/date>STEVE TEICHER - 1/20/81
<message>
<answer>
<f/u>
<filed>
<>

<subj>TECH-SEARCH CONSULTANTS -- RESUME' (ERNEST SOULIERE)
<from>ROCK, JAMES P.
<to>BELL, GORDON
<date>81/1/?
<date rec>1/19/81
<log#>1-48
<dispo/date>JOHN DIPIETRO - 1/20/81
<message>PLEASE HANDLE.
<answer>
<f/u>
<filed>
<>

<subj>WASHINGTON UNIVERSITY IN ST. LOUIS
<from>COX, JEROME R.
<to>STONE, HAROLD PROF.
<date>81/1/14
<date rec>1/19/81

<log#>1-47
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<>

<subj>AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE
<from>CAREY,WILLIAM D.
<to>BELL, GORDON
<date>81/1/16
<date rec>1/19/81
<log#>1-46
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<>

<subj>BLACK DOT (PROOFS AND GALLEYS)--COMPUTER STRUCTURES
<from>STRUCK, DEBBIE
<to>BELL, GORDON
<date>81/1/15
<date rec>1/19/81
<log#>1-45
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<>

<subj>FOUNDRY CENTER INC. -- RESUME' (CHUCK HENSEL)
<from>FOUNDRY CENTER INC.
<to>BELL, GORDON
<date>81/1/?
<date rec>1/19/81

<log#>1-44
<dispo/date>JOHN DIPIETRO - 1/20/81
<message>PLEASE HANDLE.
<answer>
<f/u>
<filed>
<>

<subj>TWX--REVENUE SECOND QUARTER
<from>STEINKRAUSS, MARK A.
<to>BELL, GORDON
<date>81/1/19
<date rec>1/19/81
<log#>1-43
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<>

<subj>AUGUT
<from>WELLINGTON, ROGER D.
<to>BELL, GORDON
<date>81/1/13
<date rec>1/19/81
<log#>1-42
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<>

<subj>NATIONAL SCIENCE FOUNDATION
<from>RESNIKOFF, HOWARD L.
<to>BELL, GORDON
<date>81/1/14
<date rec>1/19/81

<log#>1-41
<dispo/date>
<message>
<answer>
<f/u>
<filed>NSF - INFORMATION SCIENCE & TECHNOLOGY
<>

<subj>LOGETRONICS INC.
<from>JOHNSON, GORDON O.F.
<to>HINDLE, WIN
<date>81/1/9
<date rec>1/16/81
<log#>1-40
<dispo/date>CIRC. BOB GLORIOSO, SAM FULLER - 1/26/81
<message>WHERE DO WE PUT THE IMAGE PROCESSING CHARTER? SHOULDN'T YOU GUYS TAKE IT?
<answer>
<f/u>2/13
<filed>
<>

<subj>DESIGN AUTOMATION INC. -- RESUME' -- ABIGAIL BUETLER
<from>SOKAL, NAT
<to>BELL, GORDON
<date>81/1/13
<date rec>1/16/81
<log#>1-39
<dispo/date>JOHN MEYER - 1/20/81
<message>ANY INTEREST? PLEASE HANDLE.
<answer>
<f/u>
<filed>
<>

<subj>MASSACHUSETTS INSTITUTE OF TECHNOLOGY (MIT)
<from>GRAY, PAUL E.
<to>BELL, GORDON
<date>81/1/14

<date rec>1/16/81
<log#>1-38
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<>

<subj>MASSACHUSETTS BUSINESS DEVELOPMENT COUNCIL--JAPANESE PAPER "THE JAPANESE COMPUTER: PAST AND FUTURE"
<from>ALDEN, VERNON R.
<to>BELL, GORDON
<date>81/1/13
<date rec>1/16/81
<log#>1-37
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<>

<subj>UNIVERSITY OF NEWCASTLE UPON TYNE--RESUME'
<from>LEE, DR. P.A.
<to>FULLER, DR. SAM
<date>81/1/7
<date rec>1/16/81
<log#>1-36
<dispo/date>MAUREEN CULLITON, CC: SAM, BOB GLORIOSO, JOHN MEYER, JOHN SHEBELL, MICKEY SMITH, JOE CARCHIDI, STAN PEARSON - 1/20/81
<message>
<answer>
<f/u>
<filed>
<>

<subj>GILBERT PLASTICS (ELECTRO-GENERAL PLASTICS CORP.)

<from>OWENS, BRUCE E.
<to>BELL, GORDON
<date>81/1/5
<date rec>1/16/81
<log#>1-35
<dispo/date>DICK GONZALES - 1/20/81
<message>
<answer>
<f/u>
<filed>
<>

<subj>CALIFORNIA INSTITUTE OF TECHNOLOGY -- ANNUAL REPORT SILICONE STRUCTURE PROJECT
<from>GOLDBERGER, MARVIN L.
<to>BELL, GORDON
<date>81/1/9
<date rec>1/15/81
<log#>1-34
<dispo/date>CIRC: MOFFA, CLAYTON, FAGERQUIST, DEMMER, LYLE - 1/20/81
<message>
<answer>
<f/u>
<filed>RETURNED TO FILE 13
<>

<subj>CARNEGIE-MELLON UNIVERSITY--RESUME'
<from>LAI, LARRY
<to>BELL, GORDON
<date>81/12/1
<date rec>1/15/81
<log#>1-33
<dispo/date>SAM, CC:MEYER, TEICHER, VAL PATEL, MAUREEN CULLITON - 1/20/81
<message>LET'S GET HIM HERE FOR INTERVIEW.
<answer>I HAVE DISCUSSED THIS WITH LARRY ON THE PHONE. RESUME HAS BEEN ROUTED & CHRIS LARKIN WILL BE SCHEDULING TRIP & INTERVIEWS.
<f/u>2/27/81

<filed>
<>

<subj>MIT SUSTAINING FELLOWS
<from>JOHNSON, ERIC C.
<to>BELL, GORDON
<date>81/1/12
<date rec>1/14/81
<log#>1-32
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<>

<subj>RESUME' -- CHARLES R. WINSTON
<from>WINSTON, CHARLES R.
<to>BELL, GORDON
<date>81/1/10
<date rec>1/14/81
<log#>1-31
<dispo/date>JOHN DIPIETRO - 1/14/81
<message>PLEAS HANDLE.
<answer>
<f/u>
<filed>
<>

<subj>HISTORY ASSOCIATES INC.
<from>WILLIAMS, ROBERT C.
<to>OLSEN, KENNETH H. (FOR GWEN)
<date>81/1/6
<date rec>1/13/81
<log#>1-30
<dispo/date>
<message>
<answer>
<f/u>

<filed>
<>

<subj>MASSACHUSETTS INSTITUTE OF TECHNOLOGY (MIT)
<from>MOSES, JOEL
<to>OLSEN, KENNETH H.
<date>80/12/31
<date rec>1/13/81
<log#>1-29
<dispo/date>GEORGE CHAMBERLAIN - 1/16/81
<message>
<answer>
<f/u>
<filed>
<>

<subj>HARVARD UNIVERSITY
<from>OETTINGER, ANTHONY G.
<to>OLSEN, KENNETH H.
<date>80/11/21
<date rec>1/13/81
<log#>1-28
<dispo/date>TO LETTERBOOK (GB2.S1.13) - 1/22/81
<message>
<answer>
<f/u>
<filed>
<>

<subj>T.H. FLOWERS--RE: MUSEUM LECTURE (COLOSSUS)
<from>FLOWERS, T.H.
<to>BELL, GORDON
<date>81/1/6
<date rec>1/13/81
<log#>1-27
<dispo/date>TO LETTERBOOK (GB2.S1.25) - 1/22/81
<message>
<answer>
<f/u>

<filed>
<>

<subj>UNIVERSITY OF CALIFORNIA, BERKELEY--REPRINTS S-1 MARK IIA
<from>DICKMAN, LLOYD
<to>BELL, GORDON
<date>81/1/7
<date rec>1/12/81
<log#>1-26
<dispo/date>OOD, CC: LU ABEL, BOB KUSIK, ROY REZAC, VAL PATEL - 1/13/81
<message>LET'S FOLLOW THIS.
<answer>
<f/u>
<filed>
<>

<subj>MARCEL BREUER ASSOCIATES
<from>PAPACHRISTOU, TICIAN
<to>BELL, GORDON
<date>81/1/6
<date rec>1/12/81
<log#>1-25
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<>

<subj>VARIAN ASSOCIATES
<from>GINZTON, E.L.
<to>BELL, GORDON
<date>81/1/8
<date rec>1/12/81
<log#>1-24
<dispo/date>TO MJ - 1/14/81
<message>

<answer>
<f/u>12
<filed>
<>

<subj>TELECOM LIBRARY INC.
<from>NEWTON, HARRY
<to>OLSEN, KEN
<date>81/1/2
<date rec>1/12/81
<log#>1-23
<dispo/date>DEL LIPPERT - 1/12/81
<message>SHOULD WE GET OUT OF THE PUBLISTY BUSINESS?
<answer>MARCY KENAH ANSWERED HARRY NEWTON'S LETTER (1/27/81) - 1/28/81
<f/u>
<filed>
<>

<subj>TRENDS & PERSPECTIVES IN SIGNAL PROCESSING
<from>SONNENSCHEIN, ADAM (PUBLISHER)
<to>BELL, GORDON
<date>81/1/?
<date rec>1/12/81
<log#>1-22
<dispo/date>ANDY KNOWLES - 1/12/81
<message>SOMEHOW WE HAVE TO GET THIS CHARTER FOR SIG. PROC. PUT IN LDP AS A MORE GLOBAL CHARTER. LDP HAS TO UNDERSTAND THE MKT & HAVE THE EXPERTISE. WE NEED TO USE THIS IN OTHER PRODUCTS. ALL PRODUCTS WILL HAVE SIGNAL PROCESSING IN THEM SOMEDAY.
<answer>
<f/u>
<filed>
<>

<subj>TWX--YOUR RECENT VISIT TO LONDON
<from>DAY, TOM
<to>BELL, GORDON

<date>81/1/12
<date rec>1/12/81
<log#>1-21
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<>

<subj>UNIVERSITY OF ARIZONA--POSITION ANNOUNCEMENT
<from>HANSON, DAVID R.
<to>BELL, GORDON
<date>80/12/31
<date rec>1/9/81
<log#>1-20
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<>

<subj>MCGRAW-HILL BOOK COMPANY--PRINCIPLES OF COMPUTER STRUCTURES (DEADLINE 1/15/81)
<from>BAFFER, CHRISTOPHER
<to>BELL, GORDON
<date>81/1/?
<date rec>1/9/81
<log#>1-19
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<>

<subj>DR. DVORKOVITZ & ASSOCIATES
<from>DVORKOVITZ, DR & ASSOCIATES

<to>BELL, GORDON
<date>80/12/15
<date rec>1/9/81
<log#>1-18
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<>

<subj>BOROVOY, ROGER S.
<from>BOROVOY, ROGER S.
<to>BELL, GORDON
<date>81/1/5
<date rec>1/9/81
<log#>1-17
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<>

<subj>UNIVERSITY OF MICHIGAN
<from>BURKS, ARTHUR W.
<to>BELL, GORDON
<date>81/1/5
<date rec>1/9/81
<log#>1-16
<dispo/date>TO LETTERBOOK (GB2.S1.17) - 1/20/81
<message>
<answer>
<f/u>
<filed>
<>

<subj>MUSIC RELATED ACTIVITIES -- THINKING OF CHANGING HIS JOB AND WANTED TO KNOW WHO TO CONTACT.

<from>BREWSTER, FRANKLIN
<to>BERUBE, DICK (SENT TO MJ)
<date>80/12/22
<date rec>1/9/81
<log#>1-15
<dispo/date>FRANKLIN BREWSTER - 1/9/81
<message>PROF. BARRY VERCOE, MIT WILL BE ABLE TO HELP YOU. (253-7441)
<answer>
<f/u>
<filed>
<>

<subj>BLACK DOT--COMPUTER STRUCTURES PROOFS
<from>STRUCK, DEBBIE
<to>BELL, GORDON
<date>81/1/6
<date rec>1/9/81
<log#>1-14
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<>

<subj>MASSACHUSETTS INSTITUTE OF TECHNOLOGY (MIT)
<from>BUFFERD, ALLAN S.
<to>BELL, GORDON
<date>80/12/30
<date rec>1/8/81
<log#>1-13
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<>

<subj>UNIVERSITY OF TEXAS AT AUSTIN
<from>BROWNE, J.C.
<to>BELL, GORDON
<date>81/1/5
<date rec>1/8/81
<log#>1-12
<dispo/date>CALLED BROWNE FOR LIPOVSKI RESUME 1/9/81 Fri 12:36
<dispo/date>TO LETTERBOOK (GB2.S3.3) - 2/19/81
<message>
<answer>
<f/u>
<filed>MJ CALL FOLDER 1/9/81
<>

<subj>SIEMENS
<from>SCHWAB, H.
<to>BELL, GORDON
<date>80/12/30
<date rec>1/7/81
<log#>1-11
<dispo/date>
<message>
<answer>
<f/u>
<filed>SIEMENS HOLD FOR POSSIBLE TRIP FOLDER
<>

<subj>BELL LABORATORIES
<from>REUDINK, DOUGLAS O.
<to>OLSEN, KENNETH H.
<date>80/12/?
<date rec>1/7/81
<log#>1-10
<dispo/date>SAM FULLER - 1/9/81
<message>SEE ANYTHING HERE?
<answer>
<f/u>1/16/81
<filed>
<>

<subj>UNIVERSITY OF LULEA, SWEEDEN
<from>HAGGSTROM, MARWIN
<to>BELL, GORDON
<date>80/11/25
<date rec>1/6/81
<log#>1-9
<dispo/date>DENNIS KULSICK 1/7/81 Wed 10:45
<message>PLEASE HANDLE
<answer>
<f/u>
<filed>
<>

<subj>EFCIS
<from>DEPEYROT, MICHEL
<to>BELL, GORDON
<date>80/12/18
<date rec>1/6/81
<log#>1-8
<dispo/date>
<message>
<answer>
<f/u>
<filed>N
<>

<subj>RESUME' -- DILIP PATIL
<from>PATIL, DILIP
<to>BELL, GORDON
<date>80/12/31
<date rec>1/6/81
<log#>1-7
<dispo/date>NANCY STARR - 1/6/81
<message>PLEASE HANDLE.
<answer>
<f/u>
<filed>
<>

<subj>NATIONAL ACADEMY OF ENGINEERING
<from>PERKINS, COURTLAND D.
<to>BELL, GORDON
<date>80/12/24
<date rec>1/6/81
<log#>1-6
<dispo/date>
<message>
<answer>
<f/u>
<filed>
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<subj>RESUME--LEON LUMELSKY
<from>LUMELSKY, LEON
<to>BELL, GORDON
<date>80/12/28
<date rec>1/6/81
<log#>1-5
<dispo/date>SI LYLE, CC:PICOTT, MEYER - 1/7/81
<message>LET'S INVITE HIM! WE NEED A CRT DESIGNER OR 2.
<answer>
<f/u>1/23/81
<filed>
<>

<subj>TWX--VISIT TO AUSTRALIA
<from>BURNET, MAX
<to>BELL, GORDON
<date>80/1/6
<date rec>1/6/81
<log#>1-4
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<>

<subj>SCIENTIFIC AMERICAN
<from>KIRBY, C. JOHN
<to>OLSEN, KENNETH H.
<date>80/12/?
<date rec>1/5/81
<log#>1-3
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<>

<subj>MIT -- SUSTAINING FELLOWS
<from>JOHNSON, ERIC C.
<to>BELL, GORDON
<date>80/12/30
<date rec>1/5/81
<log#>1-2
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<>

<subj>EMORY AYERS ASSOCIATES INC.
<from>BARRON, THOMAS C.
<to>BELL, GORDON
<date>80/12/30
<date rec>1/5/81
<log#>1-1
<dispo/date>HENRY CROUSE - 1/7/81
<message>YOURS.
<answer>
<f/u>
<filed>
<>

00 BURT DECGRAM ACCEPTED S 9734 O 61 28-SEP-79 22:36:10
FROM: GORDON BELL   DATE: FRI 28 SEP 1979 10:34 PM EST
DEPT: OOD
EXT: 223-2236
TO: KEN OLSEN
    STAN OLSEN
    JACK SHIELDS
    WIN HINDLE
    JULIUS MARCUS
    ANDY KNOWLES
    SI LYLE
    JOHN LENG @MR16
    TED JOHNSON @CLEM
cc: LARRY PORTNER
    JACK GILMORE

SUBJECT: MAIL PRODUCT LINE

I apparently missed a M/C meeting in which we agreed to have the WP PL put in 12 systems of Electronic Mail as a test case to various corps.
I think this is a terrible mistake for two reasons: the current products are in reasonable trouble , coupled with the growth and promises of profit this year; and I strongly disbelieve in WP as a PL, versus it being a generic tool (like Fortran, or Cobol, or DECnet) that every P/L group needs and should should be permitted to sell. If it isn't too late, I think we should re-review this.

Command >

<!S>**FROM:** <from>, <subj> **LOG#**<log#>

RECEIVED: <date rec> **DATED:** <date>
REQUEST: <request>
INSTRUCTIONS:

<!E>
if <date rec>=<*>3/4/82<*>
or=<*>3/5/82<*>
or =<*>3/3/82<*>
or =<*>3/2/82<*>
or =<*>3/1/82<*>
and <dispo/date>=
then process record
<!R>
<!S>
<reply by> <from> - <subj>
FU:<f/u> - <dispo/date> - <message>
LOG#:<log#>

<!E>
PRESS: GOLD F<ile>
<subj>VT100 FOR NATIONAL MUSEUM OF MODERN ART, PARIS
<from>PIOTR KOWALSKI
<to>BELL, GORDON
<date>9/2/81
<date rec>9/3/81
<log#>8-70
<reply by>9/11/81
<dispo/date>CHAMBERLAIN 9/4/81 Fri 9:58
<message>LET'S GET HIM ONE. HE SHOULD SIGN AN AGREEMENT. IF OK, I'LL ARRANGE.
<answer>
<f/u>9/11/81
<filed>
<done>N
<>

0FRANCIS F. LEE - PROF. DEPT. OF EE AND COMP. SCI. - MIT

FU:7/31/81 - GLORIOSO 7/21/81 Tue 11:22 - COULD WE USE HIM? LET'S DECIDE & WRITE TO FRANCIS
LOG#:7-33

07/17/81ANTHONY G. OETTINGER - HARVARD--PROGRAM ON INFO. RESOURCES POLICY
FU:07/10/81 - CIRC:SCHMITT,COURTIN,LACROUTE,KO 7/22/81 -
LOG#:6-35

PRESS: GOLD F<ile>
if <done>=<*>N<*>
then process record
00 BURT DECGRAM ACCEPTED S 1112 O 12 24-FEB-80 15:22:00

****
* d i g i t a l *
****

TO: HENRY CROUSE @CLEM   DATE: SUN 24 FEB 1980
3:19 PM EST
FROM: GORDON BELL
cc: see "CC" DISTRIBUTION   DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1
A51

SUBJECT: PLEASE HELP IN THE MAKE BUY SPACE

I view we are going headlong to make all the mass storage devices except mag tape, where we don't have enough engineers to
be able to make a proposal. I don't understand this in regard to
commodity like devices such as floppy, except that people say no
company can supply our needs. We have a big unquenchable thirst
for products to support the varied systems, but there isn't
anything like enough factories or people to do the devices,

hence
we'll either not go out with a product (as in the case of
built
in fixed media devices based on the early 14" and soon to be
8"
winchester products), or we will be too expensive as in the
case
of the floppies as we see too little too late. We won in
the
marketplace by initially buying out floppies, but since then
we
have been consistently late and/ or expensive or not there
with
the product.

The two areas that are of especial concern are the removeable
prodcut that requires a new technology, pack,ie the works and
is orthogonal to the Winchester and RL tech that we have
there
and feels like it could easily be supplied by CDC as a
displacement for the RM03 (the reason is cost, but most of
that's smoke due to the interconnect); and the low end where
numerous floppies, cheap tapes and 8" Winchesters are
required.

How can we get an aggressive buy out alternatives to the
in house makes that are inevitable with our strong mfg / eng
combine?

"CC" DISTRIBUTION:

LARRY PORTNER DICK CLAYTON GRANT
SAVIERS
BILL DEMMER HERB SHANZER MIKE GUTMAN
SI LYLE BILL LOWE @CLEM BOB PUFFER
@CLEM

GB1.S2.33
+--------------------------+

| | | | | | | |

| d | i | g | i | t | a | l | interoffice memorandum

| | | | | | | | |

+----------------------------+

Subject: **Make vs Buy Guidelines Update (from 3/5/76)**

To: File

Date: 3/28/79

From: Gordon Bell

Dept: OOD

Loc: ML12-1/A51 Ext: 223-2236

What DEC SELLS not what it BUILDS is the more important issue for continuing success. In a rapidly changing industry where technologies can quickly become obsolete, it is essential that DEC maintain flexibility and not become over committed to any particular technology or process. As we make more and more of the items we sell, we become more rigid. Opportunities in the marketplace can be delayed or lost forever. Opportunities to cost reduce by building more inside will stay with us. The following guideline is intended to help us focus on these issues.

1.DEC wants to build unique products that offer specific advantages to its customers. Profitability alone is not sufficient.

2.High ROI by itself is no reason to build anything (e.g., it robs resources from other, more essential projects).

3.The general rule should be, if we don't make it now, buy it.

4.Proposals to build must explicitly demonstrate that:

a.project will result in a quantum jump in technology or

b.needed to introduce (or confine) a vital technology to DEC or

c.present or developing vendors are unable to supply demands of ON-GOING high production item.

5.All proposals to build should address and be screened by at least the following criteria:

a.DEC's forecasted needs exceed the volume of at least the smallest economically viable vendor.

b.DEC's engineering resources to accomplish task is at least comparable to vendor.

c.Incremental NOR/employee will be above the corporate average for the effort. [We should strive to increase "PRODUCTIVITY".]

d.Hardware products can be sold through the Components Group. [The product is inherently good enough to stand on its own.]

e.ROI analysis of not only the results of pursuing the project but the corresponding results when using the vendors part.

f.Level-of-integration of the project. [We should tend to increase level-of-integration-focus on MAKING what we sell--NOT what we BUY.]

g.The resulting incremental NOR to development cost ratio compare with Corporate NOR to total engineering ratio budgets. [Won't become an engineering sink.]

6.We must have a "buy out" advocate to test analysis (in Manufacturing, Purchasing, and Engineering?).

7.Proposals to "make" must be explicit with respect to the level-of-integration covered (i.e., which parts). "Making" is not a carte blanche licensing to make everything.

```
.___.___.___.___.___.___.___.
!   !   !   !   !   !   !   !
! d ! i ! g ! i ! t ! a ! l !          I n t e r o f f i c e
M e m o
!___!___!___!___!___!___!___!
```

TO: PEG: DATE: TUE 15 FEB 1983
10:31 AM EST
TMC MEMBER DIST: FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5191028948

SUBJECT: ENGINEERING MANAGEMENT PROBS 0 AND 1; ONE DATA POINT

GB4.S1.32

Probs 0 and 1 are:

0. Simply deciding what to do and then managing to do it

1. Engineering with a Quality Design Methodology

On Sunday I rode back from San Francisco with an engineer who'd been out of a good engineering school for two years. The engineer was disillusioned and was thinking of changing fields because so little was getting accomplished in their life. We commiserated because their group is so near the bottom in #0 (organization, direction) and #1 (capability).

He's never shipped a product, and went into A/D because the development group takes forever to introduce products into manufacturing. (Are we using A/D as a refuge so that people can get work done and feel a little bit good, even though the work may not really go anywhere?).

We also talked about the enjoyment of school because one worked so hard and achieved clear goals. (Bruce Delagi, at Stanford, says he's working twice as hard and enjoying it more . . . Bruce has never been a piker.)

Their project has changed by several factors of two over the last weeks, and the only real direction is that it be cheap, perform well and get to market fast. Another group has a project that may

overlap
with theirs and both shoot at and hide from one another.

Even though their education is broad, they're now pidgeon-holed as
being analog because they did a circuit. The desire is to do analog -
digital logic, software and how they work together (architecture).
Considering the other lament -- the group is unfamiliar with using the
computer (and programming) to solve problems, this is a shame. (I
think we want people who can span this great range including
electromechanical control.

He was on the west coast to look at gate arrays, but the group is
scared because they can't do the same old cut-and-try, ECO to death,
find it and fix it in DMT engineering that's their trademark. We

agreed formal training was absolutely necessry. A major problem is
they don't know they need it and they're scared to go do it. This
real concern is the fact that the group has worked or are looking to
leave because they think the management's really poor. Personnel's
taking a survey about how people feel; but he doubted people were
secure enough to tell the truth even though morale's so low.

The
complaint was that a buyout was being considered and this is no
challenge.

Given all this, the group's moving to an isolated building and everything will be worse. It can then be transferred to NOD probably.

I recruited for a really exciting project. I sure want to keep good
engineers as long as they can go someplace where they feel good and
are productive. If you know of competent people who are working on
dumb projects and don't want to be managed by clods or work with dull
people, I'd like to help place them.

WPS USERS - Leave HP mode and type <CR>

D I G I T A L INTEROFFICE MEMORANDUM

DIST:
Lu Abel ML3-2/E27 Norma Abel MR1-
2/E37
Kami Ajgaonkar ML5-5/E97 Annette Albright
TW/E16
Hank Allard ML5-2/E93 Phil Arnold CZ
Al Avery TW/A08 Ted Baker MR1-
2/E78
Paul Bauer ML3-3/B91 Dick Becker ML1-
3/E58
Gordon Bell ML12-1/A51 Jim Bell ML3-
2/E41
Leo Bennett ML4-4/E99 Dave Best
TW/A08
Dick Best ML3-3/H14 Ron Bingham MR1-
2/E85
Joe Bitto PN Carl Blatchley ML3-
6/E94
Rowland Brandwein MK-2/D3 Alyce Branum ML12-
2/E71
Mary Breslin ML5-5/E39 Dick Brewer ML5-
3/E12
Norm Brimhall ML5-5/E39 Reid Brown
TW/C10
Bert Bruce ML1-1/E24 Ralph Byrd ML12-
2/A16
Joe Carchidi TW/D08 Peter Christy ML12-
3/A62
Van Chu ML1-3/E58 John Clarke ML1-
2/E60
Dick Clayton ML12-2/E71 Roy Clites ML5-
5/E97
Dan Clont ML5-5/E97 Ralph Coffman ML4-
3/A20
Walter Colby ML12-2/E71 Peter Conklin
TW/A08
Dave Cotton ML5-3/E12 Ann Courtright ML5-
5/E97
Ron Criss MR1-2/E37 Don Crowther ML5-
5/E72
Brian Croxon TW/C04 Jim Cudmore ML1-
5/E30

Bob Daley	MK	Bill Demmer	TW/D19
Michel Depeyrot	ML3-3/B91	Dezi Dezzani	ML5-3/E12
Frank Digilio	ML1-3/E62	Marcia Donaldson	MR1-1/M55
Mike Donnelly	ML3-3/E54	Harry Drab	WS
Mike Elkins	CZ	Ulf Fagerquist	MR1-2/E78
Ed Fauvre	MK-2/E6	Paul Feresten	ML1-3/E58
Bryan Fifield	TW/C02	Heinz Findeisen	ML1-3/E63
Jim Fleming	ML4-2/E27	Bob Flynn	ML12-2/E71
Don Freniere	TW/C03	Kurt Friedrich	TW/C10
Lorrin Gale	TW/D19	Wayne Galusha	ML1-3/E58
George Gerelds	ML5-3/E22	Abe Gershnow	ML1-3/E62
John Gilbert	TW/E07	Jim Gillett	PX (Phoenix)
Richard Glantz	MR1-2/E37	Brad Glass	TW/C10
Bob Glorioso	ML3-2/E41	Dick Gonzales	ML6-2/E66
Roy Graham	ML5-5/E97	Bill Green	ML1-4/B34
Ian Gunn	MD	Mike Gutman	ML21-2/E32
Steve Gutz	ML3-5/E82	Len Halio	ML1-2/H26
Ron Ham	ML5-5/B35	Jim Hamilton	TW/C02
Don Haney	ML1-2/E65	Jim Harnedy	MK-2/E6
Frank Hassett	TW/C10	Bill Heffner	TW/C10
Steve Heiser	MR1-2/E37	John Hess	ML1-3/E63
Per Hjerppe	MR1-2/E78	George Hoff	MR1-2/E47
Bill Howerton	ML12-3/A62	Bob Hranek	ML1-5/B98

Carol Hubler	TW/A08	Jim Hughes	ML3-5/E82
Bob Jack	ML1-3/E58	Peter Jessel	ML21-1/E81
Bill Johnson	ML21-3/E87	Charles Johnson	MK1-2/D3
Steve Johnson	ML5-5/E97	John Jorgensen	MR1-2/E78
Justin Kelleher	ML12-3/A62	Bill Kelly	ML3-6/E95
John Kevill	ML1-3/E58	Lynn King	ML5-2/E93

Lou Klotz	ML1-2/E60	Oleh Kostetsky	ML5-5/E39
Mitchell Kur	ML12-2/A16	Bernie Lacroute	TW/A08
Jim Lawrence	ML8-4/E86	Roger Lawson	ML1-3/E58
Ed Lazar	ML5-3/E12	Richard Leslie	MR1-2/E78
Demetrios Lignos	CZ	Tomas Lofgren	MR1-2/E89
Richard Loveland	ML5-5/E97	Peggy Maas	ML5-3/E12
Joe Madden	ML3-6/E23	Jim Marshall	TW/A03
Art McCray	TW/C10	Ed McDonough	MO-2
Don McInnis	TW/A08	Ray Melanson	ML4-2/E90
John Meyer	ML12-1/A11	Jack Mileski	TW/C10
Jim Mills	MR1-2/E37	John Miville	MR1-2/E78
Gene Mondani	ML1-5/E30	John Morgan	MK1-2/H3
Bill Munson	ML5-5/E76	John Murray	ML1-3/E63
Paul Nelson	ML5-3/E12	Ken Nisbet	TW/D19
Carl Noelcke	ML3-3/H14	Kathy Norris	TW/A08
Tom Northrup	TW/C04	Bob Nussbaum	TW/C10
Nathan Parke	TW/B02	Stan Pearson	ML12-2/E38
Laura Persily	ML12-2/E71	Charles Picariello	ML4-4/E99
Richard Pietravalle	MK-2/D3	Ralph Platz	ML3-6/E94
George Plowman	ML5-5/E97	Larry Portner	ML12-3/A62
Roger Pothier	MR1-2/E74	Terry Potter	ML3-3/H24
Lloyd Powell	ML1-3/E63	Mike Powell	TW/C02
Horace Prindle	MR1-2/E78	Bob Puffer	ML12-2/E38

Steve Radoff ML1-3/E58 Tom Rarich
TW/A08
Larry Rasile ML12-2/E71 Dick Reilly ML4-
4/E99
Paul Rey ML8-4/E86 Glenn Reyer MK-
2/D3
Mike Riggle ML4-1/B32 Oscar Rodriguez ML12-
2/E71
Dave Rodgers TW/C04 John Rose ML12-
3/A62
Wayne Rosing TW/A03 Steve Rothman
TW/C06
Bob Rottmayer ML4-1/B32 Ken Russ ML11-
2/E83
Geoff Sackman ML1-4/A97 John Sackman ML4-
4/E99
Mike Sadofsky ML5-5/E97 Frank Sanjana ML12-
2/E71
John Sartory ML4-4/E99 Grant Saviers CZ
Henk Schalke TW/C17 Dick Schneider ML11-
4/E53
Tom Shanahan ML2-2/A15 Herb Shanzer ML21-
1/E81
Tom Sherman TW/C02 Ed Siegmann ML1-
3/E63
Ken Sills ML1-3/E58 Joe Smith ML11-
4/E53
Kevin Smith ML1-3/E58 LeRoy Smith ML4-
2/E27
Dick Snyder MR1-2/E37 John Sofio
TW/D02
Ned Somerville MR1-2/E78 Keshava Srivastava
ML1-3/E58
Joe St. Amour ML1-5/E29 Gil Steil ML5-
5/E76
Chuck Stein ML5-5/E97 Tom Stockebrand AQ
Richard Strauss ML5-5/E76 Steve Sur MR1-
1/A43
Phil Tays ML11-4/E53 Walter Tetschner ML5-
3/E12
Mike Titelbaum ML1-2/E65 Mike Tomasic ML12-
2/E71
Rollins Turner ML3-2/E41 Pete van Roekens
TW/E07
Armen Varteressian TW/E45 Jim

Wade RB
John Wanamaker TW/D17 Jane Ward ML12-3/A62
Ted Webber MK-2/D3 Mike Weinstein ML5-5/E97
Art Williams ML5-3/E12 George Wood AC/E44
Ed Wright ML12-B/B75 Mike Wurster ML5-3/E12
Chuck Youse ML1-3/E63

00 CORE DECGRAM ACCEPTED S 005787 O 479 09-MAY-83 17:34:58

```
.___.___.___.___.___.___.___.
!   !   !   !   !   !   !   !
! d ! i ! g ! i ! t ! a ! l !         I n t e r o f f i c e  M e m o
!___!___!___!___!___!___!___!
```

TO: see "TO" DISTRIBUTION DATE: MON 9 MAY 1983 3:22 PM DST

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION DEPT: ENG STAFF

EXT: 223-2236

LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5199370819

SUBJECT: LET'S GET THE AGREEMENT WITH MANCHESTER SIGNED

GB5.42

I'll sign an agreement that says we pay them a royalty on a per machine basis IF we use their machine commercially, as it is designed.
The agreement is limited to a maximum of $500K for all the machines we sell, as I understand it. The agreement ought to be on a

reasonable
per cent of each system. This is clearly the right thing to do!

Let's start using common sense in this dealing:
we don't want to turn what is basically a good relationship into a
fight among contract officers;
the amount of money involved is trivial and highly limited according
to what we will EARN from the endeavor.

Let's get the contract signed and get on with the work.

Gordon
PS
I'll be accessible in California if we can't work this out.

"TO" DISTRIBUTION:

BILL CESSFORD	ALAIN HANOVER	HPLT/DOBES @CNS1
DIETER HUTTENBERGER	DEL THORNDIKE	

"CC" DISTRIBUTION:

RAY BROWN	AL CEFALO	SAM FULLER
HEW THOMSON	WAFER/STAHL @CNS1	WARB/PYE @CNS1

MANUAL AGE

Although the study of mathematics is very ancient, the objects that ad to the birth of the computer are very sparse until the early venteenth century, when the craft generation starts.

Coins, beads, stones, and rope were used both for simple lculations and recording keeping. Thus they appear as both antecedents memory and calculating devices that separated and developed in the ghteenth century. The artifacts in the llection are relatively late representatives of the simple devices, ed in simple cultures and backwaters through the twentieth century.

The abacus is one of the earliest known computing devices and the rst hand-held calculator. It postdated the invention of the decimal stem by the Egyptians circa 3000 BC. The Greeks and Romans built and ed the abacus based on Hindu-Arabic numerals. Unlike earlier notations d devices using stones and marks, the abacus utilizes positional tation, including the representation of zeros, differences, with pabilities for multiplication and division. The Chinese abacus has ads in groups of 5 and 2, representing decimal digits. The Japanese rst modified this to 5 and 1 and then 4 and 1, a system known as bi-inary representation that was also used in early electronic digital mputers such as the IBM 650 (ca 1955).

In the operation of the abacus, a single register machine, the ving of the beads also immediately provides the answer.

Abacus, 22x16x3 cm,
Wood, 9 Digit, (B93.80).

Abacus, 2x4x6 cm,
Green, Marble and Brass, 9 Digit, (B95.80).

P Abacus, 29x14x2.5 cm,
Wood, 13 digit, (B172.81).

Soroban, 4x11x29 cm,
(B26.79).

Soroban, 10x2x40 cm,
Wood and Bamboo, 21 Digits, (B94.80).

Counting beads are simplified form of an abacus often used r teaching or given to children as a "learning" toy. Versions of unting beads are used for score keeping in such games as pool and thus ten form a simple, large scale, graphic, erasable memory and simple der.

Counting Beads,
27x19.5x1 cm, 10 digit, Red, Black, and Green Beads, Wood and

Metal, Paint worn off beads, beads missing on top, (B141.80).
Counting Beads,
37x2x44 cm, red and black beads, wood and metal, 9 rows by 10 digits, (B178.81).

.2

FROM: GORDON BELL DATE: FRI 21 SEP 1979 3:06 PM EST
DEPT: OOD
EXT: 223-2236
TO: GRANT SAVIERS
MIKE GUTMAN
BOB PUFFER @CLEM
JOHN F SMITH @CLEM

SUBJECT: MANUFACTURING - SPRINGFIELD/TS04/TU77

FOLLOW-UP: 10/5/79
GB0004/57

Given:

1. The situation in Springfield vis a vis their ability to handle the growth and new products.

2. Lack of orders on TS04 and TU77.

3. Pertec.

Let's:

1. Withdraw these products.

2. Only introduce the CSS-based STC 6250 drive.

What do you say?

Gordon

Command >
****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION   DATE: MON 31 MAY 1982
11:01 AM EDT

FROM: GORDON BELL
cc: DENNIS O'CONNOR   DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: MANUFACTURING A/D AND MANUFACTURING ENGINEERING

I attended a review of our Technical Managment Committee,
TMC,
composed of A/D managers where the plans were presented.

I am really concerned about the incredible lack of planning
and direction and co-ordination within manufacturing and
don't
see how we can possibly survive.

The problems were everywhere:
.a network to be able to get information to the plants
.networking within the plants (or anyway to help them either
 individually or collectively, given the strong lack of
 centrality of anything). This is why our Order Entry is
 so screwed up as it crosses plants and product lines.
.testing methodology and testors
.modern materials and product flow using on line computers
 (Here, I understand we buy mostly in a hodge podge fashion,
 but now we are also developing this both in Don's group and
 under Steve Gutz. This seems crazy.)

.a program to reduce product introduction times
.physical interconnect appears to be headed nowhere!
.automation in general, especially the standards to interconnect
 assembly line components

I'd like to see a strong, engineering effort applied to driving this across manufacturing. Much would take the form of
standardization, but there would have to be real leadership too.

Can't we learn from the current product line fiasco where we see massive waste and non-professionalism because everyone was told to be independent and do their own thing?

"TO" DISTRIBUTION:

DICK CLAYTON	BILL HANSON	DAVE KNOLL
DON METZGER	JACK SMITH	

GB3.S5.55

****
* d i g i t a l *
****

TO: KEN OLSEN DATE: SUN 2 MAY 1982
3:51 PM EDT

FROM: GORDON BELL
cc: ROGER CADY DEPT: ENG STAFF
    JACK SMITH EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: MEETING TO LAYOUT MANUFACTURING PRODUCT APPROACH

I think your suggestion of a Woods of 1+ days sound fine to look
at the approach to getting these products. We should start by
asking Roger to send us the literature of his products and the

strategy he's on now.

You, Jack (as mfg and eng person), me (as engineer and arch of distributed systems) and Cady (as responsible business person)
should be the nucleus. Some others:

Steve Gutz, the engineering manager
Hansen, as manufacturing person and person who has to be the guinea pig. The basic approach we are advocating is to buyout software in a clearinghouse fashion and to run it internally. Note, as a side-effect we get a shot at moving manufacturing to be CAM oriented. I want direct transfer of information from CAD to factory and this means both LANs (Ethernet) and a global net like the links between engineering sites. Here, I see a structure with a PWB/logic plant, for example, to be: three interconnected networks (on 1 EThernet): EDP, shop floor control including any automated movement, electrical design information update to inserters, testors, pwb makers, etc. In addition, a board shop would be under computer control.
Metzger, as contractor to a very large amound of CAM for Mfg.
??, as EDP facilities and standards co-ordination. Here, a network person has to exist so that any exchange is possible.
No way can this be done bottom-up by plant.
Dick Clayton, who's looking at various forms of control and automation (materials handling) within plants.
??, as person doing electrical standards for CAM part especially aimed at test.

Anyway, this would be double pronged... looking at our own computing in depth to solve mfg plants for others. I think this is the way to go! (We should also buyout all the software.)

Since HP and Univac are the biggies in this area, we should have an easy time at the market.

GB3.S5.19
****

* d i g i t a l *
****

TO: see "TO" DISTRIBUTION DATE: MON 19 APR 1982
3:06 PM EST

FROM: GORDON BELL
cc: SAM FULLER DEPT: ENG STAFF
GVPC: EXT: 223-2236
LARRY PORTNER LOC/MAIL STOP: ML12-
1/A51

SUBJECT: MANUFACTURING MARKET: WILL IT BE THE NEXT MARKET WE COVET?

I'd like to figure out a way to stop the hand to mouth existence
we travel in deciding about products and market areas. For example, Our ability to identify and move in WPS and PC's has been abyssmal! We have a good group in Engineering and Manufacturing that is dedicated to making products that we can
use internally. Similarly, Roger is on a course that looks like
it could win in the manufacturing world. HP currently looks the
best in this regard with their commitment to using their own products internally. IBM may have a similar stance.

IBM is very active in this effort, and is now starting to market
a robot. HP is commiting to both AI products and to robotics.
Their culture won't let them not go after the state of the art.

I think Sam is probably right in that this area looks like a comer. Also, we need to have product expertise in Knowledge Based Systems, particularly if the Japanese are going to be there in the 5th Generation. (There's also the question as to whether we will want to be in the home with a computer, or have a computer in a briefcase, etc.)

Is there a way to be rational about new product areas?

(I see no slack for anything, given the over commitments in engineering to existing, and past products... no matter whether
they are going to make money or not.)

Surely there's a better way to live.

"TO" DISTRIBUTION:

ROGER CADY   KEN OLSEN   JACK SMITH

ATTACHED: MEMO;37

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION   DATE: SUN 18 APR 1982
9:03 PM EST

FROM: SAM FULLER
cc: GORDON BELL   DEPT: SA&T
EXT: 225-6060
LOC/MAIL STOP: HL2-3/N11

SUBJECT: JOHN BIRK; ROBOTICS PERSON

I've talked with John today to follow up the offer we made him Friday; as
I understand it, Bob Glorioso talked with him today also.

He has at the 95% level decided to leave the Univ. of RI and go to the other
company. I think he has made the decision for a few reasons:

1. Other company has a clearer commitment to Robotics than DEC. This
is measured in $, size of group he'll manage, etc.
2. Other company was earlier with their offer.
3. California looks better than Mass. at the end of this hard

winter.
There is an outside chance DEC may still come out on top and I suggest we keep the offer open for the coming weeks.

The troubling aspect of this to me is watching IBM, HP, and a raft of other companies getting into mfg. automation. It looks like we will be trying to play catchup in mfg. automation in a few years like we're trying to play catchup in office automation today.

"TO" DISTRIBUTION:

DICK CLAYTON BOB GLORIOSO NANCY ROGOFF
TOM WILLIAMS

GB3.S4.30

ID#436

| d | i | g | i | t | a | l | **interoffice memorandum**

Subject: Manufacturing-Engineering Interface

To: OOD,
Win Hindle, ML10-2/A53
Jack Smith, ML1-4/A54

Date: 1/28/79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

Jack and I discussed the above in the context of a discussion with my staff at a recent jungle meeting. We agreed that some sort of formal communications link might be useful. One of the possibilities would be to have the chairman of the Manufacturing-Engineering Committee attend Jack's Staff Meetings on a somewhat regular basis. In this way, we could get a coupling that is now more one way via Jim Cudmore...although Jim would certainly continue to be a part of OOD.

DOCNO8/25

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Gordon Bell	ML12-1/A51	Dick Clayton	ML12-2/E71
Jim Cudmore	ML1-5/E30	Bill Demmer	TW/D19
Ulf Fagerquist	MR1-2/E78	Bill Johnson	ML3-5/H33
John Kevill	ML3-6/E94	John Meyer	ML12-1/A11
Larry Portner	ML12-3/A62	Bob Puffer	ML12-2/E38
Win Hindle	ML10-2/A53	Jack Smith	ML1-4/A54

MANY WAYS TO DO INFORMATION STORAGE AND PROCESSING

. FILES, DRAFTING ROOM, MICROFILM, MICROFICHE

. TABLE OR SLIDE RULE, CALCULATOR

. EXTERNAL SERVICE

. **LARGE, SHARED SYSTEM FOR MANY ORGANIZATIONS**

. **SMALLER, SHARED SYSTEM FOR SINGLE ORGANIZATION**

- . **CENTRAL**
- . **WITH ORGANIZATION**

. **DEDICATED, SYSTEM/USER. SOME CENTRAL FACILITY FOR DATA-EXCHANGE**

. **SPECIFIC LIBRARY OF PROGRAMS ON DESK OR HAND-HELD CALCULATOR**

MAP TO GORDON BELL'S HOME
(617-259-9144)

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                                                 |    N
                                No left           |    |
     |                         <-------         | W-----E
     |O                         |turn            |    |
         |O Light                  |                |    S
         |O                        v                |
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2___________        * |           |          |              |
   Gas       |         L|         P|          |R
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             |         n|         a|           |2
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             |          |          |           |
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                       |Trapello Rd.          |
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BOSTON
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Logan
                                       __________Mass Pike__
Airport []
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<subj>NATIONAL SCIENCE FOUNDATION
<from>RESNIKOFF, HOWARD L.
<to>BELL, GORDON
<date>80/3/24
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<subj>SYRACUS UNIVERSITY
<from>OLDFIELD, J.V.
<to>BELL, GORDON
<date>80/3/26
<date rec>3/31/80
<log#>3-66

<dispo/date>TO LETTERBOOK (GB1.S3.37) - 4/14/80
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<subj>NATIONAL RESEARCH COUNCIL
<from>BLACKBURN, JACK F.
<to>MEMBERS
<date>80/3/24
<date rec>3/28/80
<log#>3-65
<dispo/date>
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<f/u>
<filed>
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<subj>CASE WESTERN RESERVE UNIVERSITY
<from>ROGERS, JAMES L.
<to>SULLIVAN, M.J.
<date>80/3/24
<date rec>3/28/80
<log#>3-64
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<subj>ANNALS OF THE HISTORY OF COMPUTING (UNIVERSITY OF MICHIGAN)
<from>GALLER, BERNARD A.
<to>BELL, GORDON
<date>80/3/12
<date rec>3/28/80
<log#>3-63
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<subj>SOLARIS LTD.
<from>ARRATHOON, RAYMOND
<to>BELL, GORDON
<date>80/3/21
<date rec>3/27/80
<log#>3-62
<dispo/date>ARMAND LA VALLE - (CC:JIM BELL) 3/28/80
<message>PLEASE ANSWER.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>SOFTWARE ENIGNEERING REPORT (BOOK #1)
<from>SHELDON, LIZ
<to>BELL, GORDON
<date>80/2/?
<date rec>3/26/80
<log#>3-61
<dispo/date>
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<subj>EXECUTIVE HOUSE
<from>STONE, MARGARET C.
<to>BELL, GORDON
<date>80/3/21
<date rec>3/25/80
<log#>3-60
<dispo/date>JOHN MEYER - 3/26/80
<message>PLEASE HANDLE.
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<subj>NEW YORK UNIVERSITY
<from>GOLDSTEIN, MAX
<to>BELL, GORDON
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<date rec>3/25/80
<log#>3-59
<dispo/date>DICK ECKHOUSE - 3/26/80
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<subj>TEKTRONIX
<from>GOWAN, JIM
<to>BELL, GORODN

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<date rec>3/25/80
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<subj>PHOTOVOLTAICS ENERGY SOURCES
<from>INGHAM, DALE JOHN
<to>BELL, GORDON
<date>80/3/17
<date rec>3/24/80
<log#>3-57
<dispo/date>TOM SIEKMAN - 3/24/80
<message>WHAT'S THIS? MJ
<answer>
<f/u>
<filed>
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<subj>SONY INDUSTRIES
<from>SCHULHOF, MICHAEL
<to>RIGGLE, MIKE
<date>80/3/18
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<subj>FACIT, INC.
<from>MORSE, ALAN
<to>BELL, GORDON
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<date rec>3/24/80
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<subj>TECHNOLOGY RECOGNITION CORPORATION
<from>JONES, DONALD H.
<to>BELL, GORDON
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<log#>3-54
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<subj>UNIVERSITY OF MICHIGAN (RESUME'--KENNETH WINTER)
<from>GALLER, BERNARD A.
<to>BELL, GORDON
<date>80/3/7
<date rec>3/24/80
<log#>3-53
<dispo/date>ARMAND LA VALLE - 3/26/80 (CC: JIM BELL)

<message>BERNIE'S BEEN HELPFUL HERE. CAN WE INVITE HIM IN FOR AN INTERVIEW?
<answer>WE HAVE NO FUNDS FOR SUMMER HIRES. (JIM) - 4/16/80
<dispo/date>NANCY STARR CALLED RE: WINTER; HE IS NO LONGER AVAILABLE, HE IS WORKING THIS SUMMER ON A BOOK. - 5/6/80
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>CARNEGIE-MELLON UNIVERSITY
<from>DIRECTOR, S.W.
<to>BELL, GORDON
<date>80/3/20
<date rec>3/24/80
<log#>3-52
<dispo/date>SENT NOMINATION FORM IN - 3/28/80
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<subj>QUEST ASSOCIATES -- RESUME' (JOE LAVELLE)
<from>DIVIS, MICHAEL R.
<to>BELL, GORDON
<date>80/3/19
<date rec>3/21/80
<log#>3-51
<dispo/date>ARMAND LA VALLE - 3/24/80
<message>LET'S LOOK AT HIM FOR DISKS OR GRAPHICS.
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<subj>NATIONAL ACADEMY OF ENGINEERING
<from>NELSON, E. HENRIETTE
<to>COMMITTEE
<date>80/3/18
<date rec>3/20/80
<log#>3-50
<dispo/date>
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<subj>CARL D. SOUTHARD ASSOCIATES INC.
<from>DUNCAN, R.M.
<to>BELL, GORDON
<date>80/3/17
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<log#>3-49
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<subj>IAESTE/U.S.
<from>SPRINKLE, ROBERT M.
<to>BELL, GORDON
<date>80/3/17
<date rec>3/19/80
<log#>3-48
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<subj>PORTLAND COMMUNITY COLLEGE
<from>HATA, DAVID
<to>OLSEN, KENNETH
<date>80/3/7
<date rec>3/19/80
<log#>3-47
<dispo/date>JIM BELL - 3/19/80
<message>SOMEONE THERE INTERESTED?
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>ADVENT CORPORATION
<from>MITCHELL, BERNARD
<to>BELL, GORDON
<date>80/3/14
<date rec>3/18/80
<log#>3-46
<dispo/date>SENT COPIES TO DICK CLAYTON, BOB GLORIOSO, SAM FULLER, BILL PICOTT - 4/9/80
<message>
<answer>
<f/u>
<filed>
<ret-gb>ORIGINAL RETURNED - 4/9/80
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<subj>RP07 BUSINESS PLAN (PHASE III) -- COPY 4

<from>FORDE, JOHN
<to>BELL, GORDON
<date>80/2/29
<date rec>3/18/80
<log#>3-45
<dispo/date>
<message>
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<subj>LORDEN, JOHN J. -- ATTORNEY AT LAW
<from>LORDEN, JOHN J.
<to>BELL, GORDON
<date>80/3/14
<date rec>3/18/80
<log#>3-44
<dispo/date>JOHN HOLMAN - 3/19/80
<message>
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<subj>WEATERBY ASSOCIATES, INC.
<from>BELCHER, ROBERT W.
<to>BELL, GORDON
<date>80/3/13
<date rec>3/18/80
<log#>3-43
<dispo/date>ARMAND LA VALLE - 3/20/80 (CC:JACK SHIELDS)
<message>PLEASE HANDLE.
<answer>
<f/u>
<filed>

<ret-gb>
<roll>
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<subj>RESUME' - ONZELO MARKUM III
<from>MARKUM, ONZELO III
<to>BELL, GORDON
<date>80/3/17
<date rec>3/18/80
<log#>3-42
<dispo/date>ARMAND LA VALLE - 3/20/80
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<filed>
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<subj>NATIONAL RESEARCH COUNCIL
<from>BLACKBURN, JACK F.
<to>BELL, GORDON
<date>80/3/13
<date rec>3/18/80
<log#>3-41
<dispo/date>ORIGINAL RETURNED - 3/19/80 (CC:JIM BELL, ULF, BOB GLORIOSO
<message>THIS IS WHAT WE AGREED TO FILL OUT. IS THE DEADLINE (4/13) OK? COULD WE PRESENT RESULTS INTERNALLY WHEN READY?
<answer>
<f/u>4/1/80
<filed>12
<ret-gb>
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<subj>NATIONAL ACADEMY OF ENGINEERING
<from>NELSON, E. HENRIETTE
<to>COMMITTEE

<date>80/3/14
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<subj>COMPUTER SYSTEMS LABORATORY
<from>FLYNN, MICHAEL J.
<to>BELL, GORDON
<date>80/3/14
<date rec>3/17/80
<log#>3-39
<dispo/date>TO LETTERBOOK (GB1.S3.9) - 3/19/80
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<subj>UNIVERSITY OF SOUTHERN CALIFORNIA
<from>UNCAPHER, KEITH
<to>BELL, GORDON
<date>80/3/12
<date rec>3/17/80
<log#>3-38
<dispo/date>
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<f/u>
<filed>
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<subj>ED BAILEY PERSONNEL
<from>BAILEY, ED
<to>BELL, GORDON
<date>80/3/?
<date rec>3/17/80
<log#>3-37
<dispo/date>ARMAND LA VALLE - 3/17/80
<message>PLEASE HANDLE.
<answer>
<f/u>
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<subj>UNIVERSITY OF CALIFORNIA, BERKELEY
<from>BLUM, MANUEL
<to>BELL, GORDON
<date>80/3/10
<date rec>3/17/80
<log#>3-36
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<subj>INVENTION--DAVID MACK
<from>MACK, DAVID (ORIGINALLY SENT TO PETER CONNELL--PUBLIC RELATIONS)
<to>BELL, GORDON
<date>80/3/?
<date rec>3/14/80
<log#>3-35

<dispo/date>TOM SIEKMAN - 3/14/80
<message>TOM, HELP - WHO KNOWS, EINSTEIN HAD TO START SOMEWHERE.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>AIR PRODUCTS AND CHEMICALS INC.
<from>BRIAN, P.L. THIBAUT
<to>BELL, GORDON
<date>80/3/11
<date rec>3/14/80
<log#>3-34
<dispo/date>
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<f/u>
<filed>
<ret-gb>
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<subj>RESUME' (SCIENTIFIC TECHNOLOGY INC)--GYAN C. JAIN
<from>BRANCA, JOSEPH
<to>BELL, GORDON
<date>80/3/?
<date rec>3/14/80
<log#>3-33
<dispo/date>ARMAND LA VALLE - 3/14/80
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<answer>
<f/u>
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<ret-gb>
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<subj>HARRIS SEMICONDUCTOR GROUP
<from>DOBSON, W.H.
<to>BELL, GORDON
<date>80/3/10
<date rec>3/13/80
<log#>3-32
<dispo/date>ORIGINAL RETURNED TO GB - 3/17/80 (CC:STAN OLSEN, SI, LARRY, JACK GILMORE, JULIUS, ROGER, BRUCE STEWART, CAROLYN MCINTIRE)
<message>LET'S GET THE P/L GOING! TELLING THE TRUTH IN A STRAIGHT FORWARD FASHION WINS.
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<f/u>
<filed>HARRIS - 3/20/80
<ret-gb>
<roll>
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<subj>SIGNETICS
<from>UMINA, LEONARD J.
<to>BELL, GORDON
<date>80/3/10
<date rec>3/13/80
<log#>3-31
<dispo/date>LEN UMINA - 3/17/80
<message>PLEASE MAKE SURE PAUL BAUER + HERB SHANZER KNOW ABOUT THIS CHIP.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>NATIONAL RESEARCH COUNCIL
<from>BLACKBURN, JACK F.
<to>BELL, GORDON
<date>80/3/?
<date rec>3/13/80

<log#>3-30
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>RESUME' - MARTIN SCHULTZ
<from>SCHULTZ, MARTIN
<to>BELL, GORDON
<date>80/3/?
<date rec>3/13/80
<log#>3-29
<dispo/date>ARMAND LA VALLE - 3/14/80
<message>PLEASE HANDLE.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>DOWNING & DESAUTELS
<from>SCHILLACI, FELICE A.
<to>BELL, GORDON
<date>80/3/10
<date rec>3/13/80
<log#>3-28
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>RESUME' - DIANE C. WASSERMAN
<from>WASSERMAN, DIANE C.
<to>BELL, GORDON
<date>80/3/8
<date rec>3/11/80
<log#>3-27
<dispo/date>ARMAND LA VALLE - 3/12/80
<message>PLEASE HANDLE.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>EF HUTTON & COMPANY INC.
<from>CHASE, C. DAVID
<to>BELL, GORDON
<date>80/3/7
<date rec>3/11/80
<log#>3-26
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>GENERAL ELECTRIC
<from>CHIN, SHIU-KAI
<to>BELL, GORDON
<date>80/3/6
<date rec>3/11/80
<log#>3-25
<dispo/date>
<message>
<answer>

<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>CUSTOMER COMPLAINT (ROBERT ROCCHETTI)
<from>ROCCHETTI, ROBERT
<to>BELL, GORDON
<date>80/3/5
<date rec>3/11/80
<log#>3-24
<dispo/date>TO LETTERBOOK (GB1.S3.5) - 3/20/80
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>LOS ALAMOS SCIENTIFIC LABORATORY
<from>METROPOLIS, N.
<to>BELL, GORDON
<date>80/3/6
<date rec>3/11/80
<log#>3-23
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>GENERAL ELECTRIC
<from>SHAW, CHARLES A.
<to>BELL, GORDON

<date>80/3/4
<date rec>3/10/80
<log#>3-22
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>BRITTON LEE INC.
<from>BRITTON, DAVID L.
<to>BELL, GORDON
<date>80/3/5
<date rec>3/10/80
<log#>3-21
<dispo/date>ORIGINAL TO GB - (CC:GRANT, BJ, BOB DALEY, DICK SNYDER, GEORGE POONEN) - 3/13/80
<message>HELP! WHAT DO YOU WANT ME TO SAY?
<answer>
<f/u>3/21/80
<filed>
<ret-gb>
<roll>
<>

<subj>SELO SOCIETA' ELETTRONICA LOMBARDA
<from>TERRA, LUIGI
<to>BELL, GORDON
<date>80/2/26
<date rec>3/10/80
<log#>3-20
<dispo/date>JOEL SCHWARTZ - 3/11/80
<message>YOURS.
<answer>
<f/u>
<filed>
<ret-gb>

<roll>
<>

<subj>STEVENS INSTITUTE OF TECHNOLOGY
<from>EHRLICH, I. ROBERT
<to>BELL, GORDON
<date>80/2/29
<date rec>3/10/80
<log#>3-19
<dispo/date>RETURNED FORM--CANNOT ATTEND - 3/11/80
<message>
<answer>
<f/u>
<filed>FILE #13 - 3/11/80
<ret-gb>
<roll>
<>

<subj>SOCIETY OF MANUFACTURING ENGINEERS
<from>TAYLOR, R. WILLIAM
<to>BELL, GORDON
<date>80/3/3
<date rec>3/10/80
<log#>3-18
<dispo/date>RETURNED TO SME 3/11/80
<message>ASKED TO HAVE PUBLICATIONS SENT ALSO TO WILL THOMPSON & JOHN HOLMAN
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>IEEE
<from>STERN, STEVEN M.
<to>BELL, GORDON
<date>80/3/5
<date rec>3/10/80

<log#>3-17
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>IEEE
<from>HANCOCK, JOHN C.
<to>BELL, GORDON
<date>80/3/3
<date rec>3/10/80
<log#>3-16
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>RESUME - MICHAEL SCHWARTZ
<from>SCHWARTZ
<to>BELL
<date>80/3/3
<date rec>3/7/80
<log#>3-15
<dispo/date>LA VALLE - 3/7/80
<message>PLEASE HANDLE
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>TEXAS INSTRUMENTS - RE MUSEUM ASC COMPONENTS
<from>CRAGON, HARVEY
<to>BELL
<date>80/3/3
<date rec>3/7/80
<log#>3-14
<dispo/date>TO LETTERBOOK (GB1.S2.48) - 3/11/80
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>RESUME - BARRY ROISMAN
<from>ROISMAN
<to>BELL
<date>80/2/26
<date rec>3/7/80
<log#>3-13
<dispo/date>LA VALLE - 3/7/80
<message>PLEASE HANDLE.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>RESUME' - LARRY FISH
<from>FISH, LARRY
<to>BELL, GORDON
<date>80/2/?
<date rec>3/6/80
<log#>3-12
<dispo/date>TOM SIEKMAN - 3/10/80
<message>TOM, OK TO TALK?
<answer>NO - NO YET. I'LL ASSUME THE LETTER AND CLEAR UP THE

LEGALITIES. THEN GORDON CAN TALK TO HIM. TOM - 3/13/80
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>UNIVERSITY OF NEW CASTLE
<from>RANDELL, BRIAN
<to>STRECKER, BILL
<date>80/2/26
<date rec>3/6/80
<log#>3-11
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>UNIVERSITY OF NEW CASTLE UPON TYNE
<from>RANDELL, BRIAN
<to>BELL, GORDON
<date>80/2/27
<date rec>3/6/80
<log#>3-10
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>HAMMOND SOFTWARE
<from>HAMMOND, IAN

<to>BELL, GORDON
<date>80/2/?
<date rec>3/5/80
<log#>3-9
<dispo/date>ORIGINAL RETURNED TO GB - 3/17/80 (CC:TOM MCINTYRE, DAVE RODGERS, RICK PEEBLES, GEORGE PLOWMAN, PETER HURLEY, MARY BRESLIN, JIM WADE, JOEL SCHWARTZ)
<message>ANY COMMENTS? (JOEL, LOOKS USEFUL TO LDP)
<dispo/date>ORIGINAL TO GB, CC:RICHARD WITEK, RICHY LARY - 11/10/80
<message>FYI.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>SCIENTIFIC TECHNOLOGY INC.--RESUME' (MICHAEL CHESSMAN--REF. 77)
<from>MANN, JERRY
<to>BELL, GORDON
<date>80/3/?
<date rec>3/5/80
<log#>3-8
<dispo/date>JIM CUDMORE - 3/10/80 (CC: FILE #12)
<message>YOURS.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>MCGRAW-HILL BOOK COMPANY (COLLEGE DIVISION)
<from>BENSON, KATHI A.
<to>BELL, GORDON
<date>80/2/29
<date rec>3/5/80
<log#>3-7

<dispo/date>KATHI BENSON - 3/24/80
<message>I FILLED ONE OF THESE OUT FOR THE ORIGINAL COMPUTER STRUCTURES. I DON'T THINK ANYTHING HAS CHANGED MUCH SINCE THEN.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>NATIONAL SCIENCE FOUNDATION
<from>RESNIKOFF, HOWARD L.
<to>BELL, GORDON
<date>80/2/28
<date rec>3/5/80
<log#>3-6
<dispo/date>ORIGINAL TO MJ - 3/11/80
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>THAYER SCHOOL OF ENGINEERING (DARTMOUTH COLLEGE)
<from>BOYLESTAD, ROBERT L.
<to>BELL, GORDON
<date>80/2/28
<date rec>3/4/80
<log#>3-5
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>EFM ASSOCIATES--RESUME' DR. ARTHUR MONES
<from>MORRIS, E.F.
<to>BELL, GORDON
<date>80/2/29
<date rec>3/3/80
<log#>3-4
<dispo/date>ARMAND LA VALLE - 3/10/80 (CC: ULF)
<message>PLEASE HANDLE.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>MICROCOMPUTER APPLICATIONS
<from>ZARRELLA, JOHN
<to>BELL, GORDON
<date>80/2/29
<date rec>3/3/80
<log#>3-3
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>RESUME' - AKIRA OKAYA
<from>OKAYA, AKIRA
<to>BELL, GORDON
<date>80/2/27
<date rec>3/3/80
<log#>3-2
<dispo/date>ORIGINAL TO JOHN MEYER - 3/10/80 (CC: METZGER, CLAYTON, CUDMORE, SAVIERS)

<message>LOOKS INTERESTING. JOHN SHOULD WE INVITE HIM IN?
<answer>
<f/u>3/21/80
<filed>
<ret-gb>
<roll>
<>

<subj>WELLING & WOODARD, INC.
<from>LANE, CHRISTOPHER T.
<to>BELL, GORDON
<date>80/2/12
<date rec>3/3/80
<log#>3-1
<dispo/date>ED FINN - 3/10/80
<message>YOURS.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

ID#0269

| d | i | g | i | t | a | l | **interoffice memorandum**

Subject: **Volume and Market Domination**

To: Irwin Jacobs, Julius Marcus, OOD, OC, EBOD

Date: 19 SEP 78
From: Gordon Bell
Dept: OOD
Loc.: ML12-1
Ext.: 2236

follow up

10/03/78

This is the first creative idea (see attached) I have seen to get volume and market domination since the Distributors and since the DCG terminals sales. I support the need and say let's get the channel. A trip to Japan convinced me that we want to be a manufacturer at a high growth rate! I've a lengthy essay on this but the meat is:

> We (the U.S.) with all our law and business school training take the easy way out by buying manufactured goods from Japan. The ROI on this is enormous and there is no risk, because all we have to do is be good purchasing agents and distributors...and we dignify it by calling it marketing. Fortune further writes up these people as great business leadership. Many manufacturers have gone this way (RCA, GE, Chrysler), because it's a pain to think of product ideas, develop them in detail and manufacture them competitively. Also the government hassles you all the way.

While in the short term, when the Japanese start competing with us, we could simply buy their products and add on as much as they let us (their goal is to get the greatest amount of added value). The strategy doesn't work in the long term because:

1. Distribution is fundamentally the fatty part of the organization ...thus it is easy to form a lean and mean one when the need's there.

2. If all U.S. manufacturers do this (and they seem likely to, given their laziness) then there is no export of goods to pay for the Japanese products unless we

are effectively able to sell them all the land, manufacturing and people resources in the U.S.

(Any wonder why the dollar isn't worth anything overseas since this <u>paper</u> is all we're exporting?)

The point is: DEC must become a high volume manufacturer. We'll lose if we just fool around with a lot of low volume products and take their high costs while we try to pursue the diverse set of needs through the various channels (e.g., stores, big and little companies and governments, all possible uses, with all possible computing styles). TI will beat us, and so will everyone else. This implies a high growth in such an area. Given, too the sales department is limited in their ability to hire and train salespeople, there is no other alternative:

<u>Damn It -- get the business outside through another channel!</u>

How can engineering help you?

(You also might get some help from manufacturing too. I suspect Andy would concur and help.)

GB:ljp

Attachments

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Al Bertocchi	PK3-2/A56	Dick Clayton	ML12-2/E71
Jim Cudmore	ML1-5/E30	Sheldon Davis	PK3-1/C16
Bruce Delagi	ML12-1/F41	Bill Demmer	TW/D19
Ulf Fagerquist	MR1-2/E78	Win Hindle	ML5-2/A53
Jake Jacobs	PK3-1/M33	Bill Johnson	ML21-3/E87
Ted Johnson	PK3-2/A55	John Kevill	ML1-3/E58
Andy Knowles	ML5-2/A53	Ed Kramer	MR2-4/M16
John Leng	MR1-1/F35	Bill Long	ML5-2/A53
Julius Marcus	MK2/C37	John Meyer	ML12-1/A11
Ken Olsen	ML12-1/A50	Stan Olsen	MK1-2/A57
Larry Portner	ML12-3/A62	Bob Puffer	ML12-2/E38
Jack Smith	ML1-4/A54		

Digital **Interoffice Memo**

Subject: **Market Maturity versus Geography**

To: Marketing Committee
Product Line Managers
Ron Spinek

Date: 25 OCT 76
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.:

2236

CC: Ken Olsen

Having recently visited with different users for applications (markets) in a number of different locations (e.g., Europe set, West Coast, Boston Area, Pittsburgh), it's very obvious that there are significant time delays among the markets and among the various locations. There appears to be of the order of up to 5 years...and in some cases, a transient market might even disappear. Furthermore, I believe the dominant factor differentiating the market may be geography not market area.

Rather than wandering around in this market-geography space could we agree on a simple function for roughly predicting markets (based on part performance) and then parameterize it in these two dimensions?

The standard DEC model is:

$$\text{MKT Size (in Millions)} = (4/.04) \times 1.41^{t-1961}$$

i.e., we gross 41%/year or double every two years, (the PL birthright), were about 4M in 1961, and have about 40% market share.

Could it be first refined on a per P/L basis to reflect:

1. Growth rate

2. Exponential limits (i.e., saturation), eg. Try

$$y = L/(1-ae^{-bt}) \text{ (Pearl Curve?)}$$

or

$$y = Le^{-b(e^{-at})} \quad \text{(Gompertz Curve?)}$$

3. Time delays due to geography.

Although I have to believe in products as being the dominant factor in a market, and that marketing may be an art, should we move a slight direction to transform it into a respectable, quantitative discipline?

GB:ljp

LONG TERM MARKET/PRODUCT GOALS

1. PROVIDE A COMPATIBLE SET OF DISTRIBUTED COMPUTING PRODUCTS SO A

USER CAN COMPUTE (IN A TRANSPARENT FASHION) IN ANY OF THE

FOLLOWING STYLES AND SIZES WITHOUT REPROGRAMMING (OR EXTRA WORK):

- **AS SINGLE USER WITHIN TERMINAL**
- **SMALL, LOCAL SHARED SYSTEM FOR A GROUP**
- **LARGE SYSTEM SERVING SEVERAL GROUPS**

2. BECOME MORE APPLICATIONS ORIENTED.

3.   PROTECT EXISTING BUSINESS COMING UNDER ATTACK BY SPECIAL SYSTEMS

(E.G., RSTS) IMPLEMENTED BY 21-BIT MICROS (E.G., INTEL 8086).

4.   PROVIDE CURRENT USERS OF EXISTING SYSTEMS (E.G., 8'S, 10'S, AND

20'S) WITH COST-EFFECTIVE HARDWARE TO PROTECT THEIR SOFTWARE

INVESTMENT.

00 CORE DECGRAM ACCEPTED S 006011 O 593 04-AUG-82 22:08:18

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION   DATE: WED 4 AUG 1982
9:50 PM EDT

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5171520445

SUBJECT: MARKETING ADS CONTENT

Sorry my previous message had the wrong attachment which I erroneously pulled out of my EMS file. Please attach this message to the one I sent you about 2 hours ago.

Having cooled off from the last message which was really aimed at having Julius get us a decent market plan for his area together with a set of ads, and having just re-read this one in which I swore off trying to help Julius market, I've decided that my previous comments show too much patience with everybody!

Ken,
Why don't you demand an office marketing plan (and ads)?

Julius,
Why don't you produce a plan that is fit for execution?

We have been in a morass in this area and need Spencer and Benton and Bowles merely to figure out what the hell we are doing!

Julius,
Why not sell your boat and get back to work and get this out?

Love,
Gordon

PS
This is really a selfish message. Will you guys start selling the office things because with the kinds of thoughts I've been having recently about things to build, I really am going to need
a lot of money to have this kind of fun? ... and I like to have
fun.

"TO" DISTRIBUTION:

WIN HINDLE	JOHN SPENCER	JULIUS MARCUS
KEN OLSEN	JACK SHIELDS	JACK SMITH
GERRI WEATHERS		

ATTACHED: MEMO;74

****
* d i g i t a l *
****

TO: KEN OLSEN DATE: MON 14 JUN 1982 10:12 PM EDT

FROM: GORDON BELL
cc: OPERATIONS COMMITTEE: DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5166445656

SUBJECT: RE: COMMERCIAL MARKETING

You're right, I may be the problem in trying to tell the customers about our products, but I figure saying something is better than saying nothing. Maybe a little advertising directed at specifics would help. Last week I wanted to help write an ad but I couldn't find anyone in MK to talk to since they were all at the show AND there weren't even any products they sell. Since I can't ever find any people to help, or anyone there that understand products, I don't think I'm the product. I've instructed the engineers to help them on the ad because we've got some pretty exciting products and neat product messages in terms of productivity.

This is probably my final attempt to help the commercial group, but I do offer them a set of 15 or so hard hitting ads:
1. Range of compatible Data Processing products from PC's to VAX.
2. Range of compatible Transaction Processing products.
3. Range of compatible WP/office/Decset products.
4. Integration of DP, TP and office.
5. Interconnectivity via Local Area Nets and remote Lans

6. Local Area Nets for interfacing to other nets and systems.
7. Datamanagement integration
8. Distributed datamanagement (a big knockoff)
9. VMS environment for the most productivity in SW development
10. Applications languages for productivity
11. Applications (10/11 would cover the outside SW)
12. Office environment compatibility (physical design)
13. Customer installability and serviceablity for pc and group machines
14. Multiple channels and ways to by and source
15. Field support of all kinds.
16. Largest 3rd party source of hardware/software

I offer some people to help write them who know the details.

For example, in the other end of MK, Bob Daley gave me a presentation of DBMS, which is truly spectacular and its use in Transaction Processing. My ad would say:

VAX: Transaction Processing at the lowest cost, highest performance and covering the greatest range of use

TP would be defined, together with a typical task so that a novice would understand.

The computers used to do TP would be shown with their prices. There would be 2 graphs: Performance (in transactions/sec) versus the number of users ; and cost/user versus users for all the configurations.

There would be text describing the story. The novice would learn a lot and we would become known as a hot company in this area. It would be an extremely powerful ad and I think read by people who want to learn more about computing and who want to buy them too. We would also become known too.

If this doesn't work, then let's hire a super IBM type marketer like just recently became president of Prime. They're doing well and so is Wang with these types, so probably that's a better answer. We sure need to do something to get some business from prime, wang, hp and ibm.

WPS USERS - Leave HP mode and type <CR>

00 CORE DECGRAM ACCEPTED S 004130 O 721 14-JUN-82 22:32:39

****
* d i g i t a l *
****

TO: KEN OLSEN DATE: MON 14 JUN 1982
10:12 PM EDT

FROM: GORDON BELL
cc: OPERATIONS COMMITTEE: DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5166445656

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If this doesn't work, then let's hire a super IBM type marketer like just recently became president of Prime. They're doing well and so is Wang with these types, so probably that's a better answer. We sure need to do something to get some business from prime, wang, hp and ibm.

WPS USERS - Leave HP mode and type <CR>

00 BURT DECGRAM ACCEPTED S 2638 O 45 19-JAN-80 12:54:09
FROM: GORDON BELL DATE: SAT 19 JAN 1980
12:38 PM EST
DEPT: OOD
EXT: 223-2236
TO: JERRY WITMORE @MR16
cc: LARRY PORTNERProf. Martin of the Wang Institute is visiting us to explore a possible relationship. She is a solid Computer Scientist (Software Engineer) who has worked in AI (Rule-based Systems) and general software engineering. She gives special courses and consults for DEC, Smart Systems Technology, Raytheon and Sandia Labs. I believe she is an excellent critic and reviewer and product-requirements person. I see her as being useful in:

1. Sanity checks and consulting on internal or external products or groups.

2. Finding product/group opportunities for us, and playing some role in the product.

3. Ultimately building an AI Product Development Group.

GB7.20

00 BURT DECGRAM ACCEPTED S 32131 O 354 19-DEC-81
18:56:05

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION DATE: SAT 19 DEC 1981
12:10 PM EST

FROM: GORDON BELL

cc: BILL AVERY DEPT: ENG STAFF
AVRAM MILLER EXT: 223-2236
JACK SMITH LOC/MAIL STOP: ML12-1/A51

SUBJECT: MASS STORAGE AND BUILDING LOW END PRODUCTS

It's very clear that this area is going to and should be heated up and our planning assumptions reviewed again. Frankly, I don't think that the plans are worth a damn there, starting with the idea of building mini-floppies and going up to the AZTEC because they do not recognize the commodity nature of these products. (This includes mini-floppy follow-on, Maya (we have a solid record of having NEVER made a reasonable tape in terms of performance, cost, profitability, etc.), RD52, and now AXTEC due to large number of emerging alternatives.)

I don't think we can depend on Ken's enthusiasm for the RL02 to carry the day. Everyway I look at it, the RL02 costs: direct, FAT due to arcane way of producing the products, size, high service costs, inability to get a small enough system, etc. In this later regard, you should note that even with steep discounting, the 23 is only making 0.1 of its plan, and I don't think that major discounting is going to help much at all. Note the plan of 192K RL's total versus the 64K we've shipped seems incredulous.

We all have to REREAD and understand the Engineering Strategy Overview. The 5th Generation means major transitions in the product set and the way we engineer and produce products. Much of the organization outside of the VT's and CT's haven't

gotten
this message as we judge by their response. This is going to
the challenge this year.

It's going to be a lively new year.

"TO" DISTRIBUTION:

PAUL BAUER MIKE GUTMAN BOB PUFFER
GRANT SAVIERS

WPS USERS - Leave HP mode and type <CR>

Command >

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+--------------------------+                              GB0001/51
|   |   |   |   |   |   |   |
| d | i | g | i | t | a | l |   i n t e r o f f i c e   m e m o r
a n d u m
|   |   |   |   |   |   |   |
+--------------------------+
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Subject: **Rules of Thumb for Mass Storage Cost/Systems Price and Component Cost Reductions (for Red Book)**

To: OOD, Senior Product Managers,
Andy Knowles, ML10-2/A52
Mike Tomasic, ML12-2/E71

Date: 3/28/79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

<u>Relationship Between Mass Store Cost and System Price</u>

We have been tossing around the relationship between mass storage subsystem cost and system price of a factor of 10 because of a markup of a factor of 4 and the fact that the mass storage represents 2/5 (40%) of the entire system. This has been quoted as if it were like the Second Law of Thermodynamics, or an experimental constant like the speed of light. It ain't. Note:

1. Assume mass storage susbsystems of 2200, 1600, and 1100.

2. Rule of thumb would say, we can only market systems at 22K, 16K and 11K. This would imply other costs of $3300, $2400, and $1650. Now assume, the 1100 disk is not available for some reason.

3. We could market systems at either 11K (the original target system price) + 4.4K = 15.4K; or 11K + 2K = 13K...both of which are under the implicit 22K or 16K, while still maintaining

the 4 markup.

4. Alternatively, we could market systems based on either mass storage subsystem at 11K, but taking lower markups of 11K/(1650+1600) = 3.38; or 11K/(1650+2200) = 2.86. For example if the mass storage is bought out, while the markups are substantially lower, the return-on-investment may be much, much higher due to the fact that design and manufacturing tool up investments aren't required.

<u>Relationship Between Component Cost and System Price</u>
Unlike the case of mass storage where we believe a relationship exists, there is a need for some guidelines (rule of thumb) as to when we need a new component in order to achieve a lower cost system. In this case, we may spend several million dollars to build a brand new, one-chip processor, only to find that it has a negligible effect on the cost of the system. Alternatively, the same money spent to reduce a common interface, or get a lower cost mass storage system would be better. Since, we don't have a total planning system, it is imperative that the groups chartered to carry out the designs act responsibly by targeting the use a priori.

As an example, consider:

1. There is an available processor that costs $100. A new processor-on-a-chip is proposed that cost 1/2 as much, $50.

2. We build several things, terminals which cost about $500, and small systems which nominally cost $1000 to $2000.

3. The $50 cost premium means that these systems could otherwise be built for $550 and $1050, reflecting a 10% and 5% cost premium. It isn't clear that in these systems, a 10% premium will mean very much in the marketability, especially since we don't have channels of distribution oriented to these lower priced systems.

This type of cost reduction activity doesn't seem worthwhile according to the make versus buy guidelines we have tried to establish in the past, and that are attached. As a minimum, we should not do a cost reduction of the type given in the above example unless we get a 20% to 30% cost reduction! Is this a good guideline?

GB:ljp

Attachment

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Dick Clayton ML12-2/E71 Jim Cudmore ML1-
5/E30
Bill Demmer TW/D19 Ulf Fagerquist MR1-
2/E78
Mike Gutman ML3-6/E94 Per Hjerppe MR1-
2/E78
Bill Johnson ML3-5/H33 John Kevill ML3-
6/E94
Andy Knowles ML10-2/A52 Bernie Lacroute
TW/A08
John Meyer ML12-1/A11 Jack Mileski ML5-5
Stan Pearson ML12-2/E38 Larry Portner ML12-
3/A62
Bob Puffer ML12-2/E38 Mike Tomasic ML12-
2/E71

EMS 28-FEB-79
20:08:43 090 1
To: Jim Marshall
CC: Gordon Bell, John Kevill, Bernie Lacroute
From: Grant Saviers
Date: WED 28-FEB-79 20:08:43 EDT
Subject: Mass Storage for personal VAX

Your note indicates that you have concluded that AZTEC is the best productw
without stating what the selection metrics were. We would like to take a shot
at your requirements and would appreciate a statement of your goals and
requirements.

I note that the HP300 uses a 14 inch hard disk and floppy

loader/backup. It is
highly unlikely that an 8 inch disk could be costper megabyte competitive. I
believe that we can be technology competitive to HP on either 8 or 14 inch. 14
inch offers THREE times the recording area (= to capacity) at perhaps a 10 %
cost disadvantage.

I also believe that RL01 imbedded servo technology can be cost effectively
applied to floppy media. This could yield 3 to 5 megabytes at significantly
higher performance and equal or LOWER media cost than multitrack large 3M
cartridges.

By concentrating on larger floopies we also get a terminal type mass storage
systems device. The TU5900 certainly can't fill this bill. Let's minimize
our technology space and maximize utilization of each product!

Command:

EMS 1-MAR-79
13:50:07 400 1
To: Grant Saviers
From: Gordon Bell
Date: THU 1-MAR-79 13:50:07 EDT
Re: Mass Storage for personal VAX
From: Grant Saviers Date: WED 28-FEB-79 20:08:43 EST
Message ID: EMS 28-FEB-79 20:08:43 090 1

I agree with Grant. Furthermore, we probably have to use what's coming at
that time...although now is clearly the time to influence it. What are the
requirements? Do we need removability or very much removability?

Command:

EMS 2-MAR-79
10:40:45 080 1
To: John Kevill, Grant Saviers, John Meyer
CC: Mary Jane Forbes
From: Gordon Bell
Date: FRI 2-MAR-79 10:40:45 EDT
Subject: Our meeting on storage next week

Mary Jane: Please hand deliver to Bob Jack, Mike Riggle and Mike Gutman next
week before our meeting.

I view you people are spending all your time bickering about charters and not
doing work. Your people are sulking because they feel the same way you do.
There have been some past bad decisions that were made in both areas inin
selecting vendors (Pertec and ISS) and in underestimating prduct development
t that have blown the budget to hell. The comment I've heard about this that
one group is being penalized because of the stupidity of o another one is
really bad! Of course, we don't have that much money to spend, however, it
is being covered by Portner.He doesn't complain about your poor decisions.
The decisions have already been made, and we haveto live with them, build on
the errors, cut the losses however we must...the key thing is are we on the
right product path now??? [The next time I hear the word that Colorado or
whoever is apaying for the mistakes of Peyton, I will insist that we get a
new manager in Colorado. It is true, just as Colorado is alos paying for the

poor selection of ISS as a vendor...and that is a hell of lot more serios
mistake that the people who are now in Colordo made before leaving. The
point is that we are one family, and when a member takes the food money and
goes out on a binge, we're all going to be mighty hungry.]

There is a real competitive threat out there now, unlike we've ever had before
in IBM, because for once they have chased all their competitiors out of the
high end (eg Univac and Honeywell, etc) and are now coming down to take care
of us. And based on our past performance we will crumble. The big problem
will be the competitive situation in the mass storage area.

The real reason I don't want to/ am reluctant to increase funding in this area
is you and the product area. Giving that we could do all the projects on
the list, we would really fail, because they are both too late, and I think
too weak. You are all up tight about charters too intra mass storage, and
you have taken on charters outside of your past domain in a product like HSC
and this will eat into a budget like you've never seen before...because it
has an almost unbounded software component.

Help is needed and I think the system's groups represent a place where you
can get some of it. They too don't want to fail because of poor components.
Similarly, there is the outside, which based on our past record is not a
solution becuse we have picked the wrong vendors. However, some combination
of both of thes is needed, given the problem (competition) we see looming

ahead.

Maybe I'm naive, but I see that IBM has only 4 mass storage products to cover
this whole range...the 1 Mbyte floppy for getting in and out of systems; the
50 and 600 mbyte fixed disk systems and the 8xxx tape for backup. Also,
according to recent results, they may be going for density in bubbles (a
breakthrough may have happened) to cover as a system device down in the low
end, and enabling them to use floppy or some other device as the removable
media.They will no doubt offer a pile of more products for there large
systems, and I'd believe these would be in the archival are plus maybe
andother disk. (Note unlike us, these disks are seperated by factors of 50
and 12...ours currently are seperated in no increments or factors of 2, 3, 4
at the most). Also we have no way to get out of the products in production.
This is easy!! We propose it and get approved by the Marketing Committee!!!!

We can spend a little time about the charters at our meeting, but I want to
know how/ where you are going to get help from? What products do we/ will we
have to survive against IBM? How can we cut done on what we are doing and get
the quality up?

Command:

EMS   5-MAR-79

18:37:02 570 1

To: John Kevill

CC: John Meyer

From: Gordon Bell

Date: MON 5-MAR-79 18:37:02 EDT
Subject: Disks

We had a very heated discussion today in regard to disks. The perception is
that we have been screwed again by the disk group by not having competitive
products. Jack Shields casme to the rescue in saying that we decided to have
low end products (RL) versus finsish the large disk we bought from Telex and
have a big disk. His perception is that we (enginering) have operated
according to plan and there have been no surprises.   To a certain extent
he's right, but the problems we had in tape and in the RP07/8 have recently
blown any old strategy that was probably ok, ... to hell.

Win would like a discussion of how we are going to get somewhere in this
area. At that time, I didn't raise the issue that the discussion is
premature until we had the Redbook cycle complete. Let's get together quick
and meet with Win. The disucssion might take the 2 part form: Past an and
anything we might learn; and the future. Julie throws out the
ireelevant...buy someone so ask Henry to   say who'e for sale and how much
they would cost.   This is a follow onof my memo to the group last week. I
view we have done a series of dumb things each year (eg. making RK07 packs,
maybe ts04, having a redundant rk06/6 and RM03; chosing ISS; chosing Pertec;
and wehave no room for any errors in plan, product selection, execution,
etc). Here it might be appropriate to look at the state of the plans versus
cexecution for the last 3 years.

Command:

EMS 18-MAR-79
14:10:55 530 1
To: John Kevill
CC: John Meyer
From: Gordon Bell
Date: SUN 18-MAR-79 14:10:55 EDT
Subject: Prioritizing the issues and helping in mass storage

I have spent some time thinking about a whole range of issues. I want you to
get a list of the problems so we can start to address them on a one by one
basis. It is increasingly clear that the management depth is a big one, and
I am going to push to have you segment the business acccording to size so that
a single development manager wont' have cover such a big dynamic range. I.e.
let's draw a little table of disks/tape and size (3 bands), giving us 6
entries with products in each. Tell me who is responsible in each of the
boxes or set of boxes. If we get two more managers, then who's going to do
what? John Meyer, this recruiting has to get really high on your list for
recruiting...John has been doing it so far and he's got to delegate!

Intellectually we need to have someone help Gutman. I think Bob Steingart
who works for Tomasic could do it. I want to update the whole Sills charts
to se how we are doing after 2 years. By the way,. let's get Grant to
compare the spending profile in the R80 with that of the lRL01 and RK06/7 to
see (have him face directly) just how long it takes to get something done,

given the breadboard state that things afre in.   Reality can be obtaine by
facing history! I have these charts if you don't, but I think we must have
them to navigate and help your managers be realistic.

By adding more managers who report to you responsible for other size ranges,
it will be possible to have a second manager in CX. With this, I have no
worry about putting more (eg hi end buyout in CX.) there.

Command:
<n>ALPHA OMEGA EMS QUESTIONNAIRE /AO TEAM/RL0.S3.5
1/10/83 1/12/83 8:59 6 12 <>
<n>AO: SECURITY SET UP /RL0.S3.29
2/5/83 2/15/83 11:14 6 4 <>
<n>A1 OFFICE MENU PROD.REQUIREMENTS/L.VARRICHIONE/RLO.S3.21
1/17/83 1/17/83 17:07 4 3 <>
<n>A1 - NOTES AFTER USING A COUPLE OF DAYS/RL0.S3.34
3/1/83 3/12/83 1:11 12 3 <>
<n>BELL OFFICE CONFERENCE TABLE ORDERING INFO/GB1.S8.63
3/20/80 3/20/80 9:04 2 2 <>
<n>BOOK PIC LIST /RL0.S3.12
1/12/83 1/14/83 16:34 9 8 <>
<n>BOOK? - WHAT DO YOU THINK/MARCY GB3.S11.69
4/2/82 8/18/82 11:22 11 3 <>
<n>BURROUGHS--OLD OFFICE INFO NEEDED/GB1.S8.52
3/3/80 3/5/80 11:01 3 4 <>
<n>CHINA REQUEST AS VISITING MEMBER OF RESEARCH - NO/GB3.S11.93
6/1/82 6/1/82 14:20 2 3 <>
<n>CHRISTMAS CARD/GB1.S8.8
12/21/79 3/12/80 12:41 1 7
<>
<n>CMU EXPENSE BILL FOR 3/10 & 11/81/BURKE/RL0.S9.29
3/13/81 3/13/81 11:21 3 5 <>
<n>CRIB SHEET FOR DECMATE II DEMO/RL0.S3.23
2/25/83 2/25/83 10:14 2 2 <>
<n>DECUS TRIP REPORT (12/7/81) /RL1.S11.53
12/29/81 1/4/82 13:28 13 10 <>
<n>DECWORD - FILE MANAGEMENT--SAY IT ISN'T SO/RL0.S9.71
9/2/81 9/28/81 10:20 17 13 <>
<n>DECWORD - INSTALLATION +5 DAYS / GB ET AL/RL0.S9.5
9/28/81 9/28/81 12:13 35 2 <>

<n>DECWORD - NOT FOR US 200 USERS /GB2.S11.11
9/28/81 9/28/81 14:48 13 2 <>
<n>DEC-10 INSTRUCTIONS GB AREA/GB1.S8.47
2/19/80 2/19/80 15:32 2 1 <>
<n>DESK DRAWER DIRECTOR--MJ/GB1.S8.58
3/13/80 4/24/80 13:13 9 4 <>
<n>DICTAPHONE CORPORATION/GB1.S8.16
12/28/79 1/16/80 12:56 3 8
<>
<n>DIGITAL PRESS BOOK REVIEW--INTRODUCTION TO OA/GB1.S9.71
9/29/80 9/30/80 12:57 18 13 <>
<n>DINNER INVITATION LIST -- NYIT /GB3.S11.4
7/23/82 7/28/82 16:30 3 6 <>
<n>DINNER - CARVER MEAD ATTENDEES/GB3.S11.6
6/10/82 6/10/82 12:00 2 1 <>
<n>DINNER: WILKES PICNIC INVITATION/GB1.S9.62
9/3/80 9/3/80 8:50 1 2 <>
<n>DIRECTIONS TO MANCHESTER AND BOSTON STORES /GB3.S11.54
12/29/81 12/29/81 13:32 2 1
<>
<n>DIRECTIONS TO OUTLYING PLANTS.52
12/28/81 12/28/81 10:44 3 1
<>
<n>DIRECTIONS--BAY CLUB, BOSTON, TOP OF 1ST NAT.BANK/RL0.S9.44
7/30/81 7/30/81 11:46 2 1 <>
<n>DIRECT REPORT REVIEW/GB3.S11.72
4/20/82 4/20/82 14:08 3 6 <>
<n>DOC HANLDER/GB1.S8.11
12/26/79 12/26/79 13:18 4 1
<>
<n>DSS - DECISION SUPPORT SYSTEMS--HERE WE GO/GB2.S11.12
9/29/81 9/29/81 15:22 5 9 <>
<n>EMS ARCHIVING--WHAT I WOULD LIKE/GB1.S9.37
7/14/80 10/1/80 14:45 5 4 <>
<n>EMS COOKBOOK - GB & MJ/GB1.S8.54
3/6/80 10/24/80 9:04 7 13 <>
<n>EMS COOKBOOK - LABELS ONLY FOR PRINTING/GB1.S8.55
3/7/80 10/24/80 9:04 11 4 <>
<n>EMS COOKBOOK--HOW TO USE GUIDELINES/GB1.S8.51
2/29/80 10/24/80 14:57 33 29
<>
<n>EMS DISTRIBUTION PERSONAL LIST/GB3.S11.11
10/6/81 3/12/83 1:06 3 9 <>
<n>EMS ENGINEERING SUBSCRIBERS - BUDDY SYSTEM/GB1.S9.32
6/18/80 9/16/80 13:56 9 16 <>

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<n>EMS TIME TEST (GB+MJ)/GB1.S9.19
                          5/20/80 5/20/80 15:23  2     1      <>
<n>EMS--GROUPS ON INSTEAD OF INDIVIDUAL USER/GB1.S8.50
                          2/27/80 10/24/80 14:56     6        7
       <>
<n>EMS/ENGINET GATEWAY INSTRUCTIONS/GB2.S11.13
                          10/1/81 10/1/81 9:10   2     2      <>
<n>EMS/OFFICE AUTOMATION--COMING TO GRIPS /GB1.S8.37
                          2/7/80  3/24/80 14:44  7     10     <>
<n>EMS/OFFICE PROCEDURE RE MAILBOX.33
                          1/24/80 2/12/80 13:35  3     3      <>
<n>ENGINET INSTRUCTIONS FOR MAIL/GB1.S9.65
                          9/8/80  10/1/80 15:06  23    7      <>
<n>ET - FIRST DAY/RL0.S3.32
                          2/10/83 2/10/83 16:52  4     4      <>
<n>EXXON ENTERPRISES VISIT - LIST OF ATTENDEES /RL0.S9.52
                          8/3/81  9/28/81 10:21  3     2      <>
<n>FIRST REVENUE SHIP CHANGES--COPY /GB1.S8.25
                          1/10/80 1/14/80 11:16  13    6      <>
<n>FIRST REVENUE SHIP CHANGES--original/GB1.8.24
                          1/10/80 2/6/80 10:26   34    53     <>
<n>FOLLOWUP FORM/GB1.S9.12
                          5/5/80  10/1/80 14:25  2     7      <>
<n>FORCE 4K BASIC EDIT DEMO TRANSMITTAL LETTER/GB2.S11.9
                          9/28/81 9/28/81 9:55   5     3      <>
<n>FORCE 4K DEMO STEP-BY-STEP INSTRUCTIONS/GB2.S11.6
                          9/28/81 9/28/81 9:56   6     5      <>
<n>FORCE 4K UDK DEFINITIONS FOR DEMO/GB2.S11.7
                          9/28/81 9/28/81 9:51   4     2      <>
<n>FORCE 4K "OFFICE OF THE FUTURE" DEMO ORIGINAL/GB2.S11.8
                          9/28/81 9/28/81 9:14   10    1      <>
<n>FORM - MEETING SCHEDULE SHEET/RL0.S9.53
                          4/9/81  9/28/81 11:51  4     4      <>
<n>FRONT END ASSEMBLY ORG. CHART/GB3.S11.91
                          5/27/82 8/18/82 12:50  12    3      <>
<n>GATEWAY FROM EMS /GB3.S11.12
                          10/6/81 10/14/81 16:33     2        3
       <>
<n>GUTMAN ANNOUNCEMENT/RL0.S9.67
                          6/5/81  9/28/81 11:47  4     4      <>
<n>GWEN "LITTLE LADY FROM IOWA" DEC EMPLOYEE-CELEBRA./RL0.S9.12
                          1/19/80 5/12/81 16:11  3     11     <>
<n>HISTORICAL TECHNOLOGY ORDER FOR 12/79 /GB1.S8.7
                          12/20/79 9/2/80 13:50  5     10     <>
<n>IDECUS DEMO TEAM SET UP/GB1.S9.73
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                         9/30/80 10/29/80 15:54     4        7
       <>
<n>INDEX--WORKING FILES/GB1.S8.20
                         12/31/79 3/10/81 2:19  4     3     <>
<n>INTEL/DEC ATTENDEES 7/22/80 /ATTENDEES/GB1.S9.45
                         7/22/80 7/22/80 11:39  2     5     <>
<n>ITINERARY JAPAN, JUNE - JULY, 1982/GB3.S11.76
                         4/29/82 6/11/82 15:44  13    29    <>
<n>ITINERARY - CDC MEETING, DENVER, 4/1/82 /GB3.S11.65
                         3/25/82 4/1/82 11:57   3     13    <>
<n>ITINERARY - COLORADO JUNGLE (1/21-1/25/79)/GB1.S8.5
                         12/12/79 7/28/80 13:41     4        6
       <>
<n>ITINERARY - COMPRESSION/LLNL/TEKNOWLEDGE, 2/11/RL0.S3.28
                         2/4/83  2/10/83 15:36  5     12    <>
<n>ITINERARY - EUROPE NOV.21 THRU 12/6/80 /GB1.S9.58
                         9/12/80 2/10/81 14:34  12    22    <>
<n>ITINERARY - EUROPE - AUGUST/SEPTEMBER 82/GB3.S11.94
                         6/1/82  6/1/82 14:53   10    1     <>
<n>ITINERARY - GORDON/GWEN - CALIF--6/19-25/GB1.S9.31
                         6/18/80 7/30/80 16:46  6     10    <>
<n>ITINERARY - HOLLAND - 9/26/81 THRU 9/30/RL0.S9.47
                         9/9/81  9/24/81 12:37  4     8     <>
<n>ITINERARY - JULY 1/81  ATLANTA/RL0.S9.45
                         6/29/81 6/29/81 9:28   4     2     <>
<n>ITINERARY - MJ TO SEATTLE/RL0.S3.22
                         2/16/83 2/16/83 13:41  1     1     <>
<n>ITINERARY - MJ - 2/14/81 THRU 2/20 - PHOENIX/RL0.S9.35
                         2/9/81  8/12/81 13:07  3     2     <>
<n>ITINERARY - MOSTEK (DALLAS/CX/BOS), 5/31 TO 6/2/81/RL0.S9.24
                         5/28/81 9/24/81 13:45  4     4     <>
<n>ITINERARY - PALM SPRINGS/KIRKSVILLE - 1/12/83 /RL0.S3.6
                         1/10/83 1/11/83 12:05  6     4     <>
<n>ITINERARY - SYRACUSE UNIVERSITY APRIL 9, 1980/GB.S9.3
                         4/7/80  11/26/80 9:35  2     7     <>
<n>ITINERARY - SYS CONCEPTS, SAN F., 1/19/83/RL0.S3.24
                         1/18/83 1/19/83 8:23   2     4     <>
<n>ITINERARY - TAB - WASH. DC 2/18/RL0.S3.25
                         1/21/83 2/9/83 15:27   2     12    <>
<n>ITINERARY - WASH.DC, GORDON/GWEN, 6/3-5/80 /GB1.S9.17
                         5/20/80 6/2/80 8:30    3     4     <>
<n>ITINERARY - WASH. DC, 12/10/80 FOR NAE ELECTION/GB1.S9.50
                         12/8/80 12/8/80 9:09   1     1     <>
<n>ITINERARY - 1/28/81 THRU 2/7/81 - SAN FRAN./MEXICO/RL0.S9.6
                         1/12/81 6/16/81 15:05  7     16    <>
```

<n>ITINERARY - 10/22 TO 10/31/81
(SEATTLE,ALBQ,COLO,BOSTON/GB3.S11.16
10/19/81 2/23/82 10:42 8 14
<>
<n>ITINERARY - 3/29/81 THRU 4/3/81 - WASH.,OREGON/RL0.S9.34
2/6/81 4/16/81 14:28 1 9 <>
<n>ITINERARY - 3/3-4/80 - WASH. D.C. (GB&GKB)/GB1.S8.34
2/7/80 2/25/80 14:10 2 2 <>
<n>ITINERARY - 4/27 THRU 5/1 - TEXAS, COLOR/GB3.S11.70
4/20/82 6/1/82 10:21 4 16 <>
<n>ITINERARY - 6/9, NY, SIEMENS/RL0.S9.69
6/8/81 9/1/81 11:22 2 6 <>
<n>ITINERARY, LOS ANGELES, MAY 19-MAY 22/GB3.S11.81
5/12/82 7/9/82 13:36 3 11 <>
<n>ITINERARY--CLEVELAND (CASE WESTERN)/GB1.S8.62
3/18/80 3/20/80 9:55 3 2 <>
<n>ITINERARY--PHOENIX, MOTOROLA 3/31/80/GB1.S8.64
3/28/80 3/28/80 15:15 2 1 <>
<n>ITINERARY--SEATTLE/RLO:SECT9.54
8/14/81 10/19/81 11:18 6 9
<>
<n>ITINERARY: CDC/INMENS/2/2/RLO.S3.27
1/31/83 2/2/83 11:41 3 9 <>
<n>ITINERARY: JAPAN/TAIWAN JUNE 19 THRU JULY 8,1982/GB3.S11.18
6/17/82 6/17/82 15:10 6 1 <>
<n>ITINERARY: TAB MEETING DENVER 1/28/83 /RL0.S3.20
1/14/83 1/18/83 10:55 2 6 <>
<n>ITINERY/SCHEDULE CMU VISIT/ 10/9/81 / GB3.S11.13
10/8/81 10/8/81 16:41 3 5 <>
<n>JAPAN CONTACTS SUMMER OF 1978 (JULY)/GB3.S11.3
6/8/82 6/11/82 13:40 7 14 <>
<n>JOB RECLASSIFICATION/MJ. / GB3.S11.71
4/2/82 8/30/82 14:09 16 7 <>
<n>JUNGLETTE/EMS/OOD SECS/GB1.S8.22
1/8/80 1/11/80 9:25 9 3 <>
<n>KEYS TO ENGINEERING COMPOUND (ASSIGNMENT)/GB1.S8.61
3/17/80 3/17/80 11:39 3 1 <>
<n>LIBRARY--CIRC."THE SECRETARY"/CANE/GB1.S9.49
12/1/80 12/1/80 16:56 4 3 <>
<n>MAIL LOG - FORM - FOR FOLLOW UP /GB3.S11.25
11/13/81 6/7/82 15:26 2 <>
<n>MAIN MENU FY82 SCHEDULE/RL0.S9.37
7/20/81 8/17/81 12:49 3 2 <>
<n>MASS 11 WISH LIST: EMS/GENE KUSEKOSKI/3-4/RLO.S3.35
3/4/83 3/12/83 1:10 6 3 <>

<n>MCC ALPHA OMEGA ON EM - GOALS AND TIMETABLE/RL0.S3.7
1/10/83 1/12/83 8:59 2 2 <>
<n>MCC AO LETTER--QUESTIONNAIRE/RL0.S3.11
1/11/83 1/11/83 16:01 5 2 <>
<n>MCC MEMBER LIST/RLO:S3.8
1/11/83 2/16/83 11:53 26 14 <>
<n>MEETING PROCESS--SECRETARIES PART/GB1.S9.35
6/25/80 11/5/80 14:45 6 5 <>
<n>MESSAGES - UDK DEFINED/RL0.S9.33
3/20/81 11/13/81 14:46 3 6
<>
<n>MESSAGE FORM - GB OFFICE/GB2:SECT11.3
6/10/81 3/12/83 0:39 1 9 <>
<n>MESSAGE FORM/GB1.S8.4
12/12/79 7/28/80 13:41 1 5
<>
<n>MESSAGE LOG/GB1.S8.2
12/12/79 9/2/80 14:24 111 202 <>
<n>MESSAGE SPEC - GB OFFICE/GB2.S11.2
6/10/81 8/25/81 10:49 2 43 <>
<n>MESSAGE SPEC/GB1.S8.3
12/12/79 4/3/80 14:29 1 69 <>
<n>MICROFILM FILE INDEX FROM CIRCA '59 - TO 12/31/79/GB1.S9.2
3/21/80 12/11/80 12:16 4 20
<>
<n>MJ # OF WORKING PILES/GB1.S9.25
6/12/80 10/1/80 14:31 3 6 <>
<n>MUSEUM BUDGET FY81--YEAR-TO-DATE ACCRUAL SHEET/GB1.S9.41
7/17/80 7/24/80 17:31 5 7 <>
<n>MUSEUM BUDGET REQUEST/GB1.S8.48
2/21/80 2/21/80 9:29 2 2 <>
<n>MUSEUM BUDGET -LABOR CHARGES/GB1.S9.27
6/12/80 10/1/80 14:39 8 2 <>
<n>MUSEUM CAP BUDGET PREDICTION/GB1.S9.40
7/17/80 7/18/80 11:07 3 3 <>
<n>MUSEUM CURATOR JOB DESCRIPTION/SALARY RANGES/GB1.S9.43
7/17/80 7/17/80 14:43 1 1 <>
<n>MUSEUM DIRECTORY--HOW CAN WE ZIP IT UP/GB1.S8.44
2/15/80 2/15/80 13:05 5 4 <>
<n>MUSEUM INVOICE FORM/GB1.S9.46
7/24/80 10/1/80 14:51 3 5 <>
<n>MUSEUM JOB DESCRIPTION INQUIRIES--AAM/GB1.S9.38
7/14/80 7/14/80 15:14 3 3 <>
<n>MUSEUM OFFICE BLURB/GB1.S8.59
3/13/80 5/15/80 12:16 12 20 <>

<n>MUSEUM OVERRUN--WHERE IS IT/BERTRAND GWEN/GB1.S9.42
7/17/80 10/1/80 14:48 4 4 <>
<n>MUSEUM--LEGAL--GOING INTO A NEW LEAGUE/GB1.S8.45
2/15/80 2/15/80 4:58 3 3 <>
<n>NAE FORM LETTER OF TRANSMITTAL/GB1.S9.16
5/19/80 10/1/80 14:29 2 18 <>
<n>NAE SPEC/GB1.S9.23
5/23/80 9/10/80 13:32 1 9 <>
<n>NAE TABULATION/RANKING/GB1.S9.24
10/27/80 10/29/80 11:01 13 13
<>
<n>NAE 18TH ELECTION STATUS FORM/GB1.S9.22
5/23/80 10/1/80 14:30 2 13 <>
<n>NAE 18TH ELECTION TABULATION FORMS/GB1.S9.5
10/22/80 10/27/80 14:07 25 8
<>
<n>NEBULA COMMANDS--LIST OF VMS TRICKS/RL0.S3.30
2/8/83 3/12/83 1:12 6 17 <>
<n>NEBULA - NEED AN EXPANDER BOX/RL0.S3.15
1/13/83 2/22/83 10:55 4 6 <>
<n>NEWSPAPER ARTICLE REBUTTAL RE SECRETARIES/GB3.S11.15
3/23/82 8/30/82 14:11 6 7 <>
<n>OA OFFICE DEMO CARD - MJ - WPS DEMO/RL0.S9.2
1/12/81 3/12/83 0:16 1 14 <>
<n>OCE - FORM FOR HOW MY DAY IS SPENT/GB1.S8.23
1/9/80 1/14/80 11:16 6 7 <>
<n>OCE - TIME CHARTS/GB1.S8.29
1/17/80 1/23/80 13:56 3 5 <>
<n>OC WOODS AGENDA FOR 1/15 & 1/16/80/GB1.S8.27
1/12/80 1/12/80 11:26 6 3 <>
<n>OFFICE CONFIGURATION--NEBULA/DECMATES/RL0.S3.4
1/10/83 3/12/83 1:19 4 3 <>
<n>OFFICE FURNITURE, A&SG, TRIP REPORT/GB1.S9.20
7/3/80 7/3/80 14:12 8 3 <>
<n>OFFICE OF THE FUTURE SEMINAR RESULTS/GB1.S8.12
12/26/79 12/26/79 4:14 4 5
<>
<n>OFIS CONCEPTS - REVIEW /MELISSA GALLO /GB3.S11.80
5/11/82 5/17/82 10:51 4 3 <>
<n>OFIS DEMO--NOT FOR ME/RL0.S9.64
6/3/81 9/28/81 12:23 8 5 <>
<n>OFIS DOCUMENTS - MJ COMMENTS /GB3.S11.56
1/4/82 1/4/82 13:35 24 1 <>
<n>OFIS REVIEW - COMMENTS ON/GB3.S11.67
3/31/82 3/31/82 12:54 5 2 <>

<n>OFIS SPECS V0 - COMMENTS /RL0.S9.28
9/28/81 3/12/83 0:17 7 2 <>
<n>OFIS - DIRECTORY OF WHO IS DOING WHAT AT DEC/GB1.S8.65
3/31/80 4/2/80 11:20 1 2 <>
<n>ORG CHART TEST FOR CLARITY/GB1.S8.15
12/27/79 12/28/79 11:21 10 13
<>
<n>PERSONNEL JUSTIFICATION/BELL'S OFFICE/GB3.S11.77
5/6/82 6/15/82 10:28 5 3 <>
<n>PROPERTY PASS - INDEFINITE / BILL DUGGEN /GB1.S9.36
11/24/80 11/24/80 11:24 2 1
<>
<n>PROPERTY PASS--GB'S WS278 (INDEFINITE)AT HOME/RL0.S9.48
3/27/81 5/6/81 11:00 3 2 <>
<n>PURCHASING--MJ CAN SIGN FOR 69F PO'S TO 250/GB1.S8.32
1/22/80 1/22/80 13:52 2 1 <>
<n>REFERENCES: LAURIE BURROUGHS/GB3.S11.78
5/7/82 5/19/82 9:19 5 5 <>
<n>REFERENCE: VICKI WEISE/RL0.S3.31
2/9/83 2/9/83 12:38 4 1 <>
<n>RETRIEVAL*, MUST BE AUTOMATIC/TRAVIS,MAYER/GB1.S9.11
10/7/80 11/13/80 12:25 9 11
<>
<n>RPI:LETTER TO ANDREA WILSON/RLO.S3.19
1/14/83 1/26/83 11:25 3 7 <>
<n>RPI:MEMO TO DEC ATTENDEES/RLO.S3.18
1/14/83 1/17/83 13:56 2 4 <>
<n>SALARY REVIEWS FOR ENGINEERING /RL0.S9.27
4/28/81 3/12/83 0:18 6 7 <>
<n>SANDIA--WHO CAME 3/12/80/GB1.S8.57
3/12/80 4/2/80 11:15 3 6 <>
<n>SECURITY AT BELL'S / GB3.S11.38
11/19/81 11/20/81 0:39 2 2
<>
<n>SECURITY--GORDON BELL'S PERSONAL PROPERTY/GB1.S9.15
10/8/80 10/17/80 14:18 4 3
<>
<n>SEC VIEWS - 1980 ARTICLE FOR MARCH,1980/GB1.S8.53
3/5/80 1/30/81 15:02 8 10 <>
<n>SEMINAR ANNOUNCEMENTS, 6/1 & 6/4/GB3.S11.95
6/3/82 6/3/82 15:29 6 1 <>
<n>SEMINAR GANTT CHART/ GB3.S11.22
11/2/81 11/3/81 11:25 11 7 <>
<n>SEMINAR PRODUCTION SCHEDULE/SWAT1/ GB3.S11.21
11/2/81 11/2/81 14:56 17 2 <>

<n>SEYBOLD REPORT--SHE IS RIGHT ON / TJ /RL0.S9.50
9/22/81 9/28/81 13:04 15 9 <>
<n>SLIDES - AUTOMATIC INDEXING /RL0.S9.10
1/16/81 9/29/81 14:04 8 26 <>
<n>SLIDES - CALENDAR SHOWING 2 DAYS /RL0.S9.11
1/16/81 9/29/81 14:13 8 28 <>
<n>SLIDES - CALENDAR SHOWING 7 DAYS/RL0.S9.3
3/5/81 9/29/81 13:09 20 17 <>
<n>SLIDES - MAIL & SIG LOG /RL0.S9.8
1/14/81 9/29/81 14:10 3 13 <>
<n>SLIDES - MESSAGE LOG/RL0.S9.7
1/14/81 9/29/81 13:50 7 17 <>
<n>SLIDES - TEL DIRECTORY /RL0.S9.9
1/14/81 9/29/81 13:49 7 19 <>
<n>STORES - ARE THEY THE WAY?/GB3.S11.74
5/4/82 7/14/82 12:58 8 3 <>
<n>STRATEGY MEETING MISSED THE MARK--3/13/80/GB1.S8.60
3/14/80 3/14/80 9:06 5 1 <>
<n>TAG PROGRAM INPUTS/ANN JENKINS/GB1.S9.48
7/28/80 10/1/80 14:51 6 3 <>
<n>TAG PROGRAM MEETING/GB1.S9.63
9/4/80 10/1/80 14:56 2 4 <>
<n>TAG, DIARY OF A TAG/GB1.S9.39
7/16/80 7/16/80 8:54 4 2 <>
<n>TALK OUTLINE - WPS HOUSEKEEPING GUIDE/GB3.S11.79
5/11/82 5/11/82 11:19 17 1 <>
<n>TALK - EUROPEAN SALES MEETING/GB3.S11.20
10/22/81 6/7/82 15:25 11 9 <>
<n>TALK - GETTING ORGANIZED WITH WPS /GB2.S11.10
9/28/81 9/28/81 12:50 8 1 <>
<n>TALK - WPS SYMPOSIUM 5/81 /RL0.S9.15
9/28/81 9/28/81 12:29 5 1 <>
<n>TALK--5 MIN PEEK AT OA/RL0.S9.43
3/23/81 4/13/81 8:55 3 7 <>
<n>TELEPHONE BOOK COVER FOR G BELL/GB1.S8.56
3/11/80 1/12/81 15:48 13 15 <>
<n>THEME PRINT WHEEL - HOW TO/LOCKHEED/GB3.S11.89
5/24/82 5/24/82 14:55 2 2 <>
<n>THOUGHTS/GB3.S11.14
7/14/82 8/30/82 14:07 17 9 <>
<n>VOICEMAIL - HOW SECURE, AND OTHER QUESTIONS/RL0.S3.14
1/13/83 1/13/83 10:14 4 5 <>
<n>VOICEMAIL - LOOK WHAT I'VE DONE TO YOU/RL0.S3.13
1/13/83 1/13/83 10:07 5 6 <>
<n>WPS APPLICATION NOTEBOOK - AUTO INDEXING/RL0.S9.18

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                          1/25/81 1/25/81 1:24  10   2     <>
<n>WPS APPLICATION NOTEBOOK - CALENDAR/RL0.S9.17
                          1/25/81 8/5/81 9:00   22   4     <>
<n>WPS APPLICATION NOTEBOOK - MAIL LOG-SIG LOG/RL0.S9.20
                          1/25/81 1/25/81 2:00  6    2     <>
<n>WPS APPLICATION NOTEBOOK - MESSAGE LOG/RL0.S9.19
                          1/25/81 1/25/81 1:45  9    3     <>
<n>WPS APPLICATION NOTEBOOK - TELEPHONE DIRECTORY/RL0.S9.21
                          1/25/81 3/12/83 0:19  10   3     <>
<n>WPS APPLICATION NOTEBOOK--TABLE OF CONTENTS/RL0.S9.16
                          1/25/81 5/12/81 16:13 4    7     <>
<n>WPS APPLIC NOTEBOOK - WPS HOUSKEEPING GUIDE(W/O EMS)/RL0.S9.22
                          1/25/81 1/25/81 2:41  87   4     <>
<n>WPS DIG AND REVIEW BOARD FOR MM/RL0.S9.57
                          8/17/81 8/17/81 13:03 3    1     <>
<n>WPS DIG NEWS - GOALS AND OBJECTIVES/RL0.S9.42
                          3/2/81  3/9/81 9:43   4    8     <>
<n>WPS DIG NEWS-ARTICLE: APPLICATION JUNE 81/RL0.S9.23
                          3/7/81  6/29/81 11:49 1    3     <>
<n>WPS DIG - LIST OF PROJECTS TO DO /RL0.S9.39
                          2/26/81 2/27/81 9:32  9    4     <>
<n>WPS DIG - WHAT HATH WE WROUGHT?/RL0.S9.62
                          8/19/81 8/25/81 12:35 6    7     <>
<n>WPS FILE MANAGEMENT - RETRIEVAL IDEA AS OF 10/7/80/RL0.S9.72
                          9/2/81  3/12/83 0:20  10   4     <>
<n>WPS HARDWARE/SOFTWARE REVIEW/TRAVIS/GB1.S8.30
                          1/17/80 1/24/80 11:53 2    5     <>
<n>WPS OFFICE HOUSEKEEPING GUIDE--BELL'S OFFICE/GB1.S9.4
                          6/20/80 10/23/80 9:34 7    16    <>
<n>WPS SALES MEETING - SLIDE SEQUENCE FOR TALK/RL0.S9.32
                          2/4/81  9/29/81 12:51 9    10    <>
<n>WPS SOFTWARE 4.4.11--SERIOUS COMM PROBLEMS/RL0.S9.25
                          4/28/81 4/29/81 16:34 5    9     <>
<n>WPS SYMPOSIUM Q&A MAILED TO ATTENDEES /RL0.S9.14
                          9/28/81 9/28/81 12:27 30   1     <>
<n>WPS SYMPOSIUM--THANK YOU/REACTOR PANELISTS/RL0.S9.55
                          5/4/81  5/4/81 13:29  3    2     <>
<n>WPS TEST SITE--FEEDBACK ON PRELIMINARY MANUALS/GB1.S9.56
                          8/18/80 8/18/80 9:14  2    1     <>
<n>WPS - WHY OUR WPS IS BETTER THAN THE COMPETITION/RL0.S9.49
                          7/31/81 9/15/81 16:47 25   17    <>
<n>WPS/EMS + OTHER IDEAS/GB1.S8.31
                          1/21/80 1/22/80 16:04 2    3     <>
<n>WPS/EMS--FEATURES NEEDED IN TANDEM/GB1.S8.28
                          1/15/80 1/15/80 13:46 5   3      <>
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<n>WPS200 OR AN ALTERNATIVE--YOU ASKED FOR IT/BUZZ/GB1.S9.29
6/13/80 3/5/81 9:57 13 11 <>
<n>WPS200 SERIES AD - UGH! /EMS.58
9/23/81 9/28/81 13:02 10 7 <>
<n>WPS200 SYS MGR COURSE CRITIQUE/ADDITIONS/ JOHNSTON/GB1.29.30
6/18/80 3/5/81 9:44 18 11 <>
<n>WPS200--1 YEAR LATER/GB/GB1.S9.57
12/16/80 3/5/81 9:51 14 26 <>
<n>WT278 - DISKLESS WP - MY COMMENTS/ GUTMAN/GB2.S11.5
9/28/81 9/28/81 14:46 3 2 <>
<n>XMAS CARD G BELL /GB1.S9.66
12/24/80 12/24/80 9:14 2 4
<>
<n>XMAS CARD TO OOD SECS/GB1.S9.68
12/24/80 12/24/80 10:26 2 1
<>
<n>XMAS THANKS/GB1.S8.10
1/7/80 1/12/80 10:09 17 4 <>

<subj>NATIONAL RESEARCH COUNCIL
<from>BLACKBURN, JACK F.
<to>BELL, JAMES
<date>80/5/28
<date rec>5/30/80
<log#>5-74
<dispo/date>
<message>
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<subj>IBM
<from>HADDAD, JERRIER A.
<to>BELL, GORDON
<date>80/5/27
<date rec>5/30/80
<log#>5-73
<dispo/date>
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<subj>SOFTWARE ENGINEERING MONTHLY REPORT (BOOK #1)
<from>SHELDON, LIZ
<to>BELL, GORDON
<date>80/5/30
<date rec>5/30/80
<log#>5-72
<dispo/date>POSTCARD RET 6/9/80
<message>YES, I WILL ATTEND BOTH DINNER AND DAY LONG MEETING
<answer>
<f/u>
<filed>CALENDAR - NOV-80
<ret-gb>
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<subj>ROPES & GRAY
<from>BEARD, JOHN E.
<to>HINDLE, WINSTON, R.
<date>80/5/14
<date rec>5/30/80
<log#>5-71
<dispo/date>GRANT SAVIERS - 5/30/80
<message>FYI
<answer>PLEASE BE CAREFUL, I'VE HEARD MANY NEGATIVES FROM EX-EMPLOYEES (ENGINEERS, VP MFG, VP ENG.) I'LL BE GLAD TO PROVIDE SOME REFERENCES IF THERE IS ANY INTEREST. GRANT. - 6/6/80
<f/u>
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<subj>STATE UNIVERSITY OF NEW YORK AT ALBANY
<from>ROBINSON, ROBERT J.
<to>BELL, GORDON
<date>80/5/20
<date rec>5/29/80
<log#>5-70
<dispo/date>ORIGINAL RETURNED (CC:HEIDI) - 5/30/80
<message>WHAT HATS BEEN WROUGHT? WE DO THIS? WHAT TO DO?
<dispo/date>TO LETTERBOOK (GB1.S5.16) - 7/1/80
<answer>
<f/u>
<filed>
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<subj>ROCKWELL GALLERY
<from>ROCKWELL, SVETLANA
<to>BELL, GORDON
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<date rec>5/29/80
<log#>5-69
<dispo/date>
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<subj>NATIONAL ACADEMY OF ENGINEERING
<from>NELSON, MRS. E. HENRIETTE
<to>BELL, GORDON
<date>80/5/27
<date rec>5/29/80
<log#>5-68
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<subj>TWX--COMPUTER SEMINARS
<from>ABE, JIRO (TKY1--T024)
<to>MCNAMARA, JOHN E.
<date>80/5/29
<date rec>5/29/80
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<dispo/date>
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<subj>SOUTHWEST RESEARCH INSTITUTE
<from>ABRAMSON, H. NORMAN
<to>NELSON, MRS. HENRIETTE
<date>80/5/23
<date rec>5/28/80
<log#>5-66
<dispo/date>
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<subj>UNIVERSITY OF CALIFORNIA, BERKELEY
<from>KAHAN, PROFESSOR W.

<to>BELL, GORDON
<date>80/5/23
<date rec>5/28/80
<log#>5-65
<dispo/date>ORIGINAL RETURNED TO GB (CC: SAM) - 5/28/80
<message>LET'S TALK. THIS IS A MESS! WE ARE AT LEAST 50% IN THE WRONG.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>TWX--INFOTECH LIMITED
<from>START, CAROL
<to>BELL, GORDON
<date>80/5/27
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<subj>NATIONAL SCIENCE FOUNDATION
<from>RESNIKOFF, HOWARD L.
<to>BELL, GORDON
<date>80/5/23
<date rec>5/27/80
<log#>5-63
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<subj>JULIUS TOFIAS & COMPANY INC.
<from>TOFIAS, DONALD
<to>BELL, GORDON
<date>80/5/23
<date rec>5/27/80
<log#>5-62
<dispo/date>HOLMAN 5/27/80
<message>FYI
<answer>
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<subj>INTEL CORPORATION
<from>O'NEIL, RUSS
<to>BELL, GORDON
<date>80/5/23
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<log#>5-61
<dispo/date>FULLER 5/27/80
<message>GOING?
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<subj>PURDUE UNIVERSITY
<from>REEN, NOEL
<to>BELL, GORDON
<date>80/5/8
<date rec>5/23/80

<log#>5-60
<dispo/date>BILL DEMMER - 5/28/80
<message>YOURS.
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<f/u>
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<subj>EDUCOM
<from>LANDIS, CAROLYN P.
<to>BELL, GORDON
<date>80/5/10
<date rec>5/23/80
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<dispo/date>CAROLYN P. LANDIS - 6/5/80
<message>FILLED OUT THE MAILING LIST AND RETURNED.
<answer>
<f/u>
<filed>
<ret-gb>
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<subj>JRS INDUSTRIES INC.
<from>WARSHAWSKY, ERWIN H.
<to>BELL, GORDON
<date>80/5/19
<date rec>5/22/80
<log#>5-58
<dispo/date>PAT WHITE - 5/28/80
<message>YOURS.
<answer>
<f/u>
<filed>
<ret-gb>
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<subj>UNIVERSITY OF MASSACHUSETTS
<from>JONES, RUSSEL C.
<to>BELL, GORDON
<date>80/5/16
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<subj>JAPANESE COMPUTER DEVELOPMENTS
<from>FRENCH, JON M.
<to>BELL, GORDON
<date>80/5/21
<date rec>5/22/80
<log#>5-56
<dispo/date>TO LETTERBOOK (GB1.S4.17) - 5/30/80
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>RUTHERFORD AND APPLETON LABORATORIES
<from>HOPGOOD, F R A
<to>BELL, GORDON
<date>80/5/13
<date rec>5/21/80
<log#>5-55
<dispo/date>
<message>
<answer>

<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>FLOATING POINT SYSTEMS INC.
<from>SIMON, MORTON C.; SHOSTACK, KENNETH E.
<to>BELL, GORDON
<date>80/5/20
<date rec>5/21/80
<log#>5-54
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>THANK YOU LETTER--COMPUTER ENGINEERING BOOK
<from>MICHAEL, SCOTT
<to>BELL, GORDON
<date>80/5/12
<date rec>5/21/80
<log#>5-53
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>TRC--TECHNOLOGY RECOGNITION CORPORATION
<from>FERRARI, LORRAINE D.
<to>BELL, GORDON

<date>80/5/?
<date rec>5/19/80
<log#>5-52
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>INFOTECH
<from>START, CAROL
<to>BELL, GORDON
<date>80/5/7
<date rec>5/19/80
<log#>5-51
<dispo/date>TWX SENT - 5/20/80
<message>I AGREED TO SPEAK AND INTEND TO DELIVER THE PAPER BY JUNE 15. I WOULD LIKE TO MAKE ALL TRAVEL PLANS INDEPENDENT OF INFOTECH; IS THIS A PROBLEM?
<answer>
<f/u>
<filed>
<ret-gb>YES TO MJ - 5/20/80
<roll>
<>

<subj>XEROX
<from>PAKE, GEORGE E.
<to>BELL, GORDON
<date>80/5/15
<date rec>5/19/80
<log#>5-50
<dispo/date>
<message>
<answer>
<f/u>
<filed>N

<ret-gb>
<roll>
<>

<subj>KENT STATE UNIVERSITY
<from>VARGA, RICHARD S.; WANG, PAUL S.
<to>BELL, GORDON
<date>80/5/14
<date rec>5/19/80
<log#>5-49
<dispo/date>TO LETTERBOOK (GB1.S4.10) - 5/21/80
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>MAILGRAM--CONGRATULATIONS ON DEC INTEL XEROX ETHERNET ANNOUNCEMENT
<from>METCALFE, BOB
<to>BELL, GORDON
<date>80/5/16
<date rec>5/19/80
<log#>5-48
<dispo/date>
<message>
<answer>
<f/u>
<filed>N
<ret-gb>
<roll>
<>

<subj>EXCEL PERSONNEL (RESUME'--R-370)
<from>RYE, MARY
<to>BELL, GORDON
<date>80/5/7

<date rec>5/19/80
<log#>5-47
<dispo/date>ARMAND LA VALLE - 5/20/80
<message>PLEASE HANDLE.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>NATIONAL ACADEMY OF ENGINEERING
<from>NELSON, E. HENRIETTE
<to>BELL, GORDON
<date>80/5/16
<date rec>5/19/80
<log#>5-46
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>IBM
<from>LANDAUER, ROLF
<to>BELL, GORDON
<date>80/5/13
<date rec>5/19/80
<log#>5-45
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>NSF PROPOSAL FOR REVIEW - WAYNE STATE
<from>WALLACH, YEHUDA
<to>BELL, GORDON
<date>80/5/?
<date rec>5/19/80
<log#>5-44
<dispo/date>CIRC. LLOYD DICKMAN, BILL STRECKER, SAM FULLER - 5/19/80
<message>DID I MISS ANYTHING OR IS THIS JUST ANOTHER POOR PROPOSAL? NOTE: THE FORM WAS RETURNED TO WALLACH 5/19 + FILED: NSF REVIEW.
<answer>
<f/u>6/13/80
<filed>
<ret-gb>
<roll>
<>

<subj>TWX--BUSINESS ETHICS POLICY PROCEDURES
<from>DOYLE, MATT
<to>BELL, GORDON
<date>80/5/19
<date rec>5/19/80
<log#>5-43
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>COMPUTING REVIEWS
<from>BLUM, ARTHUR R.
<to>BELL, GORDON
<date>80/5/12
<date rec>5/16/80

<log#>5-42
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>

<subj>LINCOLN-SUDBURY REGIONAL HIGH SCHOOL
<from>HARVEY, BRIAN
<to>BELL, GORDON
<date>80/5/12
<date rec>5/16/80
<log#>5-41
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN
<from>VAN VALKENBURG, M.E.
<to>BELL, GORDON
<date>80/5/13
<date rec>5/15/80
<log#>5-40
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>NATIONAL SCIENCE FOUNDATION
<from>HIGGINS, (MRS.) DARCEY F.
<to>BELL, GORDON
<date>80/5/7
<date rec>5/14/80
<log#>5-39
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>NATIONAL ACADEMY OF ENGINEERING
<from>NELSON, MRS. HENRIETTE E.
<to>BELL, GORDON
<date>80/5/9
<date rec>5/14/80
<log#>5-38
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>BOARD OF OVERSEERS OF HARVARD COLLEGE
<from>SHENTON, ROBERT
<to>BELL, GORDON
<date>80/5/1
<date rec>5/14/80
<log#>5-37
<dispo/date>
<message>
<answer>
<f/u>

<filed>
<ret-gb>
<roll>
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<subj>HARVARD UNIVERSITY
<from>OETTINGER, ANTHONY G.
<to>BELL, GORDON
<date>80/5/9
<date rec>5/14/80
<log#>5-36
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>GEORGIE SOUTHERN COLLEGE
<from>WALTER, KENNETH G.
<to>OLSEN, KENNETH H.
<date>80/5/2
<date rec>5/14/80
<log#>5-35
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>MIT
<from>MOSES, JOEL
<to>BELL, GORDON
<date>80/5/12

<date rec>5/14/80
<log#>5-34
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
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<subj>NATIONAL TOOLING & MACHINING ASSOCATION
<from>HARDMAN, WILLIAM E.
<to>BELL, GORDON
<date>80/5/8
<date rec>5/14/80
<log#>5-33
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>MIT
<from>NEGROPONTE, NICHOLAS
<to>HEISLER, BILL
<date>80/5/7
<date rec>5/12/80
<log#>5-32
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>BATTELLE COLUMBUS LABORATORIES
<from>WILLS, ROGER
<to>BELL, GORDON
<date>80/6/5
<date rec>5/12/80
<log#>5-31
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>UNIVERSITY OF COLORADO AT COLORADO SPRINGS
<from>WIATROWSKI, CLAUDE A.
<to>BELL, GORDON
<date>80/5/6
<date rec>5/12/80
<log#>5-30
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>FUJITSU AMERICA INC.
<from>HISANO, KAZUO
<to>BELL, GORDON
<date>80/5/8
<date rec>5/12/80
<log#>5-29
<dispo/date>GRANT SAVIERS - 5/19/80
<message>

<answer>SILLS CONCENTRATED ON THE JAPANESE AT NCC. WE WILL GIVE YOU A REPORT WHEN COMPLETE. - 5/23/80
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>BALL COMPUTER PRODUCTS DIVISION
<from>BRAVO, RICHARD
<to>BELL, GORDON
<date>80/5/8
<date rec>5/12/80
<log#>5-28
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>SHURGART TECHNOLOGY
<from>CONNER, FINIS F.
<to>BELL, GORDON
<date>80/5/5
<date rec>5/12/80
<log#>5-27
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>MCGRAW-HILL BOOK COMPANY

<from>BAFFER, CHRISTOPHER
<to>BELL, GORDON
<date>80/5/?
<date rec>5/12/80
<log#>5-26
<dispo/date>RETURNED TO CHRISTOPHER BAFFER (CC:MJ) - 5/19/80
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>NATIONAL SCIENCE FOUNDATION (1979 SURVEY)
<from>ATKINSON, RICHARD C.
<to>BELL, GORDON
<date>80/5/?
<date rec>5/9/80
<log#>5-25
<dispo/date>BILL THOMPSON - 5/19/80
<message>FYI.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>ASSOCIATION OF SCIENCE-TECHNOLOGY CENTER
<from>TEMPLETON, MICHAEL
<to>OLSEN, KENNETH H. --(FORWARDED TO GWEN)
<date>80/5/2
<date rec>5/9/80
<log#>5-24
<dispo/date>RESPONDED WITH A LETTER - 5/20/80
<message>
<answer>
<f/u>
<filed>

<ret-gb>
<roll>
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<subj>NATIONAL SCIENCE FOUNDATION
<from>NATIONAL SCIENCE FOUNDATION
<to>BELL, GORDON
<date>80/5/?
<date rec>5/9/80
<log#>5-23
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>GEORGIA INSTITUTE OF TECHNOLOGY
<from>PEATMAN, JOHN B.
<to>BELL, GORDON
<date>80/5/6
<date rec>5/9/80
<log#>5-22
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>SUN-FLEX COMPANY INC.
<from>ROSESTONE, DOUGLAS
<to>BELL, GORDON
<date>80/5/6
<date rec>5/9/80
<log#>5-21
<dispo/date>BILL PICOTT - 5/19/80
<message>YOURS.

<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>IBM
<from>FOUNTAIN, JOSEPH P.
<to>BELL, GORDON
<date>80/5/9
<date rec>5/9/80
<log#>5-20
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>GENERAL ELECTRIC
<from>SHAW, CHARLES A.
<to>BELL, GORDON
<date>80/4/30
<date rec>5/9/80
<log#>5-19
<dispo/date>BOB GLORIOSO - 5/15/80 (CC: BILL PICOTT)
<message>I'LL SEND HIM TO YOU.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>DEFENSE ADVANCED RESEARCH PROJECTS AGENCY
<from>KAHN, ROBERT E.
<to>BELL, GORDON

<date>80/5/6
<date rec>5/9/80
<log#>5-18
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>CORPORATION FOR PUBLIC BRAODCASTING
<from>ROCKOFF, MAXINE L.
<to>BELL, GORDON
<date>80/5/6
<date rec>5/9/80
<log#>5-17
<dispo/date>ARMAND LA VALLE - 5/15/80
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>TWX--THANK YOU
<from>WINTER, JOHN (MXDF)
<to>BELL, GORDON
<date>80/5/8
<date rec>5/8/80
<log#>5-16
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
y inc.

<from>ROSESTONE, DOUGLAS
<to>BELL, GORDON
<date>80/5/6
<date rec>5/9/80
<log#>5-21
<dispo/date>BILL PICOTT - 5/19/80
<message>YOURS.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>IBM
<from>FOUNTAIN, JOSEPH P.
<to>BELL, GORDON
<date>80/5/9
<date rec>5/9/80
<log#>5-20
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>GENERAL ELECTRIC
<from>SHAW, CHARLES A.
<to>BELL, GORDON
<date>80/4/30
<date rec>5/9/80
<log#>5-19
<dispo/date>BOB GLORIOSO - 5/15/80 (CC: BILL PICOTT)
<message>I'LL SEND HIM TO YOU.
<answer>
<f/u>
<filed>
<ret-gb>

<roll>
<>

<subj>DEFENSE ADVANCED RESEARCH PROJECTS AGENCY
<from>KAHN, ROBERT E.
<to>BELL, GORDON
<date>80/5/6
<date rec>5/9/80
<log#>5-18
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>CORPORATION FOR PUBLIC BRAODCASTING
<from>ROCKOFF, MAXINE L.
<to>BELL, GORDON
<date>80/5/6
<date rec>5/9/80
<log#>5-17
<dispo/date>ARMAND LA VALLE - 5/15/80
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>TWX--THANK YOU
<from>WINTER, JOHN (MXDF)
<to>BELL, GORDON
<date>80/5/8
<date rec>5/8/80
<log#>5-16

<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>CASE WESTERN RESERVE UNIVERSITY
<from>ROSE, CHARLES W.
<to>BELL, GORDON
<date>80/4/30
<date rec>5/7/80
<log#>5-15
<dispo/date>
<message>
<answer>
<f/u>
<filed>CASE WESTERN RESERVE UNIVERSITY - 5/19/80
<ret-gb>
<roll>
<>

<subj>NORTHERN RESEARCH AND ENGINEERING CORPORATION
<from>PLATT, MELVIN
<to>BELL, GORDON
<date>80/4/10
<date rec>5/6/80
<log#>5-14
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>HOUZE, SHOURDS & MONTOGOMERY INC.
<from>HOUZE, BILL
<to>BELL, GORDON
<date>80/4/29
<date rec>5/6/80
<log#>5-13
<dispo/date>
<message>NO REFERRALS
<answer>
<f/u>
<filed>N
<ret-gb>
<roll>
<>

<subj>RESUME' - NAVAL POSTGRADUATE SCHOOL
<from>KIRK, DONALD E.
<to>BELL, GORDON
<date>80/4/25
<date rec>5/6/80
<log#>5-12
<dispo/date>ARMAND LA VALLE - 5/16/80 (CC:ANITA JONES--CMU, F/U)
<message>CAN BOB GLORIOSO OR SAM FULLER PROVIDE HOME OR SELL HIS SVC. HAVE ARMAND FIND OUT HOW MUCH + WHAT HE'D DO.
<answer>ARMAND SAYS THAT BILL AVERY IS CALLING KIRK--NO FIT IN CE.7/7/80
<f/u>5/28/80
<filed>
<ret-gb>
<roll>
<>

<subj>CARNEGIE-MELLON UNIVERSITY
<from>REDDY, RAJ
<to>BELL, GORDON
<date>80/4/7
<date rec>5/6/80
<log#>5-11
<dispo/date>ORIGINAL TO F/U (CC:OOD, ECKHOUSE, GLORIOSO) -

5/30/80
<message>INTERESTED? THEY USE OUR MACHINES - CAN WE USE THEIR WORK?
<answer>
<f/u>6/13/80
<filed>
<ret-gb>
<roll>
<>

<subj>AFIPS (ANNALS OF HISTORY OF COMPUTING)
<from>GALLER, BERNARD A.
<to>BUCHHOLZ, DR. WERNER
<date>80/4/30
<date rec>5/6/80
<log#>5-10
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>IBM
<from>ARFMAN, PATRICIA M.
<to>BELL, GORDON
<date>80/5/1
<date rec>5/6/80
<log#>5-9
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>HARVARD UNIVERSITY
<from>WHEATLAND, DAVID P.
<to>BELL, GORDON
<date>80/5/2
<date rec>5/5/80
<log#>5-8
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>INTERSIL INSIGHT
<from>PHELPS, MEL
<to>BELL, GORDON
<date>80/5/?
<date rec>5/5/80
<log#>5-7
<dispo/date>CADY 5/8/80
<message>WE HAD THIS YEARS AGO WITH THE TERMINALS (RD-TYPE?) MADE BY THE OLD MODULES GROUP. THEY WERE LOW COST, SERIAL AND ANALOG COULD BE CARRIED OVER THEM. WE HAVE TO GET BACK HERE.
<answer>
<f/u>5/23/80
<filed>
<ret-gb>
<roll>
<>

<subj>NATIONAL ACADEMY OF ENGINEERING
<from>BRIAN, P.L. THIBAUT
<to>MEMBERS
<date>80/4/30
<date rec>5/2/80
<log#>5-6

<dispo/date>ATTACHED TO LOG #4-62 WHICH IS FILED TO LETTERBOOK (GB1.S3.63) - 5/7/80
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>RESUME' - PHILLIP J. KURRLE
<from>KURRLE, PHILLIP J.
<to>BELL, GORDON
<date>80/4/28
<date rec>5/2/80
<log#>5-5
<dispo/date>ARMAND LA VALLE - 5/5/80
<message>PLEASE HANDLE.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>RESUME' - MITCHELL WYLE
<from>WYLE, MITCHELL
<to>BELL, GORDON
<date>80/4/28
<date rec>5/2/80
<log#>5-4
<dispo/date>ARMAND LA VALLE - 5/5/80
<message>PLEASE HANDLE.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>WESTERN DIGITAL CORPORATION
<from>MISSLER, CHARLES W.
<to>BELL, GORDON
<date>80/4/29
<date rec>5/2/80
<log#>5-3
<dispo/date>TO LETTERBOOK (GB1.S3.66) CC: DICK, JOE, STEVE, ROY - 5/5/80
<message>ANY OF YOU GOING?
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>STANFORD UNIVERSITY
<from>KNUTH, DONALD E.
<to>DELP, RICHARD H.
<date>80/4/28
<date rec>5/2/80
<log#>5-2
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>WEATHERBY ASSOCIATES INC.
<from>STEELE, THOMAS J.
<to>BELL, GORDON
<date>80/4/24
<date rec>5/1/80
<log#>5-1
<dispo/date>JACK SMITH - 5/1/80
<message>
<answer>

<f/u>
<filed>
<ret-gb>
<roll>
<>

<company>COMMITTEE OF CONCERNED SCIENTISTS, INC.
<from>GOTTESMAN, KAC, LEBOWITZ
<to>BELL, GORDON
<date>11/9/82
<date rec>12/10/82 Fri 14:00
<log#>12-29
<request>ASKING FOR CONTRIBUTION TO BECOME A MEMBER OF $20 OR MORE
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>UNIVERSITY COLLEGE LONDON
<from>PAUL L. BORRILL
<to>BELL, GORDON
<date>11/22/82
<date rec>12/10/82 Fri 13:50
<log#>12-28
<request>P896 FUTUREBUS PROJECT
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>MARKET/COMMUNICATIONS ANALYSIS,INC.
<from>FRANCIS L. BRIA, PRESIDENT
<to>BELL, GORDON
<date>11/30/82
<date rec>12/10/82 Fri 13:44
<log#>12-27
<request>QUESTIONAIRE BE FILLED OUT SAYING WHAT FUTURE APPLICATIONS OF SINGLE-CHIP MICROCOMPUTERS WILL BE FOR DEC
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>columbia university in city of n.y.
<from>j.f. traub, chairman
<to>BELL, GORDON
<date>12/6/82
<date rec>12/10/82 Fri 13:29
<log#>12-26
<request>NON-AVAILABLE DATES IN OCTOBER 1983 FOR CONVOCATION OF NEW COMPUTER SCIENCE BUILDING
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>YALE UNIVERSITY

<from>PROF. RICHARD C. BARKER, ELECTRICAL ENGR.
<to>BELL, GORDON
<date>12/6/82
<date rec>12/10/82 Fri 13:26
<log#>12-25
<request>PUBLICIZE AVAILABILITY OF VLSI DESIGN COURSE, INDICATE PARTICIPANTS FROM DEC, GIVE SUGGESTIONS OF OTHER ORGANIZATIONS WHO MIGHT BE INTERESTED
<reply by>ASAP
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>MICHIGAN STATE UNIVERSITY
<from>RICHARD V. DUCEY
<to>BELL, GORDON
<date>11/30/82
<date rec>12/10/82 Fri 12:21
<log#>12-24
<request>ASKING FOR RECOMMENDATION FOR CHARLIE BACHMAN FOR HONORARY DEGREE
<reply by>0
<dispo/date>12/10/82 Fri 12:22 - DR. JOHN E. CANTLON - GB3.S9.32
<message>
<answer>
<f/u>
<filed>GB3.S9.32
<done>Y
<>

<company>ACIS
<from>ALFREDO AMORE, ACADEMIC COMMITTEE
<to>BELL, GORDON
<date>11/26/82

<date rec>12/10/82 Fri 9:22
<log#>12-23
<request>INVITATION TO ATTEND 3RD LATINAMERICAN INFORMATICS CONF IN MARCY 1983
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>WANG INSTITUTE OF GRADUATE STUDIES
<from>AN WANG
<to>BELL, GORDON
<date>12/7/82
<date rec>12/8/82 Wed 14:51
<log#>12-22
<request>ACKNOWLEDGEMENT OF MEMBERSHIP ON INSTITUTE'S NATIONAL ACADEMIC ADVISORY COMMITTEE
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>THE RESEARCH BOARD
<from>NAOMI O. SELIGMAN
<to>WIN HINDLE
<date>12/6/82
<date rec>12/8/82 Wed 13:14
<log#>12-21
<request>ASKING FOR AN ANALYSIS OF DEC IN FOLLOWING AREAS: MANAGEMENT,MANUFACTURING,RESEARCH & DEV, MARKETING,

MAINTENANCE
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>MCC
<from>S.J. OLSON
<to>BELL, GORDON
<date>12/6/82
<date rec>12/8/82 Wed 10:30
<log#>12-20
<request>ENCLOSED CY OF SUBSCRIPTION AGREEMENT, BYLAWS & SAMPLE RESEARCH & DEVELOPMENT AGREEMENT
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>MCC - GRANT TO INITIALIZE PAPERWORK FOR $150K PAYMENT 12/10/82 Fri 9:46
<done>Y
<>

<company>STANFORD U, HEURISTIC PROGRAMMING PROJECT
<from>FEIGENBAUM, ED
<to>BELL, GORDON
<date>12/7/82
<date rec>12/8/82 Wed 10:01
<log#>12-19
<request>REQUEST FOR UNRESTRICTED FUNDS
<reply by>0
<dispo/date>
<message>

<answer>
<f/u>
<filed>
<done>Y
<>

<company>IEEE
<from>NANCY M. GROSCH
<to>BELL, GORDON
<date>11/29/82
<date rec>12/7/82 Tue 14:31
<log#>12-18
<request>ASKING FOR SUPPORT FOR REGULAR MEMBERSHIP IN IEEE AND COMPUTER SOCIETY
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>12 - answer sent 12/10/82 Fri 9:30
<done>Y
<>

<company>OAK INDUSTRIES INC.
<from>DR. LEO JEDYNAK, SENIOR VP
<to>BELL, GORDON
<date>12/1/82
<date rec>12/7/82 Tue 11:26
<log#>12-17
<request>REQUESTING INFORMATION ON OUR COMPANY POLICIES OF OWNERSHIP ETC.
<reply by>0
<dispo/date>12/7/82 Tue 11:27 - LARRY BORNSTEIN
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>RESUME
<from>THEODORE P. KUDRON
<to>BELL, GORDON
<date>11/30/82
<date rec>12/7/82 Tue 11:24
<log#>12-16
<request>
<reply by>0
<dispo/date>12/7/82 Tue 11:24 - JOHN DIPIETRO
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>DESIGN LOGIC INC.
<from>BILL O'CONNOR, PRESIDENT
<to>BELL, GORDON
<date>11/26/82
<date rec>12/7/82 Tue 9:52
<log#>12-15
<request>DEVELOPED A PRODUCTION TECHNIQUE & PROCESS FOR SQUARE CUTTING OFF AND/OR PROFILING TO SHAPE THE TUNGSTEN WIRE-TIPS USED IN DOT MATRIC WIRE-PRINTERS
<reply by>0
<dispo/date>12/10/82 Fri 11:26 - JOHN RING
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>ABLE ELECTRO-POLISHING CO.

<from>ZENON W. POKVITIS, PRESIDENT
<to>BELL, GORDON
<date>12/1/82
<date rec>12/7/82 Tue 9:51
<log#>12-14
<request>AVAILABILITY OF TAPE ON BETA OR VHS - 16 MINUTE PRESENTATION - WILL LOAN TAPE
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>DEFENSE ADVANCED RESEARCH PROJECTS AGENCY
<from>ROBERT S. COOPER, DIRECTOR
<to>BELL, GORDON
<date>12/2/82
<date rec>12/7/82 Tue 9:48
<log#>12-13
<request>W/BE PUTTING TOGETHER VIEWS ON NEW DEFENSE PROGRAM IN SUPER COMPUTATION AND WILL SHARE WITH US - OUR VIEWS EXPRESSED ABOUT FUTURE RESEARCH & APPLICATIONS IN CS & MICROELECTRONICS WILL INFLUENCE DEFENSE PROGRAMS IN THESE AREAS AT ARPA
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>ALPA OMEGA EXTERNAL 12/10/82 Fri 14:34
<done>Y
<>

<company>THE CHARLES BABBAGE INSTITUTE
<from>ARTHUR L. NORBERG, DIRECTOR
<to>BELL, GORDON

<date>11/82
<date rec>12/7/82 Tue 9:46
<log#>12-12
<request>ASKING GORDON TO BECOME A FRIEND OF THE CHARLES BABBAGE INSTITUTE - $30/ASSOC. MEMBER - $75/PARTICIPATING ASSOC. - $250/COLLEAGUE - $500/SUSTAINING COLLEAGUE - $1,000/PATRON
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>DEPT. OF COMPUTER SCIENCE - STANFORD UNIV.
<from>EDWARD A. FEIGENBAUM
<to>BELL, GORDON
<date>
<date rec>12/7/82 Tue 9:45
<log#>12-11
<request>FORWARDED SHORT PAPER RE IDEA THE GERMANS HAVE TO GET INTO FIFTH GENERATION EFFORT TO BE DISTRIBUTED TO ALPHA-OMEGA STEERING C'EE
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>HEIDRICK AND STRUGGLES, INC.
<from>JAMES I. STOCKWELL
<to>BELL, GORDON
<date>12/3/82

<date rec>12/7/82 Tue 9:42
<log#>12-10
<request>FORWARDING RESEARCH & DEVELOPMENT STUDY
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>MOTOROLA INC.
<from>Robert W. Galvin, Chairman of the Board
<to>BELL, GORDON
<date>11/30/82
<date rec>12/6/82 Mon 13:40
<log#>12-9
<request>WILL SUPPORT MUSEUM W/CONTRIBUTION OF $2,500 & WILL ALSO SEE TO APPROPRIATE PROVISIONING OF 6800 CHIPS, PHOTOS & MANUALS
<reply by>0
<dispo/date>12/7/82 Tue 11:29 - CC: Gwen - lookie!
<message>
<answer>
<f/u>
<filed>MUSEUM
<done>Y
<>

<company>NO.AMERICAN SOCIETY FOR CORP. PLANNING, INC.
<from>PAUL D. KLIMSTRA, V.P.
<to>BELL, GORDON
<date>11/16/82
<date rec>12/6/82 Mon 13:13
<log#>12-8
<request>ENCLOSED QUESTIONAIRES TO BE FILLED OUT IN CONJUNCTION WITH NASCP ISSUE GROUP
<reply by>0
<dispo/date>12/7/82 Tue 11:22 - RON SMART/RICK CORBEN - CAN

YOU FILL OUT?
<message>
<answer>
<f/u>12/17
<filed>
<done>Y
<>

<company>IMPERIAL/MEXICALI VALLEY IND. SEMINAR
<from>JOHN R. RENISON, SEMINAR DIRECTOR
<to>BELL, GORDON
<date>11/30/82
<date rec>12/3/82 Fri 14:41
<log#>12-7
<request>INVITATION TO SEMINAR ON FEB. 4 IN PALM SPRINGS, CA
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>MANAGEMENT RECRUITERS INC.
<from>BETH CASTELLANA
<to>BELL, GORDON
<date>11/30/82
<date rec>12/3/82 Fri 14:40
<log#>12-6
<request>RESUME: FOLLOW-UP INFO ON PHILIP STOUGHTON
<reply by>0
<dispo/date>12/7/82 Tue 13:56 - Larry Bornstein
<message>
<answer>
<f/u>

<filed>
<done>Y
<>

<company>SPS TECHNOLOGIES
<from>A.CRAIG HOOD, MGR, ADV. METALLURGICAL PRODUCTS
<to>BELL, GORDON
<date>
<date rec>12/2/82 Thu 14:07
<log#>12-5
<request>ANNOUNCING SPS TECHNOLOGIES' POWDER METALLURGY CAPABILITIES IN TITANIUM
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>TEXAS ENGINEERING EXPERIMENT STATION - TEXAS A&M UNIV.
<from>DAVID J. NORTON, ASST. DIR. FOR PROGRAMS
<to>BELL, GORDON
<date>11/23/82
<date rec>12/2/82 Thu 14:06
<log#>12-4
<request>INVITATION TO TEES 1983 RESEARCH CONFERENCE ON 1/12-13, 1983 ON TEXAS A&M UNIV. CAMPUT.
<reply by>0
<dispo/date>12/3/82 Fri 13:53 - Dick Clayton - Interested?
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>NOVA UNIVERSITY
<from>ALEXANDER SCHURE
<to>BELL, GORDON
<date>11/29/82
<date rec>12/2/82 Thu 14:04
<log#>12-3
<request>SUGGESTS PLACONG SMALL COMPUTATIONAL CAPACITY TOGETHER W/AMODEM, ALL INTEGRAL TO KEYBOARD, AS A LOW COST INTRODUCTORY COMMUNICATION ACCESS TO PC'S
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>ANALOGIC CORPORATION
<from>ROY J. CLITES, DIV. MGR., COMP. SYSTEMS DIV.
<to>BELL, GORDON
<date>11/29/82
<date rec>12/2/82 Thu 9:34
<log#>12-2
<request>THANK YOU FOR OPPORTUNITY TO PRESENT ARRAY PROCESSORS TO COMPUTING SYSTEMS GROUP
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>CAPITAL CHILDREN'S MUSEUM
<from>ANN W. LEWIN, EXEC. DIR.
<to>BELL, GORDON

<date>11/24/82
<date rec>12/1/82 Wed 14:05
<log#>12-1
<request>THANKS FOR SOFTWARE - PLEASE EXPEDITE WORD PROCESSOR
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>POLAROID
<from>CHRISTOPHER C. INGRAHAM, V.P.
<to>BELL, GORDON
<date>11/29/82
<date rec>12/1/82 Wed 9:58
<log#>11-63
<request>INTRODUCING POLAPROOF SECURITY SYSTEM
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>MANAGEMENT RECRUITERS
<from>BETH CASTELLANA, ACCT. EXECUTIVE
<to>BELL, GORDON
<date>11/24/82
<date rec>11/30/82 Tue 9:30
<log#>11-62
<request>RESUME: PHILIP STOUGHTON
<reply by>0
<dispo/date>

<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>STORAGE TECHNOLOGY CORPORATION
<from>WILL G. BASS, JR., SALES MGR.
<to>BELL, GORDON
<date>11/23/82
<date rec>11/29/82 Mon 16:08
<log#>11-61
<request>ENCLOSED INFO ON GATE ARRAY PRODUCTS MANUFACTURED BY STC MICROTECHNOLOGY
<reply by>0
<dispo/date>12/3/82 Fri 13:59 - Jeff Kalb ?
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>NATIONAL ACADEMY OF ENGR.
<from>N. BRUCE HANNAY
<to>BELL, GORDON
<date>11/23/82
<date rec>11/29/82 Mon 16:04
<log#>11-60
<request>MODIFICATIONS TO FIRST DRAFT OF REPORT OF DAS VISITING OMMITTEE
<reply by>0
<dispo/date>12/3/82 Fri 14:13 - CALLED BRUCE W/CHANGE ON PAGE 5 AS FOLLOWS - IN PARENTHESES ON THIRD PARAGRAPH - SHOULD READ "WITH 25 OR MORE POSITIONS IN COMPUTER SCIENCE. ALL HAVE EVEN LARGER FACULTIES IN CLOSELY RELATED AREAS OF ELECTRICAL ENGINEERING'- ALSO SENT CY OF CHANGE BY MAIL 12/3

<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>YALE UNIVERSITY
<from>LISA COBB, SR. ADMIN. ASST. - DEPT. OF CS
<to>BELL, GORDON
<date>11/24/82
<date rec>11/29/82 Mon 16:02
<log#>11-59
<request>ATTACHED JOSH FISHER'S CURRICULUM VITA
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>UNIV. OF CALIFORNIA, BERKELEY
<from>RICHARD J. FATEMAN, ASSOC. PROF.,CS
<to>BELL, GORDON
<date>11/23/82
<date rec>11/29/82 Mon 15:50
<log#>11-58
<request>RL02/R80 DISK-BASED VAX 11/730 SYSTEM W/EXTRA MEMORY
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>RESUME
<from>DR. S.K.SEN GUPTA
<to>BELL, GORDON
<date>11/22/82
<date rec>11/29/82 Mon 15:48
<log#>11-57
<request>ENGINEERING MANAGEMENT POSITION
<reply by>0
<dispo/date>12/1/82 Wed 9:36 L. BORNSTEIN
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>UNIV. OF ILLINOIS AT URBANA-CHAMPAIGN
<from>J.N. SNYDER, HEAD OF COMPUTER SCIENCE DEPT.
<to>BELL, GORDON
<date>11/23/82
<date rec>11/29/82 Mon 15:44
<log#>11-56
<request>GORDON SERVE AS EIGTH GILLIES LECTURER AT UNIV. IN SEPTEMBER
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>MCC
<from>R.M. PRICE

<to>BELL, GORDON
<date>11/24
<date rec>11/29/82 Mon 15:32
<log#>11-55
<request>COPIES OF CAD/CAM & PACKAGING PROGRAM PLAN FOR REVIEW
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>LAWRENCE LIVERMORE NATIONAL LABORATORY
<from>GEORGE MICHAEL & BILL BUZBEE
<to>BELL, GORDON
<date>11/15/82
<date rec>11/24/82 Wed 14:43
<log#>11-54
<request>INVITATION TO ATTEND CONF. 'THE FUTURE OF ENVIRONMENTS & WORK STATIONS IN SPT OF LARGE-SCALE COMPUTING ON 3/15-17, 1983 IN GLENEDEN BEACH, OREGON
<reply by>ASAP
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>DE-STA-CO DIVISION
<from>LIVINGSTON A. NEWBERG, SR. SALES ENGR.
<to>BELL, GORDON
<date>11/19/82
<date rec>11/24/82 Wed 14:42

<log#>11-53
<request>MANUFACTURERS OF HIGHLY STRESSED PARTS - FLAPPER VALVES
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>ELSCINT LTD - HAIFA, ISRAEL - TLX #46422 - PHONE # 972-4-525275 EXT 243
<from>VIGDOR BRECHER
<to>BELL, GORDON
<date>11/23/82
<date rec>11/23/82 Tue 11:38
<log#>11-52
<request>PROMISED DELIVERYY ON A VAX 11/730 FOR SEPT.-NOW DELAYED TO 11/20 - WAS TOLD PRODUCT ON ENGINEERING HOLD & SUGGESTED TO CHANGE ORDER TO ANOTHER MODEL - WANTS MORE DETAILS ON HOLD BEFORE MAKING DECISION
<reply by>0
<dispo/date>11/23/82 Tue 13:12 - LU PHILLIPON - WHAT'S THE STORY
<message>
<answer>
<f/u>12/3
<filed>
<done>Y
<>

<company>RESUME
<from>STEPHEN W. SWAN
<to>BELL, GORDON
<date>11/17/82
<date rec>11/23/82 Tue 8:35

<log#>11-51
<request>ELECTRICAL ENGINEERING POSITION
<reply by>0
<dispo/date>11/23/82 Tue 8:35 - JOHN DIPIETRO
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>RESUME
<from>R. D. WILSON
<to>BELL, GORDON
<date>11/18/82
<date rec>11/22/82 Mon 14:06
<log#>11-50
<request>DIRECTOR OF ADVANCED BUS. DEV. AT LEEDS & NORTHRUP CO.
<reply by>0
<dispo/date>11/23/82 Tue 8:46 - John DiPietro - Pls handle
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>INSTITUTE OF PUBLIC ADMINISTRATION
<from>ROBERT SZAKONYI
<to>BELL, GORDON
<date>11/18/82
<date rec>11/22/82 Mon 13:59
<log#>11-49
<request>LIST OF PEOPLE INTERESTED IN ATTENDING DECEMBER MEETINGS IN WASHINGTON D.C.
<reply by>0
<dispo/date>11/23/82 Tue 8:45 - Larry Bornstein - Here is

some more
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>XEROX CORPORATION - PALO ALTO RESEARCH CENTER
<from>W.J. SPENCER, VP
<to>BELL, GORDON
<date>11/19/82
<date rec>11/22/82 Mon 13:56
<log#>11-48
<request>THANKS FOR AGREEING TO SUPPORT LYNN CONWAY FOR TI FOUNDATION FOUNDERS PRIZE - ATTACHED CRAFT CY OF NOMINATION
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>SPECTRUM CERAMICS
<from>PHILIP R. SCOTT, PRESIDENT
<to>BELL, GORDON
<date>11/8/82
<date rec>11/22/82 Mon 13:46
<log#>11-47
<request>MANUFACTURERS OF CERAMIC SUBSTRATES & HERMETIC SEMICONDUCTOR ENCLOSURES
<reply by>0
<dispo/date>11/24/82 Wed 12:26 - Don Metzger - Yours!
<message>
<answer>
<f/u>

<filed>
<done>Y
<>

<company>ACCESS SYSTEM
<from>DAVID LIND, SP. PROJECTS MGR.
<to>BELL, GORDON
<date>11/82
<date rec>11/22/82 Mon 13:45
<log#>11-46
<request>ACCESS SYSTEM FM WESTERN UNION ELECTRONIC MAIL - OFFERING $100 OFF SUBSCRIPTION
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>VITALINK COMMUNICATIONS CORP.
<from>PAUL D. SCHALLER, AVP SALES - NE REGION
<to>BELL, GORDON
<date>11/18/82
<date rec>11/19/82 Fri 14:32
<log#>11-45
<request>INTEREST IN BEING A SYSTEM SUPPLIER OR A PRODUCT OEM FOR A DEC COMMUNICATIONS SYTEMS PRODUCT OFFERING
<reply by>0
<dispo/date>12/7/82 Tue 14:39 - CIRCULATED TO B. LACROUTE, A. CRAWFORD, BJ - SPOKE TO PAUL SCHALLER'S OFC & TOLD THEM TO CONTACT EITHER BERNIE OR AL
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>ROSETTA STONE ASOCIATES, INC.
<from>JOHN F. FUREY, PRESIDENT
<to>BELL, GORDON
<date>11/18/82
<date rec>11/19/82 Fri 14:31
<log#>11-44
<request>CAN HELP US GAIN ACCESS TO FOREIGN RESEARCH
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>MCC - no action taken
<done>Y
<>

<company>YALE UNIVERSITY
<from>ROGER C. SCHANK, PROF. & CHAIRMAN
<to>BELL, GORDON
<date>11/16/82
<date rec>11/19/82 Fri 14:29
<log#>11-43
<request>REFERENCE ON JOSH FISHER WHO IS BEING CONSIDERED FOR PROMOTION OF UNTENURED ASSOC. PROF. AT YALE
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>ROSETTA STONE ASSOCIATES, INC.
<from>JOHN F. FUREY, PRESIDENT
<to>KEN OLSEN
<date>11/12/82
<date rec>11/19/82 Fri 8:01

<log#>11-42
<request>CAN HELP US GAIN ACCESS TO FOREIGN RESEARCH
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>SOCIAL ECOLOGY RESERCH
<from>HOWARD I. THORSHEIM & BRUCE B. ROBERTS
<to>BELL, GORDON
<date>10/28/82
<date rec>11/3/82
<log#>11-41
<request>IMPACT OF SPACE DEVELOPMENT ON EDUCATIONAL MOTIVATION
<reply by>0
<dispo/date>11/18/82 Thu 14:36 - SHEILA PIDGEON - ANYTHING YOU WANT TO PASS ON TO THESE PEOPLE? PLEASE HANDLE.
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>O I CORPORATION
<from>JOHN R. HUGHEY, PRESIDENT
<to>BELL, GORDON
<date>
<date rec>11/18/82 Thu 14:05
<log#>11-40
<request>VLSI WATER PURITY MONITORING
<reply by>0
<dispo/date>

<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>TEXAS INSTRUMENTS
<from>HARVEY G. CRAGON
<to>BELL, GORDON
<date>11/12/82
<date rec>11/18/82 Thu 14:03
<log#>11-39
<request>WOULD LIKE GORDON TO VISIT RE VHSIC WORK IN JANUARY
<reply by>0
<dispo/date>11/22/82 Mon 15:02 - JEFF KALB - JOE ZEH - NOTE
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>TEKNOWLEDGE
<from>S.JERROLD KAPLAN,VP, BUS. DEVELOPMENT
<to>BELL, GORDON
<date>11/10/82
<date rec>11/18/82 Thu 13:55
<log#>11-38
<request>ANNOUNCING THEIR EDUCATIONAL PROGRAMS AVAILABLE
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>INSTITUTE FOR APPLIED ARTIFICIAL INTELLIGENCE, LTD.
<from>VAUD E. STEVENS, PRESIDENT
<to>KEN OLSEN
<date>11/12/82
<date rec>11/18/82 Thu 10:56
<log#>11-37
<request>APPLICATION OF AI TO MGMT.- AGREEMENT ATTACHED FOR SIGNATURE FOR PURCHASE OF A STUDY ON AI FOR $4,500.00 W/$1,500 DEPOSIT
<reply by>12/10/82
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>UNIVERSITY OF WASHINGTON - DEPT. OF COMP. SCIENCE
<from>JERRE D. NOE
<to>BELL, GORDON
<date>11/10/82
<date rec>11/17/82 Wed 14:05
<log#>11-36
<request>AFFILIATES OF CS MTG. ON JAN. 18-19,1983 - ASKING FOR COMMENTS ON FEATURES WOULD LIKE INCLUDED IN PROGRAM
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>SCIENCE - AM. ASSOC. FOR ADVANCEMENT OF SCIENCE
<from>MARY DORFMAN, SENIOR EDITOR
<to>BELL, GORDON
<date>11/9/82
<date rec>11/17/82 Wed 14:03
<log#>11-35
<request>UPDATE OF FILES FOR REFEREES OF MANUSCRIPTS SUBMITTED TO SCIENCE - FORM TO BE FILLED OUT
<reply by>0
<dispo/date>12/2/82 Thu 11:37 - NO - PLEASE REMOVE MY NAME FROM YOUR REFEREE LIST.
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>LOS ALAMOS NATIONAL LABORATORY
<from>BILL BUZBEE
<to>BELL, GORDON
<date>11/9/82
<date rec>11/16/82 Tue 14:11
<log#>11-34
<request>IMPLEMENTING LISP ON THE AFP ARRAY
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>NATIONAL ACADEMY OF ENGINEERING
<from>HAROLD LIEBOWITZ, HOME SECRETARY
<to>BELL, GORDON

<date>11/12/82
<date rec>11/16/82 Tue 14:09
<log#>11-33
<request>SIGNATURE TO AMENDMENT OF BYLAWS OF THE NAE COUNCIL
<reply by>12/1/82
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>SCIENTIFIC CALCULATIONS, INC.
<from>JEFFREY M. WALES, VP, MARKETING
<to>BELL, GORDON
<date>11/15/82
<date rec>11/15/82 Mon 13:57
<log#>11-32
<request>FORWARDING TICKETS TO AUTOFACT 4 IN PHILADELPHIA ON NOV. 30 TO DEC. 2
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>SPERRY RESEARCH CENTER
<from>TERRY WELCH
<to>BELL, GORDON
<date>11/9/82
<date rec>11/15/82 Mon 13:52
<log#>11-31
<request>INDIVIDUAL TO SPONSOR ACM/IEEE COMPUTER ARCHITECTURE SYMPOSIUM IN BOSTON AREA

<reply by>0
<dispo/date>11/17/82 Wed 12:51 - PEG, RAD, TMC, PLM's
<message>Can I have some names please -- if you're interested + Post
<answer>
<f/u>12/10
<filed>RESPONSE TO T.WELCH GB3.S11.32
<done>Y
<>

<company>UNIVERSITY OF WASHINGTON
<from>STEPHEN W. CAMP, EXEC. DIR. OF DEVELOPMENT
<to>BELL, GORDON
<date>11/10/82
<date rec>11/15/82 Mon 9:20
<log#>11-30
<request>LTR OF THANKS FOR GIFT OF $9,000 FOR THE COMPUTER SCIENCE AFFILIATE FUND
<reply by>0
<dispo/date>11/16/82 Tue 14:33 - Nancy Dube
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>NEW YORK UNIVERSITY
<from>HERBERT I. FUSFELD
<to>BELL, GORDON
<date>11/11/82
<date rec>11/15/82 Mon 9:13
<log#>11-29
<request>COMPLETION OF SURVEY ON INDUSTRIAL R&D EXPENDITURES
<reply by>0
<dispo/date>
<message>Will not complete the questionaire - information not available outside the company

<answer>
<f/u>
<filed>12
<done>Y
<>

<company>GARTNER GROUP, INC.
<from>MARY-ELLEN QUINTANA, PROGRAM DIRECTOR
<to>BELL, GORDON
<date>11/10/82
<date rec>11/12/82 Fri 14:45
<log#>11-28
<request>WANT HELP IN DEFINING STUDY ON JAPANESE INFORMATION PROCESSING INDUSTRY
<reply by>11/24/82
<dispo/date>11/17/82 Wed 14:36 - Grant Saviers - what you say?
CC: Jack A.
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>RESUME
<from>GAURANG R. DESAI
<to>BELL, GORDON
<date>11/5/82
<date rec>11/12/82 Fri 14:43
<log#>11-27
<request>RESUME - DESIGN, TEST OR APPLICATION ENGR IN AREA OF ELECT. ENGR.
<reply by>0
<dispo/date>11/12/82 Fri 16:44 - John DiPietro - Please handle
<message>
<answer>

<f/u>
<filed>
<done>Y
<>

<company>RESUME
<from>MARK H. KLINE
<to>BELL, GORDON
<date>11/9/82
<date rec>11/12/82 Fri 14:40
<log#>11-26
<request>RESUME LETTER
<reply by>0
<dispo/date>11/12/82 Fri 16:39 - John DiPietro - Please handle
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>MIT
<from>PAUL PENFIELD JR., PROF. OF ELECTRICAL ENGR.
<to>BELL, GORDON
<date>
<date rec>11/12/82 Fri 14:37
<log#>11-25
<request>INVITATION TO ATTEND FALL 1982 VLSI RSCH. REVIEW ON 12/10 IN KRESGE AUDITORIUM ON M.I.T. CAMPUS
<reply by>FRIDAY, DEC. 3
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>MCC
<from>P. W. ARNESON
<to>BELL, GORDON
<date>11/5/82
<date rec>11/11/82 Thu 9:38
<log#>11-24
<request>ENCLOSED MCC TECHNOLOGY PROGRAM PERSONNEL SELECTION, RETENTION & MOTIVATION DOCUMENT FOR GORDON'S REVIEW AND COMMENT - BE PREPARED TO DISCUSS AT BOARD MTG. 12/3/4
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>MCC
<done>Y
<>

<company>MCC
<from>S. J. OLSON
<to>BELL, GORDON
<date>11/3/82
<date rec>11/11/82 Thu 9:36
<log#>11-23
<request>ENCLOSED REVISED COPIES OF MCC BYLAWS, R&D AGREEMENT & SUBSCRIPTION AGREEMENT
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>APPLE HILL CENTER FOR CHAMBER MUSIC

<from>PATRICIA BASS, FUNDING CHAIRMAN
<to>BELL, GORDON
<date>11/8/82
<date rec>11/11/82 Thu 9:27
<log#>11-22
<request>FOR COMPUTER ASSISTANCE
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>ARTIFICIAL INTELLIGENCE
<from>CAROLE D. DILLON, ACCT. MGR.
<to>BELL, GORDON
<date>10/21/82
<date rec>11/9/82 Tue 12:53
<log#>11-20
<request>ASKING FOR FEEDBACK ON THEIR NATURAL ENGLISH QUERY SYSTEM WHICH REQUIRES NO KEY WORDS, SPECIAL SYNTAX, PUNCTUATION, STRUCTURAL GRAMMAS, USER DEFINITION.
<reply by>0
<dispo/date>11/9/82 Tue 12:57 - B.NOYCE,B.DALEY,J.MARCUS,F.HOWELL,B.HUGHES - ENCLOSED IS A SET OF BROCHURES. ANY USE TO US? HAVE YOU TALKED TO THESE GUYS? NOTE THERE IS A THREE RING MANUAL BEING ROUTED.
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>PRATT INSTITUTE
<from>RICHARDSON PRATT, JR., PRESIDENT
<to>KO
<date>11/5/82
<date rec>11/10/82

<log#>11-21
<request>RECEIVED GRANT - WILL PURCHASE DEC VAX 11/780 SYSTEM--WANTS TO MEET WITH DEC AT EARLIEST OPPORTUNITY TO SHARE PLANS
<reply by>0
<dispo/date>GB CALLED DOROTHY BRACKEN WHO IS WORKING ON THE TASK FOR PRATT. WHOLE THING FORWARDED ON TO TROCCHI 12/10/82 Fri 12:08
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>DAVE FAFARMAN
<FROM>
<TO>BELL, GORDON
<DATE>10/12/82
<date rec>11/9/82 Tue 11:08
<log#>11-19
<request>LICENSED CIVIL & STRUCTURAL ENGINEER W/COMPUTER SYSTEMS BACKGROUND W/IDEAS FOR SOFTWARE DEVELOPMENT W/VAX MACHINE - LOOKING FOR DEC SPONSORSHIP.
<reply by>0
<dispo/date>11/9/82 Tue 11:10 - PETE SMITH
<message>PLEASE CALL HIM & SEE WHAT WE CAN DO
<answer>
<f/u>
<filed>11/9/82 Tue 11:11 - 12
<done>Y
<>

<company>SRI INTERNATIONAL
<from>WILLIAM F. MILLER
<to>ROBERT PRICE, PRESIDENT, MCC - CC: G. BELL
<date>11/1/82
<date rec>11/8/82 Mon 14:36
<log#>11-18

<request>OFFERING SRI'S ASSISTANCE IN DEVELOPMENT EFFORTS OF MCC'S OBJECTIVES - DR. FRANKLIN KUO WILL ARRANGED TO VISIT MR. PRICE AFTER A/O SITE SELECTION GROUP VISITS SRI
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>MCC
<done>Y
<>

<company>INSTITUTE OF PUBLIC ADMINISTRATION
<from>ROBERT SZAKONYI
<to>BELL, GORDON
<date>11/4/82
<date rec>11/8/82 Mon 14:32
<log#>11-17
<request>INVITATION TO ATTEND MTG. TO DISCUSS RESEARCH AGENDA FOR A POSSIBLE UNIVERSITY/INDUSTRY COOPERATIVE RESEARCH CENTER ON THE MGMT. OF TECHNOLOGICAL INNOVATION AND ORG. CHANGE ON DEC. 2 OR 7 IN WASHINGTON D.C.- **REC'D FOLLOW-UP 11/16/82 Tue 14:06 - FORWARDED TO LARRY BORNSTEIN**
<reply by>0
<dispo/date>11/16/82 Tue 14:05 - LARRY BORNSTEIN - PLEASE HANDLE/RSVP
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>BOOZ-ALLEN & HAMILTON INC.
<from>HARVEY
<to>BELL, GORDON
<date>11/3/82
<date rec>11/8/82 Mon 14:22

<log#>11-16
<request>ENCLOSED ISSUE 4 OF 'INFORMATION INDUSTRY INSIGHTS' AND ENCOURAGES COMMENTS - REFERS TO ARTICLE BY PAUL BRANSTAD ON STOCK MARKET PRICE OF AN INFORMATION INDUSTRY CORPORATION.
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>ROSS SYSTEMS, INC.
<from>KEN ROSS, PRESIDENT
<to>BELL, GORDON
<date>11/3/82
<date rec>11/8/82 Mon 14:14
<log#>11-15
<request>FORWARDING BROCHURE DESCRIBING POTENTIAL MAPS APPLICATIONS ALONG W/INFO AS TO WHAT MAPS/PRO WILL DO FOR OUR VAX 11/730
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>ECI EASTERN COMPUTERS, INC.
<from>ROBERT TSUCHIGANE, VICE PRESIDENT
<to>KENNETH OLSON
<date>11/1/82
<date rec>11/8/82 Mon 14:10
<log#>11-14
<request>HAVE DEVELOPED MULTILINGUAL INFORMATION SYSTEMS THAT

INCLUDE CHINESE, JAPANESE, ARABIC AND OTHER NON-ENGLISH WESTERN LANGUAGES
<reply by>0
<dispo/date>11/17/82 Wed 8:30 - Bill Avery cc: Tom K, Dick Yen, Jack Smith
<message>Please handle. Don't we want this?
<answer>
<f/u>
<filed>
<done>Y
<>

<company>INSTITUT REMY GENTON
<from>REMY GENTON
<to>BELL, GORDON
<date>10/28/82
<date rec>11/5/82 Fri 13:57
<log#>11-13
<request>ANNOUNCING REPORT 'KEY FIGURES OF THE FRENCH MARKET FOR OFFICE AUTOMATION, INFORMATION AND TELECOMMUNICATIONS EQUIPMENT
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>INFORMATION GATEKEEPERS, INC.
<from>PAUL W. FITZGERALD, REGISTRATION DIRECTOR
<to>BELL, GORDON
<date>
<date rec>11/5/82 Fri 13:49

<log#>11-12
<request>FORWARDING FIBER OPTICS INTENSIVE COURSES BROCHURES
<reply by>0
<dispo/date>11/10/82 Wed 10:45   Charle Rupp
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>AMERICAN ASSOC. FOR THE ADVANCEMENT OF SCIENCE
<from>JEFFREY L. TERAMANI, COMMUNICATIONS ASSOCIATE
<to>BELL, GORDON
<date>11/2/82
<date rec>11/5/82 Fri 9:30
<log#>11-11
<request>20 COPIES OF PAPER FOR NEWSROOM IF GORDON PREPARES WRITTEN TEXT BY DECEMBER 1 FOR HIS PRESENTATION AT AAAS MEETING
<reply by>12/1/82
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>TECHNOLOGY CATALYSTS, INC.
<from>STEPHANIE M. GILES, 1983 TRADE FAIR MANAGER
<to>BELL, GORDON
<date>11/1/82
<date rec>11/4/82 Thu 14:27
<log#>11-10
<request>INVITATION TO HIGH TECHNOLOGY R&D TRADE FAIR ON APRIL 11-13 AT SHOREHAM HOTEL IN WASHINGTON, DC
<reply by>0

<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>LOS ALAMOS NATIONAL LABORATORY
<from>BILL BUZBEE, ASST. DIV. LEADER FOR RSCH, COMP. DIVISION
<to>BELL, GORDON
<date>10/29/82
<date rec>11/4/82 Thu 14:15
<log#>11-9
<request>THANKS FOR MATERIALS YOU SENT
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>WANG INSTITUTE OF GRADUATE STUDIES
<from>W. M. MCKEEMAN
<to>BELL, GORDON
<date>11/3/82
<date rec>11/4/82 Thu 14:12
<log#>11-8
<request>MSE STUDENTS FROM DIGITAL - EXPLAINS HOW THEY WILL TAKE STUDENTS FROM DIGITAL
<reply by>0
<dispo/date>11/17/82 Wed 9:11 - Larry Bornstein - Please disseminate to EMC,PEG,Pers. Mgrs.,D.Thorndike,S.Nathan,S.Keillor,D.Lippert,S.Pidgeon
<message>
<answer>

<f/u>
<filed>ALPHA OMEGA EXTERNAL 12/10/82 Fri 14:35
<done>Y
<>

<company>COMPUTER DESIGN
<from>RONALD W. EVANS, PUBLISHER
<to>BELL, GORDON
<date>10/25/82
<date rec>11/4/82 Thu 14:06
<log#>11-7
<request>ANNOUNCEMENT OF INDUCTION INTO THEIR COMPUTER DESIGN HALL OF FAME - NEED TO KNOW HOW MANY COPIES OF THEIR 20TH ANNIVERSARY ISSUE THEY WOULD LIKE - WILL CONTAIN ANNOUNCEMENT
<reply by>ASAP
<dispo/date>
<message>
<answer>11/12/82 Fri 17:14
<f/u>
<filed>GB3.S8.41
<done>Y
<>

<company>EDWARD A. REYNOLDS, INDUSTRIAL CONSULTANT
<from>ED REYNOLDS
<to>BELL, GORDON
<date>10/30/82
<date rec>11/3/82 Wed 14:00
<log#>11-6
<request>INFO ON ENGINEERING EDUCATION IN REPLY TO GORDON'S LETTER
ARTICLE - THE VALUE OF 'HANDS-ON' TRAINING FOR THE QUALITY ENGR. ATTACHED
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>

<filed>
<done>Y
<>

<company>
<from>BEN L. CASE
<to>BELL, GORDON
<date>10/27/82
<date rec>11/2/82 Tue 12:19
<log#>11-5
<request>RESUME: MECHANICAL ENGINEER
<reply by>0
<dispo/date>11/2/82 Tue 13:01 John DiPietro
<message>Please handle.
<answer>
<f/u>
<filed>
<done>Y
<>

<company>UNITED STATES SENATE
<from>SENATOR PAUL TSONGAS
<to>BELL, GORDON
<date>10/25/82
<date rec>11/2/82 Tue 12:15
<log#>11-4
<request>REPLY TO GORDON'S LETTER ON IMMIGRATION REFORM AND THE SIMPSON/MAZZOLI BILL
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>MIT
<from>J. PETER BARTL
<to>BELL, GORDON
<date>10/29/82
<date rec>11/2/82 Tue 12:13
<log#>11-3
<request>INVITATION TO ATTEND SYMPOSIUM 'EFFECTIVE BUSINESS MGMT: LESSONS FROM JAPAN' ON 11/17-18-19.
<reply by>ASAP
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>MCC
<from>P. W. ARNESON
<to>MCC TASK TEAM LEADERS
<date>10/28/82
<date rec>11/1/82 Mon 15:39
<log#>11-2
<request>ATTACHED DRAFT OF AREAS TO COVER IN PREPARING PRELIMINARY PROGRAM PLAN FOR 'ARTICLE 2' SECTION OF R & D AGREEMENTS
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>MICROELECTRONICS & COMPUTER TECHNOLOGY CORP.
<from>STEVEN J. OLSON

<to>BELL, GORDON
<date>10/26/82
<date rec>11/1/82 Mon 9:06
<log#>11-1
<request>MCC: LEGAL IMPLICATIONS OF DOD PARTICIPATION IN MCC PLANNING ACTIVITIES
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>DEPARTMENT OF THE NAVY, NORFOLK, VA
<from>CAPT. SHANNON D. HEYWARD
<to>BELL, GORDON
<date>10/26/82
<date rec>10/29/82 Fri 13:45
<log#>10-61
<request>DISSATISFACTION WITH SERVICE OFFERED FOR REPAIR ON A PDP-1135 COMPUTER AT U.S.NAVY FLEET ASW TRAINING CENTER WHICH RESULTED IN A ONE MONTH LOSS OF TRAINING
<reply by>0
<dispo/date>11/2/82 Tue 16:00 Dick Poulsen
<message>COULD YOU PLEASE LOOK INTO THIS? GB'S ANSWER TO HEYWARD GB3.S8.34
<answer>
<f/u>
<filed>GB3.S8.34
<done>Y
<>

<company>BABSON COLLEGE
<from>DENNIS P. GELLER, DIR, ACADEMIC COMPUTING SVCS.
<to>COMMERCIAL ENGR. PUBLICATIONS AT MK1-2/H3   CC:BELL, GORDON

<date>10/26/82
<date rec>10/29/82 Fri 9:06
<log#>10-60
<request>EXPRESSES DISSATISFACTION WITH VAX-11 USER'S GUIDE AA-H869A-TE
<reply by>0
<dispo/date>10/29/82 - ABEL,MARCUS,DALEY,HEFFNER,KEATING,ANKLAN,MAHENDRA,BJ, SW WRITERS
<message>DR. GELLER'S ABSOLUTELY RIGHT. NEVER PUBLISH A LISTING OR PROGRAM THAT HAS NOT BEEN CHECKED!! WILL YOU PLEASE SEND HIM THE CORRECTIONS TO THE MANUALS YOU'RE RESPONSIBLE FOR?
<answer>
<f/u>
<filed>GB3.S8.31
<done>Y
<>

<company>SETON HILL COLLEGE
<from>RUSSELL C. WALKER, CHAIRMAN, MATH & COMP. SCIENCE
<to>BELL, GORDON
<date>10/20/82
<date rec>10/28/82 Thu 14:32
<log#>10-59
<request>TEACHING COBOL ON A PDP 11/34 USING WATBOL COMPILER FROM UNIV. OF WATERLOO - REQUESTING ASSISTANCE IN ACQUIRING A DEC COBOL COMPILER
<reply by>0
<dispo/date>11/9/82 Tue 10:05 Roger Matus - Spitbrook - 381-2343
<message>DO WE HAVE A COBOL COMPILER FOR 11/34?
<answer>HAVE 74 ANSI - NOT A 1968 ANSI -
CALLED RUSSELL WALKER & TOLD HIM ROGER MATUS WOULD BE CONTACTING HIM.
<f/u>
<filed>
<done>Y
<>

<company>YALE UNIVERSITY DEPT. OF COMPUTER SCIENCE
<from>WILLIAM GROPP, COLLOQUIA CHAIRMAN
<to>BELL, GORDON
<date>10/26/82
<date rec>10/28/82 Thu 14:27
<log#>10-58
<request>CONFIRMATION OF VISIT BY GB ON 11/2 AT ABOVE DEPT. TALK AT 4:00 P.M. - MEET FACULTY MEMBERS AT 10:00 A.M. - DINNER AFTER TALK
REQUESTING ARRIVAL & DEPARTURE DATES AND ABSTRACT OF TALK
<reply by>ASAP
<dispo/date>
<message>
<answer>
<f/u>
<filed>ALPHA
<done>Y
<>

<company>THAYER SCHOOL OF ENGINEERING - DARTMOUTH COLLEGE
<from>BARRY RICHMOND, ASST. PROF. OF ENGR.
<to>OLSEN,KEN
<date>10/22/82
<date rec>10/28/82 Thu 14:24
<log#>10-57
<request>CONCERNED ABOUT CANCELLATION OF ENGR. MGMT. COURSE ON 10/25-29 AT LAKE MOREY IN LIGHT OF ALL THE WORK THAT HAS BEEN DONE ON THE SIMULATION MODEL
<reply by>0
<dispo/date>11/1/82 Mon 10:30
<message>L. BORNSTEIN - PLEASE CALL BARRY
K. OLSEN - WE ARE STILL GIVING CROSS-ORGANIZATIONAL COURSES (4 PER YEAR) AND THERE ARE OTHER DEC NON-CONTENT (FAIRLY USELESS) ORIENTED COURSES. LET ME URGE YOU TO USE THIS MODEL AS A REAL BASIS OF PROMOTING UNDERSTANDING OF ALL THE FUNCTIONS OF THE COMPANY BY HAVING IT TAUGHT IN THE COURSES WE HAVE NOT CANCELLED YET THIS YEAR.
<answer>

<f/u>
<filed>
<done>Y
<>

<company>EXHIBIT TECHNOLOGY, INC.
<from>R. K. VALLEY, PRESIDENT
<to>OLSEN, KENNETH H.
<date>10/15/82
<date rec>10/28/82 Thu 9:52
<log#>10-56
<request>WANTS TO MEET TO GIVE DEMONSTRATION OF A DEMONSTRABLE PROTOTYPE OF A SYSTEM WHERE FREE-FORM QUESTIONS ARE ENTERED AND PERSON APPEARS ON SCREEEN AND ANSWERS QUESTIONS.
<reply by>0
<dispo/date>10/29/82 Fri 14:56 RON REILING
<message>IS THIS OK FOR GB TO SEE? MJ
<answer>
<f/u>
<filed>
<done>Y
<>

<company>DREXEL PROPERTIES, INC.
<from>J. L. CLEMENS
<to>BELL, GORDON
<date>10/15/82
<date rec>10/27/82 Wed 14:08
<log#>10-55
<request>NEEDS HELP WITH LOSS OF DATA ON AN 1134 SYSTEM COMPUTER PURCHASED FROM US IN 1979
<reply by>0
<dispo/date>11/1/82 Mon 10:38 - STEVE DAVIS
<message>COULD YOU PLEASE ANSWER?
<answer>
<f/u>

<filed>
<done>Y
<>

<company>BUSINESS COMPUTER SYSTEMS
<from>JUDITH BECKER, STAFF WRITER
<to>BELL, GORDON
<date>10/18/82
<date rec>10/27/82 Wed 13:48
<log#>10-54
<request>WANT TO INCLUDE OUR PRODUCTS IN THEIR LISTING OF PEOPOE WHO USE MICROCOMPUTERS AND SMALL MINICOMPUTERS IN BUSINESS APPLICATIONS
<reply by>11/12/82
<dispo/date>10/29/82 Fri 14:57 BJ
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>Massachusetts Inst. of Technology
<from>PROFESSOR FRANK A MCCLINTOCK
<to>BELL, GORDON
<date>10/12/82
<date rec>10/21/82
<log#>10-53
<request>COMPUTER NEEDS IN ENGINEERING
<reply by>0
<dispo/date>10/27/82 Wed 9:39
<message>BJ - CAN YOU PLEASE HAVE SOMEONE ANSWER? HE'S RIGHT ON.
<answer>
<f/u>
<filed>12
<done>Y FROM HEFF: BOB ABRAMSON IS IN THE PROCESS OF CONTATING PROF. MCCLINTOCK AND IF INCLINED WE SHALL HAVE HIM

OUT HERE FOR THE BETTER PART OF A DAY TO LISTEN AND LEARN FROM HIM 11/5/82
<>

<company>UNIVERSITY OF WISCONSIN-MADISON
<from>MURRAY A. THOMPSON, DIRECTOR
<to>BELL, GORDON
<date>10/22/82
<date rec>10/26/82 Tue 14:34
<log#>10-52
<request>FORWARDING CYS OF TWO PROPOSALS SENT TO BILL STRECKER AND RICK CASABONA RE FAST VAX CONSIDERATIONS
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>TORRIC CORPORATION
<from>ANTHONY WAINWRIGHT, PRESIDENT
<to>BELL, GORDON
<date>
<date rec>10/26/82 Tue 14:29
<log#>10-51
<request>AVAILABILITY OF REPORT - PRODUCT DEVELOPMENT USING GATE ARRAYS - A DESIGN REFERENCE MANUAL FOR $2500 (2250 PREPAID0
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>
<from>DR. RICHARD A. PHILLIPS
<to>BELL, GORDON
<date>10/23/82
<date rec>10/26/82 Tue 14:23
<log#>10-50
<request>RESUME; OPTIC BACKGROUND
<reply by>0
<dispo/date>JOHN DIPIETRO W/CC RING, AVERY, BORNSTEIN
10/27/82 Wed 15:57
<message>PLS HANDLE
<answer>
<f/u>
<filed>
<done>Y
<>

<company>NATIONAL SEMICONDUCTOR
<from>CHARLES E. SPORCK, PRES & CEO
<to>BELL, GORDON
<date>10/19/82
<date rec>10/25/82 Mon 14:38
<log#>10-49
<request>FORWARDED CY OF STATUS REPORT ON CALIFORNIA
COMMISSION ON INDUSTRIAL INNOVATION
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>INET CORPORATION

<from>CHARLES H. SATHRUM, P.E., VP
<to>BELL, GORDON
<date>10/20/82
<date rec>10/25/82 Mon 14:34
<log#>10-48
<request>INVITATION TO WINTER EMETING OF AMERICAN NUCLEAR SOCIETY
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>J. L. PETZ COMPANY, INC.
<from>JOHN G. HUMMEL, SALES & ENGR.
<to>BELL, GORDON
<date>10/21/82
<date rec>10/25/82 Mon 14:25
<log#>10-
<request>INTRODUCTION OF THEIR PRODUCTS - MANUFACTURERS OF CABLE HARNESSES AND ELECTRONIC SUB-ASSEMBLIES.
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>SI HANDLING SYSTEMS, INC.
<from>SETH R. SCHNEIBLE, DIRECTOR, MKT. PLNG.
<to>BELL, GORDON
<date>10/8/82
<date rec>10/25/82 Mon 14:21

<log#>10-46
<request>INTRODUCING THEIR KEY TECHNOLOGIES FOR ADVANCED MFG. METHODS.
ARTICLE FROM 'MODERN MATERIALS HANDLING' ATTACHED.
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>BSI - BUSINESS SCIENCE INTERNATIONAL, INC.
<from>PETER S. KARP, PRESIDENT
<to>BELL, GORDON
<date>10/5/82
<date rec>10/25/82 Mon 14:17
<log#>10-45
<request>LOOKING FOR DEC TO COMPLETE THE WORD PROCESSOR PRODUCT CATEGORY IN THEIR SALES 'LEAD' PROGRAM IN JANUARY 1983
SIMILAR LETTER DATED 10/25/82 RECEIVED 11/1/82 Mon 9:14 AND FORWARDED TO JULIUS - **11/17/82 Wed 15:03 - SENT 10/25 LTR TO BOB HUGHES WHO IS DOING CUSTOMER CONTACT - cc: JOHN O'KEEFE**
<reply by>0
<dispo/date>10/27/82 Wed 9:30
<message> JULIUS MARCUS
<answer>
<f/u>
<filed>
<done>Y
<>

<company>ADAPTEC, INC.
<from>DON RECTOR, VP MKTG. & SALES
<to>BELL, GORDON
<date>10/20/82

<date rec>10/25/82 Mon 14:10
<log#>10-44
<request>WANTS TO SET UP APPMT. FOR PRESENTATION ON ADAPTEC'S PRODUCTS - W/CALL WITHIN FEW DAYS TO SET UP APPMT. - ANNOUNCEMENT OF NEW PRODUCT CALLED SINGLE CHIP WINCHESTER CONTROLLER DEVICE.
<reply by>0
<dispo/date>10/27/82 Wed 9:32
<message>GRANT SAVIERS
<answer>
<f/u>
<filed>
<done>Y
<>

<company>Hitachi
<from>T. Makimoto
<to>BELL, GORDON
<date>10/12/82
<date rec>10/25/82 Mon 10:20
<log#>10-43
<request>WANTS TO VISIT DEC IN MID DECEMBER - WAS INVITED TO BE A MEMBER OF COMPUTER MUSEUM. WILL CONTACT GORDON THROUGH DICK ENGLISH IN HIS SALES OFC. INTERESTED IN OUR CAD ACTIVITIES
<reply by>0
<dispo/date>10/25/82 Mon 10:17
<message>CAN I HAVE SOMEONE HOST HIM?
<answer>
<f/u>11/5
<filed>
<done>Y
<>

<company>John Rhodes & Company
<from>J. Richard Unruh, President
<to>Ken Olsen
<date>9/21/82

<date rec>10/25/82 Mon 10:10
<log#>10-42
<request>review of proposal for a multi-client study of A.I. markets
<reply by>0
<dispo/date>
<message>REPLY TO UNRUH - GB3.S8.33
<answer>
<f/u>
<filed>GB3.S8.33
<done>Y
<>

<company>TEKNOWLEDGE
<from>BARRY PLOTKIN
<to>BELL, GORDON
<date>10/19/82
<date rec>10/22/82 Fri 13:58
<log#>10-41
<request>AGENDA FOR MEETING OF THE ADVISORY BOARD FOR TECHNOLOGY STRATEGY.
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>MIT
<from>JONATHAN ALLEN
<to>BELL, GORDON
<date>10/21/82
<date rec>10/22/82 Fri 13:57
<log#>10-40
<request>SENT GORDON AN ARTICLE ON FUJITSU LIMITED
<reply by>0
<dispo/date>

<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>INTEL CORP.
<from>EUGENE J. FLATH
<to>BELL, GORDON
<date>9/28/82
<date rec>10/21/81 Wed 14:53
<log#>10-39
<request>ENCLOSED 4004 AND 8008 CHIPS AND CHIP PHOTOS GORDON REQUESTED FOR MUSEUM.
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>TARTAN LABORATORIES
<from>ANITA K.JONES
<to>BELL, GORDON
<date>10/14/82
<date rec>10/21/81 Wed 14:50
<log#>10-38
<request>INVITE TO VISIT TARTAN
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>EDWARD A. REYNOLDS, QUALITY ASSURANCE CONSULTANT
<from>EDWARD REYNOLDS
<to>BELL, GORDON
<date>10/16/82
<date rec>10/21/81 Wed 14:47
<log#>10-37
<request>COMMENTING ON 18 OCT. TIME MAGAZINE ARTICLE. DISPUTS GORDON'S COMMENT ON "THE YOUNG ENGINEERS COMING IN ARE SHARPER"
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>JOHN M. MYERS, COMMUNICATIONS RESEARCH
<from>JOHN MYERS
<to>BELL, GORDON
<date>10/19/82
<date rec>10/21/81 Wed 9:13
<log#>10-36
<request>MANUSCRIPT ON UNSTABLE EQUILIBRIA IN FLIP-FLOPS. ASKING FOR GORDON'S COMMENTS.
<reply by>0
<dispo/date>11/30/82 Tue 15:53 - L.BORNSTEIN,S.FULLER,B.STRECKER,B.JOHNSON,I.DOBES - ANY INTENT
12/10/82 Fri 15:52 - SAM FULLER - DO YOU WANT TO INVITE HIM AND TRY HIM?.. CLEARLY RESEARCH & DATAFLOW PERSON
<message>SAM, DO YOU WANT TO INVITE HIM AND TRY HIM? CLEARLY RESEARCH AND DATAFLOW PERSON? 12/10/82 Fri 12:58
<answer>
<f/u>
<filed>
<done>Y
<>

<company>MCC
<from>R.M. PRICE
<to>BELL, GORDON
<date>10/15/82
<date rec>10/20/82 Wed 10:08
<log#>10-35
<request>SUMMARY OF MEETING 8 OCT DENVER, COLORADO
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>MCC
<done>Y
<>

<company>COMPUTER REVIEW
<from>DAVID SIMPSON
<to>BELL, GORDON
<date>10/12/82
<date rec>10/19/82 Tue 3:44
<log#>10-34
<request>UPDATE A LIST OF MICROCOMPUTERS
<reply by>0
<dispo/date>10/20/82 Wed 9:57 SENT TO WIN HINDLE
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>GIFFELS ASSOCIATES, INC.
<from>RICHARD BLAND
<to>BELL, GORDON
<date>10/8/82
<date rec>10/18/82 Mon 14:43
<log#>10-33
<request>SURVEY OF COMPUTER AIDED DRAFTING AND DESIGN

SYSTEMS.
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>NATIONAL SCIENCE FOUNDATION
<from>LOUIS TORNATZKY
<to>BELL, GORDON
<date>
<date rec>9/22/82
<log#>10-32
<request>UNIVERSITY-INDUSTRY COOPERATIVE RESEARCH CENTERS: A PRACTICE MANUAL
<reply by>0
<dispo/date>10/18/82 Mon 13:50 CIRCULATED TO T. GANNON, SAM FULLER, DIETER HUTTENBERGER, AND RETURN
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>HARLAN EUGENE ANDERSON
<from>H. ANDERSON
<to>BELL, GORDON
<date>10/14/82
<date rec>10/18/82 Mon 13:44
<log#>10-31
<request>LETTER TO DR. GEO. LOW, PRESIDENT RPI, CC: TO GORDON ABOUT GERALD WILSON.
<reply by>0
<dispo/date>
<message>
<answer>

<f/u>
<filed>
<done>Y
<>

<company>TECHNISCHE HOGESCHOOL DELFT
<from>W. L. VAN DER POEL
<to>BELL, GORDON
<date>10/12/82
<date rec>10/18/82 Mon 13:43
<log#>10-30
<request>REQUESTING A MACHINE ON ANY 11/70 UNDER UNIX FOR A CHESS CHAMPIONSHIP.
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>12
<done>Y
<>

<company>US DEPT OF STATE
<from>BRUCE MCKENZIE
<to>BELL, GORDON
<date>10/14/82
<date rec>10/18/82 Mon 13:41
<log#>10-29
<request>REPLAY TO LETTER OF 20 JULY CONCERNING FOREIGN STUDENTS. LEAFLET ENCLOSED WITH GENERAL INFO.
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>
<from>DR. MARGARET W. KENNEDY
<to>BELL, GORDON
<date>8/24/82 AND 9/22/82
<date rec>8/30/82 AND 9/24/82
<log#>10-28
<request>RE: PEOPLE'S TYPEWRITER WILLING TO SELL FOR $75.
<reply by>0
<dispo/date>10/18/82 Mon 9:40 SENT CHECK FOR $75 PAYMENT FOR TYPEWRITER.
<message>
<answer>
<f/u>
<filed>GB3.S8.17
<done>Y
<>

<company>SOCIAL ECOLOGY RESEARCH
<from>BRUCE B. ROBERTS/HOWARD THORSHEIM
<to>BELL, GORDON
<date>9/8/82
<date rec>10/14/82
<log#>10-27
<request>KEN OLSEN ASKED GORDON TO ANSWER LETTER. NATIONAL SCIENCE FOUNDATION IS ESTABLISHING COMMUNICATIONS AND SIGNAL PROCESSING CENTER AT NORTH CAROLINA STATE UNIVERSITY
<reply by>0
<dispo/date>10/15/82 Fri 12:55 GORDON'S REPLY
<message>
<answer>SUGGESTED THEY CONTACT THE UNIVERSITY DIRECTLY.
<f/u>
<filed>GB3.S8.14
<done>Y
<>

<company>HILLTOP HOUSE
<from>PETER MCNIFF,MANAGER
<to>BELL, GORDON
<date>10/8/82
<date rec>10/15/82 Fri 9:34

<log#>10-26
<request>PAYMENT FOR NS B.STRECKER/LOS ALAMOS
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>SIA
<from>TOM HINKELMAN/WARREN DAVIS
<to>BELL, GORDON
<date>10/8/82
<date rec>10/15/82 Fri 9:33
<log#>10-25
<request>MONTEREY LONG RANGE PLANNING CONF. NOV 21-23
<reply by>0
<dispo/date>10/20/82 Wed 16:46 SENT TO JEFF KALB
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>SIGNETICS
<from>LEN UMINA
<to>BELL, GORDON
<date>10/11/82
<date rec>10/15/82 Fri 9:32
<log#>10-24
<request>SPECIAL STICK-ON INSERT FOR CATALOG MAILING
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>

<done>Y
<>

<company>NORMAN N. AXELROD ASSOCIATES
<from>NORMAN AXELROD
<to>BELL, GORDON
<date>10/12/82
<date rec>10/14/82 Thu 14:13
<log#>10-23
<request>EXPLAINS THE SERVICES OF THE CO. DESIGN, BREAD-BOARDS, FABRICATION, ETC.
<reply by>0
<dispo/date>10/18/82 Mon 15:35 CIRCULATE TO: GRANT SAVIERS, JOHN RING, PAUL BAUER, DAVE BROWN
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>RESUME
<from>JOHN FERNANDO
<to>BELL, GORDON
<date>10/9/82
<date rec>10/14/82 Thu 14:12
<log#>10-22
<request>RESUME--PROF. OLIVER OLDMAN SUGGESTED HE SEND IT TO GORDON
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>

<from>BILL CESSFORD
<to>BELL, GORDON
<date>10/82
<date rec>10/7/82
<log#>10-21
<request>MANCHESTER U. RESEARCH INTO NEW CPU'S
<reply by>0
<dispo/date>10/13/82 Wed 13:55 SENT TO A. HANOVER, DIETER, HUTTENBERGER, BILL CESSFORD
<message>ALAIN HANOVER PLS. HANDLE
<answer>
<f/u>11/12
<filed>
<done>Y
<>

<company>ANALOGIC
<from>ROY CLITES
<to>BELL, GORDON
<date>10/11/82
<date rec>10/13/82 Wed 13:17
<log#>10/20
<request>BROCHURES FOR THE AP500.
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>FAXGRAM, GRAPHNET
<from>JERUSALEM
<to>BELL, GORDON
<date>
<date rec>10/13/82 Wed 13:15 /10/15/82 Fri 9:31 DUPLICATE RECEIVED.
<log#>10-19
<request>CONCEPT WHERE MULTIPROCESSING CAN BE DESIGNED AND

USED. IF INTERESTED CONTACT, DR. GIDEON AIRELLY JERUSALEM.
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>BECHTEL CIVIL & MINERALS, INC
<from>SAMUEL EARDLEY
<to>BELL, GORDON
<date>10/5/82
<date rec>10/13/82 Wed 13:12
<log#>10-18
<request>HELP FROM VP ENG. FOR DATA NEEDED FOR AVCO TO COMPLETE PROJECT USING DEC EQUIPMENT.
<reply by>0
<dispo/date>10/13/82 Wed 15:02 SENT TO DOLORES GALEOTTA
<message>
<answer>
<f/u>10/15/82
<filed>CUSTOMER PROBLEM
<done>Y
<>

<company>PELL,RUDMAN & CO
<from>ANTHONY D. PELL
<to>BELL, GORDON
<date>10/11/82
<date rec>10/13/82 Wed 13:11
<log#>10-17
<request>CONSENT TO AN AMENDMENT OF LIMITED PARTNERSHIP FOR CFP EXPLORATION.
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>

<filed>
<done>Y
<>

<company>BELL LABORATORIES
<from>M.V.MATHEWS
<to>BELL, GORDON
<date>10/8/82
<date rec>10/13/82 Wed 9:26
<log#>10-16
<request>RE: RICHARD COHEN BRIEF RESUME AND INTRODUCTION.
<reply by>0
<dispo/date>10/19/82 Tue 10:20 SENT TO BOB DALEY, JULIUS MARCUS, BOB DOCKSER, MIKE MULROY.
<message>LET'S GET HIM PERMANENTLY
<answer>
<f/u>10/29 BACK TO GB 11/5/82 Fri 8:46
<filed>BELL LABS
<done>Y
<>

<company>DEUTSCH ELECTRONIC COMPONENTS DIVISION
<from>BOB WHETSELL
<to>BELL, GORDON
<date>NO DATE
<date rec>10/13/82 Wed 9:23
<log#>10-15
<request>INFORMING OF ADDITION OF DEUTSCH TO QUALIFIED PRODUCTS LIST FOR THE D38999/43.
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>ROSS STYSTEMS INC.

<from>KEN ROSS
<to>BELL, GORDON
<date>10/8/82
<date rec>10/12/82
<log#>10-14
<request>ROSS SYSTEMS SOFTWARD MAPS/PRO, DEVELOPED FOR THE PROFESSIONAL 350 PERSONAL COMPUTER.
<reply by>0
<dispo/date>RESPONSE FORM SENT TO KEN ROSS 10/18/82 Mon 10:00
<message>HAVE A PERSONAL VAX WOULD LIKE TO SEE WHAT MAPS/PRO DOES FOR US.
<answer>
<f/u>
<filed>12
<done>Y
<>

<company>JON HARVEY ASSOCIATES
<from>JACK KAPLAN
<to>BELL, GORDON
<date>9/20/82
<date rec>10/11/82 Mon 15:24
<log#>10-13
<request>CHANGE OF ADDRESS TO 425 BROAD HOLLOW ROAD,MELVILLE, NY 11746,TELE.516-249-3200
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>YES, DISPOSED
<done>Y
<>

<company>BUSINESS DEVELOPMENT INTERNATIONAL
<from>D. ROGER MACNAUGHTON
<to>BELL, GORDON
<date>10/4/82
<date rec>10/7/82 Thu 3:06
<log#>10-12

<request>ASKING GORDON TO RECOMMEND A SPEAKER ON LOCAL AREA NETWORKS FOR CONFERENCE 21,22 APR 82.
<reply by>0
<dispo/date>11/10/82 Wed 11:16 - Bernie LaCroute - Let's do this. Please handle. Who?
<message>
<answer>11/10/82 Wed 11:16
<f/u>
<filed>GB3.S8.42
<done>Y
<>

<company>ROUND HILL
<from>ROBERT M. DESMOND
<to>BELL, GORDON
<date>10/4/82
<date rec>10/6/82 Wed 13:11
<log#>10-11
<request>BROCHURE AND LETTER ON ROUND HILL DEVELOPMENT PROPERTY
<reply by>0
<dispo/date>10/6/82 Wed 13:11
<message>SENT TO GEO CHAMBERLAIN--ENVELOPE WAS ADDRESSED TO GB LETTER ADDRESSED TO G. CHAMBERLAIN.
<answer>
<f/u>
<filed>
<done>Y
<>

<company>MCC
<from>PHIL ARNESON
<to>BELL, GORDON
<date>10/4/82
<date rec>10/5/82 Tue 14:44
<log#>10-10
<request>MCC MEETING AGENDA OCT 8
<reply by>0
<dispo/date>
<message>

<answer>
<f/u>
<filed>
<done>Y
<>

<company>CALIFORNIA INSTITUTE OF TECHNOLOGY
<from>MICHAEL VORHAUS
<to>BELL, GORDON
<date>9/28/82
<date rec>10/1/82
<log#>10-9
<request>UPCOMING CALTECH INDUSTRIAL ASSOCIATES' RESEARCH DIRECTORS CONFERENCE. NOV 10 - 12.
<reply by>0
<dispo/date>10/5/82 Tue 9:02 SENT TO STEVE TEICHER
<message>GORDON CAN'T MAKE IT. CAN SOMEONE IN STEVE'S GROUP GET INVOLVED?
<answer>
<f/u>10/8
<filed>
<done>Y
<>

<company>
<from>HEATHER B. CROCKER
<to>BELL, GORDON
<date>9/30/82
<date rec>10/4/82
<log#>10-8
<request>RESUME TO MARY JANE
<reply by>0
<dispo/date>10/5/82 Tue 8:39
<message>SENT TO BOB MCGORTY, PLEASE HANDLE
<answer>
<f/u>
<filed>
<done>Y
<>

<company>CONTROL DATA
<from>STEVEN OLSON
<to>BELL, GORDON
<date>9/29/82
<date rec>10/4/82 Mon 15:57
<log#>10-7
<request>MCC FORMATION AGREEMENTS
<reply by>0
<dispo/date>10/11/82 Mon 9:06
<message>
<answer>
<f/u>
<filed>FILED MCC 10/11/82 Mon 9:08
<done>Y
<>

<company>TRILOGY
<from>GENE AMDAHL
<to>BELL, GORDON
<date>9/29/82
<date rec>10/4/82 Mon 15:55
<log#>10-6
<request>IN RESPONSE TO GB'S LETTER IN AUG. RE: JAPAN PROJECT. WILL BE GLAD TO DISCUSS FURTHER.
<reply by>0
<dispo/date>10/11/82 Mon 8:40 SENT TO STEERING COMMITTEE VIA TOM GANNON, OC, EMC, BOB PRICE (PRES. MCC).
<message>
<answer>
<f/u>
<filed>MCC-AO
<done>Y
<>

<company>THE HAYMAN COMPANY
<from>RICHARD OSBORNE
<to>BELL, GORDON
<date>9/30/82
<date rec>10/4/82 Mon 15:53

<log#>10-5
<request>IF CONSIDERING TO EXPAND HIGH-TECH IN CHICAGO AREA, HE WILL BE HAPPY TO ASSIST.
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>DEPARTMENT OF NAVY
<from>JAMES C. T. POOL
<to>BELL, GORDON
<date>9/29/82
<date rec>10/4/82 Mon 15:51
<log#>10-4
<request>MCC PROJECT MEETING IN WASHINGTON--ED WEGMAN SERVING AS ACTING DIVISION LEADER OF MATH SCIENCES DIV. HE WILL BE CONTACT FOR DIVISION OF ONR.
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>MCC
<done>Y
<>

<company>SIA
<from>Warren Davis
<to>BELL, GORDON
<date>9/16/82
<date rec>10/4/82 Mon 11:59
<log#>10-3
<request>HIGH DENSITY MEMORY STUDY
<reply by>0
<dispo/date>10/4/82 Mon 11:59 CIRCULATED TO J.KALB, P. VAN ROEKENS, G.SAVIERS

<message>RETURN TO G. BELL
<answer>
<f/u>
<filed>
<done>Y
<>

<company>
<from>SIDNEY FERNBACH
<to>BELL, GORDON
<date>9/28/82
<date rec>10/1/82 Fri 13:22
<log#>10-2
<request>AGENDA AND COMMENTS FOR LOS ALAMOS
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>SRI INTERNATIONAL
<from>WILLIAM F. MILLER
<to>BELL, GORDON
<date>9/27/82
<date rec>10/1/82 Fri 13:21
<log#>10-1
<request>SUGGESTS THAT SRI INTERNATIONAL BE CONSIDERED AS A CANDIDATE FOR A POST VN COMPUTING RESEARCH CENTER IN CONJUNCTION WITH MCC.
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>SEMICONDUCTOR RESEARCH CORPORATION
<from>
<to>BELL, GORDON
<date>9/20/82
<date rec>9/29/82 Wed 14:28
<log#>9-39
<request>INVOICE FOR ASSESSMENT SRC CONDUCT OF BASIC RESEARCH SEC.44F(E)(2) INTERNAL REVENUE CODE.
<reply by>0
<dispo/date>10/4/82 Mon 10:57
<message>SENT TO JEFF KALB--IS THIS YOURS/
<answer>
<f/u>
<filed>
<done>Y
<>

<company>
<from>JOHN VINCENT ATANASOFF
<to>BELL, GORDON
<date>9/27/82
<date rec>9/29/82 Wed 13:19
<log#>9-38
<request>PRELIMINARY COPY OF "ADVENT OF DIGITAL ELECTRONIC COMPUTING"
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>NATIONAL RESEARCH COUNCIL
<from>COURTLAND PERKINS, FRANK PRESS
<to>BELL, GORDON

<date>9/24/82
<date rec>9/28/82 Tue 9:55
<log#>9-37
<request>REQUEST DEC PARTICIPATION IN ACADEMY INDUSTRY PROGRAM
<reply by>0
<dispo/date>10/18/82 Mon 13:20 SENT TO NANCY DUBE
11/9/82 Tue 10:44 TO K. OLSEN
<message>SHOULDN'T WE JOIN?   TO K.OLSEN: I GOT THIS ARM TWIST LETTER. SHOULD WE JOIN/SUPPORT?
<answer>
<f/u>10/29 - 11/12
<filed>
<done>Y
<>

<company>
<from>RICHARD W. HERBOLD
<to>BELL, GORDON
<date>9/2/82
<date rec>9/28/82 Tue 9:57
<log#>9-36
<request>RESUME
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>WHO'S WHO IN FINANCE AND INDUSTRY
<from>SHIRLEY HAST
<to>BELL, GORDON
<date>NO DATE
<date rec>9/23/82
<log#>9-35
<request>TO INFORM GORDON HIS NAME IS UP FOR CONSIDERATION IN

WHO'S WHO IN FINANCE AND INDUSTRY. REQUESTING A COMPLETED BIOGRAPHICAL DATA FORM.
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>ASSOCIATION FOR SCIENCE-TECHNOLOGY CENTERS
<from>SHEILA GRINELL
<to>BELL, GORDON
<date>9/20/82
<date rec>9/22/82 Wed 14:28
<log#>9-34
<request>COPY OF LETTER SENT TO AVRAM MILLER THANKING HIM FOR HELP ON AN EXHIBITION PROJECT FEATURING DEC PERSONAL COMPUTERS.
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>BOARD OF OVERSEERS OF HARVARD COLLEGE
<from>DEAN PAUL C. MARTIN
<to>BELL, GORDON
<date>9/22/82
<date rec>9/22/82 Wed 14:40
<log#>9-33
<request>COMMITTEE TO VISIT THE DIVISION OF APPLIED SCIENCES TO MEET ON 17 & 18 NOV AT 9 A.M. DINNER ON TH 17TH.
<reply by>ASAP
<dispo/date>
<message>
<answer>

<f/u>
<filed>
<done>Y
<>

<company>LOVELACE, LAWRENCE & CO.
<from>GILES LOVELACE
<to>BELL, GORDON
<date>NO DATE
<date rec>9/21/82 Tue 10:29
<log#>9-32
<request>SENT INFORMATION THAT WAS REQUESTED FROM G. BELL ON SYSTEMS PACKAGES--ANALOG CODES AND MRP.
<reply by>0
<dispo/date>9/27/82 SENT TO DON METZGER.
<message>PLEASE NOTE
<answer>
<f/u>
<filed>
<done>Y
<>

<company>ANALOGIC
<from>ROY CLITES
<to>BELL, GORDON
<date>9/14/82
<date rec>NO DATE
<log#>9-31
<request>AP400 ARRAY PROCESSOR MACHINE, THE AP500 TO BE ANNOUNCED IN OCT.
<reply by>0
<dispo/date>9/21/82 SENT TO TOM GANON CC TO B. LONG, B. BRUCE. TOM, PLEASE ARRANE FOR A PRSENTATION. B. LONG - CAN YOU GET ONE OF THOSE FOR EVALUATION?
<message>
<answer>
<f/u>10/1/82
<filed>
<done>Y

<>

<company>MCC
<from>DEL ASMUSSEN
<to>BELL, GORDON
<date>9/17/82
<date rec>9/20/82
<log#>9-30
<request>MCC MEETING CALENDAR -- BOARD OF DIRECTORS MEETING FOR 26 OCT HAS BEEN RESCHEDULED. NEW TIME AND DATE TO BE DETERMINED.
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>SPERRY UNIVAC
<from>L.L.WALKER
<to>BELL, GORDON
<date>9/10/82
<date rec>9/20/82 Mon 10:14
<log#>9-29
<request>MAPPER MANNUALS G. BELL REQUESTED.
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>TEKNOWLEDGE
<from>DINA BARR

<to>BELL, GORDON
<date>9/16/82
<date rec>9/20/82 Mon 10:12
<log#>9-28
<request>THANK YOU FOR INQUIRY ON TEKNOWLEDGE PRODUCTS AND SERVICES.
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>CARNEGIE-MELLON UNIVERSITY
<from>ALLEN NEWELL
<to>BELL, GORDON
<date>9/15/82
<date rec>9/20/82 Mon 10:08
<log#>9-27
<request>THANK YOU FOR SENDING MCC DOCUMENT. DISCUSSION OF THE DOCUMENT.
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>SRC BOARD OF DIRECTORS
<from>ERICH BLOCH
<to>BELL, GORDON
<date>9/14/82
<date rec>9/20/82 Mon 10:06
<log#>9-26
<request>HEWLETT-PACKARD DECIDED TO JOIN THE SRC.

<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>TEXAS INSTRUMENTS
<from>ROB BUDZINSKI
<to>BELL, GORDON
<date>NO DATE
<date rec>9/17/82 Fri 13:43
<log#>9-25
<request>RECONSTRUCTABLE IC WORK/BOOKLET
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>TELESENSORY SPEECH SYSTEMS
<from>CHARLES M. SUTHERLAND, STURDY CO. INC., 167 WORCESTER STREET, WELLESLEY HILLS, MA 02181 (617) 235-2330
<to>BELL, GORDON
<date>8/20/82
<date rec>8/23/82
<log#>9-24
<request>REPORT AND SELLING PIECE FOR SPEECH 1000 SPEECH SYNTHESIZER BOARD
<reply by>0
<dispo/date>SENT TO LEE WILLIAMS 9/17/82 Fri 10:49
<message>
<answer>

<f/u>
<filed>
<done>Y
<>

<company>College of Engineering, University of Michigan
<from>James J. Duderstadt
<to>BELL, GORDON
<date>9/13/82
<date rec>8/16/82 Mon 14:03
<log#>9-23
<request>Thank you for advise re: letter of 8/20. Confirmation of appt. 9/29/82 at 2:00 with a rep from Ketchum. Mr. Dudley Clowes will replace Robert Carter. See 8-56 for further info.
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>12
<done>Y
<>

<company>CODENOLL TECHNOLOGY CORPORATION
<from>MICHAEL H. CODEN
<to>KEN OLSENT, REFERRED TO BELL, GORDON
<date>9/13/82
<date rec>9/15/82
<log#>9-22
<request>ENCLOSED A PRESS RELEASE INTRODUCING THE FIRST FIBEROPTIC ETHERNET LOCAL AREA NETWORK DEV. BY CODENOLL. AS A FORMER EMPLOYEE HE IS HOPING THAT DEC MAY WISH TO PURCHASE THIS EQUIP. OR USE IT IN CONJUNCTION WITH DEC PRODUCTS.
<reply by>0
<dispo/date>SENT TO B. LACROUTE 9/20/82
<message>THIS LOOKS INTERESTING? CAN WE USE IT?
<answer>
<f/u>10/1/82, PULLED FROM FU TO CALL BERNIE--PAT HAS IT
<filed>

<done>Y
<>

<company>INSTITUT REMY GENTON
<from>REMY CENTON
<to>BELL, GORDON
<date>9/6/82
<date rec>8/15/82
<log#>9-21
<request>INVITATION TO PARTICIPATE IN THE 1ST EUROPEAN SYMP OF OFFICE AUTO ON 9/24/82
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>ROLM POLITICAL COMMITTEE
<from>WALTER LOEWENSTERN
<to>BELL, GORDON
<date>9/10/82
<date rec>9/15/82 Wed 14:36
<log#>9-20
<request>REQUESTING SUPPORT FOR DAVE EMERY, U.S. SENATE SEAT FOR MAINE.
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>DUN'S MARKETING SERVICES
<from>THOMAS M. MCCARTHY

<to>BELL, GORDON
<date>9/3/82
<date rec>9/14/82 Tue 16:19
<log#>9-19
<request>SALES PIECE
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>SEMICONDUCTOR INDUSTRY ASSOCIATION
<from>TOM HINKELMAN
<to>BELL, GORDON
<date>9/8/82
<date rec>9/14/82 Tue 16:18
<log#>9-18
<request>THANK YOU FOR $200,000 DONATION, IT HAS BEEN FORWARDED TO LARRY SUMNEY, EXEC. DIR. OF THE SEMICONDUCTOR RESEARCH COOPERATIVE.
<reply by>0
<dispo/date>CC TO KALB 9/20/82 Mon 17:14
<message>YOURS NOW
<answer>
<f/u>
<filed>SIA
<done>Y
<>

<company>LAWRENCE BERKELEY LAB
<from>JAMES BAKER
<to>BELL, GORDON
<date>9/1/82
<date rec>9/14/82 Tue 15:58
<log#>9-17
<request>"IT IS THE INTENT OF THE LAWRENCE BERKELEY LAB TO SUBMIT SEMI-FORMAL PROPOSALS FOR SITE LOCATION AND FOR A SET

OF APPLICATIONS. THIS LETTER IS TO BE REGARDED AS A WARNING THAT SUCH PROPOSALS ARE IN THE WORKS".
<reply by>0
<dispo/date>10/11/82 Mon 8:36 GORDON HAS A COPY OF LETTER AND A COPY IN AO FILE. COPY SENT TO STEERING AND SITE COMMITTEE.
<message>
<answer>
<f/u>ORIG RET TO GB
<filed>
<done>Y
<>

<company>NORTHEASTERN UNIVERSITY
<from>KENNETH G. RYDER
<to>KEN OLSEN, REFERRED TO BELL, GORDON, HARVEY WEISS, AL MULLIN
<date>9/1/82
<date rec>KO 9/3/82 GB 9/14/82 Tue 15:46
<log#>9-16
<request>TO EXPLORE THE POSSIBILITIES OF INCREASED INTERACTION BETWEEN OUR UNIVERSITY AND INTERESTED INDUSTRIES
<reply by>0
<dispo/date>SENT TO LARRY BORNSTEIN, DIETER HUTTENBERGER WITH CC TO JACK SMITH
<message>WILL YOU PLEASE HANDLE THIS WHEN IT COMES UP?
<answer>
<f/u>
<filed>FILE 12
<done>Y
<>

<company>INTERNATIONAL COMPUTERS LIMITED
<from>ROBB W. WILMOT
<to>BELL, GORDON
<date>9/6/82
<date rec>9/13/82 Mon 15:41
<log#>9-15
<request>SEEKING SUPPORT FOR A SECOND PHASE OF THE LAN STANDARDIZATION EFFORT, WITH A GOAL OF PRODUCING TANGIBLE END USER BENEFITS BY EVOLVING DOCUMENT INTERCHANGE

<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>NIPPON TELEGRAPH & TELEPHONE
<from>KOICHI YAMASHITA
<to>BELL, GORDON
<date>9/6/82
<date rec>9/13/82 Mon 15:36
<log#>9-14
<request>WOULD LIKE TO MEET WITH GORDON ON 9/23/82
<reply by>0
<dispo/date>SENT TO G. WITMORE, ARNOLD KRAFT.
<message>MAKE SURE A NON-DISCLOSURE IS SIGNED.
<answer>
<f/u>
<filed>12
<done>Y
<>

<COMPANY>NATIONAL SCIENCE FOUNDATION
<FROM>KENT K CURTIS
<TO>BELL, GORDON
<DATE>9/8/82
<DATE REC>9/10/82 FRI 9:21
<log#>9-13
<request>ENCLOSED A DRAFT REPORT FROM THE MICHIGAN MEETING.
INVITATION TO FOLLOWUP MEETING 10-28/29 IN WASHINGTON.
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>

<done>Y
<>

<company>BATTELLE COLUMBUS LABORATORIES
<from>W.C. HOLTON
<to>BELL, GORDON
<date>9/7/82
<date rec>9/10/82 Fri 9:16
<log#>9-12
<request>PLEASE REVIEW PROSPECTUS: SECONDARY CONTAINMENT SYSTEMS FOR HAZARDOUS CHEMICALS AND SOLVENTS
<reply by>0
<dispo/date>sent to Jim Magaldi 9/13/82 Mon 9:45
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>E.I DU PONT DE NEMOURS & COMPANY
<from>DAVID A. PENSAK
<to>BELL, GORDON
<date>9/7/82
<date rec>9/10/82 Fri 9:12
<log#>9-11
<request>WOULD LIKE GORDON TO REVIEW USERS AND REFERENCE MANUAL FOR A GRAPHICALLY ORIENTED PROGRAMMING SYSTEM THEY HAVE DEVELOPED. HE AND GORDON DISCUSSED IT AT CALTECH LAST MAY.
<reply by>0
<dispo/date>SENT TO BILL KEATING
<message>
<answer>10/18/82 Mon 13:30 RECEIVED BILL KEATING'S ANWER--SENT A LETTER TO PENSAK.
<f/u>
<filed>12
<done>Y
<>

<company>CYNTHIA PERIPHERAL CORPORATION
<from>IVO ADAM, EXEC. VP
<to>BELL, GORDON
<date>9/3/82
<date rec>9/10/82 Fri 9:06
<log#>9-10
<request>SALES PIECE FOR PERIPHALS
<reply by>0
<dispo/date>sent to Grant Saviers 9/13/82 Mon 9:44
<message>Yours
<answer>
<f/u>
<filed>
<done>Y
<>

<company>LIEBERT CORPORATION
<from>T.C. BROWN
<to>BELL, GORDON
<date>9/2/82
<date rec>9/8/82 Wed 13:23
<log#>9-9
<request>SALES PIECE FOR ENVIRONMENTAL CONTROL SYSTEMS, SPECIFICALLY THE SMALL SYSTEM MARKET.
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>AMERICAN INSTITUTE OF AERONAUTICS AND ASTRONAUTICS
<from>JAMES J. HARFORD
<to>BELL, GORDON
<date>9/1/82
<date rec>9/7/82 Tue 14:27

<log#>9-8
<request>INVITATION TO GORDON AND THREE OTHERS TO PARTICIPATE IN A SEMINAR SPONSORED BY NASA FOR THE INDUSTRY SECTOR.
<reply by>10/15/82
<dispo/date>SENT to Don Metzger 9/13/82 Mon 9:14
<message>Yours, please answer.
<answer>
<f/u>
<filed>
<done>Y
<>

<company>THE INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, INC.
<from>RANSOM D. SLAYTON
<to>BELL, GORDON
<date>8/31/82
<date rec>9/7/82
<log#>9-7
<request>INVITATION FOR PARTICIPATE IN IEEE CONFERENCE JUNE 19-23, 1983 IN BOSTON. REQUEST FOR SUBMISSION OF PAPERS.
<reply by>9/16/82 TO DR. LEON J. RICARDI
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>HAINES LUNDBERG WAEHLER-ARCHITECTS, ENGINEERS & PLANNERS
<from>MARTIN D. RAAB
<to>BELL, GORDON
<date>8/30/82
<date rec>9/7/82
<log#>9-6
<request>SALES PIECE FOR PLANNING AND DESIGNING RESEARCH FACILITIES
<reply by>0

<dispo/date>sent to Mike Mulroy, CFO1-2/K40 on 9/8/82 Wed 11:36
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>FAIRCHILD CAMERA AND INSTRUMENT CORP
<from>C. LESTER HOGAN
<to>BELL, GORDON
<date>8/31/82
<date rec>9/3/82 Fri 9:20
<log#>9-5
<request>PROPOSAL FOR R & D WITH MCC
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>University of California, Berkeley
<from>David A. Patterson
<to>BELL, GORDON
<date>8/27/82
<date rec>9/2/82 Thu 14:09
<log#>9-4
<request>Response to request for performance check of the VMS C compiler.
<reply by>0
<dispo/date>Sent to Bill Strecker, Sam Fuller, Forest Baskett 9/13/82 Mon 9:46
<message>Note
<answer>
<f/u>

<filed>alpha-University of California/Berkeley
<done>Y
<>

<company>DESIGN AUTOMATION, INC.
<from>NATHAN O. SOKAL
<to>BELL, GORDON
<date>NONE
<date rec>9/1/82 Wed 13:40
<log#>9-3
<request>JOB FOR ADAM WINNICKI
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>CAPITAL CHILDREN'S MUSEUM
<from>CANDACE J. SULLIVAN
<to>BELL, GORDON
<date>AUGUST 27, 1982
<date rec>9/1/82 Wed 13:39
<log#>9-2
<request>APPRECIATION FOR APPOINTING A REPRESENTATIVE TO ADVISORY PANEL
<reply by>0
<dispo/date>sent to Win Hindle and Avram Miller 9/10/82 Fri 16:40
<message>WH-I strongly believe we need someone on this. Who form EDW could do it? AM-Anyone from Eng?
<answer>FROM PETER JANSEN TO SULLIVAN DATED 10/7/82
<f/u>9/17,10/15, 10/13/82 Wed 15:30 back to GB
<filed>CAPITAL CHILDREN'S MUSEUM
<done>Y
<>

<company>NEC
<from>HARUO YAMAGUCHI
<to>BELL, GORDON
<date>AUGUST 26, 1982
<date rec>9/1/82 Wed 13:37
<log#>9-1
<request>THANK YOU FOR GB LETTER
<reply by>0
<dispo/date>sent of OC and Jerry Witmore 9/13/82 Mon 9:35
<message>A key reason confirming how collaboration via NJJ helps
<answer>
<f/u>
<filed>alpha-Japan
<done>Y
<>

<company>SRI INT'L
<from>KINNEY THIELE
<to>BELL, GORDON
<date>NONE
<date rec>8/30/82 Mon 15:56
<log#>8-67
<request>ONE DAY EXECUTIVE BRIEFING SESSION ON DECISION AND RISK ANALYSIS/1982
<reply by>0
<dispo/date>SENT TO JEFF KALB 9/3/82 Fri 10:21
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>RESUME
<from>CHRIS HRIVNAK
<to>BELL, GORDON
<date>AUGUST 23, 1982
<date rec>8/30/82 Mon 13:14
<log#>8-66

<request>RESUME
<reply by>0
<dispo/date>SENT TO JOHN DIPIETRO 9/3/82 Fri 10:22
<message>PLS HANDLE
<answer>
<f/u>
<filed>
<done>Y
<>

<company>FUJITSU
<from>MATAMI YASUFUKU
<to>BELL, GORDON
<date>AUGUST 23, 1982
<date rec>8/30/82 Mon 13:12
<log#>8-65
<request>THANK YOU LETTER IN RESPONSE TO YOUR THANK YOU, ALSO TREAT MATERIAL YOU ASKED ABOUT AS CONFIDENTIAL OUTSIDE OF DIGITAL
<reply by>0
<dispo/date>cc sent to Ron Reiling
<message>
<answer>
<f/u>
<filed>alpha-Fujitsu
<done>Y
<>

<company>RESUME
<from>HAROLD A. SCOTT
<to>BELL, GORDON
<date>AUGUST 26, 1982
<date rec>8/30/82 Mon 13:10
<log#>8-64
<request>RESUME
<reply by>0
<dispo/date>SENT TO JOHN DIPIETRO 9/3/82 Fri 10:22
<message>
<answer>
<f/u>

<filed>
<done>Y
<>

<company>INTEL
<from>GARY RANCOURT
<to>BELL, GORDON
<date>AUGUST 24, 1982
<date rec>8/30/82 Mon 9:26
<log#>8-63
<request>COPY OF PRESENTATION MATERIALS UED DURING RECENT DISCUSSION
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>NCR
<from>ROY E. KUNTZ
<to>BELL, GORDON
<date>AUGUST 27, 1982
<date rec>8/30/82 Mon 9:24
<log#>8-62
<request>PRESENTATION MATERIAL ON THE MCC SOFTWARE PRODUCTIVITY PROJECT THAT GB REQUESTED FROM MARV BERISS AT DENVER III
<reply by>0
<dispo/date>sent to BJ, cc to Keating, Heffner, Saviers
<message>Should we become a member of this part of the MCC? We're going to join MCC (Microelectronics & Computer Company). They're having a planning <u>Meeting</u> all this month. <u>Let's</u> have someone participate.
<answer>
<f/u>9/17
<filed>
<done>Y

<>

<company>UNIVERSITY OF SOUTHERN CALIFORNIA
<from>HENRY SALVATORI
<to>BELL, GORDON
<date>NONE
<date rec>8/30/82 Mon 9:22
<log#>8-61
<request>INVITATION TO A SEMINAR ON PROGRAMMING CONCEPTS FOR COMPUTER NETWORKS BY PROFESSOR BRINCH-HANSEN AND RECEPTION
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>IBM
<from>ERICH BLOCH
<to>BELL, GORDON
<date>AUGUST 24, 1982
<date rec>8/30/82 Mon 9:19
<log#>8-60
<request>THANK YOU LETTER TO GB AND NOVEMBER 19 BEST DATE FOR ;HIM FOR DISCUSSION OF A PERMANENT HOME FOR THE MUSEUM
<reply by>0
<dispo/date>SENT TO GWEN 9/3/82 Fri 11:29. ORIG RETURNED TO MJ.
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>HEIDRICK AND STRUGGLES, INC
<from>JAMES I. STOCKWELL

<to>BELL, GORDON
<date>AUGUST 25, 1982
<date rec>8/30/82 Mon 9:17
<log#>8-59
<request>LETTER AND PROFILE OF A CHIEF RESEARCH AND DEVELOPMENT EXECUTIVE, WANTS AN UPDATE
<reply by>0
<dispo/date>NO INTEREST, FILED IN 12
<message>
<answer>
<f/u>
<filed>IN 12
<done>Y
<>

<company>MIT
<from>GERALD L. WILSON
<to>BELL, GORDON
<date>AUGUST 23, 1982
<date rec>8/30/82 Mon 9:15
<log#>8-58
<request>AGENDA ON CONFERENCE 10/2-3 CELEBRATING 100 YEARS OF ELECTRICAL ENGINEERING AT M.I.T.
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>KALBA BOWEN ASSOCIATES, INC
<from>REBECCA GREEN
<to>BELL, GORDON
<date>AUGUST 26, 1982
<date rec>8/30/82 Mon 9:12
<log#>8-57
<request>LETTER AND BROCHURE DESCRIBING THE PARAMETERS OF THE STRUDY IN TELECOMMUNICATIONS COMPUTER AND VIDEOTEXT

<reply by>0
<dispo/date>SENT TO WIN HINDLE 9/3/82 Fri 11:27
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>UNIVERSITY OF MICHIGAN
<from>JAMES J. DUDERSTADT
<to>BELL, GORDON
<date>AUGUST 20, 1982
<date rec>8/26/82 Thu 13:40
<log#>8-56
<request>APPRAISAL AND ADVICE CONCERNING NEW PROJECT INVOLVING INTEGRATION OF COMPUTER AIDED ENGINEERING AND TECHNICAL INFORMATION MANAGEMENT THROUGH USE OF BROADBAND COMMUNICATIONS NETWORK, WANT GB TO MEET WITH MR. CARTER FOR DISCUSSION. **BRAD CANALY [(313) 263-2160] CALLED ON 9/7/82 Tue 11:32, THEY WILL BE IN THE BOSTON AREA AND WOULD LIKE TO MEET (1/2 HOUR) WITH GORDON ON SEPT 29 OR 30.**
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>JOHN D. & CATHERINE T. MACARTHUR FOUNDATION
<from>KENNETH HOPE
<to>BELL, GORDON
<date>AUGUST 24, 1982
<date rec>8/26/82 Thu 13:36
<log#>8-55
<request>REFERENCE FOR WESLEY A. CLARK WHO HAS BEEN NOMINATED FOR A MACARTHUR FOUNDATION PRIZE FELLOW AWARD
<reply by>0

<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>CAPITAL CHILDREN'S MUSEUM
<from>CANDACE J. SULLIVAN
<to>BELL, GORDON
<date>AUGUST 20, 1982
<date rec>8/26/82 Thu 13:33
<log#>8-54
<request>WANT GB TO SERVE ON ADVISORY PANEL
<reply by>0
<dispo/date>see mail log 9-2 for more info
<message>
<answer>
<f/u>
<filed>CAPITAL CHILDREN'S MUSEUM
<done>Y
<>

<company>MIT
<from>GERALD L. WILSON TO KEN OLSEN
<to>BELL, GORDON
<date>AUGUST 23, 1982
<date rec>8/26/82 Thu 13:31
<log#>8-53
<request>CONFERENCE 10/2 AND 3 AT MIT.
<reply by>0
<dispo/date>RETURNED TO ANN 9/3/82 Fri 11:26
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>ELECTROTECHNICAL LABORATORY
<from>TOSHITSUGU YUBA
<to>BELL, GORDON
<date>AUGUST 20, 1982
<date rec>8/25/82 Wed 14:32
<log#>8-52
<request>LETTER IN REGARDS TO THE LISP MACHINE (DR. TOJO LETTER OF 7/19) THEY ARE STILL USING BUT SOMEDAY MAYBE
<reply by>0
<dispo/date>COPY SENT TO GWEN 9/3/82 Fri 11:25. ORIG RETURNED TO MJ.
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>STRATEGIC DECISIONS GROUP
<from>MICHAEL M. MENKE
<to>BELL, GORDON
<date>AUGUST 13, 1983
<date rec>8/24/82 Tue 9:17 FROM LARRY PORTNER
<log#>8-51
<request>LETTER AND BROCHURE, 2 DAY SEMINAR FOR R&D DECISION ANALYSIS AND PORTFOLIO MANAGEMENT IN EITHER SEPT. OR OCT.
<reply by>0
<dispo/date>sent to Rick Corben 9/14/82 Tue 11:22
<message>Ever go to this?
<answer>
<f/u>
<filed>
<done>Y
<>

<company>RESUME
<from>BRUCE ZUKAUSKAS
<to>BELL, GORDON
<date>AUGUST 22, 1982

<date rec>8/24/82 Tue 9:14
<log#>8-50
<request>RESUME
<reply by>0
<dispo/date>SENT TO JOHN DIPIETRO 9/8/82 Wed 15:16
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>NEC
<from>MAKOTO WATANABE
<to>BELL, GORDON
<date>AUGUST 17, 1982
<date rec>8/23/82 Mon 3:24
<log#>8-49
<request>THANK YOU LETTER FOR INVITING HIM TO COMPUTER MUSEUM
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>12
<done>Y
<>

<company>KODAK
<from>IVOR BROWN
<to>BELL, GORDON
<date>AUGUST 16, 1982
<date rec>8/23/82 Mon 1:39
<log#>8-48
<request>LETTER AND BROCHURES REFERENCING AN SP2000 MOTION ANALYSIS SYSTEM
<reply by>0
<dispo/date>CIRCULATED TO J. RING, G. SAVIER, M. RIGGLE, K. OLSEN
<message>

<answer>RETURNED TO GORDON 10/18/82 Mon 14:41
<f/u>
<filed>
<done>Y
<>

<company>BATTELLE
<from>JOHN H. LINDHOLM, JR.
<to>BELL, GORDON
<date>AUGUST 20, 1982
<date rec>8/23/82 Mon 1:36
<log#>8-47
<request>LETTER AND BROCHURE ON APPLICATIONS AND BENEFITS OF INDUSTRIAL ROBOTS--SUBSCRIPTION SERVICE
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>EXCEL PERSONNEL
<from>DAVE DIXON
<to>BELL, GORDON
<date>AUGUST 5, 1982
<date rec>8/23/82 Mon 1:30
<log#>8-46
<request>RESUME
<reply by>0
<dispo/date>SENT TO JOHN DIPIETRO 9/8/82 Wed 14:24
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>STRATEGIC DECISIONS GROUP
<from>MICHAEL MENKE
<to>BELL, GORDON
<date>8/13/82
<date rec>8/20/82 Fri 16:23
<log#>8-45
<request>SELLING CONSULTING SERVICES
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>RESUME
<from>DEBORAH F. SAVOIE
<to>BELL, GORDON
<date>8/17/82
<date rec>8/20/82 Fri 16:22
<log#>8-44
<request>LOOKING FOR EMPLOYMENT
<reply by>0
<dispo/date>SENT TO JOHN DEPIETRO/8/23/82 Mon 8:08
<message>PLS HANDLE
<answer>
<f/u>
<filed>
<done>Y
<>

<company>RESUME
<from>JOHN THOMAS
<to>BELL, GORDON
<date>AUGUST 14, 1982
<date rec>8/19/82 Thu 2:44
<log#>8-43
<request>RESUME
<reply by>0

<dispo/date>SENT TO JOHN DIPIETRO/8/19/82 Thu 3:13
<message>PLS HANDLE
<answer>
<f/u>
<filed>
<done>Y
<>

<company>ELECTROTECHNICAL LABORATORY
<from>AKIO TOJO
<to>BELL, GORDON
<date>AUGUST 12, 1982
<date rec>8/19/82 Thu 2:43
<log#>8-42
<request>LETTER AND COPIES OF OLD COMPUTERS, IN RELATION TO GB LETTER FOR COMPUTER MUSEUM
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>STATE OF FLORIDA--OFFICE OF THE GOVERNOR
<from>BOB GRAHAM
<to>BELL, GORDON
<date>AUGUST 12, 1982
<date rec>8/18/82 Wed 14:04
<log#>8-41
<request>INVITE TO PARTICIPATE 10/22-24 IN A SHOWCASE WEEKEND--OFFICIAL OPENING OF EPCOT CENTER, SHOWPLACE FOR PREVIEWING THE TECH. OF TOMORROW
<reply by>0
<dispo/date>REGRETS CALL 8/20/82 Fri 15:21
<message>
<answer>
<f/u>
<filed>12

<done>Y
<>

<company>SYRACUSE UNIVERSITY
<from>VIRGIL W. EVELEIGH
<to>BELL, GORDON
<date>AUGUST 11, 1982
<date rec>8/18/82 Wed 14:01
<log#>8-40
<request>WANT GB TO EVALUATE THEIR PROPOSED PH.D. PROGRAM IN COMPUTER ENGINEERING--PROGRAM ENCLOSED
<reply by>0
<dispo/date>SENT TO DIETER 8/24/82 Tue 11:34
<message>COULD YOU PLEASE ANSWER AND APOLOGIZE.- I'M GOING OUT OF TOWN FOR A MONTH. COULD YOU FIND SOMEONE?
<answer>
<f/u>
<filed>12
<done>Y
<>

<company>ARTHUR D. LITTLE (JAPAN), INC.
<from>YOSHIMICHI YAMASHITA
<to>BELL, GORDON (TO KEN OLSEN)
<date>AUGUST 9, 1982
<date rec>8/18/82 Wed 8:34
<log#>8-39
<request>OFFERING AN EXECUTIVE REVIEW PROGRAM OF YOUR JAPAN STRATEGY. HE AND HIS COLLEAGUES ARE VISITING THE U.S. AROUND 9/10 AND 10/20. IF INTERESTED IN THEIR PROGRAM, THEY WOULD LIKE TO MEET
<reply by>0
<dispo/date>SENT TO GRANT SAVIERS/8/19/82 Thu 3:01
<message>YOURS
<answer>
<f/u>
<filed>
<done>Y
<>

<company>UNIVERSITY OF SOUTH FLORIDA
<from>MICHAEL G. KOVAC
<to>BELL, GORDON
<date>AUGUST 5, 1982
<date rec>8/17/82 Tue 13:37
<log#>8-38
<request>WANTS A CONTACT IN DIGITAL TO DISCUSS A NEW PROJECT CALLED CEDAR (CENTER FOR ELECTRONIC DEVELOPMENT AND RESEARCH)--AND DO YOU WANT TO BE ON MAILING LIST
<reply by>0
<dispo/date>SENT TO DIETER HUTTENBERGER/8/19/82 Thu 3:03
<message>PLS ANSWER
<answer>
<f/u>
<filed>
<done>Y
<>

<company>RIKEI
<from>KO TANAKA
<to>BELL, GORDON
<date>AUGUST 12, 1982
<date rec>8/17/82 Tue 13:35
<log#>8-37
<request>A THANK YOU FOR YOUR LETTER--HE ALSO WILL BE ON EAST COAST END OF FIRST WEEK OF OCTOBER
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>meeting hold folder
<done>Y
<>

<company>ICASE
<from>ROBERT G. VOIGT
<to>BELL, GORDON
<date>AUGUST 12, 1982

<date rec>8/16/82 Mon 15:36
<log#>8-36
<request>SCHEDULE OF ACTIVITIES AT MICHIGAN MTG. ON 23RD.
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>NEC(NIPPON ELECTRIC CO., LTD.
<from>HAJIME SASAKI
<to>BELL, GORDON
<date>AUGUST 11, 1982
<date rec>8/16/82 Mon 15:33
<log#>8-35
<request>THANK YOU FOR INVITE TO BECOME MEMBERS OF MUSEUM--PLANS TO VISIT BEGINNING OF NOVEMBER
<reply by>0
<dispo/date>SENT TO PEG, TOM WILLIALMS/8/19/82 Thu 4:19
<message>LOOKOUT! ROY REZAC, CAN WE TALK BUT CONTROL THIS?
<answer>
<f/u>
<filed>MUSEUM
<done>Y
<>

<company>SRI INTERNATIONAL
<from>RESPOND TO MS. KINNEY THIELE
<to>BELL, GORDON
<date>NONE
<date rec>8/16/82 Mon 15:31
<log#>8-34
<request>INVITE TO PARTICIPATE IN A ONE DAY SENIOR EXECUTIVE BRIEFING ON STRATEGIC DECISION MAKING--FEE 690.00
<reply by>0
<dispo/date>
<message>

<answer>
<f/u>
<filed>
<done>Y
<>

<company>BUSINESS SCIENCE INTERNATINAL, INC.
<from>PETER S. KARP
<to>BELL, GORDON
<date>AUGUST 9, 1982
<date rec>8/16/82 Mon 10:18
<log#>8-33
<request>A LETTER AND BOOK--BSI'S 1982-83 SALES "LEAD" PROGRAM IN THE U.S. SMALL BUSINESS TARGET MARKET
<reply by>0
<dispo/date>SENT TO JACK SHIELDS/8/16/82 Mon 10:21
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>TOM E. FORTUNE
<from>TOM E. FORTUNE
<to>BELL, GORDON
<date>AUGUST 1, 1982
<date rec>8/16/82 Mon 10:06 (FROM KEN OLSEN)
<log#>8-32
<request>ANY INTEREST IN--NATURE AND PROBLEMS OF CITIZEN-GOVERNMENT COMMUNICATIONS.
<reply by>0
<dispo/date>RESPONDED 8/25/82 Wed 8:54, SENT CC TO KO/GB3.S7.16
<message>NO INTEREST AT THIS TIME
<answer>
<f/u>
<filed>
<done>Y
<>

<company>LABORATORY FOR ROBOT SENSOR TECHNOLOGY
<from>MINAS ENSANIAN
<to>BELL, GORDON
<date>JULY 3, 1982
<date rec>8/16/82 Mon 10:04 (FROM KEN OLSEN)
<log#>8-31
<request>PERSONAL COMM. SUGGESTING COOPERATIVE AND/OR JOINT VENTURE FOR TAKING THE NEW SCIENCE AND TECHNOLOGY OF ELECTROPHOTOGRAPHY (ETG) COMMERCIAL
<reply by>0
<dispo/date>GAVE COPY OF LETTER AND NOTE TO ANN JENKINS, SENT PACKAGE TO TOM WILLIAMS/8/19/82 Thu 4:16 /FU 9/3
<message>PLS CONTACT - WOULD YOU ANSWER THIS FOR KEN?
<answer>
<f/u>
<filed>12
<done>Y
<>

<company>CONTROL DATA
<from>S. J. OLSON
<to>BELL, GORDON
<date>AUGUST 9, 1982
<date rec>8/13/82 Fri 14:33
<log#>8-30
<request>MCC STEERING COMMITTEE MEMBERS--DEPT OF JUSTICE INQUIRY
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>NAE
<from>ALEXANDER H. FLAX

<to>BELL, GORDON
<date>AUGUST 10, 1982
<date rec>8/12/82 Thu 16:51
<log#>8-29
<request>NAE ELECTION BALLOT
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>CHINA COMPUTER CORP
<from>MATTHEW F.C. MIAU
<to>BELL, GORDON
<date>AUGUST 5, 1982
<date rec>8/12/82 Thu 16:48
<log#>8-28
<request>RESPONDING TO THANK YOU LETTER FROM JAPAN TRIP--ALSO HIS TRIP TO US HAS BEEN DELAYED
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>THAYER SCHOOL OF ENGINEERING, DARTMOUTH COLLEGE
<from>BARRY RICHMOND
<to>BELL, GORDON
<date>AUGUST 9, 1982
<date rec>8/11/82 Wed 13:53
<log#>8-27
<request>A RESPONSE TO A LETTER GB SENT TO HIM, IT REFERENCES A MODEL
<reply by>0
<dispo/date>

<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>WILLIAM MCCULLOCH ASSOCIATES, INC.
<from>WILLIAM A. MCCULLOCH
<to>BELL, GORDON
<date>AUGUST 4, 1982
<date rec>8/11/82 Wed 13:06
<log#>8-26
<request>SEEKING SOMEONE TO FILL A POSITION
<reply by>0
<dispo/date>
<message>NO CANDIDATES 8/24/82 Tue 16:36
<answer>
<f/u>
<filed>
<done>Y
<>

<company>RESUME
<from>M. M. AL-CHALABI
<to>BELL, GORDON
<date>JULY 28, 1982
<date rec>8/10/82 Tue 13:18
<log#>8-25
<request>RESUME
<reply by>0
<dispo/date>SENT TO JOHN DIPIETRO/8/11/82 Wed 14:03
<message>PLS HANDLE
<answer>
<f/u>
<filed>
<done>Y
<>

<company>LAWRENCE BERKELEY LABORATORY
<from>JAMES A. BAKER
<to>BELL, GORDON
<date>AUGUST 3, 1982
<date rec>8/10/82 Tue 13:15
<log#>8-24
<request>REF. TO ALPHA-OMEGA MEETING, LAWRENCE BERKELEY LAB., JULY 26, 1982
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>CONTROL DATA CORPORATION
<from>P. W. ARNESON
<to>BELL, GORDON
<date>AUGUST 4, 1982
<date rec>8/10/82 Tue 13:10
<log#>8-23
<request>COPY OF LETTER SENT TO KEN OLSEN, REF. LETTER FROM MR. NORRIS OF AUGUST 3, 1982. KO'S HAD A COPY OF THE DEPARTMENT OF COMMERCE STUDY, "AM ASSESSMENT OF UNITED STATES COMPETITIVENESS IN HIGH-TECHNOLOGY INDUSTRIES." CHERYL IS MAKING A COPY FOR GB
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>MASSACHUSETTS INSTITUTE OF TECHNOLOGY
<from>BARBARA B. LORY
<to>BELL, GORDON

<date>AUSUST 6, 1982
<date rec>8/9/82 Mon 14:29
<log#>8-22
<request>UPDATE OF LIST FOR VLSI SEMINAR NOTICES
<reply by>0
<dispo/date>RETURNED TO BARBARA LORY/8/17/82 Tue 10:46
<message>YES
<answer>
<f/u>
<filed>
<done>Y
<>

<company>CONTROL DATA CORPORATION
<from>R. M. PRICE
<to>BELL, GORDON
<date>AUGUST 5, 1982
<date rec>8/9/82 Mon 14:27
<log#>8-21
<request>INVITATION TO DENVER, AUG.20 TO PARTICIPATE AS A MEMBER OF THE INTERIM MCC BOARD OF DIRECTORS. CONTACT PHIL ARNESON (612-853-4759) IF ANY QUESTIONS
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>ECOLE POLYTECHNIQUE FEDERALE DE LAUSANNE
<from>JEAN-DANIEL NICOUD
<to>BELL, GORDON
<date>JULY 26, 1982
<date rec>8/9/82 Mon 14:24
<log#>8-20
<request>REF. TO SMAKY4 FOR MUSEUM. WILL BE VISITING 9/17-21 IN CALIF. WANTS TO MEET WITH F. BASKETT.
<reply by>0

<dispo/date>SENT A RETURN LETTER--GB3.S7.5 ALONG WITH ORIGINAL LETTER 8/18/82 Wed 11:38
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>DATA COMMUNICATIONS INSTITUTE
<from>YU-HUEI JEA
<to>BELL, GORDON
<date>AUGUST 2, 1982
<date rec>8/9/82 Mon 14:22
<log#>8-19
<request>A THANK YOU FOR GB LETTER TO HIM. ACKNOWLEDGED RECEIVING MUSEUM MATERIAL, WILL MAKE A DECISION AFTER VISITING IT.
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>N
<done>Y
<>

<company>FUJITSU LIMITED
<from>MATAMI YASUFUKU
<to>BELL, GORDON
<date>JULY 30, 1982
<date rec>8/9/82 Mon 14:20
<log#>8-18
<request>A THANK YOU FOR GB LETTER TO HIM, ALSO REF. JEFF KALB VISITING JAPAN, HE SHOULD CONTACT SADAO INOUE
<reply by>0
<dispo/date>JEFF KALB 8/12/82 Thu 12:21
<message>FYI
<answer>
<f/u>

<filed>N
<done>Y
<>

<company>LOS ALAMOS
<from>BILL BUZBEE
<to>BELL, GORDON
<date>JULY 30, 1982
<date rec>8/9/82 Mon 14:18
<log#>8-17
<request>MESSAGE REG. EARLY DEPARTURE FROM MCC MTG.
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>TACTICAL EQUIPMENT CORP.
<from>PHILLIP A. KAUFMAN
<to>BELL, GORDON
<date>AUGUST 6, 1982
<date rec>8/9/82 Mon 14:16
<log#>8-16
<request>LETTER AND BROCHURE ON THE DESIGN AND ANALYSIS OF TACTICAL SYSTEMS
<reply by>0
<dispo/date>SENT TO JACK SMITH/8/11/82 Wed 13:03
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>H.L. BLACHFORD, INC.
<from>DAVID C. HAMBLIN

<to>BELL, GORDON
<date>AUGUST 5, 1982
<date rec>8/9/82 Mon 14:13
<log#>8-15
<request>A THANK YOU REG. A SEMINAR ON NOISE CONTROL IN DIGITAL PRINTERS
<reply by>0
<dispo/date>JOHN RING 8/12/82 Thu 12:25
<message>YOU MIGHT LOOK AT THIS DIRECTLY
<answer>
<f/u>
<filed>N
<done>Y
<>

<company>DAMCO
<from>DAN M. MACHUT
<to>BELL, GORDON
<date>AUGUST 3, 1982
<date rec>8/6/82 Fri 14:24
<log#>8-14
<request>NEW PRODUCT ANNOUNCEMENT, PAC RAT (RANDOM ACCESS TAPE), MANUAL AND PHOTOS (2) ENCLOSED
<reply by>0
<dispo/date>GRANT SAVIERS 8/12/82 Thu 12:22
<message>YOURS
<answer>
<f/u>
<filed>N
<done>Y
<>

<company>CONTROLDATA
<from>WILLIAM C. NORRIS
<to>BELL, GORDON
<date>AUGUST 3, 1982
<date rec>8/6/82 Fri 14:20
<log#>8-13
<request>SENT TO KEN OLSEN, CC: GB; MCC STEERING COMMITTEE

<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>CLARK UNIVERSITY
<from>MARTIN R. MOSER
<to>BELL, GORDON
<date>JULY 27, 1982
<date rec>8/6/82 Fri 9:38
<log#>8-12
<request>QUESTIONNAIRE PERTAINING TO--IMPROVE ORGANIZATIONAL EFFECTIVENESS IN INDUSTRIAL RESEARCH AND DEVELOPMENT
<reply by>0
<dispo/date>CALLED MOSER OFFICE, WE WILL NOT BE RETURNING THE QUESTIONNAIRE AS IT CONTAINS SENSITIVE INFORMATION 9/10/82 Fri 13:57
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>ICASE
<from>ROBERT G. VOIGT
<to>BELL, GORDON
<date>AUGUST 2, 1982
<date rec>8/6/82 Fri 8:46
<log#>8-11
<request>INVITATION TO PARTICIPATE IN A WORKING MEETING AT HILTON SHANTY CREEK IN BELLAIRE, MICHIGAN ON AUG. 23-24. PURPOSE - TO PREPARE A POSITION PAPER ON HIGH PERFORMANCE PARALLEL COMPUTING

<reply by>0
<dispo/date>SAM TALKED TO VOIGT AND NO PROBLEM WITH DEC NOT GOING 8/20/82 Fri 9:56
<message>
<answer>
<f/u>
<filed>12
<done>Y
<>

<company>INTEL CORPORATION
<from>GARY RANCOURT
<to>BELL, GORDON
<date>AUGUST 2, 1982
<date rec>8/6/82 Fri 8:42
<log#>8-10
<request>CONFIRMATION OF YOUR MEETING AT INTEL IN SANTA CLARA, CA ON MONDAY AUGUST 9TH AT 9AM.
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>TUCKER, ANTHONY & R.L. DAY, INC.
<from>JOHN E. MACKAY
<to>BELL, GORDON
<date>AUGUST 2, 1982
<date rec>8/3/82 Tue 13:23
<log#>8-9
<request>WANTS TO MEET TO DISCUSS TAX EXEMPT BONDS
<reply by>0
<dispo/date>
<message>
<answer>

<f/u>
<filed>
<done>Y
<>

<company>DINERS CLUB INTERNATIONAL
<from>LAWRENCE P. STOIBER
<to>BELL, GORDON
<date>NONE
<date rec>8/3/82 Tue 9:25
<log#>8-8
<request>A PREFERRED CUSTOMER MEMBERSHIP FORM
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>CONTROL DATA CORPORATION
<from>P. W. ARNESON
<to>BELL, GORDON
<date>JULY 23, 1982
<date rec>8/2/82 Mon 16:06
<log#>8-7
<request>MCC TREASURER'S REPORT/6/25 CHICAGO MTG. WHERE EACH PARTICIPATING COMPANY AGREED TO PAY $4,000 FROM 5/1 THROUGH INCORPORATION. THIS IS INVOICE FOR THE $4,000.
<reply by>0
<dispo/date>FU 1 WEEK, SENT TO PURCHASING AT MLO22-1/T79 8/19/82 Thu 8:34
<message>
<answer>
<f/u>
<filed>MCC
<done>Y

<>

<company>BELL LABORATORIES
<from>D. A. COREY
<to>BELL, GORDON
<date>JULY 29, 1982
<date rec>8/2/82 Mon 16:02
<log#>8-6
<request>LETTER SENT TO JOHN FISCHER, DEC NY--REQ: FIELD SUPPORT FOR THE PURDUE CONFIGURATION DUAL PROCESSOR VAXZ 11/780
<reply by>0
<dispo/date>SENT TO DEMMER, BJ, STEVE DAVIS/8/4/82 Wed 10:27
<message>WHAT YOU SAY? IF THIS IS DONE, THEN LET'S BLESS IT.
<answer>
<f/u>
<filed>
<done>Y
<>

<company>DESIGN TECHNOLOGY CORPORATION
<from>MARVIN MENZIN
<to>BELL, GORDON
<date>JULY 21, 1982
<date rec>8/2/82 Mon 15:58
<log#>8-5
<request>REG. AUTOMATED ASSEMBLY AND TEST OF PRODUCTS
<reply by>0
<dispo/date>RETURNED BUSINESS CARD AS SUGGESTED TO DESING TECH. 8/9/82 Mon 12:58
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>SFS MANAGEMENT CONSULTANTS, INC.

<from>N. R. STOCKER
<to>BELL, GORDON
<date>JULY 30, 1982
<date rec>8/2/82 Mon 15:54
<log#>8-4
<request>RESUME OF DOUGLAS YAMAGUCHI
<reply by>0
<dispo/date>SENT TO JOHN DIPIETRO/8/4/82 Wed 10:25
<message>PLS HANDLE
<answer>
<f/u>
<filed>
<done>Y
<>

<company>UNIVERSITY OF NEWCASTLE UPON TYNE
<from>BRIAN RANDELL
<to>BELL, GORDON
<date>JULY 26, 1982
<date rec>8/2/82 Mon 15:50
<log#>8-3
<request>A NEW DEVELOPMENT IN SOFTWARE SUBSYSTEM--CALLED THE NEWCASTLE CONNECTION
<reply by>0
<dispo/date>TO: STRECKER, FULLER HUSTVEDT, CC: BJ, MAHENDRA, WILKES, BILL MUNSON/8/4/82 Wed 11:09
<mesage>WILL YOU GUYS DECIDE WHO'S GOING TO VISIT BRIAN AND GET THE PRESENTATION ON THIS
<answer>
<f/u>
<filed>U OF NEWCASTLE
<done>Y
<>

<company>SMITH BARNEY, HARRIS UPHAM & CO.
<from>JAMES E. FOX
<to>BELL, GORDON
<date>JULY 29, 1982

<date rec>8/2/82 Mon 9:34
<log#>8-2
<request>AN OFFER TO RECEIVE RESEARCH REPORTS ON YOUR INDUSTRY.
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>CARNEGIE MELLON UNIVERSITY
<from>COMPUTER SCIENCE DEPARTMENT
<to>BELL, GORDON
<date>NONE
<date rec>8/2/82 Mon 9:32
<log#>8-1
<request>PUBLICATION ANNOUNCEMENTS
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>GENERAL TELEPHONE AND ELECTRONICS
<from>THOMAS R. CROWDER
<to>BELL, GORDON
<date>JULY 28, 1982
<date rec>7/30/82 Fri 14:48
<log#>7-59
<request>PERTAINING TO AN EXCHANGE OF CORRESPONDENCE REGARDING INVOICE OF SOME MANUALS
<reply by>0
<dispo/date>sent a reply to Thomas Crowder cc: John

Alexanderson/8/4/82 Wed 9:48
<message>
<answer>
<f/u>
<filed>
<done>Y
<>

<company>U.S. DEPARTMENT OF JUSTICE
<from>NICHOLAS W. CLARK (SENT OVER TO GB FROM KO)
<to>BELL, GORDON
<date>JULY 27, 1982
<date rec>7/30/82 Fri 11:13
<log#>7-58
<request>INVESTIGATING THE PROPOSED MICROELECTRONICS AND COMPUTER TECHNOLOGY ENTERPRISES JOINT VENTURE DOJ FILE: 60-211-037-64
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<company>DIGITAL
<from>GRANT SAVIERS/JOCELYN SCARBOROUGH
<to>BELL, GORDON
<date>JULY 28, 1982
<date rec>7/30/82 Fri 9:13
<log#>7-57
<request>SPECIAL STOCK GRANT FOR DAN GOOR
<reply by>0
<dispo/date>SIGNED AND RETURNED TO GRANT SAVIERS VIA JOCELYN SCARBOROUGH/8/2/82 Mon 14:58
<message>
<answer>

<f/u>mm/dd/yy
<filed>
<done>Y
<>

<company>M.I.T. MUSEUM
<from>
<to>BELL, GORDON
<date>
<date rec>7/29/82 Thu 14:25
<log#>7-56
<request>INVITE TO WHALE WATCH--AUG 17.--ATLANTIC FISHING FLEET, RYE STATE HARBOR, RTE. 1A RYE, N.H.
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<company>CONTINENTAL TELEPHONE LABORATORIES
<from>DONALD L. STROBECK
<to>BELL, GORDON
<date>JUNE 29, 1982
<date rec>7/29/82 Thu 11:05
<log#>7-55
<request>ANOUNCEMENT THAT THEY NOW PRCOMPANY>M.I.T. MUSEUM
<from>
<to>BELL, GORDON
<date>
<date rec>7/29/82 Thu 14:25
<log#>7-56
<request>INVITE TO WHALE WATCH--AUG 17.--ATLANTIC FISHING FLEET, RYE STATE HARBOR, RTE. 1A RYE, N.H.
<reply by>0
<dispo/date>
<message>
<answer>

<f/u>mm/dd/yy
<filed>
<done>Y
<>

<company>CONTINENTAL TELEPHONE LABORATORIES
<from>DONALD L. STROBECK
<to>BELL, GORDON
<date>JUNE 29, 1982
<date rec>7/29/82 Thu 11:05
<log#>7-55
<request>ANOUNCEMENT THAT THEY NOW PROVIDE FCC CERTIFICATIONS FOR PART 68 & PART 15 OF THE FCC RULES AND REGS.
<reply by>0
<dispo/date>SENT TO DAVE BROWN/8/6/82 Fri 14:38
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<company>STERLING INSTITUTE
<from>J. STERLING LIVINGSTON
<to>BELL, GORDON
<date>JULY 26, 1982
<date rec>7/28/82 Wed 14:48
<log#>7-54
<request>LIKE TO DISCUSS HOW TO IMPROVE PROFITS
<reply by>0
<dispo/date>NO INTEREST/7/29/82 Thu 11:24
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<company>COMPUTER SYSTEMS RESEARCH GROUP
<from>TECHNICAL REPORTS
<to>BELL, GORDON
<date>NONE
<date rec>7/28/82 Wed 14:47
<log#>7-53
<request>ANY INTEREST IN TECHNICAL REPORTS
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<company>PUGH-ROBERTS ASSOCIATES, INC.
<from>ALAN R. FUSFELD
<to>BELL, GORDON
<date>JULY 23, 1982 ON MEMO; JULY 19, 1982 ON MATERIAL
<date rec>7/27/82 Tue 13:48
<log#>7-52
<request>FORMATION OF THE TECHNOLOGY MANAGEMENT GROUP LIMITED TO SERVE CLIENTS IN EUROPE AND NORTH AMERICA.
<reply by>0
<dispo/date>SENT TO LARRY PORTNER/7/28/82 Wed 11:31
<message>THIS MAY BE BETTER THAN THE PROCESSES YOU'RE LOOKING AT.
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<company>MASSACHUSETTS INSTITUTE OF TECHNOLOGY
<from>ALAN V. OPPENHEIM
<to>BELL, GORDON

<date>JULY 23, 1982
<date rec>7/27/82 Tue 9:12
<log#>7-51
<request>SEEKING FINANCIAL AID FOR A NEW COMPUTER FACILITY
<reply by>0
<dispo/date>CC: DIETER HUTTENBERGER, SAM FULLER, GEORGE CHAMBERLAIN 7/28/82 Wed 16:28
<message>THIS MIGHT BE AN ENTRY TO FORM A GOOD SIGNED PROCESSING RESEARCH GROUP AT DEC
<answer>
<f/u>8/13/82
<filed>
<done>Y
<>

<company>BOSTON UNIVERSITY
<from>NICHOLAS WASHIENKO, PH.D.
<to>BELL, GORDON
<date>NONE
<date rec>JULY 23, 1982
<log#>7-50
<request>INVITE TO PARTICIPATE IN A PRESIDENTIAL PROGRAM ENTITLED--STRATEGIC MANAGEMENT OF PRODUCTIVITY IMPROVEMENT
<reply by>0
<dispo/date>REGRETS CALLED--7/27/82 Tue 8:11
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<company>FAIRCHILD
<from>C. LESTER HOGAN
<to>KEN OLSEN
<date>JULY 20, 1982
<date rec>7/27/82 Tue 8:07
<log#>7-49

<request>REG. COMPUTER MUSEUM
<reply by>0
<dispo/date>CIRCULATED TO ROGER CADY, SAM FULLER, PETE SMITH--CC OF COVER LETTER ONLY TO FU--7/28/82 Wed 9:32
<message>WHAT DO YOU THINK
<answer>
<f/u>8/20/82
<filed>
<done>N
<>

<company>CARNEGIE-MELLON UNIVERSITY(COMP. SCIENCE DEPT.)
<from>SCOTT FAHLMAN
<to>BELL, GORDON
<date>JULY 19, 1982
<date rec>7/23/82 Fri 12:40
<log#>7-48
<request>IN REF. TO PHONE CONVERSATION OF 7/17, REGARDING HIS UNDERSTANDING OF THE VAX COMMON LISP/UNIX SITUATION AS IT AFFECTS DEC.
<reply by>0
<dispo/date>CC: BILL JOHNSON,SAM FULLER,JOHN O'KEEFE, BOB ABRAMSOM, BILL MUNSON, PAT COURTIN, LISP FILE/7/28/82 Wed 16:05
<message>IS THERE A PROBLEM IN NOT SELLING THIS ON UNIX? I SAY DO IT!
<answer>
<f/u>8/13/82
<filed>
<done>Y
<>

<company>PRIME COMPUTER INC.
<from>EDWARD ALVIN FEUSTEL
<to>BELL, GORDON
<date>JULY 20, 1982
<date rec>7/22/82 Thu 13:59
<log#>7-47
<request>REQUEST FOR A PAPER FOR A WORKSHOP ON COMPUTER

SYSTEMS ORGANIZATION IN NEW ORLEANS, LA MARCH 29-31, 1983
<reply by>0
<dispo/date>CALLED REGRETS/7/27/82 Tue 8:09
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<company>SEMICONDUCTOR RESEARCH COOPERATIVE
<from>LARRY W. SUMNEY
<to>BELL, GORDON
<date>JULY 16, 1982
<date rec>7/21/82 Wed 13:55
<log#>7-46
<request>NEXT MEETING OF BOARD OF DIRECTORS OF SEMI. RES. COOP.--AUG. 10--RESEARCH TRIANGLE PARK, NORTH CAROLINA--CONFIRM RESERV. BY 7/26 AT GOVERNOR'S INN
<reply by>0
<dispo/date>SENT TO JEFF KALB/7/21/82 Wed 15:51
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<company>VIA SYSTEM, INC.
<from>RICHARD M. JENNINGS
<to>BELL, GORDON
<date>NONE
<date rec>7/21/82 Wed 13:54
<log#>7-45
<request>INVITE TO ATTEND A MAJOR PRODUCT PRESENTATION OF RECENTLY ANNOUNCED CAD/CAM--JULY 27,28,29, HYNES AUD.
<reply by>0
<dispo/date>
<message>

<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<company>CONTROL DATA CORPORATION
<from>ON MEMO-J.W. LACEY-ON ATTACHED NOTE-PHIL
<to>BELL, GORDON
<date>JULY 13, 1982
<date rec>7/20/82 Tue 9:15
<log#>7-44
<request>ON ATTACHED NOTE - THOUGHT YOU'D LIKE TO SEE THIS
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>MCC
<done>Y
<>

<company>NATIONAL ACADEMY OF SCIENCES
<from>MRS. FRANK PRESS
<to>BELL, GORDON
<date>NONE
<date rec>7/19/82 Mon 13:33
<log#>7-43
<request>INVITATION TO A RECEPTION AT WOODS HOLE STUDY CENTER
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<company>RESUME

<from>WILLIAM J. LAZOR
<to>BELL, GORDON
<date>JULY 13, 1982
<date rec>7/19/82 Mon 13:30
<log#>7-42
<request>RESUME
<reply by>0
<dispo/date>JOHN DIPIETRO/7/21/82 Wed 13:23
<message>PLS HANDLE
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<company>CALIFORNIA INSTITUTE OF TECHNOLOGY
<from>F. E. C. CULICK
<to>BELL, GORDON
<date>JULY 15, 1982
<date rec>7/19/82 Mon 13:29
<log#>7-41
<request>A THANK YOU ON BEHALF OF COMPUTING FACILITIES ADVISORY COMMITTEE, FOR HIS CONTRIBUTIONS AS A MEMBER OF VISITING COMMITTEE.
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<company>AMA
<from>FREDERICK ARTHUR
<to>BELL, GORDON
<date>JULY 12, 1982
<date rec>7/19/82 Mon 13:27
<log#>7-40
<request>BROCHURE FOR A COURSE--ASSERTIVENESS SKILLS

<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<company>MASSACHUSETTS MUTUAL
<from>HARRISON R. NAYLOR
<to>BELL, GORDON
<date>NONE
<date rec>7/19/82 Mon 13:27
<log#>7-39
<request>INVITATION TO ACCEPT A FREE COPY OF A NEW GUIDE TO TAX CUTS UNDER THE NEW TAX LAW.
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<company>SEMICONDUCTOR RESEARCH COOPERATIVE
<from>LARRY W. SUMNEY
<to>BELL, GORDON
<date>JUNE 14, 1982
<date rec>7/16/82 Fri 13:51
<log#>7-38
<request>INVOICE FOR RESEARCH SERVICES FOR FIRST TWO QUARTERS
<reply by>0
<dispo/date>JEFF KALB/7/19/82 Mon 8:07
<message>PLS HANDLE
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y

<>

<company>KENT STATE UNIVERSITY
<from>PAUL S. WANG
<to>BELL, GORDON
<date>JULY 9, 1982
<date rec>7/14/82
<log#>7-37
<request>MET HIM IN JUNE AT COMP. SCIENCE & TECH. CONF.--HAVE A VAX-11/780--PLANS TO DEVELOP SOFTWARE UNDER UNIX FOR A LASER PRINTER SUCH AS THE LN01. WANTS TO WORK OUT DETAILS AND SUBMIT A FORMAL PROPOSAL. WANT A DONATION OF A LASER PRINTER
<reply by>0
<dispo/date>DIEETER HUTTENBERGER--7/20/82 Tue 10:02
<message>PLS ANSWER
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<company>WISKUNDE EN INFORMATICA STUDIEVERENIGING
<from>A. VERBRAECK
<to>BELL, GORDON
<date>JUNE 30, 1982
<date rec>JULY 13, 1982
<log#>7-36
<request>STUDENTS IN MATH. AND INFORMATICS AT DELFT UNIV. --WANT TO VISIT DIGITAL DURING VISIT TO U.S. --WEEKS OF 3/27 - 4/16 1983
<reply by>0
<dispo/date>JACK SHIELDS/7/15/82 Thu 10:13
<message>GB--MJ, TURN OVER TO SOMEONE IN SALES WHO'LL NOT SCREW IT UP. THEN TRACK IT. SOUNDS LIKE A VERY GOOD PIECE OF PR. DO IT.
<answer>10/7/82 JACK SHIELDS IS TALKING ABOUT AN APR 83 MTG. SALLY WILL FOLLOW-UP IN MAR 83. ALL INFO HAS BEEN SENT TO DICK DOBBIE LIASON BETWEEN EUROPE AND US
<f/u>9/1/82, 3/1/83

<filed>
<done>Y
<>

<company>RESUME
<from>BRUCE I. GALLER
<to>BELL, GORDON
<date>JULY 6, 1982
<date rec>JULY 13, 1982
<log#>7-35
<request>RESUME
<reply by>0
<dispo/date>SAM FULLER/7/15/82 Thu 8:31
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<company>KEARNEY
<from>JILL FABER
<to>BELL, GORDON
<date>JULY 7, 1982
<date rec>JULY 13, 1982
<log#>7-34
<request>HEADHUNTER - RECRUITING A MANAGER OF ADVANCED SYSTEMS
<reply by>0
<dispo/date>
<message>IF CALLS, WE HAVE NO REFERRALS 7/13/82 Tue 10:16
<answer>
<f/u>mm/dd/yy
<filed>12
<done>Y
<>

<company>MIT (DEPT. OF ELECTRICAL ENG)

<from>LOUIS D. SMULLIN
<to>BELL, GORDON
<date>JULY 9, 1982
<date rec>JULY 13, 1982
<log#>7-33
<request>INVITE TO ATTEND CENTENNIAL OF COURSE VI AT M.I.T., SAT. AND SUN. OCTOBER 2 AND 3, 1982
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<company>RESUME
<from>V. SIVAKUMAR
<to>BELL, GORDON
<date>JULY 5, 1982
<date rec>JULY 12, 1982
<log#>7-32
<request>RESUME
<reply by>0
<dispo/date>sent to John DiPietro/7/12/82 Mon 15:45
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<company>BUSINESS WEEK
<from>R. B. ALEXANDER
<to>BELL, GORDON
<date>
<date rec>JULY 12, 1982
<log#>7-31
<request>FREE TRIAL CERTIFICATE

<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<company>AMPEX
<from>E. T. FLEMING
<to>BELL, GORDON
<date>JULY 6, 1982
<date rec>JULY 12, 1982
<log#>7-30
<request>CURRENT DEVELOPMENTS OF ALAR THIN FILM MEDIA.
<reply by>0
<dispo/date>sent to Grant Saviers/7/12/82 Mon 16:07
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<company>RESUME
<from>DOUGLAS R. AHRENS
<to>BELL, GORDON
<date>JULY 7, 1982
<date rec>JULY 12, 1982
<log#>7-29
<request>RESUME
<reply by>0
<dispo/date>SENT TO JOHN DIPIETRO/7/12/82 Mon 14:24
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<company>MASSACHUSETTS INSTITUTE OF TECHNOLOGY
<from>EDGAR H. SCHEIN
<to>BELL, GORDON
<date>JULY 7, 1982
<date rec>JULY 12, 1982
<log#>7-28
<request>STUDY ENCLOSED RE: LIVING WITH TECHNOLOGY, A SURVEY ON ENGINEERS 40 TO 55 AGE BRACKET.
<reply by>0
<dispo/date>PEG AND CONSULTING ENG/7/15/82 Thu 10:37
<message>IF ANY OF YOU KNOW ANYONE APPROACHING 40 - THEN IT MAY BE WORTHWHILE TO READ THIS PAPER. I THINK SHE'S DONE AN EXCELLENT JOB OF ANALYZING AND PRESCRIBING.
<answer>
<f/u>8/13/82
<filed>
<done>Y
<>

<company>DIGITAL
<from>BABU OBILICHETTI
<to>BELL, GORDON
<date>JULY 2, 1982
<date rec>JULY 8, 1982
<log#>7-27
<request>DOCTORAL THESIS--COMPLIMENTARY COPY
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>CONTROL DATA CORP.
<from>R. M. PRICE
<to>BELL, GORDON
<date>JULY 1, 1982

<date rec>JULY 6, 1982
<log#>7-26
<request>MEETING RESULTS JUNE 25, 1982, CHICAGO ILL. SENT TO STEERING COMMITTEE MEMBERS AND CHICAGO MEETING ATTENDEES
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>MCC
<done>Y
<>

<subj>AFIPS (AMERICAN FEDERATION OF INFOR. PROCS. INC)
<from>BERNARD A. GALLER
<to>BELL, GO
RDON
<date>JUNE 30, 1982
<date rec>JULY 6, 1982
<log#>7-25
<request>WOULD LIKE A PROPOSAL FROM DEC TO SUBMIT AN ARTICLE FOR A SPECIAL ISSUE
<reply by>
<dispo/date>SENT AN ANSWER TO B.A. GALLER/GB:3.S5.76--7/14/82 cc:WES CLARK, DICK CLAYTON, COMPUTER MUSEUM & ED DECASTRO OF DG
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>N
<>

<subj>ISCO (INTEGRATED SOFTWARE SYSTEMS CORP)
<from>DAVID ROBINSON
<to>BELL, GORDON
<date>JUNE 30, 1982
<date rec>JULY 6, 1982
<log#>7-24
<request>INVITATION TO ATTEND EXECUTIVE SEMINAR ON MANAGEMENT

USE OF COMPUTER GRAPHICS. TO BE HLED JULY 27 AT THE PARIS ROOM IN QUINCY MARKET AT 8:30 A.M.--(COPY ALSO SENT TO GB FROM L. PORTNER, DISPOSED OF)
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>BAILEY EMPLOYMENT SERVICE
<from>ALBERT E. OTT
<to>BELL, GORDON
<date>JULY 1, 1982
<date rec>JULY 6, 1982
<log#>7-23
<request>RESUME
<reply by>0
<dispo/date>DIPIETRO 7/8/82 Thu 8:54
<message>PLEASE HANDLE
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>WORDEN & RISBERG
<from>NANCY C. MORTON
<to>BELL, GORDON
<date>JULY 2, 1982
<date rec>JULY 6, 1982
<log#>7-22
<request>LOOKING FOR CANDIDATE FOR OPERATIONS EXECUTIVE
<reply by>0
<dispo/date>
<message>I HAVE NO SUGGESTIONS MJ 7/8/82 Thu 8:42
<answer>
<f/u>mm/dd/yy

<filed>12
<done>Y
<>

<subj>LAWRENCE BERKELEY LABORATORY
<from>J. A. BAKER
<to>BELL, GORDON
<date>JULY 1, 1982
<date rec>JULY 6, 1982
<log#>7-21
<request>CHANGE OF ROOM FOR JULY 26 ALPHA-OMEGA MEETING - FROM THE ROOM 5132, BLDG 50A TO NEW LOCATION OF ROOM 4205, BLDG 50B.
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>LAWRENCE BERKELEY LABORATORY
<from>JAMES A BAKER
<to>BELL, GORDON
<date>JUNE 22, 1982
<date rec>JUNE 28, 1982
<log#>7-20
<request>INVITATION TO ATTEND AN INFORMATION MEETING ON THE COMPUTER AND MICROELECTRONIC ENTERPRISE (CME) ALPHA-OMEGA PROJECT ON MONDAY, JULY 26, 1982. STARTS AT 9:30 A.M., ROOM 5132, BUILDING 50A, LAWRENCE BERKELEY LABORATORY IN BERKELEY, CA.
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y

<>

<subj>AMERICAN NATIONAL METRIC COUNCIL
<from>DAVID GORIN
<to>BELL, GORDON
<date>JUNE 23, 1982
<date rec>JUNE 25, 1982
<log#>7-19
<request>WOULD LIKE TO SET UP A MEETING TO DISCUSS METRIC CONVERSION
<reply by>0
<dispo/date>JACK SMITH 7/2/82 Fri 15:03
<message>GORIN'S OFFICE WILL BE CALLING YOU NEXT WEEK
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>SEMICONDUCTOR RESEARCH CORPORATION
<from>BOARD OF DIRECTORS
<to>BELL, GORDON
<date>MAY 18, 1982
<date rec>JUNE 25, 1982
<log#>7-18
<request>MINUTES OF MEETING
<reply by>0
<dispo/date>JEFF KALB/7/15/82 Thu 10:22
<message>JEFF-NOW YOURS
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>UNIVERSITY OF WASHINGTON
<from>JEAN-LOUP BAIE
<to>BELL, GORDON
<date>JUNE 22, 1982

<date rec>JUNE 25, 1982
<log#>7-17
<request>RE: AFFILIATES PROGRAM - NEW MEMBERS
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>HEADHUNTER
<from>GLEN R. KIELLEY
<to>BELL, GORDON
<date>JUNE 21, 1982
<date rec>JUNE 25, 1982
<log#>7-16
<request>HEADHUNTER
<reply by>0
<dispo/date>
<message>IF KIELLEY CALLS: WE HAVE NO RECOMMENDATION
<answer>
<f/u>mm/dd/yy
<filed>12
<done>Y
<>

<subj>AMERICAN TITLE INSURANCE COMPANY
<from>ELLIS D. PETTIGREW
<to>BELL, GORDON
<date>JUNE 18, 1982
<date rec>JUNE 18, 1982
<log#>7-15
<request>WANT INFORMATION RE: HOME MICROCOMPUTER EQUIPMENT
<reply by>0
<dispo/date>7/9/82--SENT TO SAM FULLER
<message>
<answer>
<f/u>mm/dd/yy

<filed>
<done>Y
<>

<subj>IEEE
<from>GUY RABBAT
<to>BELL, GORDON
<date>MARCH 17, 1982
<date rec>JUNE 21, 1982
<log#>7-14
<request>NEWSLETTER ON 1982-1983 VLSI ACTIVITIES
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>AMK BERLIN
<from>WOLFGANG BURGHAUSEN & CLAUDIA KONIG
<to>BELL, GORDON
<date>JUNE 25, 1982
<date rec>JULY 2, 1982
<log#>7-13
<request>LETTER IN GERMAN, COULD NOT READ.
<reply by>0
<dispo/date>HELMUT KRINGS MAILSTOP:RT, MUNICH OFFICE 7/2/82 Fri 15:38
<message>PLEASE SAY NO OR ALERT US IF IMPORTANT
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>MCGRAW-HILL BOOK COMPANY(COLLEGE DIVISION)
<from>DAVID M. EDWARDS
<to>BELL, GORDON

<date>JUNE 21, 1982
<date rec>JULY 2, 1982
<log#>7-12
<request>ANNOUNCEMENT OF NEW ORGANIZATION. NEW UNIT TO SPECIALIZE IN COMPUTER PUBLISHING AND OF SOFTWARE DEVELOPMENT AT COLLEGE LEVEL. DAVID M. EDWARDS IS EDITOR IN CHIEF.
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>RESUME
<from>E. J. ARONOFF, PH.D.
<to>BELL, GORDON
<date>JUNE 28, 1982
<date rec>JULY 2, 1982
<log#>7-11
<subj>RESUME
<reply by>0
<dispo/date>7/9/82--SENT TO JOHN DIPIETRO
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>DR. PETER GRASSMANN
<from>DR. PETER GRASSMANN
<to>BELL, GORDON
<date>JUNE 23, 1982
<date rec>JULY 2, 1982
<log#>7-10
<request>A THANK YOU FOR LOOKING INTO PROBLEM OF RX 01 AND RX 02. A TABLE INCLUDED INDICATING AMOUNT OF DIGITAL STORAGE, THAT MAJOR HOSPITALS NEED.

<reply by>0
<dispo/date>SENT TO GRANT SAVIERS/CC: P. BAUER, JACK SHIELDS, J.C. PETERSCHMITT, W. KISTER/7/12/82 Mon 15:19
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>SRI INTERNATIONAL
<from>JULIUS J. MURAY
<to>BELL, GORDON
<date>JUNE 25, 1982
<date rec>JULY 2, 1982
<log#>7-9
<request>WOULD LIKE TO MEET AND DISCUSS MICROELECTRONICS - TECHNOLOGY, DEVICES, AND TRENDS (MDTD)
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>ERICH BLOCH
<from>ERICH BLOCH
<to>BELL, GORDON
<date>JUNE 23, 1982
<date rec>JULY 2, 1982
<log#>7-8
<request>A CONGRATULATIONS ON BEING THE RECIPIENT OF THE 1982 ECKERT-MAUCHLY AWARD.
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy

<filed>
<done>Y
<>

<subj>NEC SYSTEMS LABORATORY, INC.
<from>MAKOTO KOHNO
<to>BELL, GORDON
<date>JUNE 28, 1982
<date rec>JULY 2, 1982
<log#>7-7
<request>A THANK YOU ON BEHALF OF DR. KANAI AND HIMSELF FOR JUNE 4TH VISIT.
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>DIGITAL
<from>FRED SMITH, CORP. GOV'T SECURITY
<to>BELL, GORDON
<date>JUNE 29, 1982
<date rec>JULY 2, 1982
<log#>7-6
<request>ANNUAL SECURITY BRIEFING
<reply by>0
<dispo/date>RETURNED TO FRED SMITH/7/12/82 Mon 13:55
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>CARNEGIE-MELLON UNIVERSITY
<from>DANIEL BERG

<to>BELL, GORDON
<date>JUNE 26, 1982
<date rec>JULY 1, 1982
<log#>7-5
<request>A THANK YOU FOR AGREEING TO PROVIDE A REFERENCE IN SUPPORT OF NOMINATION OF RAJ REDDY TO MEMBERSHIP IN THE NATIONAL ACADEMY OF ENGINEERING. A COPY OF NOMINATION ATTACHED, A REFERENCE FORM TO BE RETURNED NO LATER THAN JULY 30.
<reply by>0
<dispo/date>REFERENCE MAILED TO NAE 7/20/82 Tue 12:29
<message>
<answer>
<f/u>mm/dd/yy
<filed>REFERENCES
<done>Y
<>

<subj>IREX (INTERNATIONAL RESEARCH & EXCHANGES BOARD)
<from>ELIZABETH C. SEGAL
<to>BELL, GORDON
<date>JUNE 22, 1982
<date rec>JULY 1, 1982
<log#>7-4
<request>REQUEST FOR PLACEMENT OF IREX SCHOLARS, RESUMES ATTACHED
<reply by>0
<dispo/date>7/9/82--SENT TO DAN SIEWIOREK, CARNEGIE-MELLON UNIVERSITY
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>NATIONAL SCIENCE FOUNDATION
<from>KENT K. CURTIS
<to>BELL, GORDON
<date>JUNE 28, 1982

<date rec>JULY 1, 1982
<log#>7-3
<request>READ COPY OF ALPHA-OMEGA PROPOSAL, CANNOT ATTEND MEETING GEORGE MICHAEL SET FOR JULY 26, IN BOSTON END OF JULY AND WOULD LIKE TO VISIT MUSEUM
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>CDC/MCC
<done>Y
<>

<subj>RESUME
<from>PAUL C.D. FRENCH
<to>BELL, GORDON
<date>JUNE 24, 1982
<date rec>JULY 1, 1982
<log#>7-2
<request>PLEASE REVIEW
<reply by>0
<dispo/date>7/9/82--SENT TO JOHN DIPIETRO
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>PEPSICO INTERNATIONAL
<from>PETER K. WARREN
<to>BELL, GORDON (ALSO TO KHO)
<date>JUNE 21, 1982
<date rec>JULY 1, 1982
<log#>7-1
<request>PAMPHLET ATTACHED, DESCRIBES THE SCIENCE, ENGINEERING AND REARCH CAMPUS HOOK-UP (SEARCH), A NEW SERVICE DESIGNED TO PROVIDE AMERICAN BUSINESS WITH A RAPID, COMPREHENSIVE AND DEPENDABLE RESEARCH AND DEVELOPMENT

RESPONSE FROM ACADEMIC COMMUNITY. ALSO RECEIVED COPY FROM KEN.
<reply by>0
<dispo/date>7/9/82--SENT TO DIETER HUTTENBERGER
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>NATIONAL RESEARCH COUNCIL
<from>JACOB F. BLACKBURN
<to>BELL, GORDON
<date>6/25/82
<date rec>6/30/82
<log#>6-54
<request>MINUTES OF JUNE 16 BOARD MEETING
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>CS&TB
<done>Y
<>

<subj>ADVANCED TECHNOLOGY RESOURCES CORPORTION
<from>LINDA M. TEMPERO
<to>BELL, GORDON
<date>JUNE 24, 1982
<date rec>JUNE 28, 1982
<log#>6-53
<request>WANT YOU TO CONSIDER THEIR SERVICES RE: NON-IMPACT PRINTERS INCLUDING INK JET, THERMAL AND CRT OR LASER PRINTERS
<reply by>0
<dispo/date>7/9/82--SENT TO BILL AVERY
<message>

<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>ASSOCIATED COMPUTER CONSULTANTS
<from>L. BRIAN MCGANN
<to>BELL, GORDON
<date>JUNE 24, 1982
<date rec>JUNE 28, 1982
<log#>6-52
<request>REVIEW INFORMATION ABOUT THE IF-11/ETHERNET AND SOME RELATED PRODUCTS PACKAGE FORTHCOMING
<reply by>0
<dispo/date>SENT A LETTER BACK TO ASSOCIATED COMPUTER CONSULTANTS AND FORWARDED INFO ON TO BERNIE LACROUTE/8/3/82 Tue 14:01
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>BOOZ-ALLEN & HAMILTON INC.
<from>HARVEY L. POPPEL
<to>BELL, GORDON
<date>JUNE 21, 1982
<date rec>JUNE 28, 1982
<log#>6-51
<request>ENCLOSED IS ISSUE 3 OF INFORMATION INDUSTRY INSIGHTS
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>LABORATORY FOR COMPUTER GRAPHICS & SPATIAL ANALYSIS
<from>ALLAN H. SCHMIDT
<to>BELL, GORDON
<date>JUNE 24, 1982
<date rec>JUNE 28, 1982
<log#>6-50
<request>WOULD LIKE TO MEET WITH YOU TO DISCUSS OPPORTUNITIES WITHIN DEC FOR RESEARCH AND DEVELOPMENT RELATED TO COMPUTER GRAPHICS
<reply by>0
<dispo/date>SAM FULLER/7/15/82 Thu 10:20
<message>LET'S INTERVIEW HIM ANYWAY, PLS HANDLE
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>CALIFORNIA INSTITUTE OF TECHNOLOGY
<from>LEA C. STERRETT
<to>BELL, GORDON
<date>JUNE 23, 1982
<date rec>JUNE 28, 1982
<log#>6-49
<request>TRAVEL REIMBURSEMENT CHECK IN THE AMOUNT OF $540.85
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>HAES, SEAY, MATTERN AND MATTERN
<from>WILLIAM R. GROFF, P.E.
<to>BELL, GORDON
<date>6/23/82

<date rec>6/29/82
<log#>6-48
<request>THEIR FIRM TO PROVIDE TECHNICAL EXPERTISE
<reply by>0
<dispo/date>7/9/82--SENT TO JACK SMITH
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>UNIVERSITY OF WASHINGTON
<from>ROBERT GILLESPIE
<to>DR. JOHN D. ROBERTS
<date>6/23/82
<date rec>6/29/82
<log#>6-47
<request>VISITING COMMITTEE REPORT
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>COMDIAL SEMICONDUCTOR, INC.
<from>GARY KENNEDY
<to>BELL, GORDON
<date>
<date rec>6/28/82
<log#>6-46
<request>CSI ACCEPTING CIF TAPES FOR MPC FAST TURNAROUND
<reply by>0
<dispo/date>JEFF KALB/7/22/82 Thu 8:12
<message>
<answer>
<f/u>mm/dd/yy

<filed>
<done>Y
<>

<subj>HEADHUNTER
<from>GLEN R. KIELLEY
<to>BELL, GORDON
<date>6/21/82
<date rec>6/28/82
<log#>6-45
<request>HEADHUNTER
<reply by>0
<dispo/date>
<message>IF KIELLEY CALLS: WE HAVE NO RECOMMENDATION.
<answer>
<f/u>mm/dd/yy
<filed>12
<done>Y
<>

<subj>SUMITOMO PRECISION PRODUCTS CO.
<from>MUTSUO MUKUDA
<to>BELL, GORDON
<date>6/23/82
<date rec>6/25/82
<log#>6-45A
<request>REQUEST FOR INFO IN PORTABLE PRINTER
<reply by>0
<dispo/date>7/8 FWD TO LINDA VENTIERA, CUSTOMER ASSIST. NYC-PENN PLAZA
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>SEMICUSTOM INDUSTRY SERVICE, INC.
<from>WILLIAM D. BURKARD, PRES.

<to>BELL, GORDON
<date>6/14/82
<date rec>6/24/82
<log#>6-44
<request>INFORMATION UPDATE
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>CENTRE MONDIAL
<from>DANNY HILL
<to>BELL, GORDON
<date>6/21/82
<date rec>6/24/82
<log#>6-43
<request>THANK YOU FOR HELP OVER PHONE. MANY WERE IMPRESSED WITH KNOWLEDGE
<reply by>0
<dispo/date>SENT TO J.C. PETERSCHMITT, CC: J. SHIELDS/7/12/82 Mon 15:21
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>INTERCONTINENTAL AIR FREIGHT, INC.
<from>NICHOLAS TZANNOS
<to>BELL, GORDON
<date>/21/82
<date rec>6/24/82
<log#>6-42
<request>ENCLOSED NASA REPORT ON PAYLOAD ENVIRONMENT MEASURING RESULTS.

<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>12

<done>Y
<>

<subj>CONTROL DATA CORP.
<from>PETER F. RYAN
<to>BELL, GORDON (VELL)
<date>6/21/82
<date rec>6/23/82
<log#>6-41
<request>ENC. BROCHURE ON CONTROL DATA TECHNOLOGY INST. PROGRAM--TRAINING IN APPLICATIONS LIKE CAD.
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>MORGAN GUARANTY TRUST
<from>LAWRENCE LATEULERE
<to>BELL, GORDON
<date>6/18/82
<date rec>6/23/82
<log#>6-40
<request>ENC. 1 SHARE OF STOCK FOR JOHN HESS MEMORIAL FUND.
<reply by>0
<dispo/date>
<message>
<answer>

<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>IBM
<from>ERICH BLOCH
<to>BELL, GORDON
<date>6/14/82
<date rec>6/23/82
<log#>6-39
<request>CONFIRMATION OF POSTPONEMENT OF HIS SERVING ON THE MUSEUM BOARD AND OTHER MUSEUM RELATED TOPICS.
<reply by>0
<dispo/date>sent to Gwen Bell, cc: K. Olsen/7/12/82 Mon 15:41
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>LETTER
<from>DECISION ANALYST INC.-JAMES DIGIORGIO
<to>BELL, GORDON
<date>6/17/82
<date rec>6/23/82
<log#>6-38
<request>QUESTIONAIRRE ON SHIELDING METHODS & FUTURE DIRECTION OF SHIELDING MARKET. $1.00 ATTACHED TO GET "ATTENTIN".
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>CHECK FOR $555.00
<from>ASSN. FOR COMPUTING MACHINERY
<to>BELL, GORDON
<date>6/17/82
<date rec>6/23/82
<log#>6-37
<request>REIMBURSEMENT OF TRAVEL EXPENSE - AUSTIN, TX.
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>TELEX
<from>MAX BURNET - SYDA
<to>BELL, GORDON
<date>6/18/82
<date rec>6/23/82
<log#>6-36
<request>RE DEUCE/LONG DELAY LINE. HE IS TRYING TO TRACK DOWN; BUT IT MAY HAVE BEEN SCRAPPED.
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>SHANGHAI JIAO TONG UNIVERSITY
<from>XIE ZHILIANG/SHAO, SHI-BIN

<to>BELL, GORDON
<date>5/24/82
<date rec>6/18/82
<log#>6-35
<request>RECOMMENDATIONS FOR MR. GUO ZONG-GUI TO BECOME A VISITING SCHOLAR.
<reply by>0
<dispo/date>7/9/82--SENT TO JOHN DIPIETRO
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>UNIVERSITY OF WASHINGTON
<from>BOB GILLESPIE
<to>BELL, GORDON
<date>6/10/82
<date rec>6/17/82
<log#>6-34
<request>REVISED DRAFT OF VISITING COMMITTEE REPORT -- NEEDS COMMENTS, REVISIONS BY JUNE 18.
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>ASSOCIATION OF SCIENCE AND TECHNOLOGY CENTERS
<from>SHEILA GRINELL
<to>BELL, GORDON
<date>
<date rec>6/17/82
<log#>6-33
<request>SUPPORT FOR ASTC'S CONTRIBUTION REQUEST FOR SMALLBUSINESS COMPUTING EQUIPMENT, ITS MAINTENANCE AND

$50,000. TO SUPPORT THE CONSTRUCTION AND CIRCULATION OF THE EXHIBITION.
<reply by>0
<dispo/date>AVRAM --6/21/82
<message>SHEILA WILL USE EITHER DECMATE II'S OR PROFESSIONALS. THIS IS AN EXCELLENT OPPORTUNITY TO GET OUR EQUIPMENT SHOWN AND OPERATED BY PEOPLE... WHO I THINK WIL ULTIMATELY BUY. ALSO TO: AK, LOVELAND, CIOFFI, SHIELDS, JACK SMITH REILLY.
<answer>
<f/u>
<filed>12
<done>Y
<>

<subj>DIGITAL COMPUTER MUSEUM
<from>LEON SHULMAN
<to>BELL, GORDON
<date>6/14/82
<date rec>6/17/82
<log#>6-32
<request>PRESERVE AND EXHIBIT COMPUTER THROUGH VISUALLY EXCITING EXHIBITS AND ARCHIVES
<reply by>0
<dispo/date>LETTER TO LEON - COPY TO GWEN - 6/18/82
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>SYSTEMS ARCHITECTS, INC.
<from>GEORGE S. PAN
<to>BELL, GORDON
<date>6/12/82
<date rec>6/15/82
<log#>6-31
<request>THANKS FOR YOUR SUPPORT AT 1982 COMPUTER SCIENCE AND TECHNOLOGY CONFERENCE

<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>CONTROL DATA CORP. CDC
<from>P.W. ARNESON
<to>BELL, GORDON
<date>6/11/82
<date rec>6/15/82
<log#>6-30
<request>SECOND DRAFT OF MCC BUSINESS PLAN
<reply by>0
<dispo/date>GRANT - 6/18/82
<message>TO SEND TO BRUCE IF NECESSARY AND RETURN TO G WHEN DONE.
<answer>
<f/u>mm/dd/yy
<filed>CDC/MCC
<done>Y
<>

<subj>WESTERN MICHIGAN UNIVERSITY
<from>ROGER GILLIE - PRES.
<to>BELL, GORDON
<date>6/7/82
<date rec>6/14/82
<log#>
6-29
<request>HAVE A PIECE OF EQUIPMENT FOR MUSEUM.
<reply by>0
<dispo/date>GWEN - 6/17/82
<message>
<answer>
<f/u>mm/dd/yy
<filed>12

<done>Y
<>

<subj>ROBERT M. GORDON ASSOCIATES
<from>ROBERT M. GORDON
<to>BELL, GORDON
<date>6/8/82
<date rec>6/14/82
<log#>6-28
<request>IF YOU BOUGHT mNemoDex AND HAVE AN APPLE COMPUTER -- THEY NOW HAVE mNemoDex SOFTWARE FOR YOU.
<reply by>0
<dispo/date>JEFF KALB - 6/17/82
<message>YOU'RE NOW THE OFFICIAL MEMBER
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>RESOURCE POLICY CENTER
<from>BARRY RICHMOND
<to>BELL, GORDON
<date>6/9/82
<date rec>6/14/82
<log#>6-27
<request>COPY OF SCOTT GORDON'S MASTER'S THESIS
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>SEMICONDUCTOR INDUSTRY ASSOCIATION
<from>T.D. HINKELMAN
<to>BELL, GORDON

<date>6/11/82
<date rec>6/14/82
<log#>6-28
<request>REQUESTING COMMITMENT TO MEMBERSHIP IN THE SEMICONDUCTOR RESEARCH COOPERATIVE.
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>SIDNEY FERNBACH - CONSULTANT
<from>SIDNEY
<to>BELL, GORDON
<date>6/8/82
<date rec>6/11/82
<log#>6-26
<request>NEED FOR MICROELECTRONICS MEMBERS OF MCE TO SEE MORE EMPHASIS PLACED IN THE DOCUMENT AS THEY MAY NOT SEE MUCH IN IT FOR THEM.
<reply by>0
<dispo/date>LETTER TO SIDNEY - 6/15/82
<message>THANKS FOR INPUT
<answer>
<f/u>mm/dd/yy
<filed>12
<done>Y
<>

<subj>NEW YORK INSTITUTE OF TECHNOLOGY
<from>ALEXANDER SCHURE
<to>BELL, GORDON
<date>6/8/82
<date rec>6/11/82
<log#>6-25
<request>THANKS FOR 6/2/82 LETTER. LOOK FORWARD TO SEEING YOU AT SIGGRAPH

<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>SHANGHAI JIAO TONG UNIVERSITY
<from>GUO ZONG-GUI
<to>BELL, GORDON
<date>5/20/82
<date rec>6/11/82
<log#>6-24
<request>WOULD LIKE TO BE A VISITING SCHOLAR AT CMU
<reply by>0
<dispo/date>DAN SIEWIOREK - 6/14/82
<message>PLEASE HANDLE
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>CONTRIBUTION
<from>IAN CALHAEM
<to>BELL, GORDON
<date>5/26/82
<date rec>6/10/82
<log#>6-23
<request>GIVE TWO OF THE PROFESSIONAL 350 SERIES - ONE TO BE INSTALLED WITH THE VAX IN MR AND ONE FOR HIM IN NEW ZEALAND
<reply by>0
<dispo/date>LETTER TO IAN - ALSO JOEL SCHWARTZ, DON FROST - 6/15/82
<message>
<answer>
<f/u>mm/dd/yy
<filed>12

<done>Y
<>

<subj>RESUME -- JAMES R. CHERRY
<from>JAMES
<to>BELL, GORDON
<date>6/4/82
<date rec>6/10/82
<log#>6-22
<request>PLEASE REVIEW - WOULD LIKE INTERVIEW
<reply by>0
<dispo/date>JOHN DIPIETRO - PLS HANDLE
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>RESUME
<from>PETER E. MCGRATH
<to>BELL, GORDON
<date>6/7/82
<date rec>6/10/82
<log#>6-21
<request>PLEASE REVIEW - WOULD LIKE INTERVIEW
<reply by>0
<dispo/date>JOHN DIPIETRO - PLS HANDLE
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>CALIFORNIA INSTITUTE OF TECHNOLOGY
<from>JOHN D. ROBERTS
<to>BELL, GORDON
<date>6/7/82

<date rec>6/10/82
<log#>6-20
<request>THANK YOU FOR ENROLLING AS CORP. MEMEBER OF DCM, HE WILL VISIT WHEN HE IS IN THE BOSTON AREA.
<reply by>0
<dispo/date>GWEN - 6/17/82
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>VLADIMIR KAMINSKY
<from>VLADIMIR
<to>BELL, GORDON
<date>
<date rec>6/9/82
<log#>6-19
<request>REQUEST FOR PAPERS TO BE ACCEPTED UNDER DISCLOSURE DOCUMENT PROGRAM, PRESERVED FOR 2 YEARS.
<reply by>0
<dispo/date>RON REILING - OK FOR GORDON? MJ SENT TO RON
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>FLYING TIGERS
<from>RUEBEN ROSENTHAL
<to>BELL, GORDON
<date>5/82
<date rec>6/8/82
<log#>6-18
<request>SHIPPING FIRM - IF INTERESTED FILL OUT CARD AND SEND FOR MORE INFO.
<reply by>0
<dispo/date>

<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>TEH HOSPITAL FOR SPECIAL SURGERY
<from>DR. LAWRENCE BLAU
<to>BELL, GORDON
<date>6/6/82
<date rec>6/7/82
<log#>6-17
<request>HELP ME CONVINCE MY SECRETARIES THAT DEC IS THE WAY TO GO.
<reply by>0
<dispo/date>AVERY-6/17/82///CIOFFI - WHAT DO I SAY?
<message>ALSO TO; LOVELAND, AVERY, SMITH, MJ, AO, AK.
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>ELECTRONIC NEWS
<from>DIANE SHELAN
<to>BELL, GORDON
<date>
<date rec>6/7/82
<log#>6-16
<request>SURVEY FOR MORE INFORMATION ON FLOPPY AND HARD DISK DRIVES, BACK-UP SYSTEMS, AND THEIR MANUFACTURERS.
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>THE MIT PRESS
<from>FRANK SATLOW
<to>BELL, GORDON
<date>6/1/82
<date rec>6/7/82
<log#>6-15
<request>PLEASE SEND COMMENTS ON HIS APPROACH TO SEARCH FOR BOOKS FOR PUBLICATION
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>TWX
<from>SAM FULLER
<to>BELL, GORDON
<date>6/4/82
<date rec>6/7/82
<log#>6-14
<request>ARPA NEEDS HELP, DEC SHOULD REMAIN ACTIVE WITH ARPA.
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>RESUME
<from>SCOTT GLENN
<to>BELL, GORDON
<date>
<date rec>6/4/82

<log#>6-13
<request>PLEASE REVIEW -- REFERRAL FROM PAT & BETH GLENN
<reply by>0
<dispo/date>JOHN DIPIETRO - 6/7/82
<message>LOOKS LIKE HE DIDN'T MAKE IT IN PHYSICS
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>CENTRAL NEW ENGLAND COLLEGE
<from>PAUL L. RYAN
<to>BELL, GORDON
<date>6/1/82
<date rec>6/4/82
<log#>6-12
<request>WOULD YOU LIKE TO SERVE, SEMIANNUALLY, AS A CONSULTANT THE THEIR CHAIRPERSONS?
<reply by>0
<dispo/date>CALLED REGRETS TO DEAN PAUL RYAN 6/7/82 Mon 13:43
<message>
<answer>
<f/u>mm/dd/yy
<filed>12
<done>Y
<>

<subj>WALT BUCHHOLZ HUNTER GROUP - RESUME
<from>WALT BUCHHOLZ
<to>BELL, GORDON
<date>6/2/82
<date rec>6/4/82
<log#>6-11
<request>RESUME - PLEASE REVIEW
<reply by>0
<dispo/date>JOHN DIPIETRO - 6/7/82
<message>PLEASE HANDLE
<answer>
<f/u>mm/dd/yy

<filed>
<done>Y
<>

<subj>XEROX
<from>R.C. LONICK
<to>BELL, GORDON
<date>6/1/82
<date rec>6/4/82
<log#>6-10
<request>PLEASE VISIT OUR BOOTH AT NCC
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>TWX
<from>MIKE GRAWE
<to>BELL, GORDON
<date>6/3/82
<date rec>6/3/82
<log#>6-9
<request>WHO DOES MIKE CONTACT TO LINK CINCINNATI MILACRON ACCOUNT WITH VMS GROUP?
<reply by>0
<dispo/date>6/4/82
<message>Please work this schedule through John O'Keefe & Bill Johnson
<answer>
<f/u>mm/dd/yy
<filed>12
<done>Y
<>

<subj>UNIVERSITY OF TEXAS AT AUSTIN

<from>EARNEST F. GLOYNA
<to>BELL, GORDON
<date>5/28/82
<date rec>6/3/82
<log#>6-8
<request>THANKS FOR LETTER OF MAY 3, WOULD YOU LIKE TO JOIN THEIR "FIRST-RATE ACADEMIC INSTITUTION"?
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>THE UNIVERSITY OF CONNECTICUT
<from>PETER W. MCFADDEN
<to>BELL, GORDON
<date>5/27/82
<date rec>6/3/82
<log#>6-7
<request>ESTABLISHING TEACHING FELLOWSHIPS - WOULD LIKE DEC TO SUPPORT 2 ($32K)
<reply by>0
<dispo/date>sent to BUREK, BUREK REPLIED DIRECTLY TO MCFADDEN, 8/5/82
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>ARIZONA STATE UNIVERSITY
<from>J. RUSSEL NELSON
<to>BELL, GORDON
<date>5/26/82
<date rec>6/1/82
<log#>6-6
<request>INVITATION TO GROUNDBREAKING CEREMONIES FOR ENG.

RESEARCH CENTER ON THE ASU CAMPUS- 6/9.
<reply by>0
<dispo/date>MR. NELSON - 6/2/82
<message>SORRY CAN'T ATTEND, THANKS FOR THINKING OF ME.
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>LAWRENCE LIVERMORE LABORATORY
<from>JOHN E. RANELLETTI
<to>BELL, GORDON
<date>5/20/82
<date rec>6/1/82
<log#>6-5
<request>FINDINGS OF JAPAN VISIT TO GAIN KNOWLEDGE ON THEIR PLANS FOR SUPER COMPUTER DEVELOPMENT.
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>TECHNOLOGY TRANSFER INSTITUTE
<from>NANCY A. DYER
<to>BELL, GORDON
<date>5/21/82
<date rec>6/1/82
<log#>6-4
<request>INDUSTRIAL TECHNICAL MISSION TO JAPAN ON MICROMINIATURE COMPONENT PROCESS AND QUALITY CONTROL IN JAPAN.
<reply by>0
<dispo/date>CALLED REGRETS TO NANCY DYER 6/7/82 Mon 13:26
<message>
<answer>

<f/u>mm/dd/yy
<filed>FILE 12
<done>Y
<>

<subj>FORUM FOR CORPORATE RESONSIBILITY
<from>SILLIAM STEMPER
<to>BELL, GORDON
<date>5/26/82
<date rec>6/1/82
<log#>6-3
<request>PLEASE BECOME A MEMBER OR CONTRIBUTE TO OUR ORGANIZATION.
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>XEROX
<from>D.F. DEMPSEY
<to>BELL, GORDON
<date>5/82
<date rec>6/1/82
<log#>6-2
<request>CONFIRMATION OF LONICK'S INVITATION TO ROBERT ADAMS COCKTAIL PARTY
<reply by>0
<dispo/date>JOHN RING - 6/2/82
<message>NOTE
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>EDUCATIONAL TECHNOLOGY CENTER
<from>ALFRED BORK
<to>BELL, GORDON
<date>5/24/82
<date rec>6/1/82
<log#>6-1
<request>POSSIBLITY OF DEVELOPING LEARNING MATERIAL FOR OUR PERSONAL COMPUTER
<reply by>0
<dispo/date>LETTER TO BORK ALSO TO SHIELDS, KENAH AND LIPPERT - 6/15/82 --- RON REILING--FM MJ - 6/1/82
<message>OK FOR GORDON TO SEE? MJ
<answer>
<f/u>mm/dd/yy
<filed>12
<done>Y
<>

<subj>INTERCONTINENTAL AIR FREIGHT, INC.
<from>NICHOLAS TZANNOS
<to>BELL, GORDON
<date>5/25/82
<date rec>5/28/82
<log#>5-53
<request>HELPING OUT SPACE PROGRAM -- GOOD JUMP ON THE FUTURE
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>DELTAK
<from>WILLIAM CRABTREE/DAVID MCGOVERN
<to>BELL, GORDON
<date>5/20/82
<date rec>5/26/82
<log#>5-52

<request>VIDEO ON CLERICAL AND ADMINISTRATIVE SERVICES
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>RESUME
<from>JOHN THOMAS
<to>BELL, GORDON
<date>5/21/82
<date rec>5/25/82
<log#>5-51
<request>PLEASE REVIEW
<reply by>0
<dispo/date>DIPIETRO - 5/25/82
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>MCGILL UNIVERSITY
<from>MARIANN JELINEK
<to>BELL, GORDON
<date>5/21/82
<date rec>5/24/82
<log#>5-50
<request>WANT G TO SPEAK ON STRATEGY MAKING AT CONFERENCE ON EXPLORING THE STRATEGY-MAKING PROCESS, IN MONTREAL IN OCTOBER, WILL CALL ON JUNE 1 TO CHECK IT OUT.
<reply by>0
<dispo/date>
<message>NO, I CAN'T MAKE IT
<answer>
<f/u>mm/dd/yy
<filed>

<done>Y
<>

<subj>RESUME
<from>J. WILLIAM THOMAS
<to>BELL, GORDON
<date>5/20/82
<date rec>5/24/82
<log#>5-49
<request>PLS REVIEW
<reply by>0
<dispo/date>JOHN DIPIETRO - 5/25/82
<message>PLS HANDLE
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>CALTECH VISITING COMMITTEE - HONORARIUM CHECK
<from>PROF JOHN ROBERTS
<to>BELL, GORDON
<date>5/21/82
<date rec>5/24/82 Mon 13:53
<log#>5-48
<request>
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>COMPUTER LANGUAGE INVESTORS
<from>PETE STIPANOVICH
<to>BELL, GORDON
<date>5/10/82

<date rec>5/24/82
<log#>5-47
<subject>MIRAGE - FOR THE PROGRAMMERS WORKBENCH, WOULD YOU LIKE?
<reply by>0
<dispo/date>BJ - 5/25/82
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>AMPEX
<from>E.T. FLEMING
<to>BELL, GORDON
<date>5/19/82
<date rec>5/24/82
<log#>5-46
<subject>HOSPITALITY SUITE - 6/7,8,9 -- GALLERIA HOTEL, 5060 WEST ALABAMA, CHEVY CHASE SUITE
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>SAN DIEGO STATE UNIVERSITY
<from>RAY WHITTINGTON
<to>BELL, GORDON
<date>5/20/82
<date rec>5/24/82
<log#>5-45
<subject>RESEARCH PROJECT WITH SAN DIEGO UNIVERSITY, PLEASE COMPLETE QUESTIONNAIRE
<reply by>0
<dispo/date>

<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>TEXAS INSTRUMENTS
<from>DENNIS J. FRAILEY
<to>BELL, GORDON
<date>5/20/82
<date rec>5/24/82
<log#>5-44
<subject>THANKS FOR PARTICIPATION AT 9TH SYMPOSIUM ON COMPUTER ARCHITECTURE
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>BINGHAM, DANA & GOULD
<from>JAMES S. DAVIS
<to>BELL, GORDON
<date>5/21/82
<date rec>5/24/82
<log#>5-43
<subject>FIRST ANNUAL BOD MEETING, 8:30 6/11 AT THE MUSEUM
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>BACHE
<from>DONALD H. BROWN
<to>BELL, GORDON
<date>5/19/82
<date rec>5/24/82
<log#>5-42
<subject>BROWN'S INTERPRETATION OF G'S NEW YORK PRESENTATION
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>CONSULTANT BROKERAGE
<from>VIOLA H. FINEFROCK
<to>BELL, GORDON
<date>5/19/82
<date rec>5/24/82
<log#>5-41
<subject>WOULD LIKE TO OFFER CONSULTING SERVICES
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>RESUME
<from>JEFFREY BARKLEY
<to>BELL, GORDON
<date>5/20/82
<date rec>5/24/82
<log#>5-40
<subject>PLEASE REVIEW

<reply by>0
<dispo/date>DIPIETRO - 5/25/82
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>LINKOPING UNIVERSITY, SWEDEN
<from>HAROLD W. LAWSON, JR.
<to>BELL, GORDON
<date>5/18/82
<date rec>5/24/82
<log#>5-39
<subject>WOULD LIKE TO PURSUE PLACING SWEDISH COMMERCIL COMPUTER PRODUCTS IN DIGITAL COMPUTER MUSEUM
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>HIGHER ORDER SOFTWARE, INC.
<from>MARGARET H. HAMILTON
<to>BELL, GORDON
<date>5/19/82
<date rec>5/21/82
<log#>5-38
<subject>"USE.IT" INFORMATION -- THEY WOULD LIKE TO INVITE YOU TO BE THEIR GUEST AT A DEMONSTRATION OF "USE.IT"
<reply by>0
<dispo/date>BJ - 5/25/82
<message>ANYTHING WE CAN USE HERE? IS IT CMS?
<answer>
<f/u>mm/dd/yy
<filed>

<done>Y
<>

<subj>GENERAL DEVICES, INC.
<from>RICHARD W. CLARK
<to>BELL, GORDON
<date>5/18/82
<date rec>5/21/82
<log#>5-37
<subject>FABRICATION OF SILICON WAFERS
<reply by>0
<dispo/date>JEFF KALB - 5/25/82
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>GEOPHYSICAL PROSPECTING AND SURVEYING TEAM
<from>WU YOUGUO
<to>BELL, GORDON
<date>5/7/82
<date rec>5/21/82
<log#>5-36
<subject>REQUESTING TO BE A VISITING MEMBER OF RESEARCH GROUP.
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>ADDISON-WESLEY PUBLISHING COMPANY
<from>THOMAS ROBBINS
<to>BELL, GORDON

<date>5/14/82
<date rec>5/21/82
<log#>5-35
<subject>IF YOU WOULD LIKE AN ADVANCED COPY OF MICROCOMPUTER INTERFACING SEND ENCLOSED CARD.
<reply by>0
<dispo/date>CARD RETURNED - YES WANT A COPY 5/24/82 Mon 13:33
<message>
<answer>
<f/u>mm/dd/yy
<filed>12
<done>Y
<>

<subj>ALLEGHENY FLOORING CORPORATION
<from>JOHN R. W. PEAR
<to>BELL, GORDON
<date>5/17/82
<date rec>5/21/82
<log#>5-34
<subject>FLOORING CONTRACTORS
<reply by>0
<dispo/date>TOSSED - NO INTEREST - 5/24/82
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>PAULA GOLDMAN LEVENTMAN, PHD./ECONOMIC AND POLITICAL SOCIOLOGIST
<from>PAULA LEVENTMAN
<to>BELL, GORDON
<date>5/19/82
<date rec>5/24/82
<log#>5-33
<subject>COPY OF BOOK PROFESSIONALS OUT OF WORK
<reply by>0
<dispo/date>

<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>NATIONAL ACADEMY OF ENGINEERING
<from>HAROLD LIEBOWITZ
<to>BELL, GORDON
<date>5/14/82
<date rec>5/17/82
<log#>5-32
<subject>1982 BALLOT FOR BYLAW CHANGE
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>SEMICONDUCTOR INDUSTRY ASSOCIATION
<from>T.D. HINKELMAN
<to>BELL, GORDON
<date>5/12/82
<date rec>5/17/82
<log#>5-31
<subject>MINUTES OF THE BOARD MEETING, MARCH 23, 1982
<reply by>0
<dispo/date>JEFF KALB - 5/18/82
<message>HELP!
<answer>o.k.
<f/u>5/21
<filed>12
<done>Y
<>

<subj>XEROX - DIABLO SYSTEMS INCORPORTATED
<from>BRUCE S. LEE
<to>BELL, GORDON
<date>5/13/82
<date rec>5/17/82
<log#>5-30
<subject>LITERATURE DESCRIBING NEW DIABLO ECS CAPABILITIES
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>OREGON SOFTWARE
<from>RUSTY WHITNEY
<to>OLSEN, KEN
<date>5/12/82
<date rec>5/17/82
<log#>5-29
<subject>CONGRATULATIONS AND GOOD LUCK ON PERSONAL COMPUTER ENDEAVOR.
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>ASSOCIATION SUISSE POUR L'AUTOMATIQUE - SGA - ASSPA
<from>KARL M. JAUCH, PRES.
<to>BELL, GORDON
<date>5/6/82
<date rec>5/17/82
<log#>5-28
<subject>WOULD LIKE TO TAKE YOU UP ON YOUR OFFER TO SPEAK TO

THEIR MEMBERS. SOMETIME - NOV. 82 - JAN 83 OR MARCH 83
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>RESUME
<from>BILL L. FOSNAUGH
<to>BELL, GORDON
<date>5/13/82
<date rec>5/17/82
<log#>5-27
<subject>PLEASE REVIEW - I THINK I'M GOOD
<reply by>0
<dispo/date>JOHN DIPIETRO - 5/18/82
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>UNIVERSITY OF ALABAMA IN HUNTSVILLE
<from>JOHN C. WRIGHT
<to>OLSEN, KEN
<date>4/28/82
<date rec>5/17/82
<log#>5-26
<subject>HIGH TECHNOLOGY RESEARCH CAPABILITIES OF THE UNIVERSITY
<reply by>0
<dispo/date>DIETER - 5/18/82
<message>
<answer>
<f/u>mm/dd/yy
<filed>

<done>Y
<>

<subj>Printed circuit board testing system
<from>Charles C.S. Burns - Burns Associates, Inc.
<to>BELL, GORDON
<date>5/12/82
<date rec>5/14/82
<log#>5-25
<subject>selling their product
<reply by>0
<dispo/date>DON METZGER - 5/17/82
<message>DON'T WE NEED THIS? FOR QTA!
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>Outside recruiting
<from>Nat Sokal-Pres. Design Automation, Inc.
<to>BELL, GORDON
<date>5/12/82
<date rec>5/14/82
<log#>5-24
<subject>He heard DEC may need skilled outside help - will provide
<reply by>0
<dispo/date>CIRCULATED TO PEG - 5/17/82
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>June visit by Julius Tou-University of Florida
<from>Julius T. Tou
<to>BELL, GORDON

<date>5/11/82
<date rec>5/14/82
<log#>5-23
<subject>Tou would like to visit DEC in June - asking for arrangements to be made.
<reply by>0
<dispo/date>5/17/82
<message>Dieter please handle through Dave Mitchell-Orlando sales office.
<answer>
<f/u>mm/dd/yy
<filed>12
<done>Y
<>

<subj>Stanford Univ Seminar on decision making
<from>James L. Adams - Asso. Dean School of Eng.
<to>BELL, GORDON
<date>5/5/82
<date rec>5/13/82
<log#>5-22
<subject>invitation to send participants to seminars on decision making and problem solving at Stanford U in Calif.
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>Letters from Murray Thompson re: Nautilus
<from>Murray A. Thompson
<to>Strecker, Bill
<date>4/30/82
<date rec>5/13/82
<log#>5-21
<subject>To GB-FYI from Strecker-re: Nautilus project and U. of Wisc working together. Also copy of letter to Dave Orbits from Thompson re: Nautilus.

<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>STANFORD UNIVERSITY
<from>EDWARD FEIGENBAUM
<to>BELL, GORDON
<date>5/4/82
<date rec>5/13/82
<log#>5-20
<subject>REPORT FROM LOS ALAMOS GROUP
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>Industrial Showcase-American Society for Eng. Ed.
<from>John Lisack, Jr.
<to>BELL, GORDON
<date>5/7/82
<date rec>5/12/82
<log#>5-19
<subject>Invitation to be an exhibitor in Texas at 90th conf.
<reply by>0
<dispo/date>JANE GORING - 5/13/82
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>Skill/Knowledge obsolescence
<from>Paula Leventman
<to>BELL, GORDON
<date>5/11/82
<date rec>5/12/82
<log#>5-18
<subject>study of engineers & eng. mgrs re: educational updating needs and work environment problems at DEC
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>POTENTIAL ENGINEERING CANDIDATE
<from>ALAN KAUFMAN
<to>BELL, GORDON
<date>5/72
<date rec>5/12/82
<log#>5-17
<subject>EXCEPTIONAL CANDIDATE - LET'S LOOK INTO IT
<reply by>0
<dispo/date>JOHN DIPIETRO - 5/12/82
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>RESUME COVER LETTER
<from>FRANK CASEY
<to>BELL, GORDON
<date>
<date rec>5/11/82
<log#>5-16

<subject>IS LOOKING FOR JOB
<reply by>0
<dispo/date>JOHN DIPIETRO - 5/12/82
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>TWX
<from>GERD JESSE
<to>BELL, GORDON
<date>5/10/82
<date rec>5/11/82
<log#>5-15
<subject>DR. GRASSMANN'S VISIT - HE WAS PLEASED
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>CALIFORNIA INSTITUTE OF TECHNOLOGY
<from>JOHN ROBERTS
<to>BELL, GORDON
<date>5/5/82
<date rec>5/10/82
<log#>5-14
<subject>KEN WILSON'S PAPER UNIVERSITIES AND THE FUTURE OF COMPTUER TECHNOLOGY DEVELOPMENT
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>

<done>Y
<>

<subj>CDC
<from>BOB PRICE
<to>BELL, GORDON
<date>5/6/82
<date rec>5/10/82
<log#>5-13
<subject>SUMMARY MEMO OF THE 4/30-5/1 DENVER MEETING
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>SIEMENS
<from>HELMUT T. WEINMANN, WERNER BANSEMER
<to>BELL, GORDON
<date>4/30/82
<date rec>5/10/82
<log#>5-12
<subject>LASER PRINTER DEMONSTRATION AT SEIMENS' AT NCC 82
<reply by>0
<dispo/date>JOHN RING - 5/12/82
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>EVOTEK
<from>JAMES H. LAWSON
<to>BELL, GORDON
<date>5/7/82

<date rec>5/10/82
<log#>5-11
<subject>WOULD LIKE TO GIVE YOU A PERSONAL DEMO OF THEIR 5 1/4" DISK DRIVES AT THE NCC SHOW.
<reply by>0
<dispo/date>GRANT SAVIERS - 5/12/82
<message>PLEASE HANDLE
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>HEALTH RESOURCE ANALYSTS
<from>JOHNATHAN B. WEISBUCH, M.D.
<to>BELL, GORDON
<date>5/4/82
<date rec>5/7/82
<log#>5-10
<subject>BUSIENSS -- HELPING MAKE THE HEALTH SYSTEM A LITTLE MORE EFFICIENT -- PLEASURE -- LET'S GET TOGETHER FOR LUNCH -- WILL HAVE SECRETARY CALL NEXT WEEK TO SET DATE/TIME
<reply by>0
<dispo/date>
<message>
<answer>if he calls, sorry can't make it
<f/u>mm/dd/yy
<filed>12
<done>Y
<>

<subj>TWX
<from>MIKE GRAWE
<to>BELL, GORDON
<date>4/7/82
<date rec>5/7/82
<log#>5-9
<subject>CINCINNATI MILACRON
<reply by>0
<dispo/date>

<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>CORNELL
<from>KENNETH G. WILSON
<to>BELL, GORDON
<date>
<date rec>5/7/82
<log#>5-8
<subject>ABSTRACT - UNIVERSITIES AND THE FUTURE OF COMPUTER TECHNOLOGY DEVELOPMENT
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>HARVARD UNIVERSITY
<from>WILLIAM MURPHY
<to>BELL, GORDON
<date>5/5/82
<date rec>5/6/82
<log#>5-7
<subject>WOULD LIKE TO SET UP AN INTERVIEW TO DISCUSS COMPANIES RESPONSE TO CHANGES IN THEIR ORGANIZATIONS.
<reply by>0
<dispo/date>
<message>CALLED--SORRY WOULD NOT BE PROPER TO MEET, BUT SUGGEST YOU CONTACT BOB PRICE, PRES OF CDC 5/11/82 Tue 17:31
<answer>
<f/u>mm/dd/yy
<filed>12
<done>Y

<>

<subj>NATIONAL LEGISLATIVE ACTION SURVEY
<from>RONALD REAGAN
<to>BELL, GORDON
<date>4/30/82
<date rec>5/6/82
<log#>5-6
<subject>PLEASE CONTRIBUTE TO HELP SUPPORT HIS PROGRAMS
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>JACK AGUERO
<from>JACK
<to>BELL, GORDON
<date>5/4/82
<date rec>5/5/82
<log#>5-5
<subject>JON FRENCH'S REPLACEMENT -- WOULD LIKE TO CHAT FOR A MOMENT WITH YOU TO GET UP TO DATE.
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>XEROX
<from>BRUCE S. LEE
<to>BELL, GORDON
<date>5/3/82

<date rec>5/5/82
<log#>5-4
<subject>PRINTWHEEL W/192 CHARACTERS, WILL COORDINATE PRIVATE SHOWING FOR NCC SHOW, IF INTERESTED CALL
<reply by>0
<dispo/date>JOHN RING - 5/6/82

<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>COMPUTING DEVICES COMPANY
<from>TREVOR JONES
<to>BELL, GORDON
<date>4/20/82
<date rec>5/5/82
<log#>5-3
<subject>VIDEO DISPLAY TERMINAL CONCERNS
<reply by>0
<dispo/date>BILL AVERY - 5/5/82
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>RESUME
<from>ERNEST L. GROLIMUND
<to>BELL, GORDON
<date>4/29/82
<date rec>5/4/82
<log#>5-2
<subject>PLEASE REVIEW
<reply by>0
<dispo/date>JOHN ROSE - 5/5/82
<message>PLEASE HANDLE

<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>ETA KAPPA NU - AWARDS COMMITTEE
<from>JAMES A. D'ARCY
<to>BELL, GORDON
<date>4/23/82
<date rec>5/4/82
<log#>5-1
<subject>NOMINATIONS FOR YOUNG OUTSTANDING ELECTRICAL ENGINEERS
<reply by>8/2/82
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<done>N
<>

<subj>PRIME COMPUTER
<from>EDWARD ALVIN FEUSTEL
<to>BELL, GORDON
<date>4/27/82
<date rec>4/30/82
<log#>4-77
<subject>INVITATION TO SUBMIT A PAPER TO SESSION OF A WORKSHOP ON COMPUTER SYSTEMS
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>TWX
<from>GERD JESSE
<to>BELL, GORDON
<date>4/29/82
<date rec>4/29/82
<log#>4-76
<subject>THANK YOU FOR SPENDING TIME WITH GRASSMANN
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>RESUME - WEATHERBY ASSOCIATES, INC.
<from>A.M. WARDEN
<to>BELL, GORDON
<date>4/26/82
<date rec>4/28/82
<log#>4-75
<subject>PLEASE REVIEW
<reply by>0
<dispo/date>JOHN DIPIETRO - 4/30/82
<message>YOU MIGHT CHECK WITH SAM FULLER
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>LEXIDATA CORPORATION
<from>RALPH T. LINSALATA
<to>BELL, GORDON
<date>4/27/82
<date rec>4/28/82
<log#>4-74
<subject>THREAT TO THE SUCCESS OF THE EFFORT TO MARKET A GRAPHICS WORKSTATION WITH THE VAX 11/730

<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>12 5/12/82 Wed 9:15
<done>Y
<>

<subj>RESUME - CULLINANE DATABASE SYSTEMS, INC.
<from>CHARLIE BACHMAN
<to>BELL, GORDON
<date>4/23/82
<date rec>4/27/82
<log#>4-73
<subject>COPY OF HIS SON'S RESUME
<reply by>0
<dispo/date>LETTER TO CHARLIE - 5/3/82
<message>COPIES TO DIPIETRO, BORNSTEIN, KALB, SAVIERS, METZGER - I RECOMMEND HIM AND HAVE MET IHIM. DON'T KNOW HOW MUCH CHEMICAL ENGINEERING WE DO.
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>RESUME
<from>DANIEL C. WEINBERGER
<to>BELL, GORDON
<date>4/22/82
<date rec>4/27/82
<log#>4-72
<subject>PLEASE REVIEW
<reply by>0
<dispo/date>JOHN DIPIETRO - 4/30/82
<message>PLEASE HANDLE
<answer>
<f/u>mm/dd/yy
<filed>

<done>Y
<>

<subj>HILTON RESERVATION SERVICE
<from>HILTON
<TO>BELL, GORDON
<date>4/23/82
<date rec>4/27/82
<log#>4-71
<subject>CONFIRMATION OF ROOM FOR 4/29 - 5/1
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>AMK BERLIN
<from>i. V. Harald Wilrich/i. A. Wolfgang Bughausen
<to>BELL, GORDON
<date>4/82
<date rec>4/82
<log#>4-70
<subject>IKD SOFTWARE EXPO BERLIN 1982 -- IT'S ALL IN GERMAN!!
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>CDC
<from>THOMAS G. KAMP
<to>OLSEN, KEN

<date>4/15/82
<date rec>4/27/82
<log#>4-69
<subject>PLEASE SEND US ANY REPORTS OF DEFECTIVE MATERIAL
<reply by>0
<dispo/date>SAVIERS - 4/27/82
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>OPERATIONS MANAGEMENT GROUP, INC.
<from>HAROLD M. GRISWOLD
<to>BELL, GORDON
<date>4/21/82
<date rec>4/27/82
<log#>4-68
<subject>ORGANIZATION TO SOLVE COMPLEX PRODUCTIVITY PROBLEMS.
<reply by>0
<dispo/date>FILE 12 - 4/27/82
<message>NO INTEREST
<answer>
<f/u>mm/dd/yy
<filed>12
<done>Y
<>

<subj>SRC Board Mtg
<from>Tom Hinkelman
<to>BELL, GORDON
<date>4/23/82
<date rec>4/26/82
<log#>4-67
<subject>notification of SRC Board Mtg., May 18 in
Minneapolis
<reply by>0
<dispo/date>
<message>

<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>SIA Wash. Conf.
<from>T.D. Hinkelman
<to>BELL, GORDON
<date>4/23/82
<date rec>4/26/82
<log#>4-66
<subject>Agenda and reservation form for SIA Washington Conf., May 24-25
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>SIA
<done>Y
<>

<subj>Request for paper
<from>Anita K. Jones
<to>BELL, GORDON
<date>4/21/82
<date rec>4/26/82
<log#>4-65
<subject>request for written paper on the 'limits to the growth of distributed systems'
<reply by>0
<dispo/date>ANITA JONES 4/26/82 Mon 17:05
<message>PAPER SENT
<answer>
<f/u>mm/dd/yy
<filed>12
<done>Y
<>

<subj>Fortune Mag article
<from>Mark K. Enns
<to>BELL, GORDON
<date>4/22/82
<date rec>4/26/82
<log#>4-64
<subject>read the article - writing to say hello and what he is doing now.
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>12
<done>Y
<>

<subj>Foreign Travel Trip Report: Visits with Japanese Computer Mfg.
<from>Robert H. Ewald
<to>BELL, GORDON
<date>4/15/82
<date rec>4/26/82
<log#>4-63
<subject>Los Alamos national Lab trip report visits with Japanese Computer Mfgs.
<reply by>0
<dispo/date>BRUCE DELAGI - 5/13/82
<message>SAM, ULF, KOTOK, METGER, GLORIOSO, DEMMER, AND RET. ORIG.
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>National Research Council
<from>Jacob F. Blackburn
<to>BELL, GORDON

<date>4/21/82
<date rec>4/26/82
<log#>4-62
<subject>thank you for your service on the Computer Science and Technology Board.
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>MIT
<from>PAUL PENFIELD, JR.
<to>BELL, GORDON
<date>
<date rec>4/23/82
<log#>4-61
<subject>INVITATION TO SPRING VLSI RESEARCH REVIEW - 5/17 @ MIT
<reply by>0
<dispo/date>4/27/82
<message>called regrets
<answer>
<f/u>mm/dd/yy
<filed>12
<done>Y
<>

<subj>SHEARSON AMERICAN EXPRESS, INC.
<from>JONATHAN M. ROZEK
<to>BELL, GORDON
<date>4/21/82
<date rec>4/23/82
<log#>4-60
<subject>WOULD LIKE YOU TO HEAR HIS SHPEEL ON FINANCIAL PLANNING
<reply by>0

<dispo/date>5/19/82
<message>to Tony Pell
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>MCKINSEY & COMPANY, INC.
<from>ALLAN A. KENNEDY
<to>BELL, GORDON
<date>4/22/82
<date rec>4/23/82
<log#>4-59
<subject>PURCHASING A JAPANESE FACTORY
<reply by>0
<dispo/date>SAVIERS 4/26/82 Mon 10:01
<message>PLEASE HANDLE + CC ROSE
<answer>
<f/u>mm/dd/yy
<filed>12
<done>Y
<>

<subj>Paris Conference - June
<from>Edoardo Berera
<to>BELL, GORDON
<date>4/8/82
<date rec>4/20/82
<log#>4-58
<subject>request for copy of the slides that go with presentation to be given at paris conference in June
<reply by>0
<dispo/date>slides sent to Berera
<message>
<answer>
<f/u>mm/dd/yy
<filed>FILE 12
<done>Y
<>

<subj>HEALTH RESOURCE ANALYSTS, INC.
<from>JONATHAN B. WEISBUCH, M.D. PRESIDENT.
<to>BELL, GORDON
<date>4/20/82
<date rec>4/22/82
<log#>4-57
<subject>THANKS FOR PUTTING ME IN TOUCH WITH BERTOCCHI
<reply by>0
<dispo/date>CARL ANGEL - 4/29/82
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>CARNEGIE-MELLON UNIVERSITY
<from>DANIEL P. SIEWIOREK
<to>JON BAKER
<date>4/16/82
<date rec>4/22/82
<log#>4-56
<subject>IS HAPPY WITH THE THEORY AND PRACTICE OF RELIABLE SYSTEMS DESIGN.
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>COLLEGE OF MEDICINE AND DENTISTRY OF NEW JERSEY
<from>BENJ. H. NATELSON, M.D.
<to>BELL, GORDON
<date>4/18/82
<date rec>4/22/82

<log#>4-55
<subject>IS DISSAPOINTED WITH WHAT HE HAD TO GO THROUGH TO GET WORD PROCESSING AS AN ADD ON THE PRESENT SYSTEM.
<reply by>0
<dispo/date>4/26/82
<message>Ans letter + copy to Ollie Stone, BJ, Bruce Stewart, TPL P/L Mgr., EASL - Why can't we go out and get SW for WPS and sell it? Note 500 licenses on RSTS.
<answer>
<f/u>mm/dd/yy
<filed>letter book
<done>Y
<>

<subj>RESUME
<from>JOHN E. MCNAMARA
<to>BELL, GORDON
<date>4/21/82
<date rec>4/22/82
<log#>4-54
<subject>ANDREAS PAKPCKE - PLEASE REVIEW HIS RESUME
<reply by>0
<dispo/date>SAM - 4/28/82
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>ZODIAC
<from>HANS-HUGO ENGSTROM
<to>BELL, GORDON
<date>4/14/82
<date rec>4/22/82
<log#>4-53
<subject>PATENT - OF IDEAS DISCUSSED IN 1979
<reply by>0
<dispo/date>AVERY - 4/28/82
<message>PLEASE HANDLE - HELP!!

<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>CDC
<from>P.W. ARNESON
<to>BELL, GORDON
<date>4/20/82
<date rec>4/22/82
<log#>4-52
<subject>DENVER II ATTENDANCE - PLEASE MAKE YOUR OWN RESERVATIONS
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>TWX
<from>GERD JESSE
<to>BELL, GORDON
<date>4/21/82
<date rec>4/22/82
<log#>4-51
<request>VISIT OF DR. GRASSMANN, SIEMENS
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>HITACHI AMERICA, LTD.
<from>KATSUAKI SUZUKI
<to>OLSEN, KEN
<date>2/82
<date rec>4/21/82
<log#>4-50
<request>82/83 YEARBOOK - FOCUSING ON AMERICA'S PRIORITY NEEDS.
<reply by>0
<dispo/date>CIRCULATED TO PEG - 4/23/82
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>MICROELECTRONIC AND INFORMATION SCIENCE CENTER
<from>ROBERT M. HEXTER PH.D
<to>BELL, GORDON
<date>
<date rec>4/21/82
<log#>4-49
<request>MASTER PLAN
<reply by>0
<dispo/date>DEL THORNDIKE - 4/21/82
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>TWX
<from>MAX BURNET
<to>BELL, GORDON
<date>4/20/82
<date rec>4/21/82
<log#>4-48
<request>SPEECH AT TWENTY FIFTH ANNIVERSARY AND AUSTRALIAN

DECUS.
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>CARNEGIE-MELLON UNIVERSITY
<from>A.G. JORDAN
<to>BELL, GORDON
<date>4/13/82
<date rec>4/20/82
<log#>4-47
<request>JOIN CMU IN SUPPORTING THE DEVELOPMENT OF A COORDINATED CAMPUS-WIDE PROGRAM OF RESEARCH, FIELD TUDIES AND TRAINING.
<reply by>0
<dispo/date>JORDAN 4/26/82 Mon 12:43
<message>GB3.S4.2 +
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>SIA
<FROM>ERICH BLOCH
<to>BELL, GORDON
<date>4/7/82
<date rec>4/20/82
<log#>4-46
<request>INVITE DEC TO PARTICIPATE IN COOPERATIVE RESEARCH VENTURE WITH OTHER COMPANIES. PURPOSE OF THE EFFORT IS THE ENHANCE BASIC RESEARCH IN SEMICONDUCTOR DISCIPLINES.
<reply by>0
<dispo/date>
<message>

<answer>
<f/u>mm/dd/yy
<filed>SIA
<done>Y
<>

<subj>NATIONAL RESEARCH COUNCIL
<from>HERBERT FRIEDMAN
<to>BELL, GORDON
<date>4/14/82
<date rec>4/20/82
<log#>4-45
<request>THANK YOU FOR YOUR EFFORTS ON THE COMPUTER SCIENCE AND TECHNOLOGY BOARD -- TERMINATION JUNE 30.
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>CS&TB
<done>Y
<>

<subj>TEAG
<from>GERALD DAVIS
<to>DICK LOVELAND
<date>
<date rec>4/20/82
<log#>4-44
<request>FIELD TEST OF DECMATE 278-H
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>HERTZ
<from>ROBERT T. MAGNOTTA
<to>BELL, GORDON
<date>
<date rec>4/20/82
<log#>4-43
<request>FLEET LEASING REPORT
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>N
<done>Y
<>

<subj>3COM CORPORATION
<from>MARLEEN MARTIN
<to>BELL, GORDON
<date>4/15/82
<date rec>4/20/82
<log#>4-42
<request>PROPOSAL FOR 3COM TO PREPARE A MULTI-VENDOR ETHERNET DEMONSTRATION AT THE UPCOMINGNATIONAL COMUTER CONFERENCE IN HOUSTON.
<reply by>0
<dispo/date>BERNIE - 4/28/82
<message>OK BY ME. WHAT DO YOU SAY?
<answer>
<f/u>
<filed>12
<done>Y
<>

<subj>RESUME
<from>JULLIETTE CARIGNAN
<to>BELL, GORDON
<date>4/13/82
<date rec>4/20/82
<log#>4-41

<request>PLEASE REVIEW
<reply by>0
<dispo/date>JOHN DIPIETRO - 4/21/82
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>RESUME
<from>GEORGE DARCY
<to>BELL, GORDON
<date>3/22/82
<date rec>4/20/82
<log#>4-40
<request>PLEASE REVIEW
<reply by>0
<dispo/date>JANE GORING - 4/21/82
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>NATIONAL SCIENCE FOUNDATION
<from>ALVIN I. THALER
<to>DIETER HUTTENBERGER
<date>4/15/82
<date rec>4/20/82
<log#>4-39
<request>DEC'S COOPERATION IN NEW PROGRAM--SCIENTIFIC COMPUTING RESEARCH EQIPMENT FORTHE MATHEMATICAL SCIENCES.
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>NSF GEN

<done>Y
<>

<subj>PERSONAL LETTER
<from>ANTHONY F. KENTON
<to>BELL, GORDON
<date>
<date rec>4/20/82
<log#>4-38
<request>HAS PATENT PENDING ON DEVICE THAT WILL MAKE A FINSIHED PART OR NMBERICALLY CONTROLLED PROGRAM FROM A SCALE DRAWING, WOULD LIKE TO DISCUSS JOINT VENTURE TO PRODUCE AND MARKET THE SYSTEM.
<reply by>0
<dispo/date>RON REILING - 4/21/82
<message>OK FOR GORDON
<answer>RON REILING SENT A LETTER TO KENTON, 4/29/82 TO SIGN A DISCLOSURE AGREEMENT - THIS IS FILED IN 12
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>ROLF LANDAUER
<from>ROLF
<to>BELL, GORDON
<date>4/14/82
<date rec>4/20/82
<log#>4-37
<request>PALMER'S NOMINATION--ROLF IS ALL SET, BUT MAY REFER BACK TO YOU IF NECESSARY.
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>INTEL
<from>BOB NOYCE
<to>BELL, GORDON
<date>4/8/82
<date rec>4/20/82
<log#>4-36
<request>WILL NOT SPEAK AT AAAS MEETING IN WASHINGTON NEXT DECEMBER, TOO BOOKED UP.
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>CALIFORNIA INSTITUTE OF TECHNOLOGY
<from>JOHN D. ROBERTS - JACK
<to>BELL, GORDON
<date>4/14/82
<date rec>4/20/82
<log#>4-35
<request>MATERIAL SENT PER REQUEST OF DR. GILLESPIE.
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>CALIFORNIA INSTITUTE OF TECHNOLOGY
<from>JOHN D. ROBERTS
<to>BELL, GORDON
<date>4/13/82
<date rec>4/16/82
<log#>4-34

<request>FINAL ARRANGEMENTS FOR VISITING COMMITTEE MEETING 5/19
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>UNITED TECHNOLOGIES
<from>PETER L. SCOTT
<to>BELL, GORDON
<date>4/12/82
<date rec>4/16/82
<log#>4-33
<request>ATTENDANCE AT THE DEDICATION OF THEIR UNITED TECHNOLOGIES MICROELECTRONICS CENTER 5/3 & 5/4 IN COLORADO
<reply by>0
<dispo/date>
<message>cannot attend 4/20/82 Tue 11:12
<answer>
<f/u>mm/dd/yy
<filed>n
<done>Y
<>

<subj>RESUME
<from>DOUGALS MARTIN LEIGH
<to>BELL, GORDON
<date>
<date rec>4/16/82
<log#>4-32
<request>PLEASE LOOK OVER
<reply by>0
<dispo/date>JANE GORING - 4/16/82
<message>ALSO, BJ,KOCH..HIGHLY RECOMMEDED SUMMER STUDENT
<answer>
<f/u>mm/dd/yy

<filed>
<done>Y
<>

<subj>DEFENSE LOGISTICS AGENCY
<from>E.A. GRINSTEAD
<to>BELL, GORDON
<date>4/12/82
<date rec>4/15/82
<log#>4-31
<request>BOTTOM LINE CONFERENCE INVITATION FOLLOW UP LETTER
<reply by>0
<dispo/date>CARLUCCI LETTER 4/9/82 GB3.S3.36 PLUS CALLED VICE ADMIRAL GRINSTEAD 4/16/82 Fri 15:39 WITH REGRETS
<message>
<answer>
<f/u>mm/dd/yy
<filed>LETTERBOOK WITH CARLUCCI LETTER
<done>Y
<>

<subj>WORCESTER POLYTECNIC INSTITUTE
<from>ROBERT HALL
<to>BELL, GORDON
<date>
<date rec>4/15/82
<log#>4-30
<request>STRATEGIC PLANNING FOR HIGH-TECH COMPANIES - A SPECIAL PRESIDENTIAL PROGRAM.
<reply by>0
<dispo/date>LARRY PORTNER - 4/21/82
<message>CAN WE USE THIS?
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>Task Team Work Product (suggestions and objectives)

<from>P.W. Arneson - CDC
<to>BELL, GORDON
<date>4/7/82
<date rec>4/14/82
<log#>4-29
<request>FYI task team work product - suggestions and objectives - please review.
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>DISGRUNTLED EMPLOYEE LETTER
<from>MICHAEL MARTIN
<to>BELL, GORDON & KO
<date>4/4/82
<date rec>4/12/82
<log#>4-28
<request>
<reply by>0
<dispo/date>BORNSTEIN 4/14/82 Wed 13:36
<message>EVERYTHING COPACETIC?
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>TWX
<from>MARY BRESLIN
<to>BELL, GORDON
<date>4/13/82
<date rec>4/14/82
<log#>4-27
<request>AVAILABILITY OF 11/730 SYSTEMS
<reply by>0
<dispo/date>

<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>THE BOSTON ASSOCIATES
<from>DONAL P. PECK
<to>BELL, GORDON
<date>4/13/82
<date rec>4/14/82
<log#>4-26
<request>WOULD YOU LIKE TO BUY LIFE INSURANCE FOR YOUR GRANDCHILDREN?
<reply by>0
<dispo/date>IF PECK CALLS:
<message>PLEASE CALL MY FINANCIAL ADVISOR, TONY PELL, 542-6633
MESSAGE GIVEN TO PECK ON 4/22/82 Thu 11:35
<answer>
<f/u>mm/dd/yy
<filed>N
<done>Y
<>

<subj>BUSINESS DEVELOPMENT INTERNATIONAL
<from>D. ROGER MACNAUGHTON
<to>BELL, GORDON
<date>4/9/82
<date rec>4/13/82
<log#>4-25
<request>REQUEST FOR COMPANY AND PRODUCT INFORMATION ON LOCAL AREA NETWORKS.
<reply by>0
<dispo/date>BERNIE -- 4/15/82
<message>
<answer>
<f/u>mm/dd/yy
<filed>

<done>Y
<>

<subj>TWX
<from>FRANK LEACH
<to>BELL, GORDON
<date>4/13/82
<date rec>4/13/82
<log#>4-24
<request>ENGINEERING STANDARDS
<reply by>0
<dispo/date>BILL HANSON/HOLMAN - 4/15/82
<message>CAN YOU PLEASE ANSWER THIS?
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>computer problems at MRC-London, England
<from>Hamet Strimpel
<to>BELL, GORDON
<date>3/4/82
<date rec>4/12/82
<log#>4-23
<request>response to GB letter of 2/4 re: down time problems of National Institute for Medical Research DEC20 - Dr. M. Jordan
<reply by>0
<dispo/date>ROSE ANN/SHIELDS/MJ - 4/15/82
<message>This sounds like a real pulice state we have in the field. The info from CSSE says great. The users say it's terrible. I think we ought toget tot he bottom of the story. Also, I think the administrator is scared of us.
<answer>
<f/u>mm/dd/yy
<filed>CUSTOMER COMPLAINT
<done>Y
<>

<subj>reference for the nomination of Jerry Sato IEEE Fellow
<from>F.J. Corbato
<to>BELL, GORDON
<date>4/8/82
<date rec>4/12/82
<log#>4-22
<request>fill out and return reference form before 4/30 deadline
<reply by>4/28
<dispo/date>IEEE 4/16/82 Fri 13:42
<message>
<answer>
<f/u>mm/
<filed>IEEE
<done>Y
<>

<subj>termination of Michael Martin
<from>Michael R. Martin
<to>BELL, GORDON
<date>4/4/82
<date rec>4/12/82
<log#>4-21
<request>Martin's viewpoint/explanation as towhy he was terminated after 8 years employment with DEC
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>RESUME COVER LETTER
<from>RICHARD E. KANE, JR.
<to>BELL, GORDON
<date>4/4/82
<date rec>4/9/82

<log#>4-20
<request>PLEASE CONSIDER ME
<reply by>0
<dispo/date>JANE GORING - 4/9/82
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>GORDON WAHLS EXECUTIVE SEARCH
<from>RONALD WERTEL
<to>BELL, GORDON
<date>
<date rec>4/9/82
<log#>4-19
<request>PLEASE REVIEW AND COMMENT
<reply by>0
<dispo/date>DIPIETRO - 4/9/82
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>TWX
<from>TOM KOBAYASHI
<to>BELL, GORDON
<date>4/9/82
<date rec>4/9/82
<log#>4-18
<request>FIFTH GENERATION COMPUTER PROJECT
<reply by>0
<dispo/date>KEN/GVPC,PEG - 4/12/82
<message>
<answer>
<f/u>mm/dd/yy
<filed>

<done>Y
<>

<subj>CDC
<from>R. M. PRICE
<to>BELL, GORDON
<date>4/2/82
<date rec>4/9/82
<log#>4-17
<request>SUMMARY OF 4/1/82 DENVER MEETING
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>dedication of United Technologies Microelectronics Center
<from>Gordon Hoffman
<to>BELL, GORDON
<date>
<date rec>4/8/82
<log#>4-16
<request>invitation to attend May 3 reception in Colorado Springs
<reply by>0
<dispo/date>KALB 4/14/82 Wed 13:13
<message>I DECLINED THIS. HOW ARE WE INTERFACING TO THEM? NOTE MOSTEK WANTS A JOINT PROGRAM
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>MBA Marketing Research Team survey on R&D Capital

Expenditure Survey
<from>Susam Liguori, Team Coordinator - MBA Marketing Research Team
<to>BELL, GORDON
<date>3/24/82
<date rec>4/8/82
<log#>4-15
<request>fill out survey request on R&D Capital Expenditures
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>NSF computers donation activity
<from>Dorothy K. Deringer
<to>BELL, GORDON
<date>4/5/82
<date rec>4/8/82
<log#>4-14
<request>notice to advise of NSF computer donation activity by DISE (Development in Sci. Ed)
<reply by>0
<dispo/date>DIETER,MEANY,WIN - 4/13/82
<message>PLEASE HANDLE
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>World ctr for Computer Sci
<from>Nicholas Negroponte
<to>BELL, GORDON
<date>4/6/82
<date rec>4/8/82
<log#>4-13

<request>Outline of proposal to DEC for a contribution, purchase of equip and center's participation in SU-VAX program
<reply by>0
<dispo/date>GEORGE CHAMBERLAIN - 4/12/82
<message>I'D LIKE US TO HAVE SOMEONE THERE TO INTERACT WITH/CAPTURE THE RESEARCH IDEAS. IF WE COUPLED CLOSELY, THEN I'D REALLY BE MOST SUPPORTIVE. THE PROGRAM AND BASIS IS EXCITING.
<answer>
<f/u>4/16
<filed>
<done>Y
<>

<subj>Caltech Visiting Committee
<from>F.E.C. Culick
<to>BELL, GORDON
<date>3/31/82
<date rec>4/8/82
<log#>4-12
<request>FU request for you to participate in a visiting committee for computing facilities at Caltech. Also enclosed a document which describes planning of a project - a network covering Caltech division of engineering and applied sci to provide interactive graphics and other computing resources to all faculty and students in div.
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>AMERICAN EXECUTIVE MANAGEMENT INC.
<from>EDWARD J. CLOUTIER
<to>JUSTIN KELLEHER
<date>3/31/82

<date rec>4/6/82
<log#>4-11
<request>FORWARDED FROM DIPIETRO - ANY INTEREST IN THIS CANDIDATE?
<reply by>0
<dispo/date>HANSTEIN 4/12/82 Mon 9:35
<message>FOR MANAGING CAD/CAM? + RETURN TO JOHN DIPIETRO
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>DEPUTY SECRETARY OF DEFENSE
<from>FRANK C. CARLUCCI
<to>BELL, GORDON
<date>3/30/82
<date rec>4/5/82
<log#>4-10
<request>"BOTTOM LINE CONFERENCE 5/13/82 - WASHINGTON
<reply by>4/9/82
<dispo/date>CARLUCCI 4/12/82 Mon 9:38
<message>GB3.S3.36
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>TWX
<from>MAX BURNETT
<to>BELL, GORDON
<date>3/5/83
<date rec>4/5/82
<log#>4-9
<request>HISTORY LECTURE YOU WILL BE GIVING SOON - COULD THEY VIDEO TAPE ONE?
<reply by>0
<dispo/date>
<message>

<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>TWX
<FROM>GORDON BELL
<to>MAX BURNETT
<date>3/29/82
<date rec>4/5/82
<log#>4-8
<request>WOULD LIKE A SLIDE OF DRUM FOR TALK ON 4/27.
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>WASHINGTON UNIVERSITY IN ST. LOUIS
<from>TERRENCE S. FOX
<to>BELL, GORDON
<date>4/1/82
<date rec>4/5/82
<log#>4-7
<request>IMPLEMENTATION OF A NEW INTERN FELLOWSHIP PROGRAM.
<reply by>0
<dispo/date>DEL THORNDIKE - 4/12/82
<message>CC'S DIETER, BORNSTEIN
<answer>
<f/u>4/16
<filed>
<done>Y
<>

<subj>BOSTON UNIVERSITY

<from>RUSSEL C. JONES
<to>BELL, GORDON
<date>4/1/82
<date rec>4/5/82
<log#>4-6
<request>REPORT DOCUMENTING THE PAST DECADE OF PROGRESS UNDER THE LEADERSHIP OF PRESIDENT JOHN R. SILBER
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>FELLOW GRADE NOMINATION
<from>JACK KILBY
<to>BELL, GORDON
<date>
<date rec>4/5/82
<log#>4-5
<request>PLEASE FILL OUT FORMS IF YOU AGREE.
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>N
<>

<subj>INSTITUT REMY GENTON
<from>REMY GENTON
<to>BELL, GORDON
<date>3/29/82
<date rec>4/5/82
<log#>4-4
<request>EUROPEAN SYMPOSIUM - 9/23/82 IN PARIS
<reply by>0

<dispo/date>
<mess
age>
<answer>
<f/u>mm/dd/yy
<filed>
<done>N
<>

<subj>NATIONAL ACADEMY OF ENGINEERING
<from>HAROLD LIEBOWITZ
<to>BELL, GORDON
<date>3/30/82
<date rec>4/1/82
<log#>4-3
<request>REQUESTS ACTION FOR 1982 ELECTION OF OFFICERS AND COUNCILLORS OF THE ACADEMY
<reply by>4/28/82
<dispo/date>
<message>
<answer>
<f/u>
<filed>F12
<done>Y
<>

<subj>TEKNOWLEDGE
<from>S. JERROLD KAPLAN
<to>BELL, GORDON
<date>3/29/82
<date rec>4/1/82
<log#>4-2
<request>INFO ONT HE SEMINAR "KNOWLEDGE ENGINEERING IN THE 1980'S"
<reply by>0
<dispo/date>SAM - 4/5/82
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y

<>

<subj>TWX
<from>MAX BURNET
<to>BELL, GORDON
<date>3/31/82
<date rec>4/1/82
<log#>4-1
<request>HAVE PUT TWO SLIDES IN MAIL OF THE DRUM
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>TWX
<from>GORDON BELL
<to>EDWARDO BERERA
<date>
<date rec>3/31/82
<log#>3-82
<request>WHETHER TO READ THE PAPER OF DISTRIBUTED PROCESSING OR NOT
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>WARE, FLETCHER & FREIDENRICH
<from>JONATHAN GREENFIELD
<to>BELL, GORDON
<date>3/26/82
<date rec>3/30/82
<log#>3-81

<request>SRC SIGNATURE PAGES - PLEASE RETURN THEM TO TOM SKORNIA
<reply by>0
<dispo/date>SENT TO SKORNIA 4/5/82 Mon 13:18
<message>SIGNED
<answer>
<f/u>mm/dd/yy
<filed>SRC
<done>Y
<>

<subj>MRC
<from>MONICA M. JORDAN
<to>MR. DAVE GRAVELL
<date>3/22/82
<date rec>3/30/82
<log#>3-80
<request>GENERAL COMPLAINT MADE BY MEMBER OF INSTITUTE TO MEMBER OF DEC
<reply by>0
<dispo/date>ROSE ANN GIORDANO - 4/2/82
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>SIA
<from>JONATHAN GREENFIELD/JEFF KALB
<to>BELL, GORDON
<date>3/11/82
<date rec>3/30/82
<log#>3-79
<request>JEFF'S CONCERNS MARKED IN PACKAGE
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy

<filed>
<done>Y
<>

<subj>NRC - Minutes of Board Mtg + notification of next mtg
<from>Jacob f. Blackburn
<to>BELL, GORDON
<date>3/24/82
<date rec>3/29/82
<log#>3-78
<request>intention to attend June 16 mtg?
<reply by>0
<dispo/date>CARD RETURNED 4/2/82 Fri 12:51
<message>CAN'T MAKE IT
<answer>
<f/u>mm/dd/yy
<filed>CAL 6/16
<done>Y
<>

<subj>NY METRO LUG speaking engagement
<from>Dan Harmon
<to>BELL, GORDON
<date>3/18/82
<date rec>3/29/82
<log#>3-77
<request>Do you need any equipment for talk?
<reply by>0
<dispo/date>GWEN - 3/30/82
<message>FYI
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>SIA Washington Conf - May 24,25
<from>T.D. Hinkelman
<to>BELL, GORDON

<date>3/25/82
<date rec>3/29/82
<log#>3-76
<request>invitation to attend the SIA Wash Conf. 5/24-25 at the Wash. Marriott Hotel, Wash.DC
<reply by>0
<dispo/date>KALB 3/31/82 Wed 8:18
<message>ARE YOU GOING? I CAN'T.
<answer>
<f/u>4/5
<filed>
<done>Y
<>

<subj>BOSTON UNIVERSITY
<from>NICHOLAS WASHIENKO
<to>BELL, GORDON
<date>
<date rec>3/26/82
<log#>3-75
<request>INVITATION TO A
RTICIPATE IN PRESIDENTIAL PROGRAM - STRATEGIC MANAGEMENT OF PRODUCTIVITY IMPROVEMENT
<reply by>0
<dispo/date>LP - 3/29/82
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>TWX
<from>BOB TROCCHI
<to>BELL, GORDON
<date>3/25/82
<date rec>3/26/82
<log#>3-74
<request>
<reply by>0

<dispo/date>3/29/82
<message>Eng. sem info isn't being sent to the field. Thanks for correcting me on 15K vs 7K. The GiGi designs ok. Keep up the good work of shipping 2M/quarter. Do you now have he support in VAX et al?
<answer>
<f/u>mm/dd/yy
<filed>12
<done>Y
<>

<subj>RESUME
<from>TECH-SEARCH CONSULTANTS
<to>BELL, GORDON
<date>
<date rec>3/26/82
<log#>3-73
<request>PLEASE LOOK AND ADVISE
<reply by>0
<dispo/date>JOHN DIPIETRO - 3/30/82
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>CONTROL DATA CORPORATION
<from>BOB PRICE
<to>BELL, GORDON
<date>3/22/82
<date rec>3/26/82
<log#>3-
<request>AGENDA FOR NEXT MCE MEETING 4/1/82
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>

<done>Y
<>

<subj>ASSOCIATION FOR COMPUTER MACHINERY
<from>PETER J. DENNING - PRES ACM, OSCAR N. GARCIA , PRES. IEEE CS
<to>BELL, GORDON
<date>3/8/82
<date rec>3/25/82
<log#>3-71
<request>CONGRATULATIONS - ECKERT MAUCHLY AWARD HAS BEEN CONFIRMED
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>INDIANA UNIVERSITY
<from>ED ROBERTS
<to>BELL, GORDON
<date>
<date rec>3/25/82
<log#>3-70
<request>THANKS FOR EXTERNAL RESEARCH CONFERENCE - HERE IS THE PLACE FOR YOUR COMMERCIALS
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>RESUME - ENGINEERING CAREER ASSOCIATES

<from>RALPH BENNETT
<to>BELL, GORDON
<date>
<date rec>3/24/82
<log#>3-69
<request>RESUME
<reply by>0
<dispo/date>DIPIETRO - 3/25/82
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>NAE
<from>ROLF LANDAUER
<to>BELL, GORDON
<date>3/17/82
<date rec>3/23/82
<log#>3-68
<request>WHAT DO YOU THINK OF RALPH PALMER FOR ADMISSION TO NAE
<reply by>0
<dispo/date>SENT LETTER TO RESPOND - 3/25/82
<message>
<answer>
<f/u>mm/dd/yy
<filed>IN LETTERBOOK - GB3.S3.23
<done>Y
<>

<subj>ASSOCIATION FOR COMPUTING MACHINERY
<from>NINA TOBEROFF
<to>BELL, GORDON
<date>3/17/82
<date rec>3/22/82
<log#>3-67
<request>SAMPLES OF ECKERT-MAUCHLY AWARD
<reply by>0

<dispo/date>2 vitas sent 3/29/82 Mon 14:00
<message>
<answer>
<f/u>
<filed>cal
<done>Y
<>

<subj>JAMES FINN
<from>JAMES
<to>BELL, GORDON
<date>3/17/82
<date rec>3/22/82
<log#>3-66
<request>MANAGEMENT CONSULTING SERVICES
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>HERBERT J. RICHMAN
<from>HERBERT
<to>BELL, GORDON
<date>3/19/82
<date rec>3/22/82
<log#>3-65
<request>RECEPTION FOR SENATOR RUDMAN
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>UNIVERSITY OF ALABAMA IN BIRMINGHAM
<from>VASON P. SRINI
<to>BELL, GORDON
<date>3/17/82
<date rec>3/22/82
<log#>3-64
<request>POSSIBILITY OF SUMMER APPOINTMENT
<reply by>0
<dispo/date>SAM - 3/24/82
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>MOTOROLA
<from>FRED DIVINCENZO
<to>BELL, GORDON
<date>3/19/82
<date rec>3/22/82
<log#>3-63
<request>MOTOROLA PRE-PRESS RELEASE FOR MICROPROCESSORS PRESENTATION
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>PRUDENTIAL
<from>JAMES BAKER
<to>BELL, GORDON
<date>
<date rec>3/22/82
<log#>3-62

<request>LIFE INSURANCE
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>AIR CARE
<from>STEPHEN H. HAYS
<to>BELL, GORDON
<date>3/18/82
<date rec>3/22/82
<log#>3-61
<request>SPECIAL "BLACK BOX" - WILL CALL BACK TO SEE WHAT YOU THINK.
<reply by>0
<dispo/date>
<message>**IF HAYS CALLS AGAIN, GIVE HIM THE FOLLOWING MESSAGE - 4/26/82 Mon 13:41** SORRY WE CAN'T FIND THE CORRESPONDENCE. COULD YOU PLEASE SEND US ANOTHER COPY?
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>IEEE
<from>DOLORES WRIGHT
<to>BELL, GORDON
<date>3/18/82
<date rec>3/22/82
<log#>3-60
<request>ACKNOWLEDGE RECEIPT OF NOMINATION, SIEWIOREK DOES NOT MEET IEEE REQUIREMENTS.
<reply by>0
<dispo/date>
<message>

<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>BOLT BERANEK AND NEWMAN INC.
<from>ROBERT D. BRESSLER
<to>BELL, GORDON
<date>3/17/82
<date rec>3/22/82
<log#>3-59
<request>GETTING PROTOTYPE IMP FOR MUSEUM
<reply by>0
<dispo/date>GWEN - 3/22/82
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>resume-from Bryant Bureau
<from>Ray Sadler
<to>BELL, GORDON
<date>3/16/82
<date rec>3/19/82
<log#>3-60
<request>recruiting letter
<reply by>0
<dispo/date>3/19/82
<message>John Dipietro - pls handle
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>Visiting Committee for Caltech

<from>John D. Roberts
<to>BELL, GORDON
<date>3/12/82
<date rec>3/19/82
<log#>3-58
<request>Invitation to be on Visiting Committee for Caltech and attend meeting on May 20-21 - analyses and assessment of computing and related activities.
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>TWX
<from>WHITNEY TOMLIN
<to>BELL, GORDON
<date>3/17/82
<date rec>3/18/82
<log#>3-57
<request>DETAILS OF LLNL VISIT 3/31
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>LOZANO WHITE AND ASSOCIATES
<from>ELIZABETH C. LAWRENCE
<to>BELL, GORDON
<date>3/16/82
<date rec>3/18/82
<log#>3-56
<request>KEEP US IN MIND FOR FUTURE. WILL CALL NEXT WEEK TO

DISCUSS THE PROSPECT OF WORKING TOGETHER.
<reply by>0
<dispo/date>3/22/82
<message>orig letter + attached brochure to John Rose - pls handle
<answer>
<f/u>mm/dd/yy
<filed>copy of letter in 12
<done>Y
<>

<subj>ASTC
<from>SHEILA GRINELL
<to>BELL, GORDON
<date>3/10/82
<date rec>3/17/82
<log#>3-55
<request>PROPOSAL FOR DEC SUPPORT -- WILL DISCUSS PLANS FOR COMPUTER IN YOUR POCKET.
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>#12
<done>Y
<>

<subj>ASSOCIATION FOR COMPUTING MACHINER
<from>HERBERT R.J. GROSCH
<to>BELL, GORDON
<date>3/8/82
<date rec>3/17/82
<log#>3-54
<request>WOULD LIKE TO HELP WITH THE ECONOMIST, OR MCE
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy

<filed>
<done>Y
<>

<subj>DIGITAL COMPUTER MUSEUM
<from>GWEN BELL
<to>BELL, GORDON
<date>3/15/82
<date rec>3/17/82
<log#>3-53
<request>GORDON TO BE LISTED AS A DONOR IN MUSEUM PHOTOGRAPH AND DOCUMENT COLLECTION
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>HOBBS ASSOCIATES, INC.
<from>L.C. HOBBS
<to>BELL, GORDON
<date>3/12/82
<date rec>3/16/82
<log#>3-52
<request>MANAGEMENT OF A SMALL VENTURE CAPITAL FUND
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>THE MICROPERIPHERAL CORPORATION
<from>VIKKI DARLAND

<to>BELL, GORDON
<date>3/10/82
<date rec>3/16/82
<log#>3-51
<request>JUST ANNOUNCED OEM VERSION OF THE MICROCONNECTION-ON-A-CHIP, A BELL 103, RS-232 COMPATIBLE MODEM...
<reply by>0
<dispo/date>bernie - 3/17/82
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>PRINCETON UNIVERSITY
<from>BRUCE ARDEN
<to>BELL, GORDON
<date>3/11/82
<date rec>3/16/82
<log#>3-50
<request>NEW INSTITUTE TO BE CREATED AT NASA AMES.
<reply by>0
<dispo/date>WIN - 3/23/82
<message>LET'S SELL
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>BBI ELECTRONICS REPRESENTATIVES
<from>JOHN BENSON
<to>BELL, GORDON
<date>3/10/82
<date rec>3/16/82
<log#>3-49
<request>INTRODUCE INTECH MODEL D132 LOGIC ANALYZER
<reply by>0
<dispo/date>GLORIOSO - 3/23/82

<message>FOR MODULE TESTER
<answer>
<f/u>mm/dd/yy
<filed>12
<done>Y
<>

<subj>WARE, FLETCHER & FREIDENRICH
<from>JONATHAN GREEFIELD
<to>BELL, GORDON
<date>3/11/82
<date rec>3/15/82
<log#>3-48
<request>FOR SRC - ARTICLES OF INCORPORATION, BY-LAWS, ACTION B
WRITTEN CONSENT, UNANIMOUS WRITTEN CONSENT.
<reply by>0
<dispo/date>KALB/SIEKMAN - 3/16/82
<message>DEMAND SHUTTLE TO BOTH - 3/16/82 Tue 8:35
<answer>RETURNED TO GB, HE SIGNED AND SENT THEM TO SKORNIA 4/5/82 Mon 13:19 REF: LOG 3-81.
<f/u>mm/dd/yy
<filed>SRC
<done>Y
<>

<subj>UNIVERSITY OF WISCONSIN-MADISON
<from>MURRAY A. THOMPSON
<to>BELL, GORDON
<date>3/12/82
<date rec>3/15/82
<log#>3-47
<request>PROPOSAL - HOW TO IMPLEMENT A FAST COMUTER WITH THE EXACT VAX ARCHITECUTRE
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>

<done>Y
<>

<subj>HAPCO INC.
<from>KEITH F. KNOWLES
<to>BELL, GORDON
<date>3/11/82
<date rec>3/15/82
<log#>3-46
<request>BROCHURE ON VERSITOOL PROCEDURE
<reply by>0
<dispo/date>GONZALES - 3/16/82
<message>YOURS
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>RESUME
<from>BAHA
JAVID
<to>BELL, GORDON
<date>8/9/82
<date rec>3/12/82
<log#>3-45
<request>PLEASE REVIEW - WILL CALL BACK 8/19/82
<reply by>0
<dispo/date>LACROUTE - 3/17/82
<message>WHAT DO YOU SAY? - DIPIETRO PLEASE HANDLE
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>IEEE COMPUTER SOCIETY
<from>RALPH J. PREISS, CHAIRMAN
<to>BELL, GORDON

<date>3/8/82
<date rec>3/12/82
<log#>3-44
<request>COMPUTER PIONEER AWARD FOR G
<reply by>0
<dispo/date>GB'S OFFICE CASE 3/15/82 Mon 10:52
<message>
<answer>
<f/u>mm/dd/yy
<filed>CC IN TEL TO CALL FOLDER- GB
<done>Y
<>

<subj>THE BOSTON CONSULTING GROUP, INC.
<from>ALAN J. ZAKON
<to>BELL, GORDON
<date>3/5/82
<date rec>3/12/82
<log#>3-43
<request>INVITATION TO CONFERENCE: STRATEGIC COMPETITION
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>BOOZ ALLEN & HAMILTON INC.
<from>HARVEY L. POPPEL
<to>BELL, GORDON
<date>3/8/82
<date rec>3/11/82
<log#>3-42
<request>INFORMATION INDUSTRY INSIGHTS + QUESTIONNAIRE
<reply by>0
<dispo/date>BRUCE DELAGI - 3/16/82
<message>
<answer>

<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>CONTRIBUTION COMMITTEE REQUEST - MIT
<from>NEGROPONTE
<to>BELL, GORDON
<date>?
<date rec>3/10/82 Wed 17:59
<log#>3-41
<request>CONTRIBUTION COMMITTEE REQUEST PLUS LET'S MEET
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>SEMICONDUCTOR INDUSTRY ASSOCIATION
<from>TOM HINKELMAN
<to>BELL, GORDON
<date>3/5/82
<date rec>3/10/82
<log#>3-40
<request>MINUTES OF MEETING OF JANUARY 20, 1982
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>COMPUTER SYSTEMS CONSULTANTS
<from>PETER D. MARTON
<to>BELL, GORDON

<date>3/8/82
<date rec>3/10/82
<log#>3-39
<request>INTRODUCTION TO THEIR CONSULTANT FIRM
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>TWX
<from>R.W. WILMOT
<to>BELL, GORDON
<date>3/9/82
<date rec>3/10/82
<log#>3-38
<request>SUPPORT FROM ECMA MEMBERS
<reply by>0
<dispo/date>BERNIE 3/11/82 Thu 14:36
<message>WHAT YOU SAY--LET'S ANSWER
<answer>
<f/u>3/12/82
<filed>
<done>Y
<>

<subj>LINKOPING UNIVERSITY
<from>GOESSTA H. GRANLUND
<to>OLSEN, KEN
<date>2/26/82
<date rec>3/10/82
<log#>3-37
<request>INTEREST IN PARTICIPATING IN COMPUTER THAT ALLOWS COMPUTATION TO BE PERFORMED UP TO 100,000 TIMES FASTER THAN ANY OTHER.
<reply by>0
<dispo/date>SAM - 3/16/82

<message>YOURS, YOU DO NEED AN ARCHITECTURE RESEARCH PROGRAM.
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>CONGRESS OF THE UNITED STATES
<from>JACK BROOKS - CHAIRMAN
<to>BELL, GORDON
<date>3/4/82
<date rec>3/9/82
<log#>3-36
<request>DOD INSTRUCTION 5000.5X, STANDARD INSTRUCTION SET ARCHITECTURE FOR EMBEDDED COMPUTERS REPORT.
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>MCF (ALPHA)
<done>Y
<>

<subj>UNIVERSITY OF ROCHESTER
<from>ROBERT L. SPROULL
<to>BELL, GORDON
<date>3/5/82
<date rec>3/9/82
<log#>3-35
<request>PLEASE LOCATE IN ROCHESTER, NY
<reply by>0
<dispo/date>JOHN ROSE - 3/16/82
<message>YOURS
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>MIT
<from>PAUL E. BROWN
<to>BELL, GORDON
<date>3/4/82
<date rec>3/9/82
<log#>3-34
<request>THANK YOU FOR THE VISIT AND TOURS
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>NATIONAL SCIENCE FOUNDATION
<from>JOHN B. SLAUGHTER
<to>BELL, GORDON
<date>
<date rec>3/9/82
<log#>3-33
<request>ENCLOSED MAILING LIST FOR THOSE SURVEYED
<reply by>0
<dispo/date>AL MULLIN - 3/10/82
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>DAIICHI JITSUGYO CO., LTD.
<from>T. HAGIWARA
<to>BELL, GORDON
<date>3/1/82
<date rec>3/8/82
<log#>3-32
<request>WOULD LIKE QUIET PRINTER INFORMATION

<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>SIA
<from>T.D. HINKELMAN
<to>BELL, GORDON
<date>2/1/82
<date rec>3/8/82
<log#>3-31
<request>BILL FOR 1/29 SIA MEETING - WE WILL BE BILLED
<reply by>0
<dispo/date>PAID BY AMERICAN EXPRESS OVER PHONE TO MARRIOTT 3/12/82 Fri 14:47
<message>
<answer>
<f/u>mm/dd/yy
<filed>12
<done>Y
<>

<subj>NORTH CAROLINA STATE UNIVERSITY
<from>M.A. LITTLEJOHN - R.M. HEXTER
<to>BELL, GORDON
<date>3/1/82
<date rec>3/8/82
<LOG#>3-30
<request>INVITED TO PARTICIPATE IN WORKSHOP _ "COOPERATION AND SHARING AMONG MICROELECTRONICS RESEARCH CENTERS." WASH. DC
<reply by>3/15/82
<dispo/date>KALB 3/9/82 Tue 10:35
<message>PLEASE HANDLE
<answer>
<f/u>mm/dd/yy

<filed>
<done>N
<>

<subj>BELL CONTROLS INC.
<from>R.J. BELL
<to>BELL, GORDON
<date>2/26/82
<date rec>3/8/82
<log#>3-29
<request>ARE READY TO SAMPLE LISTED IC PRODUCTS
<reply by>0
<dispo/date>TETSCHNER/JESSE/DEMMER/AVERY/MILLER/SAVELL - 3/17/82
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>ECONOMIC DEVELOPMENT BOARD
<from>DR. VINCENT YIP
<to>BELL, GORDON
<date>3/3/82
<date rec>3/8/82
<log#>3-28
<request>FUTURE POSSIBLITIES IN SINGAPORE - SCIENCE PARK
<reply by>0
<dispo/date>ROSE 3/9/82 Tue 11:47
<message>FYI
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>CARNEGIE MELLON UNIVERSITY
<from>DAN SIEWIOREK

<to>BELL, GORDON
<date>3/1/82
<date rec>3/8/82
<log#>3-27
<request>PLEASE FILL OUT IEEE PAPERS FOR NOMINATION OF WILLIAM WULF FOR ELECTION TO IEEE FELLOW.
<reply by>4/15/82
<dispo/date>FORMS MAILED TO IEEE AND POST CARD MAILED TO SIEWIOREK 3/12/82 Fri 14:21
<message>
<answer>
<f/u>mm/dd/yy
<filed>12
<done>Y
<>

<subj>SRC INTERIM BOARD
<from>IBM - ERICH BLOCH
<to>BELL, GORDON
<date>3/4/82
<date rec>3/8/82
<log#>3-26
<request>INTERIM BOARD DISCUSSIONS
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>THE UNIVERSITY OF ARIZONA
<from>T. TRIFFET
<to>BELL, GORDON
<date>3/1/82
<date rec>3/5/82
<log#>3-25
<request>REPORT OF RESEARCH AT THE UNIVERSITY
<reply by>0
<dispo/date>DIETER - 3/8/82

<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>ROCHESTER INSTITUTE OF TECHNOLOGY
<from>DR. RICHARD KENYON
<to>BELL, GORDON
<date>2/26/82
<date rec>3/5/82
<log#>3-24
<request>STARTING UNDERGRADUATE DEGREE IN MICROELECTRONIC ENGINEERING, WOULD LIKE YOUR COMMENTS AND SUPPORT
<reply by>0
<dispo/date>TEICHER - 3/8/82
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>NORTH CAROLINA UNIVERSITY
<from>J.B. O'NEAL, JR.
<to>BELL, GORDON
<date>3/3/82
<date rec>3/5/82
<log#>3-23
<request>PROPOSAL FOR UNIVERSITY/INDUSTRY COOPERATIVE RESEARCH CENTER FOR COMMUNICATIONS AND SIGNAL PROCESSING
<reply by>0
<dispo/date>DIETER - 3/10/82
<message>WHO'S LOOKING AT THIS?
<answer>3/17/82 - called with regrets on GB attending. Sent copy to Dieter FYI.
<f/u>3/12/82
<filed>12
<done>Y

<>

<subj>NORTHEASTER UNIVERSITY
<from>KARL WEISS
<to>BELL, GORDON
<date>3/2/82
<date rec>3/4/82
<log#>3-22
<request>PROPOSED COLLEGE OF COMPUTER SCIENCE
<reply by>0
<dispo/date>FILED - NORTHEASTERN - 3/10/82
<message>
<answer>
<f/u>mm/dd/yy
<filed>NORTHEASTERN UNIVERSITY
<done>Y
<>

<subj>YALE UNIVERSITY
<from>RICHARD BARKER
<to>BELL, GORDON
<date>2/26/82
<date rec>3/4/82
<log#>3-21
<request>JUST TO LET YOU KNOW -- AND ASK HELP -- BROADENING THEIR FACULTY, CAN YOU HELP WITH NAMES OF POSSIBLE CANDIDATES.
<reply by>0
<dispo/date>TEICHER - 3/8/82
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>CDC
<from>CRYSTAL A. CLIFT
<to>OLSEN, KEN

<date>2/22/82
<date rec>3/4/82
<log#>3-20
<request>HELP WITH A SEARCH AND ADVISORY REPORT FOR A CLIENT OF CDC
<reply by>0
<dispo/date>JESSEL - 3/10/82
<message>SHALL WE?
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>COMPUTING AND GOVERNMENT INTERACTIONS & ACHIEVEMENTS
<from>ERIC W. WOLF
<to>BELL, GORDON
<date>3/2/82
<date rec>3/4/82
<log#>3-19
<request>INVITATION TO BE FEATURED SPEAKER AT ASSOCIATION OF COMPUTING MACHINERY'S ANNUAL WASHINGTON CHAPTER TECHNICAL SYMPOSIUM ON 6/17.
<reply by>0
<dispo/date>
<message>THANKS BUT CAN'T 3/11/82 Thu 14:33
<answer>
<f/u>mm/dd/yy
<filed>#12
<done>Y
<>

<subj>PROPOSAL FROM H. SLAUGHTER, SACRAMENTO
<from>CAROL MANN (DEC)
<to>BELL, GORDON
<date>3/2/82
<date rec>3/4/82
<log#>3-18
<request>LOOK OVER AND COMMENT RE AN OUTSIDE VENTURE
<reply by>0

<dispo/date>SAM 3/4/82 Thu 17:02
<message>PLEASE HANDLE
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>BUSINESS RESEARCH CORPORATION
<from>WILLIAM BENJAMIN
<to>BELL, GORDON
<date>3/1/82
<date rec>3/3/82
<log#>3-17
<request>WOULD YOU LIKE TO INVEST IN OUR DATABASES?
<reply by>0
<dispo/date>CHARLIE P. - 3/5/82
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>ADVANCED DEVELOPMENT AND ENGINEERING CENTER
<from>JOHN HARPER
<to>BELL, GORDON
<date>2/26/82
<date rec>3/3/82
<log#>3-16
<request>INTRODUCING THEIR TURNKEY SYSTEMS ETC.
<reply by>0
<dispo/date>JACK SMITH - 3/5/82
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>BOLT BERANEK AND NEWMAN INC.
<from>FRANK E. HEART
<to>BELL, GORDON
<date>3/2/82
<date rec>3/3/82
<log#>3-15
<request>THANK YOU FOR ARRANGING VISIT. WOULD LIKE TO ASSIS ARPA-LIKE FUNDING BROKERAGE.
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>OMSI
<from>MICHAEL TEMPLETON
<to>BELL, GORDON
<date>2/24/82
<date rec>3/3/82
<log#>3-14
<request>RESPONSE FOR ADDITIONAL INFORMATION - ENCLOSED A COPY OF OMSI'S LATEST FINANCIAL STATEMENT.
<reply by>0
<dispo/date>FILED OMSI - 3/10/82
<message>
<answer>
<f/u>mm/dd/yy
<filed>OMSI
<done>Y
<>

<subj>MIT
<from>FRANCIS F. LEE
<to>BELL, GORDON
<date>3/1/82
<date rec>3/3/82

<log#>3-13
<request>WOULD LIKE TO EXPERIMENT WITH MICROPOWER/PASCAL.
CAN G ARRANGE FOR A LOAN?
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>BOLT BERANEK AND NEWMAN INC.
<from>STEVE LEVY
<to>BELL, GORDON
<date>2/26/82
<date rec>3/3/82
<log#>3-12
<request>THANKS FOR VISITING BBN, HOPE TO TALK TO YOU SOON
RE: NETWORK TECHNOLOGY
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>VERNON R. ALDEN
<from>VERNON
<to>OLSEN, KEN
<date>2/22/82
<date rec>3/3/82
<log#>3-11
<request>WOULD WE BE WILLING TO CONTRIBUTE A PDP 20/60 TO THE
WORLD CENTER FOR PERSONAL COMPUTERS AND HUMAN DEVELOPMENT
<reply by>0
<dispo/date>
<message>

<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>THE GOLD CARD
<from>JOHN C. SUTPHEN
<to>BELL, GORDON
<date>
<date rec>3/3/82
<log#>3-10
<request>WOULD YOU LIKE A GOLD CARD? YOU ARE SUCH A GOOD CUSTOMER
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>UNITED TECHNOLOGIES
<from>JAMES F. LYONS
<to>BELL, GORDON
<date>2/25/82
<date rec>3/2/82
<log#>3-9
<request>THANKS FOR ATTENDANCE AT MCE, HOPE TO SEE YOU IN FUTURE
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>CONTROL DATA CORPORATION
<from>WILLIAM NORRIS
<to>OLSEN, KEN
<date>2/26/82
<date rec>3/2/82
<log#>3-8
<request>DISCUSSIONS OF MEETING IN FLORIDA
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>DAIICHI JITSUGYO CO., LTD.
<from>K. HINOSHITA
<to>BELL, GORDON
<date>2/23/82
<date rec>3/2/82
<log#>3-7
<request>INTRODUCTION OF 3 COLOR PLOTTER/PRINTER
<reply by>0
<dispo/date>AVERY - 3/17/82
<message>WHAT'S THIS? HOW ABOUT TOM LOOKING AT IT?
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>BELL LABORATORIES
<from>M.V. MATHEWS
<to>BELL, GORDON
<date>2/25/82
<date rec>3/2/82
<log#>3-6
<request>REACTIONS TO REPORT OF COMPUTER SCIENCE PLANNING

COMMITTEE
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>GRENELEFE
<from>GAYLEE EVANS, JIM KOTTMEIER
<to>BELL, GORDON
<date>2/11/82
<date rec>3/2/82
<log#>3-5
<request>MEETING INFORMATION FOR MCE MEETING (DID IT ALREADY TAKE PLACE? 2/18, 2/19??)
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>HETTINGA EQUIPMENT, INC.
<from>MIRIAM MANN
<to>BELL, GORDON
<date>2/19/82
<date rec>3/1/81
<log#>3-4
<request>INTEREST IN THEIR PROCESS & EQUIPMENT - PLASTIC MOLDING SYSTEM
<reply by>0
<dispo/date>DICK GONAZALES - 3/5/82
<message>
<answer>
<f/u>mm/dd/yy

<filed>
<done>Y
<>

<subj>CONTROL DATA CORPORATION
<from>P.W. ARNESON
<to>BELL, GORDON
<date>2/24/82
<date rec>3/1/81
<log#>3-3
<request>SENT SLIDES THAT G GAVE HIM IN ORLANDO
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>NATIONAL SCIENCE FOUNDATION
<from>BERNARD CHERN
<to>BELL, GORDON
<date>2/22/82
<date rec>3/1/81
<log#>3-2
<request>DESCRIPTION OF COMPUTER ENGINEERING PROGRAM - PLEASE RATE - INNOVATIVE STRATEGIES FOR COMPUTER ENGINEERING, COLORADO STATE U
<reply by>0
<dispo/date>NSF 3/24/82 Wed 10:00
<message>
<answer>
<f/u>mm/dd/yy
<filed>NSF REVIEWS
<done>Y
<>

<subj>PACIFIC SEMI INTERNATIONAL

<from>WILLIAM TODOROF
<to>BELL, GORDON
<date>2/21/82
<date rec>3/1/81
<log#>3-1
<request>PLEASE REVIEW THE SUMMARY OF SEMI-CONDUCTORY RIBBON PROCESS SUITABLE SUITABLE FOR SOLAR SELLS
<reply by>0
<dispo/date>RON REILING - 3/2/82
<message>IS THIS OK TO GIVE TO GORDON?
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>MOTION MANUFACTURING, INC.
<from>R.W. SIEVERS
<to>BELL, GORDON
<date>
<date rec>2/26/82
<log#>2-62
<request>SENT CATALOG - ANY QUESTIONS, PLEASE CALL.
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>ABLEX PUBLISHING CORPORATION
<from>WALTER J. JOHNSON, PRES
<to>BELL, GORDON
<date>2/23/82
<date rec>2/26/82
<log#>2-61
<request>SORRY YOU CAN'T ATTEND "HARDWARE THEORY AN PRACTICE", COULD YOU PLEASE SUGGEST SOMEONE.

<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>TWX
<from>MESSAGE CENTER
<to>BELL, GORDON
<date>2/23
<date rec>2/26/82
<log#>2-60
<request>NOTIFICATION OF MESSAGE SENT
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>BRYANT BUREAU - RESUME
<from>RAY C. SADLER
<to>BELL, GORDON
<date>2/22/82
<date rec>2/26/82
<log#>2-59
<request>PLEASE REVIEW RESUME AND GET IN TOUCH WITH RAY IF INTERESTED.
<reply by>0
<dispo/date>DIPIETRO - 2/26/82
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y

<>

<subj>Comments on NYU proposal
<from>Therese Flaherty
<to>BELL, GORDON
<date>2/23/82
<date rec>2/25/82
<log#>2-58
<request>request for comments from GB on NYU research proposal to .SIA
<reply by>0
<dispo/date>TEICHER - 3/1/81
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>Computer Pioneer Award
<from>Ralph J. Preiss
<to>BELL, GORDON
<date>2/22/82
<date rec>2/24/82
<log#>2-57
<request>to inform G that he is recipient of The Computer Pioneer Award of IEEE on 30th Anniversary Occasion. More info to follow.
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>product descriptions
<from>Win Hodge

<to>BELL, GORDON
<date>2/22/82
<date rec>2/23/82
<log#>2-56
<request>bringing up to date on new products
<reply by>0
<dispo/date>BERNIE/JESSEL - 3/4/82
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>Inter Exhibition 12/8-10
<from>Dr. G. Rabbat
<to>BELL, GORDON
<date>1/4/82
<date rec>2/23/82
<log#>2-55
<request>sent from A. Bertocchi - request participation at exhibit
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>telex
<from>R. Wijnhoven
<to>BELL, GORDON
<date>2/2/82
<date rec>2/23/82
<log#>2-54
<request>explanation as to why he cannot come to DEC as invited
<reply by>0
<dispo/date>2/24/82

<message>Don Metzger let's hire him as tech. watcher
<answer>
<f/u>
<filed>12
<done>Y
<>

<subj>report on patent of didactic demical computer
<from>Silvio Meletti
<to>BELL, GORDON
<date>12/14/81
<date rec>2/23/82
<log#>2-53
<request>sent from Al Bertocchi's office (request to evaluate report)
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>resume
<from>Mukesh Prasad
<to>BELL, GORDON
<date>2/82
<date rec>2/23/82 Tue
<log#>2-52
<request>job interview
<reply by>0
<dispo/date>2/26/82
<message>Sam Fuller - How about it?
<answer>
<f/u>
<filed>fu
<done>Y
<>

<subj>Colonnade credit card
<from>Sayed M. Saleh, Managing Dir - the Colonnade Hotel
<to>BELL, GORDON
<date>2/82
<date rec>2/23/82
<log#>2-51
<request>invitation to obtain credit card
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>Agenda- NRC Board mtg of March 19
<from>Jacob F. Blackburn
<to>BELL, GORDON
<date>2/18/82
<date rec>2/23/82
<log#>2-50
<request>request for card signifying attendance at mtg or send a rep
<reply by>CALLED BLACKBURN--GB WILL NOT BE THERE NOR SEND A SUB 3/10/82 Wed 9:45
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>NRC/CSTB
<done>Y
<>

<subj>ACORN SYSTEMS, INC.
<from>RON S. CORDEK
<to>OLSEN, KEN
<date>2/11/82
<date rec>2/22/82

<log#>2-49
<request>COME VISIT OUR PLANT TO SEE HOW OUR SYSTEMS CAN HELP DEC
<reply by>0
<dispo/date>SAVIERS - 2/22/82
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>RESUME
<from>RICK EASTWICK
<to>BELL, GORDON
<date>1/28/82
<date rec>2/19/82
<log#>2-48
<request>PLEASE REVIEW
<reply by>0
<dispo/date>2/25/82
<message>John DiPiatro - Can we use him?
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>GENERAL DEVICES, INC.
<from>RICHARD W. CLARK
<to>BELL, GORDON
<date>2/16/82
<date rec>2/19/82
<log#>2-47
<request>WOULD LIKE TO OFFER SERVICES IN ENIGNEERING AND LAOUT OF IC'S
<reply by>0
<dispo/date>TOSSED - 2/22/82
<message>
<answer>

<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>RESUME
<from>DANIEL M. CRIMMINS
<to>BELL, GORDON
<date>2/11/82
<date rec>2/19/82
<log#>2-46
<request>PLEASE LOOK AT MY RESUME
<reply by>0
<dispo/date>JANE GORING - 2/22/82
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>SANTA MONICA PUBLISHING COMPANY
<from>marty
<to>BELL, GORDON
<date>2/16/82
<date rec>2/19/82
<log#>2-45
<request>IF THERE IS TIME TO LOOK OVER THE CHAPTERS OF THE NEW BOOK, PLEASE LET HIM KNOW AND HE WILL SEND G A COPY.
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>FLORIDA ATLANTIC UNIVERSITY

<from>DR. L. STROMBERG
<to>OLSEN, KEN
<date>2/26/82
<date rec>2/19/82
<log#>2-44
<request>PRELIMINARY PRESENTATION AND RESEARCH GRANT REQUEST
<reply by>0
<dispo/date>DIETER - 2/22/82
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>TWX
<from>TOM KOBAYASHI
<to>BELL, GORDON
<date>2/18/82
<date rec>2/19/82
<log#>2-43
<request>UPDATE ON SUPER COMPUTER PROJECT
<reply by>0
<dispo/date>2/22/82
<message>copy w/note to Bob Price @CDC - More on Supercomputers and copy to Ulf, Demmer, Teicher, Kalb, W. Thompson and John Rose.
<answer>
<f/u>mm/dd/yy
<filed>12
<done>Y
<>

<subj>TWX
<from>MESSAGE CENTER
<to>BELL, GORDON
<date>2/18/82
<date rec>2/18/82
<log#>2-42
<request>MESSAGE ACKNOWLEDGEMENT TO JOHN SWETS

<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>12
<done>Y
<>

<subj>RESUME
<from>EARL H. BECK
<to>BELL, GORDON
<date>2/14/82
<date rec>2/18/82
<log#>2-41
<request>WOULD BE DELIGHTED TO MEET WITH G.
<reply by>0
<dispo/date>JUSTIN - 2/22/82
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>KODAK
<from>IV
<to>BELL, GORDON
<date>2/16/82
<date rec>2/18/82
<log#>2-40
<request>SUMMARIES OF SP2000 MOTION ANALYSIS SYSTEM
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>BOLT BERANEK AND NEWMAN INC.
<from>JOHN A SWETS - CHIEF SCIENTIST
<to>BELL, GORDON
<date>2/16/82
<date rec>2/18/82
<log#>2-39
<request>CONFIRMATION OF SCHEDULED FOR LECTURE SERIS ON 2/24/82
<reply by>0
<dispo/date>FILED - ALPHA 3/4/82
<message>
<answer>
<f/u>mm/dd/yy
<filed>ALPHA - BBN (BOLT BERANEK AND NEWMAN
<done>Y
<>

<subj>TWX
<from>BRYAN SUMMERS
<to>BELL, GORDON
<date>2/12/82
<date rec>2/16/82
<log#>2-38
<request>ANNUAL CONVENTION - Keynote Speaker (COSBA) - South African Computer Services and Bureau Association
<reply by>0
<dispo/date>2/16/82
<message>Telex sent - regrets. Suggested Lewis Branscomb - IBM
<answer>
<f/u>mm/dd/yy
<filed>12
<done>Y
<>

<subj>COMPUTER SCIENCE
<from>JAVAID ASLAM
<to>BELL, GORDON

<date>2/12/82
<date rec>2/16/82
<log#>2-37
<request>PLEASE READ ATTACHED
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>TECHNOLOGY CATALYSTS, INC
<from>R.L. DICICCO
<to>BELL, GORDON
<date>2/12/82
<date rec>2/16/82
<log#>2-36
<request>HIGH TECHNOLOGY R&D FAIR
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>YALE UNIVERSITY
<from>RICHARD C. BARKER
<to>BELL, GORDON
<date>2/9/82
<date rec>2/16/82
<log#>2-35
<request>TH
ANK YOU FOR HOSPITALITY - LOOK FORWARD TO DEVELOPING A PROGRAM.
<reply by>0
<dispo/date>FILE 13 - 2/22/82

<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>CDC
<from>WILLIAM C. NORRIS
<to>OLSEN, KEN
<date>2/9/82
<date rec>2/15/82
<log#>2-34
<request>2/19/82 MEETING AGENDA IN ORLANDO
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>MIT
<from>EDGAR H. SCHEIN
<to>BELL, GORDON
<date>2/10/82
<date rec>2/15/82
<log#>2-33
<request>REACTIONS FROM CONTRACT RECEIVED.
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>TWX
<from>JIM AMBROSE
<to>BELL, GORDON
<date>2/12/82
<date rec>2/15/82
<log#>2-32
<request>DEVELOPING RELATIONSHIPS, AND WORKING ON MUTUAL PROGRAMS WITH DIGITAL
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>SIA
<from>TOM HINKELMAN
<to>BELL, GORDON
<date>2/9/82
<date rec>2/12/82
<log#>2-31
<request>PROPOSAL FOR RESEARCH BY NYU TO DEVELOP FUTURE SCENARIOS FOR U.S. SEMICONDUCTOR INDUSTRY
<reply by>0
<dispo/date>DOUG CLARK - 2/19/82
<message>WHAT DOES THEESA THINK ABOUT THIS PROPOSAL?
<answer>
<f/u>mm/dd/yy
<filed>SIA
<done>Y
<>

<subj>BALLOS & COMPANY INC.
<from>CONSTANTINE J. BALLOW - PRES
<to>BELL, GORDON
<date>2/9/82
<date rec>2/12/82
<log#>2-30

<request>HEADHUNTERS
<reply by>0
<dispo/date>
<message>NO INTEREST
<answer>
<f/u>mm/dd/yy
<filed>N
<done>Y
<>

<subj>UNIVERSITY OF CALIFORNIA, BERKELEY
<from>DAVID A. PATTERSON
<to>BELL, GORDON
<date>2/8/82
<date rec>2/12/82
<log#>2-29
<request>DRAFT OF ECKERT-MAUCHLY AWARD
<reply by>2/19
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>TWX
<from>ALVARO BAPTISTE
<to>BELL, GORDON
<date>2/10/82
<date rec>8/11/82
<log#>2-28
<request>FIRST -44COLOMBIAN CONFERENCE ON COMPUTER SCIENCE AND RELATED SCIENCES, RESCHEDULED FROM 3/22 TO 3/31. WOULD STILL LIKE YOUR ATTENDANCE
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy

<filed>
<done>Y
<>

<subj>UNIVERSITY OF WISCONSIN-MADISON
<from>MURRAY A. THOMPSON
<to>BELL, GORDON
<date>2/5/82
<date rec>2/10/82
<log#>2-27
<request>BETTERING THE VAX - WOULDLIKE TO TALK TO G ABOUT IT
<reply by>0
<dispo/date>2/12/82
<message>Bob G, Sam, Jud, Bill, Ulf, Bob Stewart, Hooper, Jenkins, McInnis. What you say? These guys got us off the dime years ago on Nebula. I say let's do it.
<answer>
<f/u>3/12/82
<filed>
<done>Y
<>

<subj>SELL A PRODUCT
<from>CRAIG L. WALKER
<to>OLSEN, KEN
<date>
<date rec>2/10/82
<log#>2-26
<request>PURCHASE OF ALTERNATIVE METHOD TO UTILIZE SOLAR AND MAN MADE ENERGY
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>MAILGRAM
<from>GUY RABBAT
<to>BELL, GORDON
<date>2/8/82
<date rec>2/10/82
<log#>2-25
<request>INVITATION TO PARTICIPATE IN AN INTERNATIONAL VLSI PANEL DISCUSSION
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>DESIGN AUTOMATION, INC.
<from>NAT SOKAL
<to>BELL, GORDON
<date>2/6/82
<date rec>2/10/82
<log#>2-24
<request>RESUME OF JUDITH HETENYI
<reply by>0
<dispo/date>JUSTIN - 2/11/82
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>TWX
<from>ROBB WILMOT/ICL PUTNEY, LONDON
<to>BELL, GORDON
<date>2/8/82
<date rec>2/10/82
<log#>2-23
<request>WHAT TO DO NEXT WITH ETHERNET, WOULD LIKE TO MEET G

IN BOSTON, APRIL 12 A.M.
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>PRINTER SYSTEMS
<from>R. TROY HUGGINS
<to>OLSEN, KEN
<date>2/5/82
<date rec>2/9/82
<log#>2-22
<request>ARE LOOKING FOR BUYERS FOR THEIR AM PRINTER SYSTEMS DIVISION.
<reply by>0
<dispo/date>AVERY - 2/22/82
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>COMPUTER REVIEW
<from>JASON GORDON - ASSOC. EDITOR/DAVE SIMPSON - TECH. EDITOR
<to>BELL, GORDON
<date>
<date rec>2/9/82
<log#>2-21
<request>WANT SOME BASIC FACTS ABOUT OUR MINICOMPUTERS TO BE PUBLISHED IN THEIR MAGAZINE.
<reply by>3/8/82
<dispo/date>RICK CORBEN - 2/18/82
<message>CAN YOU HAVE SOMEONE DO THIS?
<answer>

<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>TOTAL TRAVEL MANAGEMENT, INC.
<from>BRENT J. GARBACK
<to>BELL, GORDON
<date>2/5/82
<date rec>2/9/82
<log#>2-20
<request>WOULD LIKE OUR TRAVEL BUSINESS
<reply by>0
<dispo/date>NO INTEREST - FILE 13 - 2/11/82
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>WHO'S WHO PROOF
<from>WHO'S WHO IN TECHNOLOGY TODAY
<to>BELL, GORDON
<date>
<date rec>2/9/82
<log#>2-19
<request>PROOF OF THE PORTION OF G'S WRITE UP BEFORE IT GOES TO PRINT
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>FREDERICK HARPER

<from>RICK HARPER
<to>BELL, GORDON
<date>2/1/82
<date rec>2/9/82
<log#>2-18
<request>REQUEST TO CALL TO ARRANGE MEETING TO DISCUSS HIS MARKETING SKILLS.
<reply by>0
<dispo/date>JUSTIN - 2/11/82
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>CSIRO
<from>CRAIG
<to>BELL, GORDON
<date>1/29/82
<date rec>2/8/82
<log#>2-17
<request>COPY OF "FAR EASTERN ECONOMIC REVIEW"
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>SENATOR HATCH
<from>
<to>BELL, GORDON
<date>
<date rec>2/8/82
<log#>2-16
<request>WOULD LIKE G TO BE CHARTER MEMBER OF HIS SENAT BUSINESS ADVISORY BOARD.
<reply by>0

<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>Mail survey on industial R&D activity
<from>Albert N. Link - Auburn University, Auburn, Alabama
<to>BELL, GORDON
<date>1/26/82
<date rec>2/5/82
<log#>2-15
<request>additional firm data on R&D activities - In 1978 DEC particiapted in a mail survey gathering data on R&D - it was examined funded by National Science Foundation - summary included.
<reply by>0
<dispo/date>to link - 8/11/82
<message>G FOUND THE EXEC. RPT. OF NO VALUE, RETURNED QUESTIONNAIRE UNFILLED.
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>SIA
<from>T.D. HINKELMAN
<to>BELL, GORDON
<date>2/1/82
<date rec>2/4/82
<log#>2-14
<request>BILL FOR ROOM AT MARRIOT - RESERVED FOR G FOR THE SRC INTERIM BOARD OF DIRECTORS MEETING.
<reply by>0
<dispo/date>
<message>
<answer>

<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>NORTHEASTERN UNIVERSITY
<from>KARL WEISS
<to>BELL, GORDON
<date>2/2/82
<date rec>2/4/82
<log#>2-13
<request>COMPUTER SCIENCE PLANNING COMMITTEE REPORT - FORMULATION OF STATEMENT OF SUPPORT FOR THE PROPOSED INDEPENDENT SCHOOL MODEL.
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>PRIME
<from>NATHAN A. TEICHHOLTZ
<to>BELL, GORDON
<date>2/1/82
<date rec>2/4/82
<log#>2-12
<request>WOULD LIKE TO PRESENT - HISTORY OF RSTS - TO DEC
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>LOS ALAMOS NATIONAL LABORATORY
<from>ROBERT H. EWALD, DIVISION LEADER, JOHN E. RANELLETTI, DEPT. HEAD
<to>BELL, GORDON
<date>1/25/82
<date rec>2/4/82
<log#>2-11
<request>INVITATION TO ATTEND CONF. ON LANGUAGE ISSUES FOR LARGE-SCALE COMPUTING. - 3/16-38 -
<reply by>0
<dispo/date>2/8/82
<message>Bill Strecker - please go or send an alternate
<answer>TOM EDGERS IS GOING FROM STRECKER'S OFFICE 3/5/82 Fri 14:45
<f/u>
<filed>12
<done>Y
<>

<subj>BOWDEN & CO., INC.
<from>HARRISON R. MAGEE -VP
<to>BELL, GORDON
<date>1/29/82
<date rec>2/4/82
<log#>2-10
<request>HEADHUNTER
<reply by>0
<dispo/date>
<message>NO INTEREST
<answer>
<f/u>mm/dd/yy
<filed>N
<done>Y
<>

<subj>SCIENTIFIC CALCULATIONS, INC.
<from>GERD SCHLITT - DIRECTOR OF MARKETING
<to>LARRY PORTNER -- BELL, GORDON
<date>1/27/82
<date rec>2/3/82

<log#>2-9
<request>DEC'S IC DESIGN AUTOMATION NEEDS - WOULD LIKE TO DISCUSS WITH US.
<reply by>0
<dispo/date>TOSSED - ALREADY RECEIVED ONE ADDRESSED TO GB - #2-3
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>BOSTON RESEARCH DIRECTORS' CLUB
<from>TERRANCE HENG
<to>BELL, GORDON
<date>
<date rec>2/3/82
<log#>2-8
<request>NOTIFICATION OF MEMBERS OF THE BRDC LUNCHEON 2/11/82 - 12:30
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>MIT
<from>E. BARBARA LEWIS
<to>BELL, GORDON
<date>1/22/82
<date rec>2/3/82
<log#>2-7
<request>SYMPOSIUM AND SEMINAR ANNOUNCEMENT
<reply by>0
<dispo/date>
<message>

<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>MASS INSTITUTE OF TECHNOLOGY
<from>PROFESSOR FANO
<to>BELL, GORDON
<date>
<date rec>2/2/82
<log#>2-6
<request>NOMINATION FORM FOR MEDAL OF HONOR
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>HARVARD
<from>ANTHONY G. OETTINGER
<to>BELL, GORDON
<date>1/21/82
<date rec>2/1/82
<log#>2-5
<request>THANKS FOR OKA INVITATION
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>SIA

<from>T.D. HINKELMAN
<to>BELL, GORDON
<date>1/28/82
<date rec>2/1/82
<log#>2-4
<request>SIA PRESS RELEASE ON THE CAL/OSHA STUDY OF SEMICONDUCTOR INDUSTRY
<reply by>0
<dispo/date>KALB - 2/4/82
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>SCIENTIFIC CALCULATIONS, INC.
<from>GERD SCHLITT
<to>BELL, GORDON
<date>1/27/82
<date rec>2/1/82
<log#>2-3
<request>DISCUSS IC DESIGN
<reply by>0
<dispo/date>JUD LEONARD - 2/12/82
<message>WHO'D LIKE TO INVITE THEM IN FOR A MAJOR PRESENTATION AND SEMINAR? I'D LIKE TO ATTEND. ALSO SENT TO: LIGNOS, STRAKA, TEICHER, GOLDFEIN, CAROL PETERS, TASAR, KUSIK, DEL, GONZALES.
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>PRIME
<from>ROBERT S. SWARZ PHD
<to>BELL, GORDON
<date>1/29/82
<date rec>2/1/82

<log#>2-2
<request>THANK YOU FOR MOTO OKA INVITATION - WE ENJOYED
<reply by>0
<dispo/date>DEL - 2/4/82
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>PEAT MARWICK, MITCHELL & CO.
<from>EARL W. POWELL
<to>BELL, GORDON
<date>1/21/82
<date rec>2/1/82
<log#>2-1
<request>INVITATION TO ONE DAY SEMINAR - 1981 ECONOMIC RECOVERY TAX ACT
<reply by>0
<dispo/date>TOSSED - 2/2/82
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>CONSIDINE COMPUTING SERVICES
<from>THOMAS CONSIDINE
<to>BELL, GORDON
<date>1/27/82
<date rec>2/1/82
<log#>1-45
<request>COPY OF PAPER OR NOTES ONDISTRIBUTED PROCESSING AND ITS LIMITS. - COULD NOT ATTEND DECUS.
<reply by>0
<dispo/date>2/5/82
<message>
<answer>2/5/82 - sent reprint

<f/u>mm/dd/yy
<filed>12
<done>Y
<>

<subj>STANFORD UNIVERSITY - DEPT. OF CHEMISTRY
<from>
<to>BELL, GORDON
<date>1/25/82
<date rec>2/1/82
<log#>1-44
<request>
<reply by>0
<dispo/date>ORIG - FU2/12 - HINDLE - 2/4/82
<message>ALSO TO LONG, PETE SMITH, MEANY, ROCKWELL, FULLER, ECKHOUSE--HELP, WHAT YOU GUYS THINK HERE? CAN I GET SOMEONE FROM THETECHN P/L TO HLEP ME? WE MUST BE HIGHLY VISIBLE THERE
<answer>
<f/u>2/12
<filed>GB--COMPUTERS IN SCIENCE ADVISORY BOARD
<done>Y
<>

<subj>TEAG
<from>GERALD DAVIS
<to>BELL, GORDON
<date>1/21/82
<date rec>2/1/82
<log#>1-43
<request>PERSONAL IMPRESSION RE: DEC'S DEV. OF SMALL SYSTEMS
<reply by>0
<dispo/date>ON CIRCULATION TO AK, KO, AVERY - 2/12/82
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>ENGINEERING PERSONNEL - GORDON WAHLS EXECUTIVE SEARCH
<from>C. KENNEDY HICKMAN
<to>BELL, GORDON
<date>
<date rec>1/29/82
<log#>1-42
<request>
<reply by>0
<dispo/date>DIPIETRO - 1/29/82
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>COMPUTER CAREERS
<from>SALLY KING, CPC
<to>BELL, GORDON
<date>1/25/82
<date rec>1/28/82
<log#>1-41
<request>POSITION SEARCH
<reply by>0
<dispo/date>JUSTIN - 1/29/82
<message>PLEASE HANDLE
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>SIGNETICS
<from>EARLY DUFRESNE
<to>BELL, GORDON
<date>
<date rec>1/27/82
<log#>1-40
<request>

<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>CPU DESIGN TEAM
<from>RALPH MOORE, PRES. MICRO DIGITAL, INC.
<to>KEN OLSEN
<date>11/17/81
<date rec>1/26/82
<log#>1-39
<request>
<reply by>0
<dispo/date>1/26/82
<message>BOB GLORIOSO, ULF, DEMMER, SAM - NOTE, GORDON (ALSO CALL BOB AND READ HIM THE MEMO - ASK HIM TO CALL. GB THINKS IT WOULD BE WORTHWHILE TO AT LEAST TALK TO THEM.
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>DESIGN AUTOMATION, INC.
<from>NATHAN O. SOKAL
<to>BELL, GORDON
<date>1/22/82
<date rec>1/26/82
<log#>1-38
<request>
<reply by>0
<dispo/date>GUTMAN, CROXON, SCHALKE -- 1/29/82
<message>
<answer>
<f/u>mm/dd/yy
<filed>12

<done>Y
<>

<subj>COMMUNICATIONS RESEARCH DIVISION
<from>JILL P. MESIROV
<to>BELL, GORDON
<date>1/21/82
<date rec>1/26/82
<log#>1-37
<request>
<reply by>0
<dispo/date>DICK ECKHOUSE - 1/29/82
<message>ALSO TO DIPIETRO
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>MITRE
<from>HOWARD P. FOLEY - PRES, AND C.A. ZRAKET - EXEC. VP
<to>BELL, GORDON
<date>1/18/82
<date rec>1/26/82
<log#>1-36
<request>
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>NATIONAL RESEARCH COUNCIL
<from>DR. RICHARD B. MARSTEN
<to>BELL, GORDON
<date>1/18/82

<date rec>1/25/82
<log#>1-35
<request>
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>NATIONAL RESEARCH COUNCIL
<from>DR. RICHARD B. MARSTEN
<to>BELL, GORDON
<date>1/21/82
<date rec>1/25/82
<log#>1-34
<request>
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>MANAGEMENT WORKSHOP - HIGH TECH
<from>NORTHEASTERN U.
<to>BELL, GORDON
<date>
<date rec>1/25/82
<log#>1-33
<request>
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy

<filed>
<done>Y
<>

<subj>Institute for Scitific Information
<from>Bonnie Cohen
<to>BELL, GORDON
<date>1/18/82
<date rec>1/20/82
<log#>1-32
<reply by>0
<dispo/date>ALLEN NEWELL - 1/28/82
<message>IS THERE A CHANCE YOU'D WANT TO WRITE THIS? IT REALLYMAKES ONE FEEL NICE. I CAN'T DO IT AS I'M OVER SUBSCRIBED MORE THAN USUAL.
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>Workshop on Life-long Cooperative Education - MIT
<from>Robert Fano
<to>BELL, GORDON
<date>1/18/82
<date>1/20/82
<log#>1-31
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>resume + letter
<from>David B. Siegrist

<to>BELL, GORDON
<date>1/10/82
<date rec>1/19/82
<log#>1-28
<reply by>0
<dispo/date>1/19/82
<message>John Meyer, pls handle
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>Committee on External Nominations of IEEE
<from>Ivan A. Getting
<to>BELL, GORDON
<date>1/14/82
<date rec>1/19/82
<log#>1-28
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
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<subj>SRC Interim Board
<from>Warren Davis
<to>BELL, GORDON
<date>1/15/82
<date rec>1/19/82
<log#>1-27
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>

<done>Y
<>

<subj>TECH-SEARCH CONSULTANTS - RESUME
<from>JAMES P. ROCK
<to>BELL, GORDON
<date>
<date rec>1/18/82
<log#>1-26
<reply by>0
<dispo/date>1/19/82
<message>John Meyer - Pls handle
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>DESIGN AUTOMATION, INC.
<from>NATHAM O. SOKAL - PRES
<to>BELL, GORDON
<date>1/14/82
<date rec>1/18/82
<log#>1-25
<reply by>0
<dispo/date>1/19/82
<message>John Meyer, Pls handle
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>SME MANUFACTURING
<from>RALPH E. CROSS - PRES
<to>BELL, GORDON
<date>1/18/82
<date rec>1/18/82
<log#>1-24

<reply by>0
<dispo/date>DIETER - 1/26/82
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>TWX
<from>TOM KOBAYASHI
<to>BELL, GORDON
<date>1/13/82
<date rec>1/15/82
<log#>1-23
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>MIT
<from>PAUL E. GRAY - PRES.
<to>BELL, GORDON
<date>1/12/82
<date rec>1/15/82
<log#>1-22
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>UNIVERSITY OF TEXAS AT AUSTIN
<from>J.K. AGGARWAL
<to>BELL, GORDON
<date>12/82
<date rec>1/14/82
<log#>1-21
<reply by>0
<dispo/date>LIBRARY - 2/4/82
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>L. THOMPSON ASSOCIATES, INC.
<from>LARRY THOMPSON
<to>BELL, GORDON
<date>1/11/82
<date rec>1/13/82
<log#>1-20
<reply by>0
<dispo/date>MEYER - 1/15/82
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>RESUME
<from>ROBERT H. FIGLER
<to>BELL, GORDON
<DATE>1/10/82
<date rec>1/13/82
<log#>1-19
<reply by>0
<dispo/date>MEYER - 1/15/82
<message>
<answer>

<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>COMPUTER SYSTEMS CONSULTANTS
<from>PETER D. MARTON - VP MARKETING
<to>BELL, GORDON
<date>
<date rec>1/12/82
<log#>1-18
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>CAHNERS PUBLISHING COMPANY, INC.
<from>ROBERT C. WYNKOOP
<to>MATT HABINOWSKI
<date>1/7/82
<date rec>1/12/82
<log#>1-17
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>...TEXAS INSTRUMENTS
<from>EDWARD P. O'NEILL, VP MARKETING
<to>DON METZGER
<date>1/4/82

<date rec>1/12/82
<log#>1-16
<reply by>0
<dispo/date>KALB TEICHER - 1/18/82
<message>FYI, ARE YOU GOING TO BE AT DECU'S PRESENTATION IN 2 WKS?
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>NATIONAL ACADEMY OF ENGINEERING NOMINATION FORMS
<from>ACADEMY OF ENGINEERING
<to>BELL, GORDON
<date>SPRING 1982
<date rec>1/11/82
<log#>1-15
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>UNIVERSITY OF TEXAS AT AUSTIN
<from>ROBERT E. BOYER
<to>BELL, GORDON
<date>1/6/82
<date rec>1/11/82
<log#>
1-14
<reply by>0
<dispo/date>ENG STAFF - 1/28/82
<message>I'D LIKE A VOLUNTEER HERE.
<answer>Called Boyer 2/24/82 gave him Rose Ann Giordano's name as a possile alternate for GB

<f/u>mm/dd/yy
<filed>12
<done>Y
<>

<subj>CDC Mtg
<from>William Norris
<to>Ken Olsen
<date>11/6/81
<date rec>1/11/82
<log#>1-13
<reply by>0
<dispo/date>
<message>copy of original invitation which we have no record of receiving
<answer>
<f/u>mm/dd/yy
<filed>13
<done>Y
<>

<subj>INNOTECH
<from>R. DONALD GAMACHE
<to>BELL, GORDON
<date>1/4/82
<date rec>1/8/82
<log#>1-12
<reply by>0
<dispo/date>1/13/82
<message>file 12 - no action
<answer>
<f/u>mm/dd/yy
<filed>12
<done>Y
<>

<subj>IBM
<from>GUY RABBAT, PH.D.
<to>BELL, GORDON
<date>1/4/82

<date rec>1/8/82
<log#>1-11
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>GALE ENGINEERING CO., INC.
<from>PAUL S. LEBARON, JR., R.L.S.
<to>BELL, GORDON
<date>1/6/82
<date rec>1/8/82
<log#>1-10
<reply by>0
<dispo/date>1/13/82
<message>John Rose - Our next engineering site in Mass?
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>CENTER FOR INFORMATION POLICY RESEARCH
<FROM>JOHN C. LEGATES
<to>BELL, GORDON
<date>1/5/82
<date rec>1/8/82
<log#>1-9
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>IBM
<from>GUY RABBAT
<to>BELL, GORDON
<date>12/22/81
<date rec>1/6/82
<log#>1-8
<reply by>0
<dispo/date>TEICHER,CUDMORE,KABL, PEG:, MCINNIS - 1/14/82
<message>HAVE WE GOT ANYTHING TO PRESENT? PLEASE DISUSS WITH YOUR STAFF. I;D LIKE STEVE TO HANDLE THIS ONE.
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>ACIS
<from>CORFERIAS - FERIA INTERNACIONAL
<to>BELL, GORDON
<date>12/13/81
<date rec>1/5/82
<log#>1-7
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>RESUME
<from>EXECUTIVE SOURCE, INC.
<to>BELL, GORDON
<date>
<date rec>1/5/82
<log#>1-6
<reply by>0

<dispo/date>JOHN DIPIETRO - 1/6/82
<message>PLS HANDLE
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>SREE CONSULTANTS
<from>KIRIT PATEL - EDITOR
<to>BELL, GORDON
<date>12/29/81
<date rec>1/5/82
<log#>1-5
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>AMERICAN DEFENSE PREPAREDNESS ASSOCIATION
<from>LTC RUDY ROSE
<to>BELL, GORDON
<date>12/21/81
<date rec>1/4/82
<log#>1-4
<reply by>0
<dispo/date>1/7/82
<message>called regrets
<answer>
<f/u>mm/dd/yy
<filed>12
<done>Y
<>

<subj>ALEX PUBLISHING CORP.

<FROM>WALTER J. JOHNSON
<to>BELL, GORDON
<date>12/31/81
<date rec>1/4/82
<log#>1-3
<reply by>0
<dispo/date>
<message>
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>

<subj>VLSI DESIGN
<from>JERRY WERNER
<to>BELL, GORDON
<date>12/31/81
<date rec>1/4/82
<log#>1-2
<reply>0
<dispo/date>1/14/82
<message>filled out card for free subscription and returned
<answer>
<f/u>mm/dd/yy
<filed>
<done>Y
<>
<g>Mr.
<fn>Robert
<ln>Everett
<tel>617-271-2529
<co>The MITRE Corporation
<add>P.O. Box 208
<csz>Beford, MA 01730
<entered>8/16/82
<lst>AO
<>

<g>Dr.
<fn>Gene

<ln>Amdahl
<tel>
<co>Trilogy Systems Corporation
<add>Chairman of the Board
19200 Pruneridge Avenue
<csz>Cupertino, CA 94014
<entered>8/16/82
<lst>AO
<>

<g>Dr.
<fn>Robert
<ln>Noyce
<tel>408-987-8165
<co>Intel Corporation
<add>Vice Chairman of the Board
3065 Bowers Avenue
<csz>Santa Clara, CA 95051
<entered>8/16/82
<lst>AO
<>

<g>Dr.
<fn>Lester
<ln>Hogan
<tel>415-962-2744
<co>Fairchild Camera and Instrument Corporation
<add>464 Ellis Street
MS 20-2234
<csz>Mountain View, CA 94042
<entered>8/16/82
<lst>AO
<>

<g>Prof.
<fn>Ed
<ln>Feigenbaum
<tel>415-497-4079
<co>Stanford University
<add>Computer Science Department
<csz>Stanford, CA 94305
<entered>8/16/82

<lst>AO
<>

<g>Prof.
<fn>Michael
<ln>Dertouzos
<tel>253-2145
<co>MIT
<add>Computer Science Department
77 Massachusetts Avenue
<csz>Cambridge, MA 02139
<entered>8/16/82
<lst>AO
<>

<g>Prof.
<fn>Allen
<ln>Newell
<tel>
<co>Carnegie-Mellon University
<add>Computer Science Department
Schenley Park
<csz>Pittsburgh, PA 15213
<entered>8/13/82
<lst>AO
<>

<g>Dr.
<fn>David
<ln>Brandin
<tel>415-326-6200
<co>SRI
<add>
<csz>Menlo Park, California 94025
<entered>8/13/82
<lst>AO
<>

<g>Mr.
<fn>William
<ln>Miller
<tel>415-326-6200

<co>SRI
<add>
<csz>Menlo Park, California 94025
<entered>8/13/82
<lst>AO
<>

<g>Prof.
<fn>Raj
<ln>Reddy
<tel>
<co>Carnegie-Mellon University
<add>Computer Science Department
Schenley Park
<csz>Pittsburgh, PA 15213
<entered>8/13/82
<lst>AO
<>

<g>Dr.
<fn>Bob
<ln>Kahn
<tel>202-694-5922
<co>ARPA
<add>1400 Wilson Boulevard
Room 730
<csz>Arlington, VA 22200
<entered>8/13/82
<lst>AO
<>

<g>Dr.
<fn>Robert
<ln>Cooper
<tel>202-694-5922
<co>ARPA
<add>1400 Wilson Boulevard
Room 730
<csz>Arlington, VA 22200
<entered>8/13/82
<lst>AO
<>

<g>Mr.
<fn>Duane
<ln>Adams
<tel>202-694-5922?
<co>ARPA
<add>1400 Wilson Boulevard
Room 730
<csz>Arlington, VA 22200
<entered>8/13/82
<lst>AO
<>

<g>Mr.
<fn>Kent
<ln>Curtis
<tel>202-357-9747
<co>NSF
Room 339
1800 G Street NW
<csz>Washington, DC 20550
<entered>8/13/82
<lst>AO
<>

<g>Dr.
<fn>Frank
<ln>Kuo
<tel>415-326-6200
<co>SRI
<add>
<csz>Menlo Park, California 94025
<entered>8/13/82
<lst>AO
<>

<g>Mr.
<fn>Steve
<ln>Adkins
<tel>
<co>Control Data Corp.
<add>2800 E. Old Sharkopee Rd.

<csz>Minneapolis, MN 55420
<entered>8/13/82
<lst>AO
<>

<g>Mr.
<fn>Roger
<ln>Anderson
<tel>
<co>Lawrence Livermore National Lab
<add>P.O. Box 808, MS L306
<csz>Livermore, CA 94550
<entered>8/13/82
<lst>AO
<>

<g>Dr.
<fn>Paul
<ln>Armer
<tel>
<co>Stanford University
<add>Computer Science Department
<csz>Stanford, CA 904305
<entered>8/13/82
<lst>AO
<>

<g>Mr.
<fn>Don
<ln>Austin
<tel>
<co>Dept. of Energy
<add>Office of Basic Energy Science
ER-17 GTN
<csz>Washington, DC 20545
<entered>8/13/82
<lst>AO
<>

<g>Mr.
<fn>Tim

<ln>Axelrod
<tel>
<co>Lawrence Livermore National Lab
<add>P.O. Box 808, MS L306
<csz>Livermore, CA 94550
<entered>8/13/82
<lst>AO
<>

<g>Dr.
<fn>James
<ln>Baker
<tel>415 486-5739
<co>Lawrence Berkeley Labs
<add>1 Cyclotron Rd., MS 50B-2232
<csz>Berkeley, CA 94720
<entered>8/13/82
<lst>AO
<>

<g>Dr.
<fn>Forest
<ln>Basket
<tel>
<co>Digital Equipment Corp.
<add>4410 El Camino
<csz>Los Altos, CA 94022
<entered>8/13/82
<lst>AO
<>

<g>Dr.
<fn>William
<ln>Buzbee
<tel>
<co>Los Alamos National Lab
<add>Computing Division
P.O. Box 1663
<csz>Los Alamos, NM 87454
<entered>8/13/82
<lst>AO
<>

<g>Mr.
<fn>Bruce
<ln>Colton
<tel>
<co>Control Data Corp.
<add>2800 E. Old Sharkopee Rd., HQM270
<csz>Minneapolis, MN 55420
<entered>8/13/82
<lst>AO
<>

<g>Dr.
<fn>Richard
<ln>Fateman
<tel>
<co>University of California-Berkeley
<add>Electrical Eng. & Computer Science Dept.
519 Evans Hall
<csz>Berkeley, CA 94720
<entered>8/13/82
<lst>AO
<>

<g>Mr.
<fn>Robert
<ln>Fink
<tel>
<co>Lawrence Berkeley Laboratory
<add>1 Cyclotron Rd, MS50B
<csz>Berkeley, CA 94720
<entered>8/13/82
<lst>AO
<>

<g>Dr.
<fn>Dieter
<ln>Fuss
<tel>
<co>Lawrence Livermore National Lab
<add>P.O. Box 808, MS L561

<csz>Livermore, CA 94550
<entered>8/13/82
<lst>AO
<>

<g>Dr.
<fn>Alberto
<ln>Grunbaum
<tel>
<co>Lawrence Berkeley Laboratory
<add>UC Berkeley - CSAM
1 Cyclotron Rd., 50A-2129
<csz>Berkeley, CA 94720
<entered>8/13/82
<lst>AO
<>

<g>Mr.
<fn>Bob
<ln>Harvey
<tel>
<co>Lawrence Berkeley Lab
<add>1 Cyclotron Rd.
MS50A-4112
<csz>Berkeley, CA 94720
<entered>8/13/82
<lst>AO
<>

<g>Ms.
<fn>Paula
<ln>Hawthorn
<tel>
<co>Lawrence Berkeley Lab
<add>1 Cyclotron Rd.
MS50B-3238
<csz>Berkeley, CA 94720
<entered>8/13/82
<lst>AO
<>

<g>Dr.

<fn>Earl
<ln>Hyde
<tel>
<co>Lawrence Berkeley Lab
<add>1 Cyclotron Rd.
MS50A-4133
<csz>Berkeley, CA 94720
<entered>8/13/82
<lst>AO
<>

<g>Dr.
<fn>William
<ln>Lester, Jr.
<tel>
<co>Lawrence Berkeley Lab-UC Berkeley
<add>1 Cyclotron Rd.
MS50D-106
<csz>Berkeley, CA 94720
<entered>8/13/82
<lst>AO
<>

<g>Dr.
<fn>Brendan
<ln>McNamara
<tel>
<co>Lawrence Livermore National Lab
<add>Magnetic Fusion Dept.
P.O. Box 808, MA L630
<csz>Livermore, CA 94550
<entered>8/13/82
<lst>AO
<>

<g>Dr.
<fn>George
<ln>Michael
<tel>
<co>Lawrence Livermore National Lab
<add> P.O. Box 808, MS L306
<csz>Livermore, Ca 94550

<entered>8/13/82
<lst>AO
<>

<g>Mr.
<fn>Jack
<ln>Pfister
<tel>
<co>FERMILAB
<add>National Excelerator Lab
P.O. Box 500
<csz>Batavia, IL 60510
<entered>8/13/82
<lst>AO
<>

<g>Dr.
<fn>James C.T.
<ln>Pool
<tel>
<co>Office of Naval Research
<add>Mathematical & Information Science Dept.
800 North Quincy St.
<csz>Arlington, VA   22217
<entered>8/13/82
<lst>AO
<>

<g>Dr.
<fn>Carl
<ln>Quong
<tel>
<co>Lawrence Berkeley Lab
<add>1 Cyclotron Rd., MS50B-3238
<csz>Berkeley, CA 94720
<entered>8/13/82
<lst>AO
<>

<g>Dr.
<fn>John
<ln>Riganati

<tel>
<co>U.S. Dept. of Commerce
<add>National Bureau of Standards
L-219 Tech Building 225
<csz>Washington, DC   20234
<entered>8/13/82
<lst>AO
<>

<g>Mr.
<fn>Reuhl
<ln>Phillips
<tel>
<co>Sperry Univac
<add>P.O. Box 500
<csz>Blue Bell, PA 19424
<entered>8/13/82
<lst>AO
<>

<g>Dr.
<fn>Sid
<ln>Fernbach
<tel>415 443-1300
<co>Lawrence Berkeley Laboratory
<add>2020 Research Dr.
<csz>Livermore, CA 94550
<entered>8/13/82
<lst>AO
<>

<g>Mr.
<fn>Robert
<ln>Lillestrand
<tel>612 853-3711
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Post v N Computing: A 10 YEAR, DIRECTED RESEARCH PROGRAM AND NATIONAL FACILITIES AIMED AT PARALLEL PROCESSING

A Draft Outline*
&
Invitation For A Proposal(s)**

Gordon Bell, DEC

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Sid Fernbach, Consultant to CDC

Bob Lillestrand, CDC

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13 August 1982

* Substantive references to previous and ongoing work and

bibliographic references have been omitted. While we believe the general direction is correct, specific tactics such as the applications to focus on, will be subject to change with the final proposal(s). We now solicit both conceptual and detailed critiques.

** The final proposal must come from the program group dedicated to produce the results. Thus we solicit:

- o sites
- o individual researchers and a program director
- o applications and other research projects

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1. Some Critical Global Questions
2. Why use CDC's Advanced Flexible Processor?
3. Rough Budget

OVERVIEW

This proposal began as an exercise by positing a computing environment we believe is attainable in 10 years based on parallelism uncharacteristic of the single, von Neumann machine and then asking ourselves:

> Are we doing anything significant to understand and build this environment?

The result was overwhelming:

1. most industrial research appears to be aimed at incrementally improving today's products and processes; while

2. academic research is aimed at basic research and the mechanism of getting grants, producing papers and Ph.D's.

The objective of this program is to develop the technology and build next generation computers by establishing several National Laboratories for computer science and engineering research within the U.S. military, academic and industrial community. This technology is essential:

1. for defense;

2. to improve the declining computer and semicomputer part of the U.S. Information Processing Industry which now constitutes and supports much of our economy directly and via exports; and

3. as a basis for much of the 21st Century Industries.

The declining technology position in the computers and semicomputer industry is a national crisis. As such, this necessitates these unique aspects of the program:

1. collaboration among national science, defense,

university and industrial applied research, often called technology, in a fashion not unlike the VHSIC program;

2. National laboratories so that limited machine and people resources can be shared, unlike the VHSIC program;

3. a large, fast network including access both for experimentation and to extend the program to other research sites;

4. construction of prototypes by industry for evaluation within the research community;

5. technology transfer by industrial residents at the laboratories;

6. tighter coupling of application (need), architecture, construction and use by co-location in order to rapidly engineer, build and test ideas. This speeds up migration of ideas to use by applying engineering resources earlier.

These facilities will be the hub of a goal directed research program aimed at new VLSI-based, highly parallel computing structures. Parallel processing systems, including: specialized processors and hardware algorithms, multiprocessors, multicomputers, dataflow and high speed local area network based meshes will be built and evaluated. Evolutionary projections show a performance increase in processing of only a factor of 3 (Fig. 1) to 11 (Fig. 2) over the next 10 years. In contrast, the Japanese Fifth Generation Research Project, is aimed at producing high speed and parallel computers with a factor of 100 to 1000 more computing power for conventional and Knowledge Based computing systems by 1990 (Fig. 2).

Another major goal of the program is VLSIzation, the ability to transfer an algorithm, simulated within the computing environment, to VLSI limited only by the foundry time in much the way programs are currently compiled. By it's nature, this structure adds inherent parallelism to computing. The national facilities would also support the goal that computers would do a substantial part of the VLSI design. Research in the parallel computing structures we target will rely on accomplishment of these goals.

A new computer generation is marked by concurrence of technology and needs causing a new computing structure and resulting in new use. We believe this driving need is for the ability to transmit, store, and process (understand) the same information as people, including voice, natural languages and images. Images are a major data type of this research program because of the links with people. The research need is driven both by hardware and technology and by the potential of Knowledge Based Systems requiring much higher performance. These must be coupled with signal processing to assimilate voice and images.

The program would be organized in 3 phases, covering roughly a decade, in order to focus the work in a timely fashion. Generations have historically taken 7-10 years and consist of two periods: specification and construction; followed by use and evaluation. The immediate installation of the most powerful, high speed network of general purpose computers would start the program in the use and evaluation phase. Results based on application of this facility would then be applied to produce new VLSIzed computing structures by the end of this first phase. The second phase would apply these newer structures, forming the basis for new designs in the final program phase.

MOTIVATION FOR THE PROGRAM

The U.S. lead in the combined Information Processing Industries is now declining relative to Japan. While there are many reasons for the decline, these are noteworthy and represent the motivation for this program:

1. The U.S. (and World) funding for basic and applied research is large. This mechanism produces far more results than can be applied.

2. There is NO U.S. effort or policy aimed at systematically examining the basic research results and refining them so they can be applied to products. The cost to do applied research on even a small fraction of the basic research is usually far greater than the original work and is well beyond the scope of a single company or a laboratory. Furthermore, most laboratories doing research can only carry ideas to the paper stage because of the engineering nature of the final stages to build and test the idea. Thus, overfunding research relative to applied research means a "spilling" of knowledge that forms the basis of a significant industry.

3. U.S. companies have not worked collaboratively to develop these technologies because of legal and cultural reasons.

4. U.S. industry has been especially short sighted in its funding of this phase of research. Now, many short term, mundane product opportunities (eg. another Z80 + CP/M based personal computer) exist to attract resources resulting in further decline. This is further fueled by the venture capital market and increased R&D tax credits which in turn produce even more mundane products.

5. An inadequate supply of people and equipment exist to carry out the work in industry and the research organizations.

6. A research program aimed at parallelism requires interaction and co-location with a user community.

We marvel at the effectiveness of the Japanese collaborative research programs and believe we must emulate them. Both France and the U.K. have established programs aimed at the next computer generation. Note the past and present programs in the Information Processing area:

1. Pattern Information Processing- voice and vision

2. VLSI- improved processing characteristics (eg. 64K and 256K rams resulted in a 2 year lead over U.S. industry)

3. Supercomputers- high speed technology

4. Optoelectronics- just established

5. Standard Minicomputer for NTT- Fujitsu, NEC and Hitachi

6. Fifth Generation Computer- Fujitsu, NEC, Hitachi, Mitsubishi, Matsushita, Oki, Sharp. ICOT Lab and 10 year program were established. The first phase builds Relational Database and Prolog machines.

7. Local Area Network standards as part of the Fifth Generation.

8. Next generation research and technology program.

THE RESEARCH PROGRAM CONTENT

RESEARCH OBJECTIVES

This work is undertaken with the expectation that the confluence of the disciplines of parallel processing applied to image processing, and knowledge engineering, and implemented using VLSI will prove fertile. It, and the resulting VLSIzation process, that of first understanding specific algorithm and tasks and then VLSI'ing them, may well be a major characteristic of the next generation computing systems, which the Japanese call the Fifth Computer Generation.* The establishment of a quasi-competitive, but coordinated program of research using common research facilities is intended to stimulate a national understanding of such systems and their potential application.

The work is aimed at a fundamental understanding of parallelism and its application to a class of problems critical both to the growth of the computer industry in this country and to the maintenance of a preeminant US position in intelligence based military systems.

ESTABLISHING AND USING THE FACILITIES: PHASE ONE

The short term focus will be on installing and applying parallel approaches to image procesing and logic/circuit/process simulation problems, especially dataflow. We think it is vital to understand the range of dataflow from theory to practice across a wide range of applications. In its simplest form, dataflow can be viewed as a formalized, generalization of pipelining that is conventionally used for graphics and image process. In its more general form, dataflow looks appealing for logic simulation, signal routing, and conventional array processing type tasks where a great deal of parallelism exists, but cannot be exploited due to the difficulty of expressing algorithms in conventional languages. It is indeed possible that dataflow-specific machines <u>will not</u> exist, instead dataflow languages will enable programs to be written for large, multiprocessors. The centers will be based on a high performance local area network to interconnect the central machines, including:

- supercomputers,
- experimental machines (dataflow and conventional multiprocessors and multicomputers), and
- the CDC AFP.*

The AFP will operate with <u>fixed microprograms</u> to simulate several computer structures including dataflow computers. This will enable researchers to begin now and to understand the limits and use of dataflow architecture, for example. These efforts must be put to the test of representative applications in order that the tradeoffs discovered be relevant to solve.

* One of us (GB), believes that the current generation, number 5, is based on powerful personal computers interconnected via local area networks. The Japanese are working on the sixth generation, beginning in the late '80's.

It is essential to have real applications on which to "benchmark" various designs. The following applications cover some of the possible important military and industrial problems: scanning electron microscopic image enhancement, automated assembly inspection, target identification, digital system design and construction (eg. logic simulation, routing and IC signature analysis). The actual applications should be made firm with final proposal.

While the initial results have focused on using a dataflow architecture to examine its limits, the network and facilities we envision are much more extensive and will be used as alternative ways of computing.

PROGRAM DEVELOPMENT OF THE CENTRAL FACILITIES

It is expected that the central research facilities will be enriched further over time by including, as additional research tools, the fruits of the aspects of this program particularly focussed on realizing more powerful forms of processor interconnect and process (or operator based) intercommunication. It is expectd, further, that several realizations of parallel solutions to specific application image processing problems will be implemented (in VLSI) and included in the central research environment.

UNDERSTANDING PARALLELISM: PHASE TWO

In the middle phase of the program here proposed, the principle results will include a deep understanding of the dimensions and metrics that describe the space of parallel computing - costs, performance, programming expense, and reliability. The proposed facilities provide a rich set of alternative realizations for parallel computing - ranging from tightly coupled multiprocessors to conventional Local Area Networks. We do not believe that the kind of interconnect for switching is a particularly fruitful area of study because it is really an economic issue that shifts with technology, regulation, market demand, and supply. Thus, the goal is to provide various structures for evaluation and use very rapidly, but not to research the interconnect possibilities!

END POINTS

Expert systems and knowledge engineering efforts are expected to yield their most important results in the last phase of the program. Significant milestones are established throughout the research effort: discerning the computational (and data management) primitives underlaying current rules-based expert systems languages, establishing an effective integration of image and symbolic information into a knowledge base (consistent with the data management primitives noted above), realizing a VLSI implementation of a highly parallel, post von Neumann computer structure for expert systems, trying it out on (say) a SEM analysis problem, a fully automated VLSI design, and finally on an expert system for (semiconductor) process/crisis management (or threat evaluation and reconnaissance mission). These will, in turn, provide the understanding needed for a second VLSI implementation of the expert system engine above.

SINE QUA NON

As a necessary ingredient of effective VLSI implementations supporting the research goals of this program we need the 1990's VLSI equivalent not merely of the Guttenberg Press but of the linotype machine and the automatic typesetter. The process would be completely controlled by an individual or small group. The most important element of this program then is the development of the capability for (fully) automated VLSI circuit design from representations of parallel algorithms simulated on the parallel computing facilities proposed. At first, this will likely be by means of both conventional supercomputers and the dataflow machine simulators running at the central facility.

The automated design capabilities will be made to stand the test of real use in VLSI implementatins of (at least one) dataflow machine. The design of this machine will be based on the measurement and analysis of simulated dataflow machines running applications as noted earlier. These design capabilities will be also tested in VLSI realizations of IC signature analysis dataflow algorithms and the mobile object identification and tracking projects implemented previously. The culmination of efforts in image encoding and compressions will be a special purpose VLSI processor chip that provides full motion video-conferencing within the bounds of a 56 Kbps phone line, for example.

A FACILITY TO UNDERSTAND AND EXPLOIT PARALLELISM

New computer applications usually result from having new, higher performance computers allowing solution of problems that previously were computationally intractable. Performance increases in computing come from two sources: technology improvements and increased parallelism. This program is aimed at understanding and exploiting parallelism to gain performance.

VLSI contributes to parallelism in two ways.

> First, commodity processors allow the low cost construction of the most cost effective systems. That is the Mips/chip of microprocessors far outstrips the densest, high performance ECL gate arrays.
>
> Second, VLSIzation is an inherently parallel process - standard algorithms are off loaded.

To date, attempts to improve performance through highly parallel structures has been relatively disappointing. We believe the major reason for this lack of progress is the high real and personal cost to build and evaluate parallel structures. This program supports systematic research and development on the following alternatives. In this regard, we posit this fundamental hypothesis: <u>in order for a new computer structure to be attractive to a user, and hence ultimately developed and exist, it must offer an order of magnitude improvent in performance over his current method of computation.</u>

SPECIALIZED PROCESSING (AND VLSIZATION)

Historically, an order of magnitude or more speed improvement has resulted from looking at the execution times of particular work and then building hardware to carry out the function. VLSIzation is a realization that this evolutionary process exists and is an attempt to formalize the process.

Some examples of "off-loading" using special function hardware:

1. Floating point hardware versus a software interpreter

2. Channels, I/O Processors and I/O Computers versus interrupt and hardwired I/O

3. Display processors

4. Array Signal Processors

5. Front end (communications) and back end (disk, file and database) computers

A need, resulting from a computation on a particular kind of data occurs.

This need is then a requirement for a new computing structure. The function is then "off-loaded" in specialized hardware that operates in parallel with the general purpose computer.

By having a general purpose, very high speed system, the resulting, specialized structures can be totally simulated before they are committed to VLSI designs. In this way the designer can interact with the structure in a quickly iteractive fashion instead of waiting at each iteration for fabrication and system (re) integration.

MULTIPROCESSORS

Every time a new computer class is formed, there are strong arguments to build multiprocessors for performance reasons. Invariably, others build higher performance Uniprocessors at the same time and deliver more power via the strictly sequential approach. Multiprocessors were proposed by the early 60's, with Burroughs probably delivering the first one (B5000). By the early 70's Burrough's, CDC, DEC, GE, IBM and Univac had all built 2 - 4 processor multiprocessors. Unfortunately, these were either used in an asymmetrical fashion, or at most they were used in an ordinary multiprogramming environment. In no cases was parallel processing of a single task provided.

In 1966 Lehman investigated parallel processing of a single task with a 16 procesor multiprocessor and showed that for various tasks speed-ups were possible. By 1975 two 16 processor systems were built by BTL and at CMU. The CMU system was predicted on the 11/40 minicomputer, as a way to afford the construction, and speed-ups of up to 10 were observed in various algorithms.

CDC's Advanced Flexible Processor is an ideal machine to investigate the use of multiprocessors and multicomputers since the interconnection among the computers is via very high speed local links (ultra LAN) and shared memory. It can be used in many ways, including:

1. a 16 computer multiprocessor;

2. a 16 processor multiprocessor;

3. a fixed, intrpreter for particular structures (eg. dataflow); or

4. a particular, dedicated pipeline processing configuration (eg. image processing).

Several laboratories are building systems with up to several hundred microprocessors.

LLL is building a multiprocessor, the successor to the S1, with 16 supercomputer class processors. As soon as the processor's available, it should be extended to the multiprocessor case for evaluation, since the processors are both tightly coupled and have very fast inter processor communication mechanisms. This should be within the next three years.

DENELCOR is offering a 64 processor multiprocessor which requires investigation. We strongly recommend the installation of this machine in the facility in order to work on the multiprocessor problem.

Recently, Schwartz, et al at NYU has proposed the Ultra-Computer, a multiprocessor with up to 16,000 VLSI microprocessors. Just as soon as we can operate a reasonable number of processors together, construction should begin on this very large multiprocessor.

It's safe to say that one can produce conventional parallel processors which should be able to deliver up to a factor of four, for specially coded programs. A factor of 10 is possible, but there has to be a significant amount of research to make this automatically possible. Studies continue to indicate vast amounts of parallelism in algorithms that we have no way of exploiting.

We believe that the optimistic (Fifth Generation) projection for computing power speed-up over the next decade could be accomplished simply and entirely by parallel processing using multiprocessors and not by semiconductor and packaging technology if a significant effort were applied! Undoubtedly the dataflow language is an important part of this effort to represent, control and thereby exploit this form of parallelism.

MULTICOMPUTERS

Very little has been done formally with arrays of tightly coupled multicomputers where independent computers (Pc-Mp pairs) operate independently and communicate with one another by sending messages. By 1980, CM*, a multicomputer system based on the LSI-11 microprocessor with 5 clusters of 10 computers was constructed, and speedups of up to 30 were observed for particular problems, including speech recognition. Because there is less interconnection among the computers, it is more difficult to predict the performance: the algorithm has to be carefully partitioned across computers rather than distributed in memory.

In addition to AFP, we believe that other multicomputers should be constructed and used, particularly those with several hundred computers. Here, we would support the construction of several, (say 6) different multicomputer alternatives.

DATAFLOW ARCHITECTURES

Although many dataflow computers have been proposed, only a half dozen computers have been built. The performance of dataflow computers is not understood, although the use of dataflow graphs and languages to express parallelism is promising. In particular, dataflow appears to be most useful in expressing signal processing operations. For example, the AFP is programmed using a dataflow-like representation for image processing tasks. Individual computer modules can be assigned to various processing stages of say a digital filtering task. The AFP also appears to be ideal to simulate static dataflow architectures and their application. It would be microprogrammed to be a general purpose dataflow machine using separate computer modules in a functional fashion: matching store, switching, processing, and i/o.

ULTRA-, FAST-, AND CONVENTIONAL LOCAL AREA NETWORKS

Local Area Networks, LANs, are systems which normally allow the physical distribution of functional, server components to cover a local geographical area (eg. a building, or campus). The functional servers roughly correspond to various parts of a shared system: person servers (computing workstations/terminals), file servers, print servers, and communicatins servers. The communications is via message passing protocols. While the curent 10 Mbit/sec LANs are relatively slow, they are well matched to today's, slow terminals, personal computers and for intercomputer networking.

Researchers have also posited that LANs can be used to provide high performance, parallel processing. We too believe higher speed LANs are the backbone interconect architecture for new computer structures. The higher speed, 100 Mbit/s LANs will be the basis for interconnecting functional computers in a hierarchy as shown in the facilities section (Fig. 3).

We view the Ultra-LAN as a major architectural component and standard for truly fast, highly parallel structures of this next generation. Note that the ring that interconnects the AFP provides transmission at about 2 Gbits/sec for each computer node connected for the tightly connected computers. Thus, the AFP would be used for some studies of this type of LAN-based architecture.

The purpose of the hierarchy of three LANs is summarized:

Ultra-LAN	2 Gbits x p	AFP's processor intercommunication; as first basis for an ultra-LAN architecture
Fast-LAN	100 Mbits	Facility computer intercommunication and center to remote sites, forming a single cluster
LAN	10 Mbits	Individual workstations to form centers

PARALLEL PROCESSING FOR KNOWLEDGE BASED SYSTEMS

It has not been widely agreed that Knowledge based Systems can exploit parallelism. For Rule Based Systems, it is believed that many rules can be evaluated in parallel. The research will be aimed at first answering the question, and then simulating and evaluating the resulting structure. AFP might be used to simulate such a structure, provided this approach looks worthwhile.

THE RESEARCH PROGRAM FORM

ORGANIZATION, DIRECTION AND RELATIONSHIP TO ONGOING RESEARCH

A program office, together with a board of directors would contract the research in a fairly structured fashion. While research of this type is not commonly done today in computer science, we believe it can and must be done effectively by a joint industry and computer science research laboratory efort. <u>Industry can be effective at providing facilities and systems</u> that have been traditionally absent from the research laboratories. In effect, this is the major motivation for the proposal.

A major goal of the research project is to provide a large infusion of computing systems to support existing, more basic and unstructured work, including robotics.

The purpose would not be to change the nature of the existing unstructured research to be highly focused and goal directd, but rather to provide additional resources so that both the structured project and unstructued work could co-exist and complement one another.

The centers would be aimed at very similar research targets in order to get the benefit of "friendly competition". Similarly, several approaches would be examined within a center. This approach was successful in the mid-70's in speech research and should be the "model" direction. However, the speech research resulted in few, commercialized industrial or military applications, because the research coupling between academic and industrial research was poor. Unfortunately, the final transfer phase of research was terminated before the program ended.* It is this gap between basic research and applications research that the program is fundamentally addressing. It is interesting to note that NEC had an advanced development operating separately, but concurrently with the ARPA program. The result is that NEC provides recognition products.

We would hope that a better model to follow is VHSIC. It is crucial that the participants be able to exploit the technology for commercial and military applications propitiously. Unlike VHSIC, we believe that the work should be done at a few sites with movement of personnel.

THE PROGRAM OFFICE

The fabric of this research is a fairly close weave. The environments are, indeed, established anticipating that unexpected leverage and collaborations will yeild significant results not included in the program plan. However, it is precisely the existance of a structured program and the interrelation of its several work flows that will enable this to occur. The program office is responsible for the successive development of the fabric using resources as it can find them and coordinating efforts so work can easily build upon what came before.

* Personal communication with Allen Newell and Raj Reddy at CMM.

The program office will set adequate standards so that ideas meet no unnecessary boundaries between the workers and the worksites in this program. Early, stable agreement on the common rules, language, workstation, the network and the general computational support structure will be among the most important contributions of the program office, the goal is to use this commonality of interface to allow pyramiding of work - being careful not to pyramid risk.

The program uses applications to test ideas, and uses realizations of those ideas to build the next generation applications. It even uses these applications themselves to acomplish future generation realizations fueling the next cycle. The central facilities are the place that application tools for realizing ideas, the realizations themselves, and the applications for testing ideas all come together. This must all flow forward rather than bottleneck into a deadlocking interdependencies. The opportunity and expectation for people to build on each others work as it becomes available is the key. In the natural uncertainties inherent in this ambitious program of research, there must be enough alternative paths so clever people can use their wits to find a critically helpful piece of another's work or another's facility wherever it may turn up.

The program office must have the ability to facilitate the construction of important engineering breadboards so that systems can be rapidly built and evaluated. We envision utilizing the industrial sponsors for this breadboarding.

The program office is deliberately kept small to force most standards to be developed collaboratively with the groups doing the work. The program staffing for the parallel computing facilities is very light in the expectation that site personnel will be provided by the host institution. The Budget Table, Appendix 3, provides a more detailed breakdown.

PROGRAM BENEFICIARIES

The program was conceived in order to improve this flow of basic and applied research into industrial research and eventually into products. The main beneficiaries are those who use these ideas to eventually build products. Products will not come directly from this program.

On the other hand, virtually everyone will benefit by the program:

1. the U.S. technology will be drastically improved - thereby improving defense and the economy;

2. the researchers will be more effective and productive by having more meaningful work;

3. certain research will be published; and

4. researchers will still migrate from the coupled programs, being attracted by venture capital, and build higher technology products.

TRANSFERING THE TECHNOLOGY

The most effective means of technology transfer is through the transfer of people. Program sponsors will each have the right to place people in each project of the program. It is expected that assignments be for a three year interval and that the assigned person return to the sponsoring organization prepared to produce the competitive products of the late 80's.

To insure a co-operative working environment among the members of a project team, intellectual property rights for the work done as a team using the facilities of the host institution will be controlled by the policies of the host institution. However, each program sponsor will have the right to a non-exclusive license at reasonable terms.

A major part of the transfer will occur when the sites and industry collaborate on fabricating a design that a site has specified.

With VLSIzation, chips produced as part of a research project would be licensed to the sponsors. The "rights" to chips and software produced as part of a research program are indeed not clear at this time and vary among the institutions. This area would have to be worked out between the institution and the program.

Other mechanisms for technology transfer include sponsor access to prototypes, distribution of published technical reports and invitations to program seminars.

Seminars will be held quarterly for program sponsors with invited speakers from universities, government and industry.

In inviting speakers the organizers of the seminars will have the freedom to draw on the wide range of topics encompassed by the program, including:

- Pattern and image processing applications
- A. I. algorithm research
- Multi-processor architectural developments
- CAD/CAM software systems
- VLSI design process advancements

FACILITIES

HIERARCHIES OF AREA NETWORKS

The program would be organized around at least central research computation centers containing a variety of production and experimental computing systems (nodes) interconnected via 100 Mb/s links and forming the central facility for a hierarchical set of closely coupled, high performance, local area networks. The centers will be linked to several campuses via the highest available links so that they could be used in a clustered fashion "as if local" computation centers.

Each site would contain supercomputers, AFP's and experimental computers.

ARPA-NET II

In effect, we're proposing ARPA-net II. This must come into operation relatively soon, to be used to interconnect the more remote research to the centers. High bandwidth, such as several video channels would be needed to avoid limiting the interaction between sites. Here, the goal would be to provide only millisecond delays between processes operating on separated machines.

VLSIZATION FACILITY

Since the projects would be designing many VLSI chips, the facility would need a way to build state of the art VLSI chips from mask design. this could be acomplished by a multi-year committment of appropriate existing capacity to the needs of the program.

LOCATION

The program would start immediately and be coupled to existing computer science and computer engineering research facilities and programs. Facility selection is strictly on the basis of the intensity and quality of work in VLSI, image processing, parallel computing and AI. Either Lawrence Livermore or Berkeley Laboratories would be ideal sites for the computation center which would link to Stanford, SRI, and UC/Berkeley. MIT, MITRE or Lincoln Laboratory could be the basis of an East Coast facility. Los Alamos has the largest network of supercomputers and support computers including storage and image production. If a central site were Los Alamos, this would force the development and installation of high speed links to other sites.

APPLICATION CENTERS

The following very imcomplete list of application centers is included as an example of how work would be contracted by the program office to expertise centers throughout the country.

D
E
V
E
L
O   o Higher Performance Interprocessor Or Communications Structure
P   (CMU, Univ. Illinois)
M
E   o Dataflow Simulation And Parallel Algorithm Compilers
N   (Lawrence, MIT, Berkeley)
T
        o VLSI Design Automation For Parallel Computation
T   (MIT, Lincoln Laboratory, Berkeley)
O
O
L
S

A
P   o Image Enhance/Map/Encode/Compress
P   (Goddard, Univ. Maryland, LASL, Lawrence)
L
I   o Feature Extract/Target ID/Automated Inspection
C   (GM, GE, SRI, Univ. Texas)
A
T   o Image And Symbol Knowledge Representation/Expert System
I   (Stanford, MIT)
O
N
S

DELIVERABLES

The work encompassed is broken into three classes shown in the Deliverables Table. Within each class there are families of projects and finally the projects themselves. The program runs about ten years broken into rough phase transitions at the end of 1985 and 1989. The work in the first phase puts the research environment and work standards in place and develops the first generation tools and applications. The second phase includes several machine realizations that use the tools and runs the test bed applications. In this phase, the research facilities are enriched with the machines realized by program efforts. These are in turn, the base of the second generation tools and applications. Finally, the third phase provides refinements and solves the hard problems that depended on the new understandings generated in the first two phases of the program.

DELIVERABLES TABLE

```
                     A
                     P
DELIVERABLES
                     P  '82   '83   '84   '85   '86   '87   '88   '89   '90   '
91                   '92
                     L
                     I
Communications       C   reconfigurable 100 MBy/s LAN       256cpu @ 100
MBy/s LAN
  Structures         A               256 cpu @ 10 MBy/s LAN
                     T                                        1000 cpu @
100MBy/s LAN
                     I
Dataflow and         O       simulator ok   hotspot analysis
Parallel             N                                  VLSI dataflow machine
Compilers            S           dataflow compiler
                     |
Parallel VLSI        E              parallel logic simulator running on
Dataflow simulator
Design Automat.      N       VLSI parallel compiler        expert system
for VLSI design
                     V
                     I
Program Office       R    pick 1 rules language       next generation rules
language
Work Standards       O  common workstation (LISP?)
                     N       1,10,100 MBy/s LAN's    parallel rules VLSI
2nd implementation
                     M
Parallel Comput.     E        1 MBy/s NAN & gate
  Environment        N  AFP  AI-VLSI support facilities           VLSI
dataflow on 100 MBy/s
                     T    I   II    III                IC signature analysis
array
                     |
Image Enhance        D                   256 cpu node on 10 MBy       4096
cpu node on 100
Map/Code/            E             SEM enhancement dataflow
Compress             V
                     E                   Full motion video-conferencing in
56Kb/s
                     L
                     ($500)
Feature Extract      O                    IC signature analysis dataflow
Target ID/           M                                          SEM scan
analysis expert system
Inspect              E
                     N
Image/Symbol         T                  parallel rules language primatives
expert systems for
```

Knowledge/ process/crisis mgt. Expert	T O O L	image/info=knowledge

MOTIVATING SUMMARY

The motivation for this approach is timeliness and effectiveness:

1. THE RESEARCH PROGRAM SHOULD START NOW

2. WE NEED COUPLING OF INDUSTRIAL R&D AND APPLICATIONS WITH COMPUTER SCIENCE RESEARCH

3. WE CAN BUILD ON EXISTING RESEARCH PROGRAMS AND COMPUTERS

It is essential that we start now on the research program, as our computer science research has been drifting these last few years as both industry and computer science research have both gotten large, diffused, and independent of one another. Significant industrial research outside of IBM, Bell Labs and Japanese companies is non-existent and there is no coupling of basic and industrial research. For example, we believe there is better coupling of Bell Labs work to the Japanese computer industry via NTT's, ECL, than between Bell Labs and the U.S. Information Industry. Furthermore, both the academic and industrial research communities are now poorly coupled to real applications. We believe that program focus of some of the existing research efforts into a goal directed system will enhance their productivity and enable the continuation of a vital Information Industry for the 21st Century.

APPENDIX 1

SOME CRITICAL GLOBAL QUESTIONS (AND ANASWERS)

1. Why is the establishment of national facilities the correct way to attach the parallel problem?

.

No single lab now has critical mass or focus in anyone area - currently all resources are difused.

.

The lab(s) and programs operate together to do the work.

.

Users, architects, and builders must couple.

2. What impact will this proposed program have on existing research facilities? Programs?

.

The intent is to build on, and <u>extend</u> current facilities by additionla resouces. We believe that this program is close enough to some of the existing.

2

a. What about the extra space required for these facilities?

. We don't know.

3. How will this effort help the basic problem of a shortage of qualified researchers?

- It is hoped that a "program" will stimulate the demand to produce more researches over the long term.

- Short term, the focus should increase everyone's effectiveness.

- We hope to apply industrial researchers to the problem that are now difused and often operate as a sub-critical mass.

4. Who is supposed to benefit from this proposal and in what specific ways?

(See Section on Program Beneficiaries)

5. Is there a nationla crisis and exactly what is it?

(See section on Motivation for the Program)

6. What evidence do you have to support the level of funding which is projected as being adequate to achieve the goals?

This is really a draft outline for concrete proposals. From this we expect specific sites to be established and operated in very targetted areas: such as parallel knowledge based systems, high performance parallel processing and parallel image processing.

7. What, exactly is the overall objection of the program?

(See the first sentence of this document)

APPENDIX 2

WHY USE CDC'S ADVANCED FLEXIBLE PROCESSOR?

The AFP has demonstrated high performance in digital image and signal - processing tasks. For example, a processor system can transform the every co-ordinate of a million point picture in 1/30 second. Several systems are in operation today. It includes various support software including simulators.

Traditionally, we design, build and then use. A machine as fast and general as AFP would require at least 5 years to build. By using the current AFP as a general purpose research tool, we can gain at least 5 years on starting such a program from scratch. To illustrate, consider the several data-flow projects that could use AFP today to simulate architectures. Since we need to evaluate these architectures by using them, we could understand the benefits and drawbacks of these machines five years (or so) sooner by adopting the AFP as a hardware simulation base.

The CDC AFP provides a very fast, flexible, microprogrammed set of up to 16 computer modules for experimenting in various parallel computing structures of various type. A single, AFP microprogrammed processor provides the following capability:

. 20 to 800 Mops in 16 parallel, 16-bit arithmetic and logic units

. Microprogrammed control

. Access to 32 Megaword (256 Megabyte block oriented memory)

. 2 X 1 Gbits/sec communication with neighbors in ring

A flexible multiprocessor and multicomputer structure are both provided since, the sixteen processors can be interconnected both to a common 32 Megabyte memory and to adjacent processors.

The AFP can thus be used as a <u>tool</u> to study several different computer structures that we believe are much of the basis of the next generation.

Because AFP is so highly parallel, including having functional units with side effects, we believe it will not be imcroporgrammed to any great extent.

The mode we envision is that it would operate in several configurations, with fixed microprograms to behave as:

1. Set of microprogrammed pipelined, functional units within each processor. Four units can be initiated every 20 nanoseconds, although an average of seven units operate in parallel for most problems. Because of the difficulty of programming this highly parallel structure, the most important benefit, or side-effect will be understanding in how to do it effectively. Because the microprogramming so heavily pipelined, we believe a better understanding of dataflow techniques for expressing algorithms will result from the use. Nearly all high performance machines are pipelined; hence, we believe AFP is a good vehicle to get a better understanding of pipelining.

2. 16 processor multiprocessor with shared memory and very fast interprocessor intercommunication. Here, the processors will be programmed to be particular ISP, such C. If C could become the basis of the machine, then UNIX could be run.

3. Set of 16 Computer Modules microprogrammed for particular functions. AFP was designed to be operated in this mode for image processing.

4. A dataflow computer. This is a special case of item

3 whereby particular computers are programmed to behave as the various functionla units of a dataflow computer.

5. A set of special, parallel processing architectures using individual, microprogrammed processors as the functional units of the particular structures. In this mode, AFP turns out to be a very good emulator of relatively complex VLSI chips.

6. An experimental Ultra-LAN based architecture. To examine how computers can be coupled effectively and work together on a task, the AFP looks like an ideal for study.

APENDIX 3

ROUGH BUDGET

The program expenses are estimated at approximately $18M/year running from 1982 through 1989. Equipment is expensed as delivered. In general two or three "competitive but collaborative" groups are charged with each project family.

YEAR 1

Program	# Expenses Sites Manpower	Heads (ea.site)	Total ($M) Heads Equip	
Communications/Structures	2 -	5	10	1
Dataflow & Parallel Computation	1 -	1	1	.1
Parallel VLSI Design Automation	1 -	3	3	.3
Parallel Computing Environment	1 15	2	2	.2
Image/Symbol/Knowledge/ Expert Studies	1 -	3	3	.3
	6 15		19	1.9

YEAR 2

Program	# Expenses Sites	Heads (ea. site)	Total ($M) Heads

	Manpower	Equip.		
Communications/Structures	2 5	5	10	1
Dataflow & Parallel Computation	3 -	3	9	.9
Parallel VLSI Design Automation	2 -	5	10	1
Parallel Computing Environment	2 10	2	4	.4
Image/Symbol/Knowledge	3 -	5	15	1.5
Expert Studies				
Image Enhancement Studies	1 -	3	3	.3
Feature Extraction Studies	1 -	5	5	.5
----------------	-------------------------------			
	14 15		56	5.6

YEAR 3

Program	# Sites	Heads (ea. site)	Total Heads	Expenses ($M) Manpower	Equip.
Communications/Structures	2	6	12	1.2	5
Dataflow & Parallel Computation	3	3	9	.9	-
Parallel VLSI Design Automation	2	5	10	1.0	-
Parallel Computing Environment	3	2	6	.6	8
Image/Symbol/Knowledge	3	5	15	1.5	-
Expert Studies					
Image Enhancement Studies	2	5	10	1.0	-
Feature Extraction Studies	3	5	15	1.5	-
	18		77	7.7	13

YEAR 4

Program	# Sites	Heads (ea. site)	Total Heads	Expenses ($M) Manpower	Equip.
Communications/Structures	2	6	12	1.2	5

Datflow & Parallel Computation	3 -	3	9	.9
Parallel VLSI Design Automation	2 -	5	10	1.0
Parallel Computing Environment	3 5	2	6	.6
Image/Symbol/Knowledge Expert Studies	3 -	5	10	1.0
Image Enhancement Studies	2 -	5	10	1.0
Feature Extraction Studies	3 -	5	15	1.5
	18 10		77	7.7

YEAR 5

Program	# Expenses Sites Manpower	Heads (ea. site) Equip.	Total ($M) Heads	
Communications/Structures	2 5	6	12	1.2
Dataflow & Parallel Computation	3 1	3	9	.9
Parallel VLSI Design Automation	2 0	5	10	1.0
Parallel Computing Environment	2 5	2	6	.6
Image/Symbol/Knowledge	3 -	5	15	1.5
Expert Studies				
Image Enhancement Studies	2 1	5	10	1.0
Feature Extraction Studies	3 -	5	15	1.5
----------------	--------------------------------			
	18 12		77	7.7

YEAR 6

Program	# Expenses Sites Manpower	Heads (ea. site)	Total ($M) Heads Equip.	
Communications/Structures	2 5	6	12	1.2
Dataflow & Parallel Computation	3	3	9	.9

	-			
Parallel VLSI Design Automation	2 -	5	10	1.0
Parallel Computing Environment	2 5	2	6	.6
Image/Symbol/Knowledge Expert Studies	3 -	5	15	1.5
Image Enhancement Studies	2 -	5	15	1.5
Feature Extraction Studies	3 -	5	15	1.5
	18 10		77	7.7

YEAR 7

Program	# Sites	Heads (ea. site)	Total Heads	Expenses ($M) Manpower	Equip.
Communications/Structures	2	5	10	1	4
Dataflow & Parallel Computation	2	3	6	.6	-
Parallel VLSI Design Automation	2	5	10	1	-
Parallel Computing Environment	3	2	6	.6	5
Image/Symbol/Knowledge Expert Studies	3	5	15	1.5	-
Image Enhancement Studies	1	5	5	.5	-
Feature Extraction Studies	3	5	15	1.5	-
	16		67	6.7	9

YEAR 8

Program	# Sites	Heads (ea. site)	Total Heads	Expenses ($M) Manpower	Equip.
Communications/Structures	2	5	10	1	

	1			
Dataflow & Parallel Computation	1 -	2	2	.2
Parallel VLSI Design Automation	1 -	5	5	.5
Parallel Computing Environment	3 5	2	6	.6
Image/Symbol/Knowledge Expert Studies	1 -	5	5	.5
Image Enhancement Studies	1 -	1	1	.1
Feature Extraction Studies	1 -	5	5	.5
	10 6		34	3.4

YEAR 9

Program	# Sites	Heads (ea. site)	Total Heads	Expenses ($M) Manpower	Equip.
Communications/Structures	2	5	10	1	-
Dataflow & Parallel Computation	-	-	-	-	-
Parallel VLSI Design Automation	1	2	2	.2	-
Parallel Computing Environment	2	2	4	.4	3
Image/Symbol/Knowledge	-	-	-	-	-
Expert Studies					
Image Enhancement Studies	-	-	-	-	-
Feature Extraction Studies	1	2	2	.2	-
	6		18	1.8	3

YEAR 10

Program	# Sites	Heads (ea. site)	Total Heads	Expenses ($M) Manpower	Equip.

Communications/Structures	1	5	5	.5	-
Dataflow & Parallel Computation	-	-	-	-	-
Parallel VLSI Design Automation	1	1	1	.1	-
Parallel Computing Environment	1	2	2	.2	1.8
Image/Symbol/Knowledge Expert Studies	-	-	-	-	-
Image Enhancement Studies	-	-	-	-	-
Feature Extraction Studies	-	-	-	-	-
	3		8	.8	1.8

GB3.S7.3

Post v N Computing: A 10 YEAR, DIRECTED RESEARCH PROGRAM AND NATIONAL FACILITIES AIMED AT PARALLEL PROCESSING

A Draft Outline*

&

Invitation For A Proposal(s)**

Gordon Bell, DEC

George Clark, Harris

Bruce Delagi, DEC

Sid Fernbach, Consultant to CDC

Bob Lillestrand, CDC

Red Phillips, Univac

13 August 1982

* Substantive references to previous and ongoing work and bibliographic references have been omitted. While we believe the general direction is correct, specific tactics such as the applications to focus on, will be subject to change with the final proposal(s). We now solicit both conceptual and detailed critiques.

** The final proposal must come from the program group dedicated to produce the results. Thus we solicit:

o sites

- individual researchers and a program director
- applications and other research projects

TABLE OF CONTENTS

1. Some Critical Global Questions
2. Why use CDC's Advanced Flexible Processor?
3. Rough Budget

OVERVIEW

This proposal began as an exercise by positing a computing environment we believe is attainable in 10 years based on parallelism uncharacteristic of the single, von Neumann machine and then asking ourselves:

> Are we doing anything significant to understand and build this environment?

The result was overwhelming:

1. most industrial research appears to be aimed at incrementally improving today's products and processes; while

2. academic research is aimed at basic research and the mechanism of getting grants, producing papers and Ph.D's.

The objective of this program is to develop the technology and build next generation computers by establishing several National Laboratories for computer science and engineering research within the U.S. military, academic and industrial community. This technology is essential:

1. for defense;

2. to improve the declining computer and semicomputer part of the U.S. Information Processing Industry which now constitutes and supports much of our economy directly and via exports; and

3. as a basis for much of the 21st Century Industries.

The declining technology position in the computers and semicomputer industry is a national crisis. As such, this necessitates these unique aspects of the program:

1. collaboration among national science, defense, university and industrial applied research, often

called technology, in a fashion not unlike the VHSIC program;

2. National laboratories so that limited machine and people resources can be shared, unlike the VHSIC program;

3. a large, fast network including access both for experimentation and to extend the program to other research sites;

4. construction of prototypes by industry for evaluation within the research community;

5. technology transfer by industrial residents at the laboratories;

6. tighter coupling of application (need), architecture, construction and use by co-location in order to rapidly engineer, build and test ideas. This speeds up migration of ideas to use by applying engineering resources earlier.

These facilities will be the hub of a goal directed research program aimed at new VLSI-based, highly parallel computing structures. Parallel processing systems, including: specialized processors and hardware algorithms, multiprocessors, multicomputers, dataflow and high speed local area network based meshes will be built and evaluated. Evolutionary projections show a performance increase in processing of only a factor of 3 (Fig. 1) to 11 (Fig. 2) over the next 10 years. In contrast, the Japanese Fifth Generation Research Project, is aimed at producing high speed and parallel computers with a factor of 100 to 1000 more computing power for conventional and Knowledge Based computing systems by 1990 (Fig. 2).

Another major goal of the program is VLSIzation, the ability to transfer an algorithm, simulated within the computing environment, to VLSI limited only by the foundry time in much the way programs are currently compiled. By it's nature, this structure adds inherent parallelism to computing. The national facilities would also support the goal that computers would do a substantial part of the VLSI design. Research in the parallel computing structures we target will rely on accomplishment of these goals.

A new computer generation is marked by concurrence of technology and needs causing a new computing structure and resulting in new use. We believe this driving need is for the ability to transmit, store, and process (understand) the same information as people, including voice, natural languages and images. Images are a major data type of this research program because of the links with people. The research need is driven both by hardware and technology and by the potential of Knowledge Based Systems requiring much higher performance. These must be coupled with signal processing to assimilate voice and images.

The program would be organized in 3 phases, covering roughly a decade, in order to focus the work in a timely fashion. Generations have historically taken 7-10 years and consist of two periods: specification and construction; followed by use and evaluation. The immediate installation of the most powerful, high speed network of general purpose computers would start the program in the use and evaluation phase. Results based on application of this facility would then be applied to produce new VLSIzed computing structures by the end of this first phase. The second phase would apply these newer structures, forming the basis for new designs in the final program phase.

MOTIVATION FOR THE PROGRAM

The U.S. lead in the combined Information Processing Industries is now declining relative to Japan. While there are many reasons for the decline, these are noteworthy and represent the motivation for this program:

1. The U.S. (and World) funding for basic and applied research is large. This mechanism produces far more results than can be applied.

2. There is NO U.S. effort or policy aimed at systematically examining the basic research results and refining them so they can be applied to products. The cost to do applied research on even a small fraction of the basic research is usually far greater than the original work and is well beyond the scope of a single company or a laboratory. Furthermore, most laboratories doing research can only carry ideas to the paper stage because of the engineering nature of the final stages to build and test the idea. Thus, overfunding research relative to applied research means a "spilling" of knowledge that forms the basis of a significant industry.

3. U.S. companies have not worked collaboratively to develop these technologies because of legal and cultural reasons.

4. U.S. industry has been especially short sighted in its funding of this phase of research. Now, many short term, mundane product opportunities (eg. another Z80 + CP/M based personal computer) exist to attract resources resulting in further decline. This is further fueled by the venture capital market and increased R&D tax credits which in turn produce even more mundane products.

5. An inadequate supply of people and equipment exist to carry out the work in industry and the research organizations.

6. A research program aimed at parallelism requires interaction and co-location with a user community.

We marvel at the effectiveness of the Japanese collaborative research programs and believe we must emulate them. Both France and the U.K. have established programs aimed at the next computer generation. Note the past and present programs in the Information Processing area:

1. Pattern Information Processing- voice and vision

2. VLSI- improved processing characteristics (eg. 64K and 256K rams resulted in a 2 year lead over U.S. industry)

3. Supercomputers- high speed technology

4. Optoelectronics- just established

5. Standard Minicomputer for NTT- Fujitsu, NEC and Hitachi

6. Fifth Generation Computer- Fujitsu, NEC, Hitachi, Mitsubishi, Matsushita, Oki, Sharp. ICOT Lab and 10 year program were established. The first phase builds Relational Database and Prolog machines.

7. Local Area Network standards as part of the Fifth Generation.

8. Next generation research and technology program.

THE RESEARCH PROGRAM CONTENT

RESEARCH OBJECTIVES

This work is undertaken with the expectation that the confluence of the disciplines of parallel processing applied to image processing, and knowledge engineering, and implemented using VLSI will prove fertile. It, and the resulting VLSIzation process, that of first understanding specific algorithm and tasks and then VLSI'ing them, may well be a major characteristic of the next generation computing systems, which the Japanese call the Fifth Computer Generation.* The establishment of a quasi-competitive, but coordinated program of research using common research facilities is intended to stimulate a national understanding of such systems and their potential application.

The work is aimed at a fundamental understanding of parallelism and its application to a class of problems critical both to the growth of the computer industry in this country and to the maintenance of a preeminant US position in intelligence based military systems.

ESTABLISHING AND USING THE FACILITIES: PHASE ONE

The short term focus will be on installing and applying parallel approaches to image procesing and logic/circuit/process simulation problems, especially dataflow. We think it is vital to understand the range of dataflow from theory to practice across a wide range of applications. In its simplest form, dataflow can be viewed as a formalized, generalization of pipelining that is conventionally used for graphics and image process. In its more general form, dataflow looks appealing for logic simulation, signal routing, and conventional array processing type tasks where a great deal of parallelism exists, but cannot be exploited due to the difficulty of expressing algorithms in conventional languages. It is indeed possible that dataflow-specific machines <u>will not</u> exist, instead dataflow languages will enable programs to be written for large, multiprocessors. The centers will be based on a high performance local area network to interconnect the central machines, including:

- supercomputers,

- experimental machines (dataflow and conventional multiprocessors and multicomputers), and

- the CDC AFP.*

The AFP will operate with <u>fixed microprograms</u> to simulate several computer structures including dataflow computers. This will enable researchers to begin now and to understand the limits and use of dataflow architecture, for example. These efforts must be put to the test of representative applications in order that the tradeoffs discovered be relevant to solve.

* One of us (GB), believes that the current generation, number 5, is based on powerful personal computers interconnected via local area networks. The Japanese are working on the sixth generation, beginning in the late '80's.

It is essential to have real applications on which to "benchmark" various designs. The following applications cover some of the possible important military and industrial problems: scanning electron microscopic image enhancement, automated assembly inspection, target identification, digital system design and construction (eg. logic simulation, routing and IC signature analysis). The actual applications should be made firm with final proposal.

While the initial results have focused on using a dataflow architecture to examine its limits, the network and facilities we envision are much more extensive and will be used as alternative ways of computing.

PROGRAM DEVELOPMENT OF THE CENTRAL FACILITIES

It is expected that the central research facilities will be enriched further over time by including, as additional research tools, the fruits of the aspects of this program particularly focussed on realizing more powerful forms of processor interconnect and process (or operator based) intercommunication. It is expectd, further, that several realizations of parallel solutions to specific application image processing problems will be implemented (in VLSI) and included in the central research environment.

UNDERSTANDING PARALLELISM: PHASE TWO

In the middle phase of the program here proposed, the principle results will include a deep understanding of the dimensions and metrics that describe the space of parallel computing - costs, performance, programming expense, and reliability. The proposed facilities provide a rich set of alternative realizations for parallel computing - ranging from tightly coupled multiprocessors to conventional Local Area Networks. We do not believe that the kind of interconnect for switching is a particularly fruitful area of study because it is really an economic issue that shifts with technology, regulation, market demand, and supply. Thus, the goal is to provide various structures for evaluation and use very rapidly, but not to research the interconnect possibilities!

END POINTS

Expert systems and knowledge engineering efforts are expected to yield their most important results in the last phase of the program. Significant milestones are established throughout the research effort: discerning the computational (and data management) primitives underlaying current rules-based expert systems languages, establishing an effective integration of image and symbolic information into a knowledge base (consistent with the data management primitives noted above), realizing a VLSI implementation of a highly parallel, post von Neumann computer structure for expert systems, trying it out on (say) a SEM analysis problem, a fully automated VLSI design, and finally on an expert system for (semiconductor) process/crisis management (or threat evaluation and reconnaissance mission). These will, in turn, provide the understanding needed for a second VLSI implementation of the expert system engine above.

SINE QUA NON

As a necessary ingredient of effective VLSI implementations supporting the research goals of this program we need the 1990's VLSI equivalent not merely of the Guttenberg Press but of the linotype machine and the automatic typesetter. The process would be completely controlled by an individual or small group. The most important element of this program then is the development of the capability for (fully) automated VLSI circuit design from representations of parallel algorithms simulated on the parallel computing facilities proposed. At first, this will likely be by means of both conventional supercomputers and the dataflow machine simulators running at the central facility.

The automated design capabilities will be made to stand the test of real use in VLSI implementatins of (at least one) dataflow machine. The design of this machine will be based on the measurement and analysis of simulated dataflow machines running applications as noted earlier. These design capabilities will be also tested in VLSI realizations of IC signature analysis dataflow algorithms and the mobile object identification and tracking projects implemented previously. The culmination of efforts in image encoding and compressions will be a special purpose VLSI processor chip that provides full motion video-conferencing within the bounds of a 56 Kbps phone line, for example.

A FACILITY TO UNDERSTAND AND EXPLOIT PARALLELISM

New computer applications usually result from having new, higher performance computers allowing solution of problems that previously were computationally intractable. Performance increases in computing come from two sources: technology improvements and increased parallelism. This program is aimed at understanding and exploiting parallelism to gain performance.

VLSI contributes to parallelism in two ways.

First, commodity processors allow the low cost construction of the most cost effective systems. That is the Mips/chip of microprocessors far outstrips the densest, high performance ECL gate arrays.

Second, VLSIzation is an inherently parallel process - standard algorithms are off loaded.

To date, attempts to improve performance through highly parallel structures has been relatively disappointing. We believe the major reason for this lack of progress is the high real and personal cost to build and evaluate parallel structures. This program supports systematic research and development on the following alternatives. In this regard, we posit this fundamental hypothesis: <u>in order for a new computer structure to be attractive to a user, and hence ultimately developed and exist, it must offer an order of magnitude improvent in performance over his current method of computation.</u>

SPECIALIZED PROCESSING (AND VLSIZATION)

Historically, an order of magnitude or more speed improvement has resulted from looking at the execution times of particular work and then building hardware to carry out the function. VLSIzation is a realization that this evolutionary process exists and is an attempt to formalize the process.

Some examples of "off-loading" using special function hardware:

1. Floating point hardware versus a software interpreter

2. Channels, I/O Processors and I/O Computers versus interrupt and hardwired I/O

3. Display processors

4. Array Signal Processors

5. Front end (communications) and back end (disk, file and database) computers

A need, resulting from a computation on a particular kind of data occurs.

This need is then a requirement for a new computing structure. The function is then "off-loaded" in specialized hardware that operates in parallel with the general purpose computer.

By having a general purpose, very high speed system, the resulting, specialized structures can be totally simulated before they are committed to VLSI designs. In this way the designer can interact with the structure in a quickly iteractive fashion instead of waiting at each iteration for fabrication and system (re) integration.

MULTIPROCESSORS

Every time a new computer class is formed, there are strong arguments to build multiprocessors for performance reasons. Invariably, others build higher performance Uniprocessors at the same time and deliver more power via the strictly sequential approach. Multiprocessors were proposed by the early 60's, with Burroughs probably delivering the first one (B5000). By the early 70's Burrough's, CDC, DEC, GE, IBM and Univac had all built 2 - 4 processor multiprocessors. Unfortunately, these were either used in an asymmetrical fashion, or at most they were used in an ordinary multiprogramming environment. In no cases was parallel processing of a single task provided.

In 1966 Lehman investigated parallel processing of a single task with a 16 procesor multiprocessor and showed that for various tasks speed-ups were possible. By 1975 two 16 processor systems were built by BTL and at CMU. The CMU system was predicted on the 11/40 minicomputer, as a way to afford the construction, and speed-ups of up to 10 were observed in various algorithms.

CDC's Advanced Flexible Processor is an ideal machine to investigate the use of multiprocessors and multicomputers since the interconnection among the computers is via very high speed local links (ultra LAN) and shared memory. It can be used in many ways, including:

1. a 16 computer multiprocessor;

2. a 16 processor multiprocessor;

3. a fixed, intrpreter for particular structures (eg. dataflow); or

4. a particular, dedicated pipeline processing configuration (eg. image processing).

Several laboratories are building systems with up to several hundred microprocessors.

LLL is building a multiprocessor, the successor to the S1, with 16 supercomputer class processors. As soon as the processor's available, it should be extended to the multiprocessor case for evaluation, since the processors are both tightly coupled and have very fast inter processor communication mechanisms. This should be within the next three years.

DENELCOR is offering a 64 processor multiprocessor which requires investigation. We strongly recommend the installation of this machine in the facility in order to work on the multiprocessor problem.

Recently, Schwartz, et al at NYU has proposed the Ultra-Computer, a multiprocessor with up to 16,000 VLSI microprocessors. Just as soon as we can operate a reasonable number of processors together, construction should begin on this very large multiprocessor.

It's safe to say that one can produce conventional parallel processors which should be able to deliver up to a factor of four, for specially coded programs. A factor of 10 is possible, but there has to be a significant amount of research to make this automatically possible. Studies continue to indicate vast amounts of parallelism in algorithms that we have no way of exploiting.

We believe that the optimistic (Fifth Generation) projection for computing power speed-up over the next decade could be accomplished simply and entirely by parallel processing using multiprocessors and not by semiconductor and packaging technology if a significant effort were applied! Undoubtedly the dataflow language is an important part of this effort to represent, control and thereby exploit this form of parallelism.

MULTICOMPUTERS

Very little has been done formally with arrays of tightly coupled multicomputers where independent computers (Pc-Mp pairs) operate independently and communicate with one another by sending messages. By 1980, CM*, a multicomputer system based on the LSI-11 microprocessor with 5 clusters of 10 computers was constructed, and speedups of up to 30 were observed for particular problems, including speech recognition. Because there is less interconnection among the computers, it is more difficult to predict the performance: the algorithm has to be carefully partitioned across computers rather than distributed in memory.

In addition to AFP, we believe that other multicomputers should be constructed and used, particularly those with several hundred computers. Here, we would support the construction of several, (say 6) different multicomputer alternatives.

DATAFLOW ARCHITECTURES

Although many dataflow computers have been proposed, only a half dozen computers have been built. The performance of dataflow computers is not understood, although the use of dataflow graphs and languages to express parallelism is promising. In particular, dataflow appears to be most useful in expressing signal processing operations. For example, the AFP is programmed using a dataflow-like representation for image processing tasks. Individual computer modules can be assigned to various processing stages of say a digital filtering task. The AFP also appears to be ideal to simulate static dataflow architectures and their application. It would be microprogrammed to be a general purpose dataflow machine using separate computer modules in a functional fashion: matching store, switching, processing, and i/o.

ULTRA-, FAST-, AND CONVENTIONAL LOCAL AREA NETWORKS

Local Area Networks, LANs, are systems which normally allow the physical distribution of functional, server components to cover a local geographical area (eg. a building, or campus). The functional servers roughly correspond to various parts of a shared system: person servers (computing workstations/terminals), file servers, print servers, and communicatins servers. The communications is via message passing protocols. While the curent 10 Mbit/sec LANs are relatively slow, they are well matched to today's, slow terminals, personal computers and for intercomputer networking.

Researchers have also posited that LANs can be used to provide high performance, parallel processing. We too believe higher speed LANs are the backbone interconect architecture for new computer structures. The higher speed, 100 Mbit/s LANs will be the basis for interconnecting functional computers in a hierarchy as shown in the facilities section (Fig. 3).

We view the Ultra-LAN as a major architectural component and standard for truly fast, highly parallel structures of this next generation. Note that the ring that interconnects the AFP provides transmission at about 2 Gbits/sec for each computer node connected for the tightly connected computers. Thus, the AFP would be used for some studies of this type of LAN-based architecture.

The purpose of the hierarchy of three LANs is summarized:

Ultra-LAN	2 Gbits x p	AFP's processor intercommunication; as first basis for an ultra-LAN architecture
Fast-LAN	100 Mbits	Facility computer intercommunication and center to remote sites, forming a single cluster
LAN	10 Mbits	Individual workstations to form centers

PARALLEL PROCESSING FOR KNOWLEDGE BASED SYSTEMS

It has not been widely agreed that Knowledge based Systems can exploit parallelism. For Rule Based Systems, it is believed that many rules can be evaluated in parallel. The research will be aimed at first answering the question, and then simulating and evaluating the resulting structure. AFP might be used to simulate such a structure, provided this approach looks worthwhile.

THE RESEARCH PROGRAM FORM

ORGANIZATION, DIRECTION AND RELATIONSHIP TO ONGOING RESEARCH

A program office, together with a board of directors would contract the research in a fairly structured fashion. While research of this type is not commonly done today in computer science, we believe it can and must be done effectively by a joint industry and computer science research laboratory efort. <u>Industry can be effective at providing facilities and systems</u> that have been traditionally absent from the research laboratories. In effect, this is the major motivation for the proposal.

A major goal of the research project is to provide a large infusion of computing systems to support existing, more basic and unstructured work, including robotics.

The purpose would not be to change the nature of the existing unstructured research to be highly focused and goal directd, but rather to provide additional resources so that both the structured project and unstructued work could co-exist and complement one another.

The centers would be aimed at very similar research targets in order to get the benefit of "friendly competition". Similarly, several approaches would be examined within a center. This approach was successful in the mid-70's in speech research and should be the "model" direction. However, the speech research resulted in few, commercialized industrial or military applications, because the research coupling between academic and industrial research was poor. Unfortunately, the final transfer phase of research was terminated before the program ended.* It is this gap between basic research and applications research that the program is fundamentally addressing. It is interesting to note that NEC had an advanced development operating separately, but concurrently with the ARPA program. The result is that NEC provides recognition products.

We would hope that a better model to follow is VHSIC. It is crucial that the participants be able to exploit the technology for commercial and military applications propitiously. Unlike VHSIC, we believe that the work should be done at a few sites with movement of personnel.

THE PROGRAM OFFICE

The fabric of this research is a fairly close weave. The environments are, indeed, established anticipating that unexpected leverage and collaborations will yeild significant results not included in the program plan. However, it is precisely the existance of a structured program and the interrelation of its several work flows that will enable this to occur. The program office is responsible for the successive development of the fabric using resources as it can find them and coordinating efforts so work can easily build upon what came before.

* Personal communication with Allen Newell and Raj Reddy at CMM.

The program office will set adequate standards so that ideas meet no unnecessary boundaries between the workers and the worksites in this program. Early, stable agreement on the common rules, language, workstation, the network and the general computational support structure will be among the most important contributions of the program office, the goal is to use this commonality of interface to allow pyramiding of work - being careful not to pyramid risk.

The program uses applications to test ideas, and uses realizations of those ideas to build the next generation applications. It even uses these applications themselves to acomplish future generation realizations fueling the next cycle. The central facilities are the place that application tools for realizing ideas, the realizations themselves, and the applications for testing ideas all come together. This must all flow forward rather than bottleneck into a deadlocking interdependencies. The opportunity and expectation for people to build on each others work as it becomes available is the key. In the natural uncertainties inherent in this ambitious program of research, there must be enough alternative paths so clever people can use their wits to find a critically helpful piece of another's work or another's facility wherever it may turn up.

The program office must have the ability to facilitate the construction of important engineering breadboards so that systems can be rapidly built and evaluated. We envision utilizing the industrial sponsors for this breadboarding.

The program office is deliberately kept small to force most standards to be developed collaboratively with the groups doing the work. The program staffing for the parallel computing facilities is very light in the expectation that site personnel will be provided by the host institution. The Budget Table, Appendix 3, provides a more detailed breakdown.

PROGRAM BENEFICIARIES

The program was conceived in order to improve this flow of basic and applied research into industrial research and eventually into products. The main beneficiaries are those who use these ideas to eventually build products. Products will not come directly from this program.

On the other hand, virtually everyone will benefit by the program:

1. the U.S. technology will be drastically improved - thereby improving defense and the economy;

2. the researchers will be more effective and productive by having more meaningful work;

3. certain research will be published; and

4. researchers will still migrate from the coupled programs, being attracted by venture capital, and build higher technology products.

TRANSFERING THE TECHNOLOGY

The most effective means of technology transfer is through the transfer of people. Program sponsors will each have the right to place people in each project of the program. It is expected that assignments be for a three year interval and that the assigned person return to the sponsoring organization prepared to produce the competitive products of the late 80's.

To insure a co-operative working environment among the members of a project team, intellectual property rights for the work done as a team using the facilities of the host institution will be controlled by the policies of the host institution. However, each program sponsor will have the right to a non-exclusive license at reasonable terms.

A major part of the transfer will occur when the sites and industry collaborate on fabricating a design that a site has specified.

With VLSIzation, chips produced as part of a research project would be licensed to the sponsors. The "rights" to chips and software produced as part of a research program are indeed not clear at this time and vary among the institutions. This area would have to be worked out between the institution and the program.

Other mechanisms for technology transfer include sponsor access to prototypes, distribution of published technical reports and invitations to program seminars.

Seminars will be held quarterly for program sponsors with invited speakers from universities, government and industry.

In inviting speakers the organizers of the seminars will have the freedom to draw on the wide range of topics encompassed by the program, including:

- Pattern and image processing applications
- A. I. algorithm research
- Multi-processor architectural developments
- CAD/CAM software systems
- VLSI design process advancements

FACILITIES

HIERARCHIES OF AREA NETWORKS

The program would be organized around at least central research computation centers containing a variety of production and experimental computing systems (nodes) interconnected via 100 Mb/s links and forming the central facility for a hierarchical set of closely coupled, high performance, local area networks. The centers will be linked to several campuses via the highest available links so that they could be used in a clustered fashion "as if local" computation centers.

Each site would contain supercomputers, AFP's and experimental computers.

ARPA-NET II

In effect, we're proposing ARPA-net II. This must come into operation relatively soon, to be used to interconnect the more remote research to the centers. High bandwidth, such as several video channels would be needed to avoid limiting the interaction between sites. Here, the goal would be to provide only millisecond delays between processes operating on separated machines.

VLSIZATION FACILITY

Since the projects would be designing many VLSI chips, the facility would need a way to build state of the art VLSI chips from mask design. this could be acomplished by a multi-year committment of appropriate existing capacity to the needs of the program.

LOCATION

The program would start immediately and be coupled to existing computer science and computer engineering research facilities and programs. Facility selection is strictly on the basis of the intensity and quality of work in VLSI, image processing, parallel computing and AI. Either Lawrence Livermore or Berkeley Laboratories would be ideal sites for the computation center which would link to Stanford, SRI, and UC/Berkeley. MIT, MITRE or Lincoln Laboratory could be the basis of an East Coast facility. Los Alamos has the largest network of supercomputers and support computers including storage and image production. If a central site were Los Alamos, this would force the development and installation of high speed links to other sites.

APPLICATION CENTERS

The following very imcomplete list of application centers is included as an example of how work would be contracted by the program office to expertise centers throughout the country.

D
E
V
E
L
O o Higher Performance Interprocessor Or Communications Structure
P   (CMU, Univ. Illinois)
M
E o Dataflow Simulation And Parallel Algorithm Compilers
N   (Lawrence, MIT, Berkeley)
T
   o VLSI Design Automation For Parallel Computation
T   (MIT, Lincoln Laboratory, Berkeley)
O
O
L
S

A
P o Image Enhance/Map/Encode/Compress
P   (Goddard, Univ. Maryland, LASL, Lawrence)
L
I o Feature Extract/Target ID/Automated Inspection
C   (GM, GE, SRI, Univ. Texas)
A
T o Image And Symbol Knowledge Representation/Expert System
I   (Stanford, MIT)
O
N
S

DELIVERABLES

The work encompassed is broken into three classes shown in the Deliverables Table. Within each class there are families of projects and finally the projects themselves. The program runs about ten years broken into rough phase transitions at the end of 1985 and 1989. The work in the first phase puts the research environment and work standards in place and develops the first generation tools and applications. The second phase includes several machine realizations that use the tools and runs the test bed applications. In this phase, the research facilities are enriched with the machines realized by program efforts. These are in turn, the base of the second generation tools and applications. Finally, the third phase provides refinements and solves the hard problems that depended on the new understandings generated in the first two phases of the program.

DELIVERABLES TABLE

```
               A
               P
DELIVERABLES
               P  '82   '83   '84   '85   '86   '87   '88   '89   '90   '91
'92
               L
               I
Communications C   reconfigurable 100 MBy/s LAN       256cpu @ 100 MBy/s LAN
  Structures   A                256 cpu @ 10 MBy/s LAN
               T                                         1000 cpu @ 100MBy/s
LAN
               I
Dataflow and   O       simulator ok   hotspot analysis
Parallel       N                                VLSI dataflow machine
Compilers      S           dataflow compiler
               |
Parallel VLSI  E               parallel logic simulator running on Dataflow
simulator
Design Automat.N       VLSI parallel compiler        expert system for VLSI
design
               V
               I
Program Office R    pick 1 rules language       next generation rules language
Work Standards O  common workstation (LISP?)
               N       1,10,100 MBy/s LAN's    parallel rules VLSI     2nd
implementation
               M
Parallel Comput.  E            1 MBy/s NAN & gate
  Environment  N  AFP  AI-VLSI support facilities            VLSI dataflow on
100 MBy/s
               T    I   II    III                IC signature analysis array
               |
Image Enhance  D                    256 cpu node on 10 MBy         4096 cpu
node on 100
Map/Code/      E            SEM enhancement dataflow
Compress       V
               E                    Full motion video-conferencing in 56Kb/s
               L                                                   ($500)
Feature ExtractO                     IC signature analysis dataflow
Target ID/     M                                       SEM scan analysis
expert system
Inspect        E
               N
Image/Symbol   T                   parallel rules language primatives
expert systems for
Knowledge/
process/crisis mgt.
Expert         T                            image/info=knowledge
               O
               O
```

L

MOTIVATING SUMMARY

The motivation for this approach is timeliness and effectiveness:

1. THE RESEARCH PROGRAM SHOULD START NOW

2. WE NEED COUPLING OF INDUSTRIAL R&D AND APPLICATIONS WITH COMPUTER SCIENCE RESEARCH

3. WE CAN BUILD ON EXISTING RESEARCH PROGRAMS AND COMPUTERS

It is essential that we start now on the research program, as our computer science research has been drifting these last few years as both industry and computer science research have both gotten large, diffused, and independent of one another. Significant industrial research outside of IBM, Bell Labs and Japanese companies is non-existent and there is no coupling of basic and industrial research. For example, we believe there is better coupling of Bell Labs work to the Japanese computer industry via NTT's, ECL, than between Bell Labs and the U.S. Information Industry. Furthermore, both the academic and industrial research communities are now poorly coupled to real applications. We believe that program focus of some of the existing research efforts into a goal directed system will enhance their productivity and enable the continuation of a vital Information Industry for the 21st Century.

APPENDIX 1

SOME CRITICAL GLOBAL QUESTIONS (AND ANASWERS)

1. Why is the establishment of national facilities the correct way to attach the parallel problem?

- No single lab now has critical mass or focus in anyone area - currently all resources are difused.

- The lab(s) and programs operate together to do the work.

- Users, architects, and builders must couple.

2. What impact will this proposed program have on existing research facilities? Programs?

- The intent is to build on, and <u>extend</u> current facilities by additionla resouces. We believe that this program is close enough to some of the existing.

2a. What about the extra space required for these facilities?

- We don't know.

3. How will this effort help the basic problem of a shortage of qualified researchers?

- It is hoped that a "program" will stimulate the demand to produce more researches over the long term.

- Short term, the focus should increase everyone's effectiveness.

- We hope to apply industrial researchers to the problem that are now difused and often operate as a sub-critical mass.

4. Who is supposed to benefit from this proposal and in what specific ways?

(See Section on Program Beneficiaries)

5. Is there a nationla crisis and exactly what is it?

(See section on Motivation for the Program)

6. What evidence do you have to support the level of funding which is projected as being adequate to achieve the goals?

This is really a draft outline for concrete proposals. From this we expect specific sites to be established and operated in very targetted areas: such as parallel knowledge based systems, high performance parallel processing and parallel image processing.

7. What, exactly is the overall objection of the program?

(See the first sentence of this document)

APPENDIX 2

WHY USE CDC'S ADVANCED FLEXIBLE PROCESSOR?

The AFP has demonstrated high performance in digital image and signal - processing tasks. For example, a processor system can transform the every co-ordinate of a million point picture in 1/30 second. Several systems are in operation today. It includes various support software including simulators.

Traditionally, we design, build and then use. A machine as fast and general as AFP would require at least 5 years to build. By using the current AFP as a general purpose research tool, we can gain at least 5 years on starting such a program from scratch. To illustrate, consider the several data-flow projects that could use AFP today to simulate architectures. Since we need to evaluate these architectures by using them, we could understand the benefits and drawbacks of these machines five years (or so) sooner by adopting the AFP as a hardware simulation base.

The CDC AFP provides a very fast, flexible, microprogrammed set of up to 16 computer modules for experimenting in various parallel computing structures of various type. A <u>single</u>, AFP microprogrammed processor provides the following capability:

- 20 to 800 Mops in 16 parallel, 16-bit arithmetic and logic units
- Microprogrammed control
- Access to 32 Megaword (256 Megabyte block oriented memory)
- 2 X 1 Gbits/sec communication with neighbors in ring

A flexible multiprocessor and multicomputer structure are both provided since, the sixteen processors can be interconnected both to a common 32 Megabyte memory and to adjacent processors.

The AFP can thus be used as a <u>tool</u> to study several different computer structures that we believe are much of the basis of the next generation.

Because AFP is so highly parallel, including having functional units with side effects, we believe it will not be imcroporgrammed to any great extent.

The mode we envision is that it would operate in several configurations, with fixed microprograms to behave as:

1. Set of microprogrammed pipelined, functional units within each processor. Four units can be initiated every 20 nanoseconds, although an average of seven units operate in parallel for most problems. Because of the difficulty of programming this highly parallel structure, the most important benefit, or side-effect will be understanding in how to do it effectively. Because the microprogramming so heavily pipelined, we believe a better understanding of dataflow techniques for expressing algorithms will result from the use. Nearly all high performance machines are pipelined; hence, we believe AFP is a good vehicle to get a better understanding of pipelining.

2. 16 processor multiprocessor with shared memory and very fast interprocessor intercommunication. Here, the processors will be programmed to be particular ISP, such C. If C could become the basis of the machine, then UNIX could be run.

3. Set of 16 Computer Modules microprogrammed for particular functions. AFP was designed to be operated in this mode for image processing.

4. A dataflow computer. This is a special case of item 3 whereby particular computers are programmed to behave as the various functionla units of a dataflow computer.

5. A set of special, parallel processing architectures using individual, microprogrammed

processors as the functional units of the particular structures. In this mode, AFP turns out to be a very good emulator of relatively complex VLSI chips.

6. An experimental Ultra-LAN based architecture. To examine how computers can be coupled effectively and work together on a task, the AFP looks like an ideal for study.

APENDIX 3

ROUGH BUDGET

The program expenses are estimated at approximately $18M/year running from 1982 through 1989. Equipment is expensed as delivered. In general two or three "competitive but collaborative" groups are charged with each project family.

YEAR 1

Program	# Sites	Heads (ea.site)	Total Heads	Expenses ($M) Manpower	Equip
Communications/Structures	2	5	10	1	-
Dataflow & Parallel Computation	1	1	1	.1	-
Parallel VLSI Design Automation	1	3	3	.3	-
Parallel Computing Environment	1	2	2	.2	15
Image/Symbol/Knowledge/ Expert Studies	1	3	3	.3	-
	6		19	1.9	15

YEAR 2

Program	# Sites	Heads (ea. site)	Total Heads	Expenses ($M) Manpower

Equip.

Communications/Structures 2 5 10 1
5

Dataflow & Parallel Computation 3 3 9
.9 -

Parallel VLSI Design Automation 2 5 10 1
-

Parallel Computing Environment 2 2 4
.4 10

Image/Symbol/Knowledge 3 5 15 1.5
-
Expert Studies

Image Enhancement Studies 1 3 3 .3
-

Feature Extraction Studies 1 5 5 .5
-

----

14 56 5.6
15

YEAR 3

Program	# Sites	Heads (ea. site)	Total Heads	Expenses ($M) Manpower	Equip.
Communications/Structures	2	6	12	1.2	5
Dataflow & Parallel Computation	3	3	9	.9	-
Parallel VLSI Design Automation	2	5	10	1.0	-
Parallel Computing Environment	3	2	6	.6	8
Image/Symbol/Knowledge	3	5	15	1.5	-
Expert Studies					
Image Enhancement Studies	2	5	10	1.0	-
Feature Extraction Studies	3	5	15	1.5	-
	18		77	7.7	13

YEAR 4

Program	# Sites	Heads (ea. site)	Total Heads	Expenses ($M) Manpower	Equip.
Communications/Structures	2	6	12	1.2	5

Datflow & Parallel Computation	3	3	9	.9	-
Parallel VLSI Design Automation	2	5	10	1.0	-
Parallel Computing Environment	3	2	6	.6	5
Image/Symbol/Knowledge Expert Studies	3	5	10	1.0	-
Image Enhancement Studies	2	5	10	1.0	-
Feature Extraction Studies	3	5	15	1.5	-
	18		77	7.7	10

YEAR 5

Program	# Sites	Heads (ea. site)	Total Heads	Expenses ($M) Manpower	Equip.
Communications/Structures	2	6	12	1.2	5
Dataflow & Parallel Computation	3	3	9	.9	1
Parallel VLSI Design Automation	2	5	10	1.0	0
Parallel Computing Environment	2	2	6	.6	5
Image/Symbol/Knowledge	3	5	15	1.5	-
Expert Studies					
Image Enhancement Studies	2	5	10	1.0	1
Feature Extraction Studies	3	5	15	1.5	-
	18		77	7.7	12

YEAR 6

Program	# Sites	Heads (ea. site)	Total Heads	Expenses ($M) Manpower	Equip.
Communications/Structures	2	6	12	1.2	5
Dataflow & Parallel Computation	3	3	9	.9	

-

Parallel VLSI Design Automation	2	5	10	1.0	-
Parallel Computing Environment	2	2	6	.6	5
Image/Symbol/Knowledge Expert Studies	3	5	15	1.5	-
Image Enhancement Studies	2	5	15	1.5	-
Feature Extraction Studies	3	5	15	1.5	-
	18		77	7.7	10

YEAR 7

Program	# Sites	Heads (ea. site)	Total Heads	Expenses ($M) Manpower	Equip.
Communications/Structures	2	5	10	1	4
Dataflow & Parallel Computation	2	3	6	.6	-
Parallel VLSI Design Automation	2	5	10	1	-
Parallel Computing Environment	3	2	6	.6	5
Image/Symbol/Knowledge Expert Studies	3	5	15	1.5	-
Image Enhancement Studies	1	5	5	.5	-
Feature Extraction Studies	3	5	15	1.5	-
	16		67	6.7	9

YEAR 8

Program	# Sites	Heads (ea. site)	Total Heads	Expenses ($M) Manpower	Equip.
Communications/Structures	2	5	10	1	

1

Dataflow & Parallel Computation	1	2	2	.2
	-			
Parallel VLSI Design Automation	1	5	5	.5
	-			
Parallel Computing Environment	3	2	6	.6
	5			
Image/Symbol/Knowledge - Expert Studies	1	5	5	.5
Image Enhancement Studies	1	1	1	.1
-				
Feature Extraction Studies	1	5	5	.5
-				

10		34	3.4
6			

YEAR 9

Program	# Sites	Heads (ea. site)	Total Heads	Expenses Manpower	($M) Equip.
Communications/Structures	2	5	10	1	-
Dataflow & Parallel Computation	-	-	-	-	-
Parallel VLSI Design Automation	1	2	2	.2	-
Parallel Computing Environment	2	2	4	.4	3
Image/Symbol/Knowledge Expert Studies	-	-	-	-	-
Image Enhancement Studies	-	-	-	-	-
Feature Extraction Studies	1	2	2	.2	-
	6		18	1.8	3

YEAR 10

Program	# Sites	Heads (ea. site)	Total Heads	Expenses Manpower	($M) Equip.

Communications/Structures	1	5	5	.5	-
Dataflow & Parallel Computation	-	-	-	-	-
Parallel VLSI Design Automation	1	1	1	.1	-
Parallel Computing Environment	1	2	2	.2	1.8
Image/Symbol/Knowledge Expert Studies	-	-	-	-	-
Image Enhancement Studies	-	-	-	-	-
Feature Extraction Studies	-	-	-	-	-
	3		8	.8	1.8

GB3.S7.3

22 November 1982

Mr. Joe Traub
450 Riverside Drive
New York, N.Y. 10027

Dear Joe:

Enclosed is a much revised version of the project called Alpha Omega which we submitted as part of MCC (Microelectronics and Computer Consortium/ Company). It is now called Post von Neumann Computing.

Since the original proposal, I visited Japan's ICOT (Fifth Generation) laboratory where 40 researchers are at work defining an architecture that they expect to build within two years. The construction will be done by the companies as an engineering task. It's very clear to me that we (the U. S.) has to move rapidly on a program along these lines, if we expect to design and build competitive systems in the late 80's.

The proposal is now a framework for establishing specific, detailed proposals for sites and other facilities (eg. ARPAnet II). Furthermore, the program is predicated on a unique organization that has not been used since WWII.

I would like your comments at this stage before the proposal has wider circulation. Please do not circulate outside your organization.

Sincerely,

Gordon Bell
Vice President, Engineering
Digital Equipment Corporation

Enclosure

CC: Tom Gannon

GB3.S7.4

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SUBJ: ALPHA OMEGA...POST vN COMPUTING: PERSONS AND COMMENTS?

TO: PEG
RAD
TMC
Bruce DeLagi
Michael Poe
Arnold Kraft
Barry Rubinson

Date: August 2, 1982
From: Gordon Bell
Dept: Eng. Staff
MS: ML12-1/A51
Ext:223-2236
EMS: @CORE

GB3.S6.48

Bruce Delagi and I led a group from CDC, Univac, and Harris to define a research program on parallel computing for use across a large array of problems including AI. This is a program which we believe must be executed in order to do the basic work necessary to produce machines to compete with those produced by the Fifth Generation Computer Program.

CALL FOR COMMENTS ON THE DRAFT PROPOSAL

Please call or EMS me for a copy of the research proposal. Bruce is going to give a seminar at Hudson on it and we'd like to get your comments on how the proposal can be improved either by narrowing or widening the scope.

CALL FOR PEOPLE WHO WOULD LIKE TO WORK ON THE PROJECT

Now, we would like to carry the proposal into the next phase by having the group who are going to carry out the work write the detailed research proposal/plan.

If you would like to work on this, please let me know now. Individuals are needed.

We are looking for someone to head the program. Any candidates?
(Please forward message as appropriate).

00 CORE DECGRAM ACCEPTED S 005092 O 429 04-AUG-82 16:44:19

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* d i g i t a l *
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TO: see "TO" DISTRIBUTION DATE: WED 4 AUG 1982 3:58 PM EDT

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5171520001

SUBJECT: ALPHA OMEGA...POST VN COMPUTING: PERSONS & COMMENTS?

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the group who are going to carry out the work write the detailed research proposal/plan.

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We are looking for someone to head the program. Any candidates? (Please forward mesage as appropriate).

"TO" DISTRIBUTION:

BRUCE DELAGI	ARNOLD KRAFT	PEG:
RAD:	BARRY RUBINSON	TMC:

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+---------------------------+                    GB3.S6.47
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SUBJ: YOUR SUPPORT FOR JOINING MCC, AN R&D CONSORTIUM

TO: OPERATIONS COMMITTEE Date: AUGUST 2, 1982
PEG From: Gordon Bell, Jack
Smith,
Arnold Goldfein Grant Saviers
Peter Christy Dept: Eng. Staff
Henry Crouse MS: ML12-1/A51 Ext:
223-2236
Bruce DeLagi EMS: @CORE

CDC has been leading an effort to define an R&D consortium aimed at doing the work necessary to allow our companies to build future competitive products. The U.S. is producing much research in the universities and other organizations. This work is "open" to the world, and the Japanese have operated a number of programs that take this basic research and move it into a pre-production research phase by corporate, government (MITI) funded consortia (eg. NEC, Fujitsu, Hitachi, Oki, Mistubishi, Sharp, Matshusta). The scarcity of people and money requires collaboration!

The Japanese focussed development MITI/industry consortia programs include:
1. VLSI (now terminated) that resulted in semiconductor process (eg. 64K, 256K ram)
2. Pattern Information Processing (speech and video chips).
3. Supercomputers (started two years ago). Fujitsu just announced being number one here.
4. Optoelectronics, just announced
5. Minicomputers for NTT, just announced with Fujitsu, NEC and Hitachi.
6. The Fifth Computer Generation (40 person lab operating).

The MCC projects which we could be involved with are:
1. An International Office, aimed at technology assessment.
2. A CAD/CAM development program aimed at standardization and interchange of electronic and semiconductor CAD/CAM data.
3. Advanced interconnects.

4. Software productivity.
5. Semiconductor factory automation.
6. Parallel Architectures for the Next Computer Generation.

Engineering has participated in task forces which have broadly defined these programs. For example, Bruce Delagi and Gordon led the group called Alpha Omega which has defined a research program aimed at the Next Generation. Various laboratories and government funding agencies now are interested in supporting it, and 4 companies want to join in this.

We believe DIGITAL MUST join this consortium and become a member of several groups (eg. 1, 3, and 6 above) to save our scarce resources, to get the work done and to establish the standards and technology for the future. CDC, Univac, NCR, Motorola, Mostek, National, Harris and GE look like first pass members.

Attached is a description of the enterprise and its operation. Can we have your support for becoming a member of MCC?

00 CORE DECGRAM ACCEPTED S 000338 O 92 06-JUN-82 19:01:49

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION DATE: SUN 6 JUN 1982
6:44 PM EDT

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5165631667

SUBJECT: MORE ON MCE PRESENTATION BY CDC

MCE was started by CDC as a joint effort with the first meeting being attended by CEOs by many computer and semiconductor companies. Since then, the support to look at consortia has progressed more rapidly and more positively than I expected.

Task forces from various companies went off and explored whether it would be worthwhile to do research, a/d or standards settings in these areas.

Bruce and I led a group aimed at a 10 year research program, called Alpha Omega which would let us build really large ai machines that would compete with the Japanese.

The group likes Alpha Omega. In addition, there seems to be useful work that can be done in building a CAD workstation and in A/D for packaging especially in standards. Programming productivity was explored to no avail. An effort at automating semiconductor processing is being explored.

Tomorrow, Jim Lacey, Phil Arneson VP's of CDC are going to be here to present where we are. Bob Price (not the president) is running the co-ordination.

This is not a CPI-type endeavor, but a consortia much more like Ethernet, or in some cases like the SRC (Semiconductor Research Consortia).

DEC will continue to support MCE on the basis of need from each of the groups. The need has to be based on our need in each area. That's why you're requested to come. We want to explore this together.

Not only do I need your counsel and feedback on this endeavor, but it can't happen without your belief that we need it!

PLEASE JOIN US at 10:30 through lunch.

"TO" DISTRIBUTION:

PETER CHRISTY	BRUCE DELAGI	EMC:
ULF FAGERQUIST	BOB GLORIOSO	WIN HINDLE
JEFF KALB	GEORGE KATRONGE	DON METZGER

JOE REILLY ROY REZAC STEVE TEICHER

WPS USERS - Leave HP mode and type <CR>

MOTIVATION FOR ALPHA OMEGA

The U. S. lead in the combined Information Processing industries is now declining relative to Japan, and potentially to France and the U.K. While there are many reasons for this decline, these are noteworthy and represent the motivation for this program:

1. The U. S. (and World) funding for basic and applied research is large. This mechanism produces far more results than can be applied.
2. There is NO U. S. effort or policy aimed at systematically examining the basic results and refining them so they can be applied to products. The cost to do applied research on even a small fraction of the basic research is usually far greater than the original work and is well beyond the scope of a single company.
3. U. S. companies have not worked collaboratively to develop these technologies because of legal and cultural reasons.
4. U. S. industry has been especially short sighted in its funding of this phase of research, especially in light of the many short term, mundane product opportunities (eg. another Z80 + CP/M based personal computer).
5. An inadequate supply of people exist to carry out the work in industry and the research organizations.
6. A research program aimed at parallelism requires interaction and co-location with a user community.

We marvel at the effectiveness of the Japanese collaborative research programs and believe we must emulate them. Note the past and present programs in the Information Processing area:

1. Pattern Information Processing- voice and vision
2. VLSI- improved processing characteristics (eg. 64K and 256K rams)
3. Supercomputers- high speed technology
4. Optoelectronics- just established
5. Standard Minicomputer for NTT- Fujitsu, NEC and Hitachi
6. Fifth Generation Computer- Fujitsu, NEC, Hitachi, Mitsubishi, Matsushita, Oki, Sharp. ICOT Lab and 10

year program established. First phase builds a Relational Database and a Prolog machine.

7. Local Area Network standards as part of Fifth Generation.

The entire industry is a set of relatively loosely coupled 4-6 stage pipelines consisting of: basic and applied research at the universities and research organizations; industrial research aimed at discovering, refining and applying the basic research to produce feasiblity models for products; advanced product development; product development; and product enhancement. The main set of pipelines and pipeline stages include: an ensemble of interacting and internicine military organizations and suppliers; IBM, ATT, and world computer and semicomputer suppliers.
Bob Price, Director, Microelectronics/CAD, for CDC; Bruce Delagi and myself will present the MCE program.

OBJECTIVES

This work is undertaken in the expectation that the confluence of the disciplines of parallel (image) processing, knowledge engineering - expert systems and vlsi implementation will prove to be a fertile ground. Further, it may well form the necessary ground on which to establish the foundation of the fifth generation computing systems. We need this as a nation, in order to retain our industrial and military leadership. The establishment of a coordinated program of research and common (slightly competitive) research facilities is intended to stimulate a great deal of bootstrapping to develop an increasingly broad and deep national understanding of such systems and their potential application.

The work is aimed at a fundamental understanding of parallelism and its application to a class of problems critical both to the growth of the computer industry in this country and to the maintenance of a pre-eminant US position in intelligence based military systems.

Date: June 7
Time: 10:30 to 12:30 (including lunch)
Place: Engineering Conference Room - ML12-1

RSVP - to MJ DTN:223-2237

Comment from Bob Price: Review of strawhorse business plan for MCE - 1st introduction.

On Saturday, several people from LASL visited us and we talked about the negative gap in our technology with Japan for Supercomputers. While we don't build them, the technology and ideas invariably feed the main line and ultimately VLSI. Large machines too are vital in the design of VLSI chips today. Note:

Dr. Robert Ewald
Computing Division
Los Alamos National Laboratory

Dear Bob:
Thank you for the presentation to the Alpha Omega MCC team members on Saturday on the position of the Japanese in supercomputers and the need for a strong research program on parallelism along the lines of our draft Alpha Omega report. We were delighted to review LASL's facilities and computer science and engineering research.

Various proposals to establish a national facility have come before government committees, but I've never supported them because they've been too vague and weren't based on a need. In writing the Alpha Omega proposal, the urgent need for a large effort with critical mass and focus on parallelism became clear.

Personally, I was really gratified to learn of the possiblity of having focussed research at a LASL managed institute in both VLSI and supercomputing, together with the fact that you might support LANs at other sites with computing. This is the only real ray of hope I've seen to date since I became a member of SRC and MCC. I want to encourage you to proceed as rapidly as possible to approach both SRC and MCC to propose the establishment of such a facility. In this regard, I hope you can present your cursory proposal to SRC this month. Hence, I'm sending a copy of this letter to Erich Bloch and Larry Sumney, the Director.

Thanks again for the personal efforts of you, Billy Buzbee and Byran McCormick. I intend to accept your offer to present the supercomputer data to a local audience as soon as I return from Japan.

LASL has a fine record of building competitive, timely hardware. I think we have an urgent need for your help again.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:mal
GB3.S5.68
June 17, 1982

Dr. Robert Ewald
Computing Division
Los Alamos National Laboratory
Los Alamos, New Mexico

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Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:mal
GB3.S5.69

cc Erich Bloch
Bob Lillestrand

Ken Olsen
Bob Price
Larry Sumney

TO: BOB INMAN
CC: MCCTAB AND ALPHA OMEGA
FROM: GORDON BELL
SUBJECT: COLOCATION WITH HPP CENTER, PALO ALTO

GB4.S1.36

The Heuristic Programming project (HPP) is moving to a separate laboratory facility on 701 Welch Road, very near the Stanford campus. They might offer us temporary space, provided we eventually locate near them.

Ed Feigenbaum is proposing an Institute as Center for HPP which would be supported by government and industrial sponsors. Sponsors would send people there for 3+ years. This would be somewhat "open" along the lines of ICOT, but it would not be freely open ala a university.

Ed suggests that we (Alpha-Omega) locate nearby and have a few people who would be jointly in both laboratories.

Bob Kahn, ARPA, has promised the center and PARAVAN support starting in October.

It would seem this is exactly the opportunity we're looking for.

Bruce Delagi is proposing a parallel VLSI architecture project for knowledge based systems (PARAVAN). A draft copy of the proposal is available from me.

Let's discuss this Friday.

November 22, 1982

Control Data Corporation
1101 East 78th Street

Minneapolis, MN 55420

Attention: D. H. Steffes (BMN03B)

Reference: P. W. Arneson's letter of July 23, 1982
Invoice for MCC incorporation

Dear Mr. Steffes:

Please find enclosed a check for $4000 from Digital Equipment Corporation to cover MCC incorporation expenses.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB3.S7.32

Enclosure

Pat McCormick

I have known Pat McCormick since July, 1972, when she worked as an architectural designer for my home and office. Subsequently she came to work at Digital, responsible for remodelling 1.5 million sq. ft. (formerly woolen mill buildings built in the late 1800's through early 1900's) which house engineering and some manufacturing. She was in our Facilities Planning Group on a corporate wide basis.

She successfully interfaced with the various groups who occupy space and operated within various cost and other design constraints. Overall, the space has been significantly upgraded. This has included the design of our own very highly portable partition system prior to the recent availability of satisfactory externally manufactured systems. Here designs were significantly lower cost and we still build them. The work has been widely cited, and a brochure is enclosed describing the mill which shows some before and after photos.

Overall, she was effective in bringing about change in an environment that is suspicious of architects. Despite this concern about the architectural profession, she has operated effectively as a professional and I encouraged her to pursue a degree. Hopefully your program is flexible enough so that she can get credit for experience/accomplishments and take the necessary courses while continuing work.

Gordon Bell
Vice President, Engineering
Digital Equipment Corporation

May 2, 1978

Dr. Jack McCredie
Vice Provost for Computing
Carnegie-Mellon University
Schenley Park
Pittsburgh, PA 15213

Dear Jack:

It was good to talk with you last week in regard to the CMU-DEC interaction. I'm sorry that there has been a strain in the relationship, but am delighted that the 2050 is now performing well and that you are delivering so many terminal hours to your users. The long time to get the machine up is inexcusable.

In regard to the numerous DEC salespeople who refer customers to visit CMU, I am asking that Ulf discuss this directly with you to get a better arrangement so that you aren't spending so much time. Frankly, I believe we should get a videotape of the CMU systems and this should answer many of the questions for potential visitors.

As to what would make a good research project, I am quite excited that you would take our various DECnet components and interconnect all the computers on campus (10, 20 VAX, 11s on RT, M and Unix). Connecting the commercial front office computers would be interesting too. It would be of interest to know how difficult this is, and how you go about such an undertaking. Although we sell systems for such a network, it is yet to be a standard product because special software and complex hardware is still required. I'd like to know just how this is done and what performance and benefits you really get out of the network.

I saw the VAX-11/780 in chemistry and was pleased as to how well things had gone there.

Again, thanks for discussing the situation with me. I don't believe any of us really are bent on taking advantage of CMU or taking the relationship for granted. We want to continue what has been a unique relationship.

Sincerely,

Gordon Bell
Vice President,
Engineering
Professor, Computer
Science and
Electrical Engineering
Carnegie-Mellon
University, on leave

GB:ljp

CC: Jim Bell
Lloyd Dickman
Chuck Eichenlaub
Ulf Fagerquist
Win Hindle
Baird Lashley
Dick van Horn, CMU

24 May 1983

MCC TECHNICAL ADVISORY BOARD (TAB)

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24 May 1983

MCC TECHNICAL ADVISORY BOARD (TAB)

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National Semiconductor Corporation
2900 Semiconductor Drive
Mail Station D3655
Santa Clara, CA 95051

****
* d i g i t a l *
****

TO: JOE CHENAIL   DATE: THU 15 APR 1982 9:19 AM EST
BRUCE DELAGI   FROM: GORDON BELL
GEORGE KATRONGE   DEPT: ENG STAFF
DON METZGER   EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: RE: TASK FORCE MEETING MICROELECTRONICS PACKAGING

We're attempting to form a research consortium with several companies. The feasibility depends on whether we can establish significant programs. Please attend. I don't think we need to discuss our plans. The purpose is to devise a research program that would help us build better products. The goal is to not duplicate research and A/D. Also we may want to use this group to drive some standards. Please call Bruce Delagi too.

ATTACHED: MEMO;60

****
* d i g i t a l *
****

TO: GORDON BELL
1:02 PM EST

DATE: WED 14 APR 1982

FROM: JOE CHENAIL
DEPT: PTD PHYS INTERC
EXT: 280-7247
LOC/MAIL STOP: QI-1/B17

cc: JOE CHENAIL
DON METZGER

SUBJECT: TASK FORCE MEETING

****
* d i g i t a l *
****

INTEROFFICE MEMORANDUM

TO: Gordon Bell

CC: Joe Chenail
Don Metzger

DATE: 14 APR 1982
FROM: Joe Chenial
DEPT: Adv. Mfg. Technlology
EXT: 280-7222
LOC/MAIL STOP: QI-1/B17

SUBJ: TASK FORCE MEETING MICROELECTRONICS PACKAGING

This memo is from George Katronge.

I received a call from Mr. Mike McGuire of Harris Semiconductor. He invited me to sit-in on a Task Force meeting on Microelectronics Packaging scheduled for April 21st in Melbourne Florida. He mentioned that you had recommended that I participate as a member of this task force.

My understan ding is that this is a task sponsored by computer Microelectronics Technology Corp., a research

consortium which
DEC is a sponsor/member.

1. Can you provide me with some background.

2. Should I attend this meeting?

3. If we participate, how open can we be about our plans,
strategies, etc.

Other representatives at the up-comming meeting include:

Marshall Andrews - Harris
Jim Geers - Signetics
Kent Hansen - Motorola

14-APR-82 13:01:05 S 13372 EMML

GB3.S4.32

ALPHA OMEGA: A 10 YEAR, DIRECTED RESEARCH PROGRAM AIMED AT IMAGE, KNOWLEDGE BASED, AND PARALLEL PROCESSING

[committee and authorship]

OVERVIEW

GOAL AND TIMELINESS

By January 1983 we must establish several National facilities as part of ongoing computer science research and start to operate a goal directed research program aimed at high performance computing based on parallelism and new computing structures made possible by VLSI. Evolutionary projections show an increase of only a factor of 3 (Fig. 1) to 11 (Fig. 2) over the next 10 years (Fig. 1) for scientific processing. For example, the Fifth Generation Research Project is aimed at producing computers with a factor of 100 to 1000 more computing power for conventional and for Expert computing systems by the end of the decade (Fig. 2).

The need for research is driven both by the hardware technology of VLSI, networks and by the software technology of Knowledge Based Systems, together with signal processing of voice and images. A new generation is the concurrence of technology and need causing a new computing structure whereby new uses are possible. We believe the need is the ability to transmit, store, and process (understand) the same information as people, including voice, natural lanaguages and images. Images are the central theme of the research program.

In order to continue to supply state of the art computing to the world, we believe it is necessary to have a research program aimed at building and understanding parallel processing systems of all kinds (specialized processing, multiprocessors, multicomputers, and large computing meshs based on high speed local area networking). The target is image processing and knowledge based systems.

A major goal of the project is the ability to transfer a parallel algorithm, simulated within the computing environment, to VLSI limited only by the foundry time. These facilities would also support the goal that computers would do a substantial part of the VLSI design.

The program would be organized into approximately 3 phases covering roughly a decade and would begin now with the installation of the most powerful, high speed network of general purpose computers. In this way, results based on use can be applied to produce VLSI by the end of the first phase. The second phase would use these newer structures, forming the basis for new designs in the final phase.

FACILITIES

Hierarchies of Local Area Networks Around Centers

The program would be organized around at least two research computation centers containing a variety of experimental computing systems (nodes) interconnected via very high speed links forming a hierarchical set of closely coupled, high performance, local area networks. The centers will be linked to several campuses via 100-300 Mbit fiber optic links so that they could be used in a clustered fashion "as if local computation centers". Since ARPA-net II is coming into operation relatively soon, it can be used to interconnect other, more remote research to the centers, although the intensity of interaction would certainly be less due to the limited bandwidth.

CDC's AFP, A Key Element of the Center

The centers would contain a large, fast, tightly coupled multi-processor, manufactured by CDC called the Advanced Flexible Processor networked with general purpose and special purpose computers. Because of its speed, microprogrammability and extensive interconnectivity, the AFP will be used to simulate various computer structures.

VLSI Design

Since the projects would be designing many VLSI chips, the facility would need a way to build state of the art VLSI chips from mask design.

Location

The program would start immediately and be coupled to existing computer science and computer engineering research facilities and programs. Facility selection is strictly on the basis of the intensity and quality of work in VLSI, image processing, parallel computing and AI. Lawrence Livermore Laboratory would be an ideal site for the computation center which would link to Stanford, SRI, UC/Berkely and Lawrence Berkeley Laboratory. MIT and Lincoln Laboratory could be the basis of an East Coast facility.

ORGANIZATION AND DIRECTION

A program office, together with a board of directors would contract the research in a fairly structured fashion. While research of this type is not commonly done today in computer science, we believe it can be done effectively by a joint industry and computer science research laboratory effort. <u>Industry can be effective at providing facilities and building hardware</u> that has been traditionally absent from the research laboratories.

The purpose would not be to change the nature of the existing unstructured research to be highly focussed and goal directed, but rather to provide additional resources so that both the structured project and unstructured work could co-exist and complement one another.

A major goal of the resarch project is to provide a large infusion of computing systems to support existing more basic and unstructured work, including robotics.

The centers would be aimed at very similar research targets in order to get the benefit of "friendly competition". Similarly, several approaches would be examined within a center. This approach was successful in the mid-70's in speech research.

MOTIVATION FOR THE APPROACH

The motivation for this approach is timeliness and effectiveness:

1. THE RESEARCH PROGRAM SHOULD START NOW
2. COUPLING OF INDUSTRIAL R AND D WITH COMPUTER SCIEN RESEARCH
3. BUILD ON EXISTING RESEARCH PROGRAMS AND COMPUTERS

It is essential that we start now on the research program, as our computer science research has been drifting these last few years as both industry and computer science research have both gotten large, reached critical mass, and become independent of one another. It is also the intent that the program focus some of the existing programs into a goal directed system.

It should be noted that by using the current AFP as a general purpose research tool, <u>we can gain at least 5 years</u> on starting such a program. Traditionally, we design, build and then use. A machine as fast and general as AFP would require at least 5 years to build. For example, several data-flow projects could use AFP today to simulate architectures. We now need to evaluate the architectures by using them.

A FACILITY TO UNDERSTAND AND EXPLOIT PARALLELISM

New computer applications usually result from having new, higher performance computers allowing solution of problems that were computationally intractable. Performance increases in computing come from two sources: technology improvements and increased parallelism. AO is aimed at understanding and exploiting parallelism to gain performance.

To date, attempts to improve performance through highly parallel structures has been relatively disappointing. AO supports systematic research and development on the following alternatives.

SPECIALIZED PROCESSING ATTACHED TO A CONVENTIONAL UNIPROCESSOR

Historically, an order of magnitude or more speed improvement has resulted from looking at the execution times of particular work and then building hardware to carry out the function.

Some examples of "off-loading":

1. Floating point hardware versus a software interpreter
2. Channels, I/O Processors and I/O Computers versus interru
   and hardwired I/O
3. Display processors
4. Array Signal Processors

A need, resulting from a computation on a particular kind of data occurs. This need is then a requirement for a new computing structure. The function is then "off-loaded" in specialized hardware that operates in parallel with the general purpose computer.

By having a general purpose, very high speed system, the resulting, specialized structures can be totally simulated before they are committed to VLSI designs. In this way the designer can interact with the structure in an iterative fashion instead of waiting for fabrication and the slow system integration process.

MULTIPROCESSING

Every time a new computer class is formed, there are strong arguments to build multiprocessors for performance reasons. Invariably, others build higher performance Uniprocessors at the same time and deliver more power via the strictly sequential approach. Multiprocessors were proposed by the early 60's, with Burroughs probably delivering the first one (B5000). By the early 70's Burroughs, CDC, DEC, GE, IBM and Univac had all built 2 - 4 processor multiprocessors. Unfortunately, these were either used in an assymetrical fashion, or at most they were used in an ordinary multiprogramming environment. In no cases was parallel processing of a single task provided.

In 1966 Lehman investigated parallel processing of a single task with a 16 processor multiprocessor and showed that for various tasks speed-ups were possible. By 1975 two 16 processor systems were built by BTL and at CMU. The CMU system was predicated on the 11/40 minicomputer, as a way to afford the construction, and speed-ups of up to 10 were observed in various algorithms.

Current Research Needs
Recently, Schwartz, et al at NYU has proposed the Ultra-Computer, a multiprocessor with up to 16,000 VLSI microprocessors. Several laboratories are building systems with up to several hundred microprocessors. LLL is building a a multiprocessor with 16 supercomputer class processors. DENELCOR is offering a 64 processor multiprocessor which requires investigation. CDC's Advanced Flexible Processor can be programmed to behave as a conventional 16 processor multiprocessors computer.

It's safe to say that one can produce conventional parallel processors which should be able to deliver up to a factor of four, for specially coded programs. A factor of 10 is possible, but there has to be a signficant amount of research to make this automatically possible. Studies continue to indicate vast amounts of parallelism in algorithms that we have no way of exploiting. Notice that the optimistic projection for computing power speed-up over the next decade could be accomplished simply and entirely by multiprocessing, and not by semiconductor and packaging technology if a signficant effort were applied!

MULTICOMPUTERS

Very little has been done formally with arrays of tightly coupled multicomputers. By 1980, CM*, a multicomputer system based on the LSI-11 microprocessor with 5 clusters of 10 computers was constructed, and speedups of up to ? was observed for particular problems, including speech recognition. Because there is less interconnection among the computers, it is more difficult to predict the performance because the algorithm has to be carefully partitioned across computers rather than distributed in memory.

CDC's Advanced Flexible Processor is an ideal machine to investigate the use of multicomputers because the interconnection among the computers is via very high speed local links (ultra LAN). AFP is described in detail below.

DATA-FLOW ARCHITECTURES

Although many data-flow computers have been proposed, only a half dozen computers have been built. The performance of data-flow computers is not understood, although the use of data-flow graphs and languages to express parallelism is promising. In particular, data-flow appears to be most useful in expressing signal processing operations. The CDC AFP has been programmed using the data-flow representation; and individual computer modules can be assigned to various processing stages. The AFP also appears to be ideal to simulate static data-flow architecture and application. It would be microprogrammed to be a general purpose data-flow machine using seperate computer modules in a functional fashion: matching store, switching, processing, and i/o.

ULTRA-, FAST-, AND CONVENTIONAL LOCAL AREA NETWORKS

Local Area Networks are systems which allow the physical distribution of functional, server components to cover a local, geographical area (eg. a building, or campus). The functional servers roughly correspond to various parts of a shared system: person servers (computing workstations/terminals), file servers, print servers, and communications servers. The communications is via message passing protocols. Researchers have posited the notion that LANs can be used to provide high performance, parallel processing. While the current LANs are relatively slow (10 Mbits/sec), they are ideally matched to today's, slow terminals and personal computers. In the future, we believe higher speed LANs are needed, and can form the basis for interconnecting functional computers in a hierarchy as shown in the facilities section (Fig. ?) providing 100 Mbits. Also note that the ring that interconnects the AFP provides transmission at about 2 Gbits/sec for each computer node connected for the tightly connected computers.

The purpose of the hierarchy of LANs is summarized:

Ultra-LAN	2 Gbits x p	AFP's processor intercommunicatio
Fast-LAN	100 Mbits	Facility comput intercommunication and center to remote sites, formi cluster
LAN	10 Mbits	Individual workstations to centers

PARALLEL PROCESSING FOR KNOWLEDGE BASED SYSTEMS

It has not widely agreed that Knowledge Based Systems can exploit parallelism. For Rule Based Systems, it is believed that many rules can be evaluated in parallel. The research will be aimed at first answering the question, and then simulating and evaluting the resulting structure. AFP could be used to simulate such a structure, provided this approach looks worthwhile.

WHY USE CDC'S ADVANCED FLEXIBLE PROCESSOR?

The CDC AFP provides a very fast, flexible, microprogrammed set of computer modules for experimenting in various parallel computing structures of various type. A single, AFP microprogrammed processor provides the following capability:

250 to 800 Mops in 16 parallel arithmetic and logic units

Microprogrammed control
Access to 32 Megaword memory
2 x 1 Gbytes / sec communication with neighbors in ring

Sixteen processors can be both interconnected to a common 32 Megabyte memory and to adjacent processors in a ring structure, providing both a very flexible multiprocessor and multicomputer.

The AFP can thus be used as a tool to study several different computer structure problems:

1. Microprogramming of 16 pipelined, functional units with the processor. Four units can be initiated every nanoseconds. Because of the difficulty of programming th highly parallel structure, the most important benefit, or sid effect will be understanding in how to do it effectivel Because the microprogramming so heavily pipelined, we belie a better understanding of dataflow techniques for expressi algorithms will result from the use.
2. A 16 processor multiprocessor with shared memory and ve fast interprocessor intercommunication. Here, a processor wi be programmed to be a particular ISP, such as one capable interpreting some language effectively (eg. C).
3. A set of 16 Computer Modules programmed for particul functions. AFP was designed to be operated in this mode f image processing.
4. Microprogrammed as a Dataflow Computer. This is a speci case of 3 whereby particular computers are programmed to beha as the various functional units of a Dataflow computer.
5. Special, parallel processing architectures usi individual, microprogrammed processors as the functional uni of the particular structures. In this mode, AFP turns out be a very good emulator of relatively complex VLSI chips.

January 15, 1982

Dr. Lowell Wood
Lawrence Livermore Laboratory
P.O. Box 808-L-276
700 East Avenue
Livermore, CA 94550

Dear Lowell:

The petition letter to stop the MCF began to look like a hopeless morass given the large government-industry effort.

I did not send the file containing the letter and its response to anyone until now. I do not intend to send the petition letter to anyone, but you're welcome to a copy of the attached file as it now stands to use anyway you want.

I still regard the MCF as a major waste of what should be our most precious and talented designers. Since we (the U.S.) are manpower limited, the effort spreads us thin and means we don't build competitive (with the Japanese) products. In the past, having relatively obsolete military machines may have been unimportant because the Russian computer technology was very bad.

With VLSI, the ability to copy chips, and the flow of technology, I view we are going to wind up with the situation where the Russians are using standard U.S. designed microprocessors, such as the Motorola 68,000 or Intel 8086, running UNIX. This will put the U.S. military at an instantaneous six year lag in computers!

Good luck in your attempt to influence the MCF direction.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:mal
ID#GB3.S1.69

We believe the MCF (Military Computer Family) approach to procuring a military computer is wrong. The standardization, architectural and procurement requirements can be better met by adopting virtually any existing, commercial architecture or even several architectures.

The probability that the MCF approach can result in a machine competitive with available commercial systems is low.

a. This has been the case historically in every military design effort.

b. The military can't match the level, diversity and speed of industrial development.

c. It is unlikely that even an advanced concept can become available before it is out moded by standard commercial products. This may put us in a militarily precarious position. Ironically, our Russian counterparts use U.S. architectures and do have access to world-wide semiconductors.

d. The quantity-price relationship will make MCF substantially more expensive than any other commercial design.

Furthermore, the MCF carries a great risk of standardizing on one or more inferior design. Carrying out this project will be a significant drain on our scarce computer scientists and engineers.

The objectives of standardization are laudable, however these objectives can be clearly and simply met by standardization on an existing, commercial architectures supporting a DOD Standard High Level Language versus the development and subsequent procurement of a new and unique architecture.

Respectively,

ULF FAGERQUIST
BILL MCBRIDE @MR16
MARKETING COMMITTEE:
MARKETING COMMITTEE: @CLEM
MARKETING COMMITTEE: @MR16

SUBJECT: MARKETING COMMITTEE AGENDA ITEM--1/21/80

I'M VOTING NO HERE.

Under no circumstances should we say anymore about 2080 than we have already widely stated! We can repeat the party line, "We are working on a 20 follow-on with several times (targeted 2-3 times) the performance and less price (target of 1/2) to be shipped in the next 3 years".

There has yet to be a good design review for the Phase 0 -> Phase 1 transition!

GB:swh
GB1.S1.28

Command >
Command >
Command > P Q
To stop the spooler type <CR> after you hear the bell ring
Put printer at top of form and type <CR>

00 CORE DECGRAM ACCEPTED S 001202 O 324 13-NOV-82 17:07:09

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!   !   !   !   !   !   !   !
! d ! i ! g ! i ! t ! a ! l !          I n t e r o f f i c e
M e m o
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TO: FOREST BASKETT   DATE: SAT 13 NOV 1982
4:42 PM EST

FROM: GORDON BELL

cc: SAM FULLER

DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5181684364

SUBJECT: RE: DINNER WITH TOM MCWILLIAMS

We didn't get into the issue of the machine. They are still enthusiastic about the machine and think that it is no problem. If there is a major problem, and the machine will never work, I didn't get behind the facade. They have a very convincing story about the machine, and appear to be resolved to finish it, including going ahead with the full machine.

The goal is to make about 6 of the 25K chip ones, then move to build the Mark III, a very tightly packed one where they put 25K chips on 50 boards, on 1/2" centers, on double sides ala cray, on 15" water cooled boards (250/side). I saw the boards and said we'd like to work with them on packaging... which we badly need. This means a Venus could go down to 10x10x10 cube, and with 2 zif connectors on the edges, could get the delays down by over a factor of 2 over venus. With the MCAIII, this could be quite a decent machine IF we can make a Venus I.

The Mark IV is put the whole processor on a wafer... by 87.

I was impressed that the I box ran in such a short time from power up time.

I said that you think that for simple benchmarks the machine done there will compute very fast. Tom really went after the

benchmark issue, cause there's so much there for transcendentals,
vectors, matricies, LISP,... ?, and mP's. In the interest of CS, I want to see the machine run badly and see how close to a cray they come. Whether, after they have a Pc running, they will want to go on is still an issue. I assume that if they get this one running at 80ns, then they will want to go on with the program. I don't see how they can alter their course unless the machine fails to work, but at least to the outside world, they are not ready to remotely admit that it has any problems.

I'm about to write a letter of encouragement to them, but will wait till after your meeting to send it. It's clearly the best way to get Tom to come. I think you ought to make an offer of Titans to them for mP work. Also, it would be worth

getting Tom's input on a non-disclosed basis. Somehow, we need to get him to your lab gradually.

He's now working on Scald III, to do the scaling of the IIA to get it to the new packages. This is precisely the work we need now on Venus and Nautilus... Is there a program that can convert these designs into different packaging and logic? (I think clearly yes, but the only question is what form is needed to express the initial design such that a program has a chance.) This is critical to our future. It's probably largely AI based, and it's the second highest priority Ai program I know of.

I offered to give 50% off on a 4 processor 784 so that they could start to do mP software work before they get their machine.
This offer was made to George Michaels and Tom thought it was a terrific idea. Also, the CS guys under George are ecstatic

too, since they could also do their dataflow simulation on it too,. Does it make any sense for you to install a 784 there that they could compute on? (It would solve some of their logistics problems, but it might not really get them hooked the way they need to, to get the work done.)

Command >

MECHANICAL GENERATION

The second pre-computer generation started about 1810 and was brought about by the change from handcraft to mechanical technology. Two machines establish the beginning of the period: the Jacquard loom and the planimeter. In the 1790's Joseph Jacquard integrated a design based on the ideas of Bouchon, deVaucauson, and Falcon, for an automatic harness controlled by punched cards connected to an endless roll that would mechanize fancy weaving. This was shown at an exhibition in Paris in 1801 and by 1812, ten thousand Jacquard looms were in operation in France alone (Strandh, p. 195). The planimeter, the first instrument for directly measuring an area bounded by an irregular curve, appears to have been invented by the Bavarian engineer J. M. Hermann in 1814. It was improved by Lamule in 1816, and constructed in 1817 (Pugh, 1975). With the need for surveying and recording land ownership, the planimeter rapidly came into widespread use.

Analog calculating devices flourished in the mechanical generation. Specialized slide rules were spawned for a wide variety of uses: by revenuers to calculate tax on alcoholic beverages, lumbermen for cordage, printers for paper quantity, and traders for interest rates (Turner, 1980). A company still exists in the North of England that makes specialized slide rules. Although the technology is based on a previous generation and two-three part analog calculators do not need mechanization, they were improved by industrialized forms of production.

Mechanical digital calculators had their beginnings within this generation and flourished in the next. In 1820, Charles de Colmar, an insurance agent, experimented with a four-function calculator, but it was not built or distributed until the 1850s. The invention of practical mechanical calculators began in the last ten years of the century when Baldwin, Burroughs, and Felt were in business in the U.S., and Odhner had started his company in Russia. Then in the next generation, they became embedded in Western office procedures and practices.

ANALOG CALCULA
(described in the Craft generation)

2-3 PART

LEVEL REFERENCE

The use of analog devices for calculating differences often depended on the analysis of a position in reference to ground or horizon position. The simple gunnery level with its few moving parts has evolved to sophisticated analog circuitry guiding missiles.

Gunnery Level, Swift & Anderson Inc., ca 1910, Lead,
Brass and Glass, (B66.80).

INTEGRATOR

Integrators are analog calculators that perform the mathematical integration function. The two-three part mileage readers are indeed very primitive forms of this phenomena. In calculus, integration is carried out by continuously summing up rectangles whose height is represented by the value of a function and whose width approaches zero. The infinite sum of all of these results is a value that represents the area under the function. In an integrator this process is duplicated by means of a wheel sliding on a rotating cone or disk. As the function increases, the wheel is slid further out on the disk, making it spin faster to account for the greater area under the function.

"Morris's Measuring Instrument", Morris, 5.5d x1 cm, Metal, Paper, Cloth, Glass, (B128.80).

Map Measure and Compass, Tacro Inc., 7x3.5x.5 cm, Chrome, Paper, Glass, (B129.80).

<u>Map Mileage Reader</u>, Depose H.C., 12x3.5dx.5 cm, Metal, Paper and Glass,, (B140.80).

<u>Map mileage reader and compass</u>, SELSI, ca 1930, 11x3.5x.5 cm, The handle also serves as a pencil, (B152.81).

<u>MULTIPLE PART</u>

DRAWING INSTRUMENTS

PANTOGRAPHS

The pantograph is a device mechanically changing the scale of a drawing, speeding up engineering processes whole insuring reasonalbe accuracy. The pantograph was invented between 1603 and 1605 by the Germany astronomer, Christoph Scheiner, and greatly improved in 1743 by the Parisian craftsman, Claude Langlois (L'e Turner 1980). The devices usually consist of four brass bars, jointed in pairs, one pair being twice the length of the other. Under the joints are small castors, and one long bar has a tracing point, and a short arm has a pen held by a sliding head that is set to the ratio required. On the other long bar is a pivot point in the form of a heavy brass disc. While the invention occurred in the craft generation, significant use was not possible until machine tooling increased precision.

P
<u>Pantograph</u>, ca 1850, 85x15x8 cm Case, Brass and Wood, Engraved, J. Davis Cheltenham, (B134.80).

<u>Pantograph</u>, A & W Smith, ca 1820, 59x7x5.5 mahoganny case, Brass, (B153.81).

"A rare type of brass pantograph", P. Delehar.

LEVEL REFERENCE

<u>Sextant</u>, Heath and Co. Ltd., ca 1920, 35x25x17 cm, Certified at The National Physics Laboratory, (B69.80).

INTEGRATOR

PLANIMETERS

Instruments for directly measuring an area bounded by an irregular curve are based on an idea developed by the Bavarian engineer, J M Hermann, in 1814. The first commercially successful devices were made by Ernst of Paris. In 1851, John Sang of Kirkcaldy invented and made a "platometer" resembling the planimeter of Ernst.

Their operation is based on continuous integration. A curve is traced using the pointer, with the area read off on the dial after the complete perimeter has been traversed. As the pointer is moved the rollers that measure distance on the conical shaft calculate the product of the vertical distance times the horizontal distance. As a curve is traversed in a clockwise direction, the top area is integrated in a positive direction. On the return trip the integration is negative and the net value is provided.

P
"<u>Platometer</u>", J. Sang, ca 1860, 9x15x37 cm, Brass, (B6.76).

<u>Planimeter</u>, The A. Leitz Co., ca 1900, 2x4x28 cm, German Silver and Steel, (B49.79).

This instrument for measuring the area of any plane figure was invented by Professor Jacob

Amsler in 1856. It is a proportional instrument in that the unit can be changed by altering the radius of the tracing arm.

Use. The weighted point is fixed and the tracing pointer guided exactly once round the outline of the figure whose area is to be measured. The difference of the readings on the graduated roller before and after this operation gives the area of the figure in units dependent on the setting of the tracing arm.

OTHER

INTEGRATING DEVICES

?M?

"Directions for Making a Machine to Solve Equations", Rowning, J., 1768, 22x18x2 cm, (B48.79).

This

work describes the first analog computer designed to solve algebraic equations of the n'th degree expessed in the form y = a + bx + cx2 + dx3 + . . . + qxn . It was completed in 1768 by Rowning based upon the graphical method invented by A. deSegner in 1751. In 1770 an actual machine mechanized to the second degree was presented to the Royal Society, but apparently no longer exists. Rowning's instrument consists of a number of adjustable straight bars, or "rulers," centred and combined together in such a way as to occupy progressively the various positions in accordance with deSegner's graphical construction. Movement in two directions at right angles to one another is secured by means of two pairs of racks and pinions. The curve is drawn by a pencil on the underside of a piece of pasteboard supported by two adjustable bars.

Use.

Segner's method consisted in finding, by graphical construction, the values of y for various assumed values of x, plotting the curve, and reading off the values of x at the points where the curve intersected the axis of x, thus obtaining the real roots of the equation. The impossible or imaginary roots were indicated by the points where the curve approached and reached from the axis of x, without reaching it.

"Lowry-bowyer Telemeter", Lowry Mfg. Co., ca 1900, 15x78x7 cm, Aluminum and Wood, (B53.80).

A version of the classical trigonometer signed and dated "THE LOWRY MFG. CO./BOSTON, U.S.A./PAT. 1887, '92, '96". It has two four and a half inch compass bearing dials, one fixed at the end of the twenty-six inch long graduate slotted base plate, the other sliding, and each with graduated pivoted arms of 18 3/8" radius. It was intended for the analog solution of the plane triangle knowing two angles and included side, two sides and the included angle, or three sides. Thus it was useful for problems both of navigation and gunnery.

DIGITAL CALCULA

The Digital Order, Class Calcula has five families: single register, two register, three-four register, complex and programmable. The abacus, a single register, manually operated, portable calculator, was not challenged until the development of equally portable and inexpensive electronic pocket calculators. Abacus-type machines have been unique because with a skilled, accurate operator, they could carry out diverse and complex functions, including long mulitplication and division. They had the characteristic of all single-register machines, i.e., the only record of the operator's input was the current result on the single register. The dual calculator Sharp-Elsi Mate, with both a soroban and a four-function electronic calculator, was manufactured to preserve a culture, i.e., to teach children to use a soroban and not to use the calculator. If abacus-like machines are so extraordinary, why in fact were mechanical calculators ever invented? Probably, because of the likelihood of human error, and desire for simple aids with some kind of memory to check the human operator.

The Pascaline (1645) is the first of the mechanical, single register calculators. All machines using the Pascal-wheel principal subtracted by adding the one's complement of the total. Two register calculators, developed in the late nineteenth century, were characterized by using the keyboard as one register and using bi-directional wheels for direct subtraction.

Three and four register calculators were derived from Leibniz's concept of a stepped-wheel mechanism allowing an improved automatic carry, thus multiplication and division. Otto Steiger's Millionaire, a heavy brass machine based on purely mechanical principles, also had the first fully automatic multiply. Millionaire production came to a halt in the nineteen-thirties, when these machines were kludged with key punches and motors in an unsuccessful effort to meet the growing competition of electric motor-driven machines.

In the 1870s, both Frank Baldwin and Wilhelm Odhner developed a compressed version of the stepped wheel device with one large wheel and all operations based on its rotation. Machines of this type were widely distributed in Europe under the names Odhner and Brunsviga. The principal was most refined as the Curta, produced through the nineteen-sixties.

In 1911, when Baldwin was old enough to retire he met Frank Monroe and they started the Monroe Calculator Company (Chase, 1980). The Monroematics, electric calculators, were among the first electrified automatic machines.

Four-function electronic calculators are the general-purpose calculators of the nineteen-eighties: school children and people balancing their check books have become about as attached to their calculators as to their watches. The inexpensive four-function electronic pocket calculator has replaced almost all other forms of analog and digital calculators.

Complex digital calculators stem from the Difference Engine, outlined by Charles Babbage in the eighteen-twenties and built by Scheutz later in the century.

SINGLE REGISTER

Three kinds of mechanisms divide this family into three genuses: Pascal wheel; Pascal strip; and keyed wheel. The original machine was based on a toothed wheel driven by a stylus. Pascal's bulky machine with its long teeth was replaced by many streamlined variants. As teeth on the wheels became more compressed the volume of the machine was taken up by the diameter of the wheels themselves, giving rise to the Pascal strip -- simply an elongated circle. From the nineteen-thirties to fifites, the Pascal strip family provided a portable, cheap and, relatively widely used alternative. However, key punch equipment is faster and more accurate for the average office worker. Dorr E. Felt was the first person to patent and manufacture a key-punch variant of the wheel, the Comptometer, marketed mainly for the growing bureaucracy of turn-of-the-century industry.

PASCAL WHEEL

THE

PASCALINE

P

Pascaline replica by Roberto Guatelli, 1645, Bronze, (B150.81).

A replica of the first mechanical adding machine.

Use. The dials show the French monetary unit, the livre, which was divided into 12 deniers, each subdivided into 20 sols. The essential part of the machine was its decimal carry; each toothed wheel moved forward one unit (one-tenth of a revolution on each wheel except those of deniers and sols) when the previous wheel had completed one revolution. Subtraction is based on complementary numbers revealed by moving the strip at the top of the calculator.

p

VARIOUS REFINEMENTS

"Addometer", Reliable Typewriter & Adding Machine Co., USA, 1x5x30 cm, Brown with red and white dials and yellow numbers, Metal, Case, Instructions, Stylus, and Calculator, (B179.81).

"Addometer" Reliable Typewriter & Adding Machine Corp., 1x5x30 cm, Black, Metal, (B85.78).

"Addometer" Reliable Typewriter and Adding Machine Corp., 1x5x30 cm, Dark Gray, Metal and Fiber, (B96.80).

"BRI-CAL POCKET ADDING MACHINE", BRI-CAL, 1900, 12.5 cm diameter, Black, Metal, Loaned by Dick Rubinstein (X13.80).

"Quixsum Adding Machine Model C", Precision Adding Machine Co. Inc., ca 1930, 7x18x48 cm, (B38.79).

The Quixsum is a good example of how the stepped wheel principle of Pascal can be used to operate any special measures, not necessarily base ten. In this case it adds English units of feet and inches.

Use. To add a number to the register, the appropriate digit is dialed. The result is displayed in a notch at the top of each wheel.

"SEE CALCULATOR", Selective Educational Equipment Corp., 1968, 18x4x1 cm, (B31.79).

A small replica of the Pascal-type adder made to illustrate the mechanism.

P PASCAL STRIP

"BABY CALCULATOR", ca 1950, 1x8x6 cm, Tin, (B76.80).

"BABY CALCULATOR", 14.5x7.5x7 cm, Black, Gold and Red, Metal, (B149.81).

"B.U.G. Calculator", ADDI-COSMOS, 4.5x20.5x4 cm, Brass, Steel, Wood, fabric, (B131.80).

"EXACTUS", ca 1950, 7x11x.5 cm, (B36.79).

A linear form of the simple Pascal two function calculating device that uses complement arithmetic.

Use. Addition or subtraction is carried out by dialing the numbers starting with the least significant. A carry is performed by moving the final digit around the corner to the next linear register.

KEYED WHEEL

All machines in this category are derived from the invention of Dorr E. Felt who helds an 1887 patent (#371,496) for the machine. In 1884, at age 22, Felt, a machinist, conceived his idea while watching the ratchet-feed motion of the planer that he ran. He wrote: "Watching the planer-feed set me to scheming on ideas for a machine to simplify the hard grind of the bookkeeper in his day's calculation of accounts. I realized that for a machine to hold any value to an accountant, it must have greater capacity than the average expert accountant. Now I know that many accountants could mentally add four columns of figures at a time, so I decided that I must beat that in designing my machine. Therefore, I worked on the principle of duplicate denominational orders that could be stretched to any capacity within reason. The plan I finally settled on is displayed in what is generally know as the "Macaroni Box" model. This crude model was made under rather adverse circumstances. The construction of such a complicated macine from metal, as I schemed up was not within my reach from a monetary standpoint, so I decided to put my ideas into wood. It was near Thanksgiving Day of 1884, and I decided to use the holiday in the construction of the wooden model. I went to the grocer's and selected a box which seemed to me to be about the right size for the casing. It was a macaroni box, so I have always called it the macaroni box model. For keys I procured some meat skewers from the butcher around the corner and some staples from a hardware store for the key guides and an assortment of elastic bands to be used for springs. When Thanksgiving day came I got up early and went to work with a few tools, principally a jack knife. I soon discovered that there were some parts which would soon require better tools than I had at hand for the purpose, and when night came I found that the model I had expected to construct in a day was a long way from being complete or in working order. I finally had some of the parts made out of metal, and finished the model soon after New Year's day, 1885." (Felt in Turck, 1921) He produced eight finished machines before September, 1887, and two were immediately put into service for training operators.

One of the first trained operators, George W. Martin wrote Felt on November 6, 1887, "...in accordance with your request I have called on as many businessmen as I will have time to call on owing to the fact that the Gas Co. has written for me to come to work next Monday morning. The names and addresses are as follows: Sprague Warner and Co., Michigan Avenue and Randolph Pelkin and Brooks, Lake and State Streets, Melville E. Stone, Editor, of the Daily News, and the Freight Auditor of the C.B.&Q RR. These Gentlemen are very much please with the machine and say they will give it a trial as soon as you put it on the market." (Turck, 1921, p. 71)

According to Turck, "significant proof of Felt's claim as the first inventor of the modern calculating machine is justified by the fact that no other multiple-order key-driven calculating machine was placed on the market prior to 1902." (Turck, 1921, p.75)

Use. For each digit a push button from 1 to 9 is selected which rotates a Pascal-type wheel with the corresponding number of increments. Numbers are subtracted by adding the complement (shown in smaller numbers). The carrying of tens is accomplished by power generated by the action of the keys and stored in a helical spring, which is automatically released at the proper instant to perform the carry. Through effective marketing and training of skilled operators versed in complement arithmetic at Comptometer Schools, these machines became the workhorse of the accounting profession in the first part of the century. They never successfully advanced into the electro-mechanical era, but remained purely mechanical, two-function adding and subtracting machines.

COMPTOMETER

P

"Comptometer" #505, Felt & Tarrant Mfg Co., ca 1895, USA, Walnut, Brass & Other Metals, (B174.81).

An early Comptometer with the springs showing on the upper keys. The keys are molded differently on alternative rows to give the operator a "feeling" of relative location. The walnut cabinetry and tooling was clearly a hand-made.

"Comptometer", Felt & Tarrant Manufacturing Co., 1914, 37x28x15 cm, Green, Metal, (B9.76).

"Comptometer", Felt & Tarrant Mfg Co., ca 1920, 36x22x15 cm, Bronze, Metal, (B57.80).

COMPTOMETER COPIES

"Burroughs Model 5", Burroughs, 28x25x12 cm, Black, Metal, (B7.76).

"Burroughs" Burroughs, 18x25x27 cm, (B8.76).

"Burroughs Adding Machine Model A", Burroughs, 22x15x12 cm, Black, Metal, 5 Digit, (B14.76).

"Burroughs" Burroughs Adding Machine Company, ca 1920, 15x30x25 cm, Black, Metal, Complement Arithmetic Nine Digits, (B22.78).

"Burroughs Calculator", Burroughs, ca 1910, 18x23x30 cm, Black and green, Metal, 11 Digit, Stands on legs at a tilt for ease of operation, (B155.81).

"Plus" Bell Punch Co. Ltd., 15x30x40 cm, Green, Metal, Model #909/C/V/504.929/A, (B81.80).

An electrified modification of the Comptometer.

TWO REGISTER

TAB INDICATOR

"Adding Machine", Wolverine Supply and Manufacturing Co., ca 1950, USA, 10x15x23 cm, Red, blue, and cream, Tin, (B167.81).

"American Adding Machine", American Can Company, ca 1920, Black, Metal, Digits worn, (B137.81).

Essentially a Pascal-like single register machine, only the digits are grooved and stay in place showing the entry (a second register) until they are cleared.

"American Adding Machine", American Can Company, ca 1920, USA, 22x22x19 cm, Black with green, Metal, Rusted and worn, (B180.81).

KEYED WHEEL

One register is formed by the depressed keys, in contrast to the single register comptometer type where the keys are on springs. The other register is the accumulator. In many cases, these also started as printing and adding machines. The first practical machine resulted from William S. Burrough's patent of 1892. Prior to this a number of machines were patented and experimented with, particularly the patents of Henry Pottin (No. 312,014, 1885) and William S. Burroughs (Nos. 388,116 and 388,118, 1888). Like the comptometer type, until the adaptation of Wm. E. Swalm's patent of 1910 (No. 1,028149), complement arithmetic was used for subtraction. In 1907, Burroughs sold 13,314 adding and listing machines, and with 58 different styles of Burroughs (including comptometer copies) claimed to be the leading producer in an ad in the February 1908 issue of Office Appliances Magazine.

"Allen-Wales Printing Adding Machine", Allen-Wales Adding Machine Corp., 20x20x40 cm, Black, Metal, (B89.80).
P
"Burroughs", Burroughs, 28x38x40 cm, (B42.80).

"The Burroughs Adding and Listing Machine", Burroughs, ca 1900, Black, Metal with beveled glass sides, (B156.80).

"The Burroughs Adding and Listing Machine", Burroughs, ca 1910, Black, Metal with beveled glass, Adapted for motorized operation, (B157.81).

"Burroughs" Adding Machine #8A193393,

Burroughs, ca 1950, USA, 22x37x20 cm, Green and Black, Metal, 8 digits with paper tape printing, (B173.81).

"<u>Wales Visible Adding Machine</u>", Wales the Adder Machine Co., 20x24x38 cm, Metal and Plexi Replacements for Glass, (B88.80).

<u>3-4 REGISTER</u>

STEPPED WHEEL

In 1820, Chevalier Charles X Thomas de Colmar designed and introduced the first multiplication machine made commercially available for general sale. Although it was not patented until 1851, the main features of the 1820 design remained unaltered. The mechanism has three parts, concerned with setting, counting, and recording respectively. Any number up to 999,999 may be set by moving the pointers to the numbers 0 to 9 engraved next to the six slots on the fixed cover plate. The movement of any of these pointers slides a small pinion with ten teeth along a square axle, underneath and to the left of which is a Leibniz stepped wheel. The Leibnix wheel, a cylinder having nine teeth of increasing length, is driven from the main shaft by means of a bevel wheel, and the small pinion is thus rotated by as many teeth as the cylinder bears in the plane corresponding to the digit set. This amount of rotation is transferred through one of a pair of bevel wheels, carried on a sleeve on the same axis, to the 'results' figure wheel on the back row on the hinged plate. This plate also carried the figure wheel recording the number of turns of the driving crank for each position of the hinged plate. The pair of bevel wheels is placed in proper gear by setting a lever at the top left-hand cover to either "Addition and Multiplication" or "Subtraction and Division". The "results" figure wheel is thereby rotated anti-clockwise or clockwise respectively.

<u>Use</u>. Multiplying 2432 by 598 may be performed as follows: Lift the hinged plate, turn and release the two milled knobs to bring all the figure wheels to

show zero; lower the hinged plate in its position to the extreme left; set the number 2432 on the four slots on the fixed plate; set the lever on the left to "multiplication" and turn the handle eight times; lift the hinged plate, slide it one step to the right, and lower it into positon; turn the handle nine times; step the plate one point to the right again and turn the handle five times. The product 1,454,336 will then appear on the top row, and the multiplier 598 on the next row of figures.

"Arithmometer", Chevalier Charles Xavier Thomas de Colmar, ca 1850, 10x18x58 cm, Brass, (B3.76). *p*
"Tates Arithmometer", C & E Layton, 10x17x58 cm, Brass and Wood, (B82.80).

This machine, which is of the Thomas type, embodies the modifications patented in 1884 and 1903 by S. Tate, who in 1883 was the first in England to manufacture this type of calculating machine. His patents were later taken over by C. and E. Layton.

"BUNZEL", Thomas-type arithmometer, Bunzel Mfg, Vienna, ca 1910, Wood, Metal, (B143.81).

AUTOMATIC STEPPED WHEEL

MILLIONAIRE

The Millionaire was invented in 1893 by Otto Steiger and was the first direct multiplying calculator to be commercially successful. Between 1894 and 1935, 4,655 millionaires were sold.

Use. One turn of the crank automatically multiplies the accumulator by a single digit specified by a pointer in the upper left hand corner of the machine. The pointer is reset for each digit in

the multiplier until the computation is complete.
P
"<u>Millionaire</u>", EGLI & CO., 1903, 17x52x28 cm, Brass, 6 Digit, (B1.75).

"<u>Millionaire</u>", EGLI & CO., ca 1910, 18x29x76 cm, Brass 10 Digit, (B17.78).

"<u>Millionaire</u>", Hans W. Egli, 18x29x76 cm, Brass, 8 Digit, (B91.76).

"<u>Millionaire</u>", Hans W. Egli, ca 1920, Brass, Electrified 8 Digit Model, (B136.81).

"<u>Millionaire</u>" #272, HANS W. EGLI CO., ca 1900, Switzerland, 18x29x76 cm, wooden case, brass calculator, 8 digit, wooden stand, case, and calculator, (B161.81).

ROTARY

The German patent of W. T. Odhner, 1891, was acquired by Messrs. Grimme, Natalis & Co., and was embodied in a machine known as the "Brunsviga".

<u>Use</u>. Although the machine performs multiplication by repeated addition as in the Thomas type, the use of the Odhner wheel instead of the Leibniz toothed wheel led to a more compact design. The Odhner wheels fit very close together on the axle on the back. A setting lever, the end of which projects through a slot in the cylindrical portion of the cover plate, forms part of each wheel. If a lever is set against any figure (1 to 9) of its slot, a corresponding number of pins are made to project from its wheel. When the operating handle is turned, these pins gear with small toothed wheels of the product register, which in turn gear with the number wheels in front. The product register is mounted on a longitudinally movable carriage arranged in front of the machine, which carries a second counter for

registering the multiplier or the quotient. The handle is turned in a clockwise direction for addition and multiplication, and counter-clockwise for subtraction and division.

p

"Trinks-brunsviga" Trinks-brunsviga, ca 1940, 15x12x36 cm, (B80.80).

This example is a further adaptation of the Brunsviga and sits on a wood board that was part of a disappearing desk top.

"DE TE WE" Harmann Manus, Gift of Declan and Margrit Kennedy (D190.80).

"Original Odhner", Odhner, ca 1920, Grey, Metal, (B135.80).

"Curta" Contina Ag Mauren, 10d x 12 cm, Black, Metal, (B87.79).

The Curta is the ultimate example of the rotary mechanical calculator. Its small size requires better manufacturing technology than any other mechanical calculator. Model I had an 8 digit input setting, 6 digit counter, and 11 digit accumulator. Model II had an 11 digit setting, 8 digit counter, and 15 digit accumulator. Prior to the electronic calculator, the Curta was the only four-function portable calculator and as such was especially popular for use at car rallies.

CONTROL

CARD-CONTROLLED - LOOM

The origin of punched card program control can be traced to 18th century developments in the French silk weaving industry.

In 1725 Basile Bouchon, the son of an organ manufacturer, devised a perforated tape control for weaving ornamental patterns. Before then, draw looms were operated by two people, one to control the shuttle, and the other to control warp threads by means of cords. A row of perforations across a tape automatically selected the warp threads in Bouchon's loom, reducing the assistant's task to that of pressing the mechanism against a set of needles that sensed which holes had been punched.

In 1728 Falcon, a master silk weaver in Lyons, constructed a loom replacing the perforated tape with a row of connected punched cards. His loom used several rows of needles so that four hundred or more cords could be controlled. At Falcon's death in 1765, about forty of his looms were in operation.

In 1746, Jacques de Vaucanson, the celebrated inventor of automata, designed the first draw loom to function completely automatically. While this innovation was significant, the use of a perforated cylinder rather than a row of cards was retrogressive.

In 1804 Jacquard commercialized and improved de Vaucanson's fully automatic loom utilizing the punched cards of Falcon. Each card carried an individual pattern line. Mounted on a belt, the cards wound over a prism shaped like squared cylinder which revolved with a ratchet system. To extend a pattern, more cards were added, so that complex non-repetitive patterns could be created on the loom.

By the 1830s, thousands of examples of Jacquard looms were operating in France. It is then understandable that Charles Babbage in 1836 chose to use Jacquard mechanisms as program-control devices to direct the wheels and gears in his Analytical Engine.

P

"Jacquard Loom Mechanism", ca 1805, 16x36x40 cm, Wood, Brass, and Steel, Paper Cards Added by Peter Delehar, (B117.80).

A rare and important contemporary model of the first loom device invented by J. M. Jacquard (1752-1834) for use in the French silk weaving industry. The loom was automatic. Patterns in fabric were generated by programmed punched cards.

TRANSDUCTION

COPIER

"The Edison Mimeograph No. 1", A.B. Dick, ca 1900, 13x33x43 cm, Wood Case and Frames, (B78.80).

TYPEWRITER

The typewriter evolution belongs within the taxonomy as these machines were adapted to become I/O devices.

The first patent for a "writing machine" was granted to Henry Mill in 1714. (Science Museum 78) Starting in 1829 a number of Americans produced a variety of writing machines. The first commercially successful machine was manufactured by E Remington and Sons in 1874, based on the invention of Christopher L. Sholes.

The Type Writer was not quickly adopted, and its name did not suggest its labor-saving virtues. The salesmen finally struck descriptive paydirt through the simile: "The Type Writer is to the pen what the sewing machine is to the needle" (Sutherland, 1981). The four-row Type Writer keyboard, with the most commonly used letters emplaced for the left hand -- just as it remains --, was present on the Remington built Sholes Type Writer. The machine that went on sale in 1874, was finished in gleaming black, embossed with hand-stenciled flowers and portraits of ladies, equipped with a sewing-machine-style table, with foot treadle for cariage return and line spacing. Since the printing was done on the bottom of the cylinder instead of the front, the typist who wished to inspect writing-in-progress was forced to raise the carriage on its hinges for a look. In 1878, the "Perfected Type Writer No. 2" was a simpler, functional machine. By 1881, the typewriter proved a commercial success and the Remingtons hired a small team to build a sales force. Then in 1886, when difficulties in the gun business as well as other activities brought the Remington Arms Company into banckruptcy, the men who had developed the typewriter sales organization set up a new firm, Remington Typewriter Company. A number of rivals appeared, but only the Underwood Company and the Wagner Typewriter Company, which built similar sales organizations succeeded in becoming major competitors. (Chandler, 1977). According to Alfred D. Chandler, Jr.,

> "The Remington experience underlines in a dramatic fashion the necessity of creating an extensive marketing organization to sell a new office machine in volume. ... As the experience of all the new mass-produced machinery companies emphasizes, they could sell in volume only if they created a massive, multiunit marketing organization. all their products were new, all were relatively complicated to operate and maintain, and all relatively costly. No existing marketer knew the product as well as the manufacturer. None had the facilities to provide after-sales service and repair. Few were willing to take the risk of selling on installment, a marketing device which these machinery makers had to invent. Nor were outsiders abole to maintain close control over collections, essential to assure a continued cash flow on which the financial health of the enterprise rested. Finally by using uniform slaes techniques, bringing together regularly members of a nation-wide sales force, and comparing the activities and performances of the many different sales offices, the single, centrally controlled sales department was able to develop more effective marketing techniques. It was also able to obtain a constant flow of information on the changing shifts in demands and customer requirments. ... The economies of speed and scale, and their national, often global, marketing organizations gave the pioneering firms an impressive competitive advantage and so made it easy for them to continue to dominate their industries" (Chandler, 1977, pp 308-9).

The typewriter stayed remarkably stable in design through the first half of the twentieth century. New ideas, such as the daisy wheel, that were to become part of the electro-mechanical typewriter associated with computers, were only tried out as toys in this era. The large corporations, listening to their customers (who were essentially conservative -- not innovative) saw no reason for any kind of retooling or rethinking. Thus, in the mechanical generation one sees percursors of the typewriters of the seventies and eighties built as not-very-well-engineered toys.

P
"Bennett", 27x12x4 cm, Black with Yellow Letters, Metal, (B142.81).

Very compact with three positions for the keys and a wheel device. Small sized ribbon and removable carriage.

"Bing No. 2" Bing, ca 1930, 15x28x38 cm, 1926 patent pending, (B43.80).

"Corona No. 3", Corona, ca 1920, 23x25x12 cm, Black, Metal, Carriage folds up over Keyboard, (B63.80).

"CORONA FOUR", Corona Typewriter Co., Inc. Groton, NY, ca 1920, 26x31x11 cm, Black, (B154.81).

"Dial Typewriter", MARX, ca 1950, 15x15x30 cm, (B75.80).

"Favorit 2" Adler, ca 1940, 36x28x11 cm, Black, German Keyboard, (B67.80).

"Featherweight Blickensderfer", Blickensderfer, ca 1900, 25x30x13 cm, Aluminum, 501 Special Stamped on Base, (B116.80).

The "Blick" was the first typewriter intented to be readily portable. It was designed by Georges Blickensderfer and patented in 1890 and first sold in 1893.

Use. Each key had three positions, upper and lower case and a figure that positioned three levels of the printing wheel.

"Junior Typewriter", MARX 28x13x18 cm, Gray and Blue, Tin, Bent & Rusty, (B101.80).

"Molle No. 3", Molle Typewriter Co., 25x28x33 cm, Black, Metal, (B65.80).

"NOISELESS TYPEWRITER", The Noiseless Typewriter Co., ca 1915, 30x30x30 cm, Black, Metal, Text typed on the machine. Loaned by Ed Luwish (X5.80).

"The New Simplex Typewriter No. 1", Simplex Typewriter Company, ca 1920, USA, 22x12x6 cm, red, yellow, and black, wooden base with metal, cardboard case and typewriter, (B165.81).

The simplex is a small, inexpensive, home typewriter that only holds paper less than seven inches wide. U.S. patent numbers 1138427, 1204912, 1521408, 1865288, 1869426, and 1957373.

Use: From the Directions for Operating in the case: "First: Hold the machine with rack side toward you. Push carriage to the left to starting point. When doing this see that dog does not catch in rack. Insert paper between rollers from the front. Put finger on key of letter desired and swing it into notch in rim of typecase near the dog: Press downward to print. To make a space without prining, press down on any key near to but not in the notch. To ink apply only a drop of ink to each pad with the end of a matchstick or toothpick. Be careful not to bend the pads down so far as to prevent them from springing back into position. Use only Simplex Ink which will be supplied at 10 cents per tube, cheap ink destroys the face of the type. Do not oil. If keyplate sticks take a rag moistened with vaseline and hold against underside of keys at the notch and twirl type plate around a few times. If the carriage does not move forward freely, apply a little vaseline to the carriageway where it rubs. Caution! Keep oil or vaseline away from rubber type and ink pads. Oil will swell and destroy the letters."

"Simplex Portable Typewriter Special Demonstrated Model S" Typewriter , Simlex Typewriter Co., Inc., ca 1930, USA, 24x8x16 cm, Green and red, Metal, (B166.81).

"Underwood Typewriter No. 5", Underwood, 22x30x30 cm, (B15.76).

DMCAT1.4

October 4, 1979

David Fisher
DOD C.S. Research
OUSDRE
3D 1079 Pentagon
Washington, DC 20301

Dear Mr. Fisher:

This is to confirm your meeting with Gordon Bell on October 26, 1:00 p.m., here in Maynard.

Enclosed is a map showing you how to get here and where to park. We are looking forward to seeing you.

Sincerely,

Mary Jane Forbes
Secretary to Gordon Bell

GB:swh
GB0004/66
Enclosure

FROM: GORDON BELL DATE: TUE 5 FEB 1980 12:53 PM EST
DEPT: OOD
EXT: 223-2236
TO: LARRY PORTNER
DICK CLAYTON
ULF FAGERQUIST
GRANT SAVIERS
BILL JOHNSON
BILL DEMMER
SI LYLE

SUBJECT: MEETING OUR COMMITMENTS

From: Larry Portner, and Gordon Bell

Last Date: 1/18/80
Revised Date: 1/30/80

Our current performance versus our plan has reached an all-time low; while there are many reasons, including how the commitments themselves are established, this conclusion is unmistakable!

Are the root problems:

omanagement attention at the top levels of the organization?

oproject management expertise at the middle management level?

o review procedures at the organizational level?

oviable planning processes for ascertaining our ability to perform before the commitments are established?

o doing state-of-the-art work with an inadequate technology or understanding base?

The solution to most of these problems must reside within each organization. It is inconceivable that the Office of Central Engineering (OCE) can solve these problems, we belive establishing real accountability at all levels of the engineering organization is the only way.

We must begin to measure Engineering Management against their plans! This would not be the only metric; we still expect quality, innovation, and the appropriate degree of risk, but a significantly greater proportion of our development activities must produce the promised capability, product cost and quality **on schedule**. The December 17 management system package is a start in this direction.

At our next dinner meeting (February 12) can we discuss the details on how to deal with our schedule performance and resulting loss in credibility?

GB:swh
GB1.S1.44

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+---------------------------+                      GB0004/61
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| d | i | g | i | t | a | l |  i n t e r o f f i c e   m e m o r
a n d u m
|   |   |   |   |   |   |   |
+---------------------------+
```

Subject: **Meeting with Ken: Our Philosophy, Keeping People, Charters (and Diletantes)**

To: OOD

CC: Ken Olsen, ML10-2/A50
Shel Davis, PK3-1/C21

Date: 9/25/79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

Follow-up: 11/1/79

Our Philosophy

I think we ought to go through the exercise of trying to write up, on a page what it is we have that's unique. Bruce really frightens me because either: he doesn't understand that all engineering processes pretty much look alike and only differ by the environment which encourages drive, motivation, brightness, ability to communicate and perform better; or we are totally average, and have only a few significant products by having at least a good enough environment to permit a few great people to build an occasional great product, otherwise everything is average. In any case, I would like to get your input and then write down a draft of the DEC Engineering Philosophy.

On Losing People

Let's also write down our thoughts on keeping some of the critical people we have now. Let's do a case-by-case post mortem (so to speak) and build a model including: Kevill, Gourd, Hughes, etc. Anything we do philosophically or organizationally or in human resources planning should address whether these people might have stayed or not.

Charters and Diletantes

As we address the charters, it occurs to me that we might just have a problem because of some of our openness: namely, we encourage testing and review of all sorts of things, including R and D, new busses, etc. What happens is that some of the doers are often tempted to do what all the reviewers want, and only the really skillful developers know when to say no.

Another factor which I especially understand is being able to be a diletante, go to everyone's review and work on every project (except my own). Given the organization where all of OOD has clear charters, plans, and is busily executing the plans, I believe there are only two diletantes (Larry and I and possibly some people in the TD and Research Groups), and I really worry that many of our project workers are not able to say no to requests to be on every possible review or new project (especially in the definition phase). On several recent occasions, I know I've seen people that should be at home, rather than being in what amount to be peripheral reviews. Hopefully only a few people are doing this, but it's an easy trap because we have an incredible number of really interesting projects going on.

September 29, 1978

Louise Melton
Advertising and Promotional Services
69 Eaton Road
Framingham, Mass. 01701

Dear Louise:

Enclosed are copies of the publications Gordon referred to.

I understand you already have a copy of the Engineering Orientation Manual. As this is "Company Confidential" material, please return it when you are finished.

Thank you,

Mary Jane Forbes

```
+---------------------------+                         <>
|   |   |   |   |   |   |   |
| d | i | g | i | t | a | l |          i n t e r o f f i c e
|   |   |   |   |   |   |   |            m e m o r a n d u m
+---------------------------+
```

SUBJ: <>

TO: <>

Date: <>
From: Gordon Bell
Dept: OOD
MS: ML12-1/A51 Ext: 223-2236
EMS: @CORE

Digital **Interoffice Memo**

Subject: **Clarifying Responsibility (Drive?) for Memory Hierarchies**

To: OOD
Jim Bell
Bill Demmer
Mike Gutman
Bob Peyton
Grant Saviers
Bill Strecker
Mike Tomasic
Steve Teicher

Date: 5 OCT 76
From: Gordon Bell
Dept: OOD
Loc.: ML12-1
Ext.: 2236

The Stratton Mountain meeting presented the dilemma of who's in charge of memory hierarchies.

Those not directly responsible: R&D (although they can be asked, coerce, comment), any task force, any committee, any planning group, and me (except ultimately).

Fundamentally, providing the hardware hierarchy is the responsibility of Dick Clayton generally and the system managers or hardware system managers.

1. VAX - Bill Demmer
2. LSI-11/Krypton - Steve Teicher
3. 11/34-11/70? - Dick Clayton?, Mike Tomasic

4. System 10/20 - Ulf

If the task proves to be as simple as attaching to/or being a part of:

1. Primary memory - Mike Gutman
2. Secondary memory - Grant Saviers
3. Tertiary memory - Bob Peyton

Then, they are responsible. It's clear Mike Gutman is responsbile for availability of semiconductor or magnetic bubbles. For a simple software solution with "CCD disks", then Mike, Larry and Dick are on the hook.

Jim Bell and Mike Gutman were to get with Dick to get us started here.

Although this memo is awful specific, I don't mean to be that careful or let anyone shirk their responsibility.

GB:ljp

Digital **Interoffice Memo**

Subject: **Memory Hierarchy Costs**

To: Distribution

Date: 4 OCT 76

From: Gordon Bell

Dept: OOD

Loc.: ML12-1

Ext.: 2236

F/U 10/12

The application of CCD (and possibly bubbles) depends on the certainty of the price relationship between main memory (e.g., MOS) and CCD's.

Dean Toombe at TI promised me this, also I talked with Gelback (Intel) and Tom Longo (Fairchild) about this, and they agreed.

Can we "collect" on these promises now to get memory hierarchy design going?

GB:ljp

Distribution

Dick Clayton
Al Erny
Mike Gutman
Henry Lemaire
Bill Strecker
Brian Croxon
Bill Green
Dave Hamel
Grant Saviers

+---------------+
! d i g i t a l !   i n t e r o f f i c e   m e m o r a n d u m
+---------------+

Subject: **Memory Price Decline and Multi-Processors and/or Multi Computers to Maintain System Revenue in the 1980's**

To: Marketing Committee, OOD,
George Beason, Roger Cady,
Patrick Courtin, Sam Fuller,
John Leng, Jim Marshall,
Jack Shields, Bill Strecker,
Mike Tomasic, Pete vanRoekens

Date: 10 MAY 78
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

follow up 5/24/78

The crude, but accurate, price erosion model I've been using since 1975 is simply driven by main memory cost and price.

It is:

System price ($) per byte of main memory

$$= 3 \times 5 \times 8 \times .005 \times .79^{t-1972} \times \text{no. of bytes}$$

$$= .6 \times .79^{t-1972} \times \text{no. of bytes}$$

<u>where</u>

3 is markup (roughly)
5 is fact that about 1/5 of system is primary memory
8 is 8 bits/byte
.005 is cost of a bit in 1972
.79 is 21% price decline per year for memory
1972 is base year

Some system prices at various times using the model:

Bytes	1978	1980	1982
1	.146	.091	.057
8K	1.2K	745	467
65K (Qbus limit)	9.6K	5.96K	3.7K
256K (Ubus limit)	28.3K	23.9K	14.9K
1M	153K	95.4K	59.8K
2M (11/74 bus limit)	306K	190.8K	119.5K
8M	1,225K	763K	478K

Some concerns:

1. How do we get enough applications for the larger systems our salesmen are selling? [Note the system price we sell has been increasing -- maybe because of the salespeople we hire.]

2. Can we/should we provide cost-effective enough processors to balance these larger memories? [Note, Gene Amdahl has maintained that 1 inst/sec. requires 1 byte of primary memory.]

3. Can we think of selling systems down in the $10K and below range? [Note in 1982 a 256 Kbyte system will only sell for $14.9K, whereas a 65 Kbyte system will sell for $3.7K!]

4. Will the more expensive multiprocessor and multicomputer systems help the revenue/sales problem while providing much greater RAM and expandability that we can sell? [Note that a duplex computer costs only slightly more than twice the above machines.] [Note, isn't this what IBM is up to in providing multiprocessors?]

With the next version of M+ being oriented to the 11/74 mP, I believe our subsequent 11 hardware in the Unibus area should also support them. This design in the 11 area should be as easy as adding additional memory. I'd hope that new processors can use the 11/74 multiport memory -- this also gets the mips up in line with the memory size.

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Jim Bell	ML3-2/E41	Dick Clayton	ML12-2/E71
Jim Cudmore	ML1-4/E30	Bill Demmer	TW/D19
Ulf Fagerquist	MR1-2/E78	Win Hindle	ML5-2/A53
Ted Johnson	PK3-2/A55	John Kevill	ML1-3/E58
Andy Knowles	MR2-2/A52	Julius Marcus	MK2/C37
John Meyer	ML12-1/A11	Stan Olsen	MK
Larry Portner	ML12-3/A62	Bob Puffer	ML12-2/E38
Bill Thompson	ML12-1/F41		
George Beason	ML5-2/E93	Roger Cady	MK
Patrick Courtin	MK	Sam Fuller	TW/A08
John Leng	MR1-1/A65	Jim Marshall	TW/A03
Jack Shields	PK3-2/A58	Bill Strecker	ML3-2/E41
Mike Tomasic	ML12-2/E71	Pete vanRoekens	ML12-2/E71

+---------------+
! d i g i t a l ! i n t e r o f f i c e m e m o r a n d u m
+---------------+

Subject: **Memory Price Disparity on 20 and VAX**

To: Bill Demmer, John Leng, Jack Shields

CC: Marketing Committee,

Date: 10 MAY 78
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

Ulf Fagerquist

I just talked with Jack McCredie at CMU and he was considering an upgrade on a 2040 to get to a 2060 as the cheapest way to get performance.

He asked whether he should switch to VAX given:

2060	175K	2.3 Mbytes
VAX	88K	2 Mbytes

The service is also twice as expensive on the 2060.

He's confused given a comment by John Leng that our memories are corporate wide.

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Win Hindle	ML5-2/A53	Ted Johnson	PK3-2/A55
Andy Knowles	MR2-2/A52	Stan Olsen	MK
Bill Thompson	ML12-1/F41		
Bill Demmer	TW/A08	Ulf Fagerquist	MR1-2/E78
John Leng	MR1-1/A65	Jack Shields	PK3-2/A58

MEMORY SALES

$1160M

!

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                              !
                                                                     !
          DISK                !
                                                                     !
          78%                 !
                                                                     !
                              !
                                                                     !
                              !
                                                                     !
                              !
                                                                     !
                              !
                                               $730M                 !
                              !
                                                                     !
                              !
                                          -----------------          !
                              !
                                          !              !           !
                              !
                                          !              !           !
                              !
                                          !              !           !
                              !
                                          !              !           !
                              !
                                          !              !           !
                              !
                                          !     DISK     !           !
                              !
                                          !      57%     !           !
                              !
                                          !              !           !
                              !
                                          !              !           !
                              !
                                          !              !           !
                              !
                                          !              !           !
                              !
               $300M                      !              !           !
                              !
                                          !              !           !
                              !
```

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----------------  !           !             !           !
!                 !           !             !           !
                  !
!    DISK         !           !             !           !
                  !
!     30%         !           !             !           !-------
--------!
!---------------!  !---------------!        !  TAPE    7%
                  !
!  TAPE     18%   !           !  TAPE    10%!           !
                  !
!---------------!  !           !            !---------------!
!                 !           !---------------!         ! MEMORY
15%               !
!  MEMORY   52%   !           !             !           !
                  !
!                 !           !  MEMORY  33%!           !
                  !
!                 !           !             !           !
                  !
!                 !           !             !           !
                  !
----------------  ----------------        ----------------
    FY74                          FY79
FY84
```

This is neat. Your last one was a whopper though. Other groups might try it (e.g. Term/PC, Computer Systems, Comm./nets; PPPI, Semis/micros, Software) if it can be tuned to save us time. We are inundated in news now and this can help (e.g. I read or scan about 40 journals, magazines, per month).

How about trying to make it better? How about producing an abstract or digest of the news, getting it down to six pages maximum?

Put one paragraph or sentence/article. Put any tables in that are relevant that have data. Arrange them into priority order or keyed somehow. Make the full article available via EMS request.

```
****************
* d i g i t a l *
****************
```

TO: see "TO" DISTRIBUTION DATE: MON 13 OCT 1980
6:46 PM EDT

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION DEPT: OOD

EXT: 223-2236

LOC/MAIL STOP: ML12-1/A51

SUBJECT: RE: MERCURY

I have been the advocate of getting Hg off the CI, without any success. Tonite, it was clear why it is a very interim step:

We must have NI on the high performance machines (i.e Venus, 780, the 2080), simply because there is no way to transfer data at high speeds between the next level machines such as Comet or 780 or personal VAX's or other machines that have files by going through mercury, because it will be a fundamental
bandwidth limiter.   In the past, my arguments have centered on distributing the Comm. around the building and the fact that the NI is where we want our ultimate Comm, and hence doing Hg on CI is just an interim thing.

Now, I can prove that what we are doing is interim, cause we must do NI on all machines.   So, given that we as usual assume we have infinite resources, and besides we have little
confiidence in our ability to do the job in a straightforward fashion, but instead have to do a lot of incremental jobs which we will forever have to support, then it is clear
DO THE WRONG THING, get Hg on CI if you think you can and then let's do it right the next time around.

Good luck.

PS
Any idea where we get all the bucks for the interim projects?
Any idea when we get to the long term?

Any idea who's going to do the A/D so that we can get the right product?
...
Gordon

"TO" DISTRIBUTION:

JOE CARCHIDI SAM FULLER GEORGE PLOWMAN

"CC" DISTRIBUTION:

JIM BARBOUR BILL DEMMER JOHN GILBERT
ALAN KOTOK BERNIE LACROUTE TOMAS LOFGREN
STAN PEARSON LARRY PORTNER DAVE RODGERS

GB1.S7.49

EMS 2-APR-79 09:44:17 260 1
To: John McNamara
CC: Sam Fuller, Bill Johnson, Wayne Rosing, Peter van Roekens
From: Gordon Bell
Date: MON 2-APR-79 09:44:17 EDT
Subject: Mercury + Multidrop

Also to: Bob Savell (not on EMS)

Reference your memo on Mercury Design Review Meeting, 3/21/79.

I don't want any more unit record equipment on anything BUT multidrop.

What about IPG Bus support? Cost?

Command:
****
* d i g i t a l *
****

TO: JOHN MCNAMARA DATE: SUN 6 JUL 1980
6:00 PM EDT

FROM: GORDON BELL
cc: see "CC" DISTRIBUTION DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: RE: MERCURY ON NI

I think we could get Terry to help or I suspect Mickey Smith knows. I know that an 11/34 will front end a 10/20, and that the aggragate data rate (average) is very low, and I suspect the peak is too, given the response time of the Operating System. The input case where there are only a few characters,
where NI is bad (20 bytes of overhead) doesn't bother me, and on output, I can't see it being a limit. Say that we all could
use 2400 baud lines (I can't tell the difference between 1200 and 2400 because I can't drive the system that fast). This would mean that NI would support 4000 terminals at 2400 baud. A VAX supports 25-100, a 10/20 30-200, hence, I see no problem
at all in NI being easily able to handle say 50 or so VAX 780's
or 10/20's. The bottleneck looks like the system (ie just handling the load that a terminal implies), and the next bottleneck might be Mg (how many bits/second do you think it will deliver?). I don't see NI as being anywhere near the limiting bottleneck. This also co-incides with the Xerox observation that the peak rates observed on their 3 mbit Ethernets are somewhere around 300k, even with several hundred
nodes including some concentrators I believe.

NI isn't the limit that I can see at all. This will make the common front end to all the systems that the 10/20, DECnet, and
VMS and Hydra groups have commited to. So let's go ahead with
it.

"CC" DISTRIBUTION:

BRESLIN VIA PEARSON   JOE CARCHIDI   JOHN GILBERT
TOMAS LOFGREN   STAN PEARSON   DAVE RODGERS

GB1.S5.48

EMS   15-FEB-79 11:21:08 520 1
To: Gordon Bell
From: John McNamara
Date: THU 15-FEB-79 11:21:08 EDT
Subject: Mercury Communications Subsystem

Thank you for your recent comments on this. Here are some answers to your
questions.With regard to 64Kb, YES, we would like to provide 32K or 64K bytes
at FCS with capability to replace the 16K chips with 64K chips when they
become available and thus expand to 128K or 256K bytes. The DECSYSTEM-20
people want this for COMNETS software and George Plowman would like it for a
general purpose network node. With regard to DEC dataway , we have been
talking with John Holz and he is interested in building a line card for DEC
dataway and programming the microcontroller (11ISP) appropriately. If we have
any problem there, it's that they are too anxious to use Mercury!(i.e. they

want it before FCS). Withe rega rd to PUSART, YES, but... For present design
purposes we are using a UART and a USRT to give us an async/sync line card,
but as soon as PUSART is available, we intend to use it to save space and $.
At present, it looks like that will be around FCS, however, so we will start
with the UART/ USRT combination. The modularity of the Mercury design is such
that we would o only have to redesign a double board (5x7) to do that, so that
is not a problem. Frankly, since weintend to use FONZs, Tinys, and other
"not-quite- here-yet products", I'd just as soon wait on PUSART to keep the
number of unknowns in this project under control. With regard to multiple
Mercuries on one ICCS, YES, definitely. For cost goals, we would like to keep
the cost to $100 per line so that we are in the DZ11 with KMC11 area, offering
better packaging, performance, RAMP, etc. for the same price. With regard to
ICCS power cost, etc, YES, we see that as a possible problem and are pursuing
two avenues. 1) the lastest ICCS thought is "make it cheaper" and 2) we are
looking at methods of connecting the Mercury directly to low end COMETs and
Nebulas , particularly Nebulas, without ICCS level of in erconnect.

Again, thanks for your interest and let me know if you have any other question
----
Command:

EMS 5-MAR-79 19:04:19 000 1
To: Wayne Rosing, John McNamara, Sam Fuller, William Strecker

To: George Plowman
CC: Bill Demmer, Peter van Roekens, William Strecker, Bill Johnson
CC: Chuck Stein, George Plowman, Mary Jane Forbes
From: Gordon Bell
Date: MON 5-MAR-79 19:04:19 EDT
Subject: Mercury and the Interconnect (Wayne's Status Report)

Pete, give a copy to John Gilbert too.

I'm glad the review of Mercury went well. It feels we really need it!

Is it possible that Mercury should be connected by the Local Area Network
Interface instead of ICCS? This would be a lot cheaper, possibly it would
not handle the data rate, but it could be much more remotable? Note if this
interface is used...it would presumable alread exist as a connection to
other computers, and hence maybe woudn't be needed as a special one. This
would eliminate one expensive piece of hardware on minimal systems.

John, why not make an interface that has like 8 intrfaces to it and uses a
single board...even though it would use several slot spaces in mercury? It
seems like we always have this option.

I'm concerned about the mercury software. Can I urge you in HYdra to go
after Doug McClure who's now working on MInnow and who did the ANF10, and
which by all accounts is about 3 years ahead of DECnet in terms of capability.
He shuld be working in DECnet, probably but couldn't get along with the former
head of programming there (who's since left)..

As a seperate issue, I'm too distressed that the Merimack hardware folks
don't attend the important interconnect meetings. This is indicative of the
whole interconnect area...which is going to take a lot of much tigher
management with some required participation and results and not a lose,
federated, research project with no schedule, etc. and no clear resposnsibility for hardware, software etc..

Command:
The Research Assistant reports to the Exhibit Coordinator and the Programs Coordinator.

Exhibits Area

A. The assistant aids with cataloging new pieces for the museu. See accessioning   for more procedural details.

1. catalogs each new piece on B list (=Bell), D list (=DEC) or X list (=from other sources) recording relevant information as name, manufacturer, donor, etc.

2. send acknowledgment letter (form letter on Jamie P. floppy)

3. send contract for donation or loan (form on Jamie P floppy)

4. send thank you (form on same)

B. Work on potential acquisitions

1. Follow up by phone, letter if word of potential new piece is received

2. Get more information, pictures, history if possible

Other Areas of Assistance

A. Tours
1. conduct tours
2. compile tour information for future use

B. Store
1. work in store when needed
2. prepare slide collections for future sale

C. Special Projects

For example, researching names of famous mathematicians and others for Spitbrook Conference Rooms naming

Floppies used:

Meredith: slide collection and list of people/addresses who requested information on slides, and date of response

Store: list of all books in store, flea market items, posters, etc.

Jamie P: correspondence, form letters for accessioning

B list: collection pieces loaned from Bells

D list: collection pieces from Digital

X list: collection pieces from other sources

10/20

MESSAGE

THE GENERAL PURPOSE (MAINFRAME) TIMESHARING MACHINE DECSYSTEM 10 INTRODUCED

TIMESHARING; DECSYSTEM 20 IS EVEN BETTER AND MORE USER ORIENTED.

MARKET

MAINFRAME GENERALITY THROUGH THE LANGUAGES AND APPLICATIONS THAT HAVE

EVOLVED OVER ITS 15 YEAR LIFE. TIMESHARING. SPECIFIC SOFTWARE THAT

IT HAS (E.G., MULTI-TERMINAL APL).

BASIC HARDWARE STRATEGY

. SUPPORT EXISTING CUSTOMER BASE WITH BETTER PERFORMANCE AT LESS

COST (BETTER FIELD INTEGRATION) AND MORE RELIABILITY

. IF 2020 SUCCEEDS, BUILD A BIGGER BASE AT ITS PRICE LEVEL

. DON'T ENTER LOWER COST, NEW PDP-11 COMPETITIVE MARKET

BASE OPERATING SYSTEM

. NO O/S ENHANCEMENTS, ONLY IMPROVED PERFORMANCE, RELIABILITY AND

INTERCONNECTIVITY IMPROVEMENTS

. PROGRAMMING IN DEC COMPATIBLE LANGUAGES

COMMERCIAL LANGUAGES/APPLICATIONS

. USE AS GENERAL PURPOSE MAINFRAME

. COBOL WOULD BE 11 COMPATIBLE

.   ENCOURAGE APPLICATIONS (E.G., BUSINESS ANALYSIS) THEN MARKET

<u>TECHNICAL LANGUAGES/APPLICATIONS</u>

.   SELL. DON'T ENHANCE

.   ENCOURAGE APPLICATIONS (E.G., MILITARY COMMAND AND CONTROL);

THEN MARKET

<date>12/24/80
<name>WHEN YOU ARE EMS'ING DAVE BROWN, WHO DO YOU THINK YOU ARE GETTING? WHO DO YOU WANT?
<tel#>
<subj>
<arc>D
<priority><u>ACTION--ASAP</u>
<reply>DAVID BROWN, DOING FCC STUFF FOR HOLMAN
<>

<date>12/29/80
<name>JANET STRAZZULLA
<tel#>264-5429
<subj>JULIUS IS BRING IN BOB DOYLE, INVENTOR OF THE MICRO TERMINAL, SOMETIME IN THE NEXT FEW WEEKS. DOYLE IS LOOKING FOR VENTURE CAPITAL OF ABOUT $1M. JANET SENT YOU SOME INFO AROUND DEC 5 ON THIS TERMINAL INCLUDING DOYLE ADDRESS. THE MANUAL IS COMING.
<arc>Y
<priority><u>FYI</u>
<reply>COPY OF MANUAL PLEASE
<>

<date>12/24/80
<name>SCHWARTZ
<tel#>
<subj>EMS--WHO IS RESPNSIBLE FOR RUNNING WHAT DOYLE IS DOING AND GOING TO DO IN THIS CANADIAN VENTURE?
<arc>D
<priority>ACTION--ASAP
<reply>HASN'T WORKED ANYTHING WITH US YET, BUT IF HE DOES WITH DEMMER
<>

<date>12/24/80
<name>ED SALINAS
<tel#>405-947-0938
<subj>WANTS TO TALK WITH SOMEONE RE ELECTRO MAGNETIC CONTROL CIRCUIT DESIGN. THEY ARE ESTABLISHING A NEW AREA... (OKLA ENG. SOCIETY).
<arc>D
<priority>ACTION--ASAP
<reply>CALL FCC, WASH,DC--THEN FOUND THEY WERE RECRUITERS
<>

<date>12/19/80
<name>Glenn Reyer--decided to take the position with Stewart. Thanks for your help.
<tel#>
<subj>
<arc>D
<priority>FYI
<reply>
<>

<date>12/19/80
<name>Prof. Ballantyne
<tel#>607-256-4109
<subj>Cornell--wants to ask Sam Fuller to be part of the Visiting Committee in Engineering. Would entail 1 meeting/year.
<arc>Y
<priority>ACTION--WHEN POSSIBLE
<reply>OK HERE TO EXTEND THE INVITATION

<>

<date>12/19/80
<name>Lee Williams will be able to attend the WPI meeting afterall.
<tel#>
<subj>
<arc>D
<priority>FYI
<reply>
<>

<date>
<name>
<tel#>
<subj>
<arc>Y D
<priority>ACTION--ASAP ACTION--WHEN POSSIBLE FYI
<reply>
<>

<date>12/16/80
<name>ENG COMMITTE ON 1/15 AND POOR ATTENDANCE--AS OF NOW YOU ARE SCHED FOR AN OC WOODS. WILL KEEP IN TICKLER JUST IN CASE.
<tel#>
<subj>
<arc>D
<priority>FYI
<reply>
<>

<date>12/15/80
<name>HENRY CROUSE
<tel#>3-2610
<subj>
<arc>D
<priority>ACTION--ASAP

<reply>
<>

<date>12/15/80
<name>BILL THOMPSON
<tel#>3-3779
<subj>
<arc>D
<priority>ACTION--ASAP
<reply>
<>

<date>12/15/80
<name>OC MEETING 12/22--YOU AND LARRY BOTH AWAY. WANT ANYONE ELSE TO COVER? I'LL HAVE AN AGENDA BY THURSDAY.
<tel#>
<subj>
<arc>D
<priority>ACTION--ASAP
<reply>
<>

<date>12/15/80
<name>G--PLEASE READ/FILE/DELETE OUT OF YOUR EMS MAILBOXES BY FRIDAY SO I CAN SORT YOUR MAIL WHILE YOU ARE AWAY: SHORT-MAILBOX, FYI-MAILBOX; ALSO TECH-MAILBOX AND GEN-MAILBOX IF YOU CAN.
<tel#>
<subj>
<priority>FYI
<arc>D
<reply>
<>

<date>12/15/80
<name>BOB ELDER WILL BRING INFO GWEN ASKED FOR WHEN HE MEETS AT YOUR HOUSE TOMORROW MORNING.
<tel#>
<subj>

<arc>D
<priority>FYI
<reply>
<>

<date>12/15/80
<name>RIGGLE
<tel#>
<subj>YOU WILL BE RECEIVING A CAR RE THE FACILITY UPGRADE THIN FILM HEADS. WE HAVE HIT A SNAFU IN THE PROGRAM. THE VENDOR/CONTRACT WAS SELECTED AT $40K PREDICATED ON PLANT ENGINEERING DOING PART. PE IS NOT GETTING IT DONE SO WE LOST THE CONTRACT AND LOST THE TIMING. WE NOW HAVE ANOTHER CONTRACT + MATERIAL TO FINISH THE WORK--SHOULD COME IN UNDER $125K.
<priority>FYI
<arc>D
<reply>
<>

<date>12/10/80
<name>ROGER REYNOLDS, U OF CAL
<tel#>714-755-8815
<subj>RE HIS REQUEST TO THE CONTRIBUTION COMMITTEE. WANTED FURTHER CLARIFICATION AND I PUT HIM IN TOUCH WITH MARY ANN BUREK (3-4277) WHO CORRESPONDED WITH HIM THAT WE COULD NOT HELP IN HIS REQUEST.
<priority>FYI
<reply>
<>

<date>12/10/80
<name>WIN HODGE
<tel#>714-998-0607
<subj>BUILDING A SET OF CONTROLLER CARDS THAT CONVERT A COMPUTER INTO A PABX. WOULD LIKE TO TALK TO YOU ABOUT IT. THE SWITCH SET IS LIKE A CONTROLLER BUT COMPUTER CAN DO OTHER THINGS AS WELL. HAVE DESIGNED THS FOR ONE COMPUTER BUS AND THEY COULD DO IT FOR THE PDP-11
<priority>ACTION--WHEN POSSIBLE

<reply>
<>

<date>12/10/80
<name>BILL AVERY (JEAN)
<tel#>231-6956
<subj>RE A MICROELECTRONICS PROPOSAL THAT WAS SENT TO YOU. BILL IS LOOKING FOR COMMENTS--DO YOU HAVE ANY COMMENTS?
<priority>ACTION--WHEN POSSIBLE
<arc>D
<reply>
<>

<date>12/9/80
<name>ANDY KNOWLES, SEC. SHARON
<tel#>231-6313
<subj>A MEETING WITH ED CRANCH, PRES OF WPI, TO TALK ABOUT ENGINEERING INTERFACE--TEACHING HELP; WHERE COMPUTER SCIENCE AND ELECTRICAL ENGINEERING ARE GOING; WANTS TO COMMUNICATE SOME OF THEIR PROGRAMS PLUS CONCERNS; LARGE 10 CUSTOMER. AK WOULD LIKE TO KNOW WHO YOU THINK SHOULD BE THERE?
<priority>ACTION--ASAP
<arc>D
<reply>
<>

<date>12/9/80
<name>MR. MARK MCDONOUGH
<tel#>367-9200
<subj>POSTIONS, INC: HAS A CANDIDATE, SENIOR DESIGNER -- MASTERLESS AND CONTENTIONLESS COMMUNICATIONS ARCHITECTURE. WORKED FOR DG, TOOK OFF 6 MONTHS AGO AND DECIDED HE NEEDS A BIG COMPANY TO MARKET HIS IDEAS.
<priority>ACTION--ASAP
<reply>
<>

<date>12/9/80

<name>AVRAM--WILL SEE YOU 9:15 ON THURSDAY TO BRING YOU IN SYNC ON THE GALACTIC ARCHITECTURE REVIEW MEETING AND TO REVIEW KEY ISSUES ON THE PRODUCT.
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<subj>
<priority><u>FYI</u>
<arc>D
<reply>
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<date>12/8/80
<name>GUESS WHAT--IT IS CHRISTMAS CARD TIME AGAIN!!
<tel#>
<subj>
<priority><u>ACTION--WHEN POSSIBLE</u>
<arc>D
<reply>
<>

<date>12/8/80
<name>CHRISTY
<tel#>3-6110
<subj>RE FONZ CHIPS: 1)SILICON DYES OR 2)PACKAGED CHIPS?
<priority><u>ACTION--ASAP</u>
<arc>D
<reply>
<>

<date>12/8/80
<name>TONY PELLS
<tel#>720-2030
<subj>CAN'T MAKE IT TOMORROW TO THE HOUSE FOR MEETING WITH GWEN
<priority><u>FYI</u>
<reply>
<>

<date>12/8/80

<name>FRANK ZERESKI
<tel#>225-4816
<subj>SCORPIO REVIEW WILL BE HELD 1/16, SHERATON ROLLING GREEN, 8:30 TO 2:00. YOU CAN'T MAKE IT: ECKHOUSE' EXTERNAL RESEARCH MEETING AT THE TARA.
<priority>FYI
<reply>
<>

<date>12/5/80
<name>JIM WADE--DO YOU WANT TO SET UP A MEETING WITH BILL HANSEN, DEMMER, SI, WADE, LP, YOURSELF, RE EUROPEAN ENGINEERING? ONLY TIMES AVAILABLE: TUESDAY EVENING, YOUR HOUSE?, FRIDAY MORNING-BEST FOR YOU, OR THURSDAY MORNING.
<tel#>
<subj>
<priority>ACTION--ASAP
<reply>
<>

<date>12/5/80
<name>DANIEL ANDERSON
<tel#>713-483-5240
<subj>AN OLD FRIEND--PERSONAL
<priority>ACTION--WHEN POSSIBLE
<reply>
<>

<date>12/5/80
<name>WES CLARK
<tel#>
<subj>THE TURING MACHINE IS AT CALTECH (CARVER MEAD) BEING USED IN A SURVEY COURSE. FYI--BOB ARNZER WAS CO-BUILDER, CHARLIE MOLNER AT WASH. U IS OWNER. WANT TO WRITE TO MEAD?
<priority>ACTION--WHEN POSSIBLE
<reply>
<>

<date>12/5/80

<name>LARRY IS HAVING A RECAP WITH KO ON 12/10 (U R IN WASH. DC/NAE). LP WILL CALL YOU OVER THE WEEKEND, OR YOU CAN CALL HIM.
<tel#>
<subj>
<priority>ACTION--ASAP, ACTION--WHEN POSSIBLE, FYI
<reply>
<>

<date>12/5/80
<name>GERHARD FRIEDRICH, DEC
<tel#>1883
<subj>RE PAUL STRASSMAN, VP OF INFORMATION PRODUCUTS, XEROX, CALLING HIM TO SEE IF YOU HAD ANY COMMENTS ON THE ENGLISH-FRENCH TRANSLATION MANUALS HE SENT. WE DO HAVE A LOG ENTRY FOR JULY SHOWING RECEIPT OF MAIL FROM STRASSMAN--DO YOU REMEMBER THEM? ANY COMMENTS?
<priority>ACTION--WHEN POSSIBLE
<reply>
<>

<date>12/5/80
<name>NANCY HIKE
<tel#>3431
<subj>ANY STOCK ACTIVITY FOR NOVEMBER?
<priority>ACTION--ASAP
<reply>
<>

<date>12/5/80
<name>STAN OLSEN
<tel#>264-5000
<subj>HE'LL SEE YOU AT MC ON MONDAY--12/8
<priority>FYI
<reply>
<>

<date>12/5/80
<name>PROF ED FREDKIN

<tel#>412-621-6250
<subj>RE ETHERNET
<priority>ACTION--WHEN POSSIBLE
<reply>
<>

<date>12/3/80
<name>EMIL BERGER
<tel#>215-363-3072
<subj>QYX COMPANY, RE METAFONT--HE IS INTERESTED IN GETTING THE SW TO RUN ON A VAX.
<priority>ACTION--WHEN POSSIBLE
<reply>
<>

<date>12/3/80
<name>DEL THORNDIKE
<tel#>225-4741
<subj>HAVING A GOING AWAY PARTY FOR CRAIG, DEC. 16, 5:30 ANTONIOS, COCKTAILS. ASKED IF YOU WOULD KEYNOTE AFFAIR. I TOLD HER IT WAS PROBABLY MORE APPROPRIATE IF STEVE WAS THE HOST, AND THAT I WOULD CONFIRM BACK IF YOU WERE ABLE TO ATTEND. (IF YOU DO GO, I'M SURE YOU WOULD BE WILLING TO SAY A FEW WORDS???)
<priority>ACTION--WHEN POSSIBLE
<reply>
<>

<date>12/3/80
<name>RAY WOOD, DEC WASHINGTON DC
<tel#>341-2000
<subj>CAPITAL CHILDREN'S MUSEUM--REQUEST FOR CONTRIBUTIONS COMMITTEE.
<priority>ACTION--ASAP
<reply>
<>

<date>12/3/80

<name>HEFFNER
<tel#>
<subj>HOW ABOUT A DINNER FOR HUSTVEDT AS NEW SR. CONSULTING ENGINEER?
<priority><u>ACTION--WHEN POSSIBLE</u>
<reply>
<>

<date>12/1/80
<name>HARRY GORALNICK
<tel#>3-7635
<subj>DCU--YOU ARE OVERDRAWN (HOW DOES 5K GRAB YOU?) I ASKED HIM TO PLEASE CARRY YOU UNTIL MONDAY...
<priority><u>ACTION--ASAP</u>
<reply>
<>

<date>12/1/80
<name>PROF. LEE
<tel#>253-2598
<subj>WANTS TO SEE YOU, BUT I TOLD HIM YOU WOULD CALL. HE HAS BEEN TEACHING REAL TIME COMPUTING FOR 2 YEARS USING THE 11/03. HE IS "TEACHING A UNIQUE WAY AND IS CONSIDERING WRITING A TEST BOOK AND WOULD LIKE TO DISCUSS THIS." WANTS TO USE THE 11/03 AS THE MACHINE AND THE RT11 AS THE OS. "DOES DEC HAVE ANY PLANS THAT MIGHT AFFECT THE LONGEVITY OF THE MACHINE?"
<priority><u>ACTION--WHEN POSSIBLE</u>
<reply>
<>

<date>12/1/80
<name>HANK MAURER
<tel#>225-4223
<subj>RETURNED YOUR CALL OF 11/17.
<priority><u>ACTION--WHEN POSSIBLE</u>
<reply>
<>

<date>12/1/80
<name>DEMMER GAVE YOU THE "ANDOVER II PROPOSAL" (AT THE LAST DINNER MEETING)--DO YOU HAVE ANY COMMENTS?
<tel#>
<subj>
<priority>ACTION--ASAP
<reply>
<>

<date>12/1/80
<name>KEN REQUESTED THE DEC. 12 HALF-DAY WOODS MEETING BE CANCELLED--YOU, LP, KO AND SI.
<tel#>
<subj>
<priority>FYI
<reply>
<>

<date>11/25/80
<name>DOUG CLARKE
<tel#>247-2023
<subj>PERSONAL
<priority>ACTION--WHEN POSSIBLE
<reply>
<>

<date>11/20/80
<name>BOB EVERETT'S WIFE DIED MONDAY NIGHT OF CANCER. THE FUNERAL IS TOMORROW IN WINCHESTER AT 10:00A. KEN WILL BE GOING--HENCE, WE MOVED THE MORNING MEETING FROM 8:30 TO 8:00A AT YOUR HOUSE.
<tel#>
<subj>
<reply>
<>

<date>11/20/80
<name>TOM DOPRIAK CALLED FROM R&D--HE IS GOING TO CMU BUT THE MEETING WAS CHANGED FROM 11/19 TO 12/5.
<tel#>
<subj>
<reply>
<>

<date>11/18/80
<name>YOUR #'d PC DOCUMENT REQUESTS. OK TO GIVE TO: PAUL BAUER, Bob SAVELL (TW/B02)?
<tel#>
<subj>
<reply>YES
<>

<date>11/18/80
<name>KEITH UNCAPHER
<tel#>
<subj>RE HELPING ARPA GET $20M OF EQUIPMENT FUNDS

<reply>EARL HYTE, 231-4784, JOEL SCHWARTZ AREA, SAID HE WOULD CALL - 11/24/80
<>

<date>11/13/80
<name>WEINSTEIN--IMPLICATION TO BUILD A COOKIE CUTTER FOR THE BASE SYSTEM. 12% MARKET SHARE IN 1985 EQUALS ABOUT 135,000 UNITS SHIPPED.
<tel#>
<subj>
<reply>
<>

<date>11/13/80
<name>SHINLEVER
<tel#>231-6936
<subj>RE WAXMAN
<reply>
<>

<date>11/13/80
<name>GILMORE--STEWART GAVE JACK THE RESPONSIBILITY OF FOLLOWING UP ON THE MIT LETTER TO KEN. ROCHE IS SETTING UP A MEETING WITH MIT ON NOV. 19. ANDY AND MEANY ARE BEING APPRISED OF WHAT IS HAPPENING. CONFIDENTAIL MATERIAL WILL BE DISCUSSED WITH MIT.
<tel#>
<subj>
<reply>
<>

<date>11/10/80
<name>PLEASE TAKE A CHECK ON YOUR ITINERARY FOR EUROPE--ATTACHED--SO WE CAN MAKE ANY CHANGES.
<tel#>
<subj>
<reply>
<>

<date>11/10/80
<name>PROF. STRANG
<tel#>253-4383
<subj>MIT--RE CHINA
<reply>
<>

<date>11/6/80
<name>DOROTHY, DAN' SEC
<tel#>412-578-2619
<subj>DO YOU WANT TO SEE THE PAGE PROOFS--I THOUGHT WE HAD ALREADY SAID NO. RIGHT?
<reply>
<>

<date>11/14/80
<name>
<tel#>
<subj>
<reply>
<>

<date>11/6/80
<name>DENNY DOYLE
<tel#>621-2153
<subj>RE AN UPDATE ON SI'S VISIT.
<reply>
<>

<date>11/6/80
<name>JACK GILMORE CALLED TO THANK YOU FOR THE NOTE.
<tel#>
<subj>
<reply>
<>

<date>11/6/80
<name>LP IS INTERESTED IN GOING TO JAPAN WITH YOU--IF YOU WERE SERIOUS IN YOUR EMS, WHEN DO YOU WANT TO GO?
<tel#>
<subj>
<reply>
<>

<date>11/5/80
<name>FRANK SAWYER, MCGRAW HILL--SENDING OUT A TECHNICAL JOURNAL REVIEW--A MARKETING REPORT ON ENGINEERING TOMORROW. I SUGGESTED WE ASK YOU FIRST IF YOU WANTED TO REVIEW IT--HE SAID HE'D SEND IT ANYWAY AND IT WAS PERFECTLY ALL RIGHT IF YOU DIDN'T WANT TO--HE IS FULFILLING AN AGREEMENT TO SEND OUT N NUMBER FOR REVIEW.
<tel#>
<subj>
<reply>
<>

<date>11/5/80
<name>BOB SHINLEVER
<tel#>231-6936
<subj>RE THE WAXMAN AFFAIR.
<reply>
<>

<date>11/3/80
<name>JOHN SHEBELL
<tel#>3-3101
<subj>MGR. OF CORP. RAMP GROUP--RE SIEWIOREK. WILL DAN/DEC BE IN A COMPROMISING POSITION IF DAN GOES ON SABBATICAL AND DOES CONSULTING ON THE WEST COAST, I.E. INTEL? (JOHN IS ON EMS).
<reply>
<>

<date>11/3/80

<name>GILMORE WILL TALK TO YOU TOMORROW (AT SPIT BROOK) ABOUT MIT BEING A TEST SITE FOR EMS.
<tel#>
<subj>
<reply>
<>

<date>11/3/80
<name>WHO HAVE ATANASOFF DINNER?
<tel#>
<subj>
<reply>
<>

<date>11/3/80
<name>GONZALES IS NOW ON EMS.
<tel#>
<subj>
<reply>
<>

<date>11/3/80
<name>RE THE ACM: ALL SET FOR JAN 28, 7:00PM. FYI: 200-300 ATTENDEES, TECHNICAL, MANY HP PEOPLE. 1 HOUR TALK THEN QUESTIONS. HELD AT HP GEN. SYS. DIV. AUDITORIUM, CUPERTINO. HUANG SAID HE WOULD PICK YOU UP AT THE HOTEL, TAKE TO SEMINAR AND RETURN YOU TO HOTEL. CUPERTINO IS ABOUT 45 MIN. DRIVE FROM SF. WHERE DO YOU WANT TO STAY: SUNNYVILLE HILTON OR GREAT AMERICA--BOTH IN SANTA CLARA AND ENROUTE TO CUPERTINO. YOU LEAVE THE NEXT DAY AT 3:00ISH--WANT TO LEAVE OPEN? TALK: GENERATING COMPUTER GENERATIONS?
<tel#>
<subj>
<reply>
<>

<date>10/31/80
<name>DR. BROWN

<tel#>512-471-5023
<subj>WOULD LIKE A READING, ON THE PHONE, RE JACK LIPOVSKY BECOMING A FULL PROFESSOR.
<reply>
<>

<date>10/31/80
<name>ALLAN KENT
<tel#>3-8701 OR 247-2529
<subj>RE THE ENGINEERING ORIENTATION MANUAL--HOLMAN HAS ASKED ALLAN TO DELAY IT UNTIL JULY BECAUSE OF HOLMAN PENDING REORGANIZATION. ALLAN SAYS HE CAN HAVE IT OUT BY JANUARY (LAST ONE WAS JAN 80). I TALKED WITH JOHN AND IT IS BECAUSE OF PENDING REORGANIZATION OF ALL ENGINEERING THAT HE WOULD LIKE TO HOLD. ALSO JOHN SAID HE WOULD HANDLE IT.
<reply>
<>

<date>10/28/80
<name>RAY SORENSON
<tel#>206-682-0911
<subj>PERSONAL RE ENGINEERING--REFERRED TO YOU BY COLO
<reply>
<>

<date>10/28/80
<name>JOHN CSENGE
<tel#>535-5820
<subj>PERSONAL
<reply>
<>

<date>10/28/80
<name>ROGER BOROVOY,INTEL
<tel#>408-987-8192
<subj>INTEL RE MIT AND CLASS OF '56 GIFT CAMPAIGN
<reply>
<>

<date>10/27/80
<name>PLOWMAN
<tel#>247-2902
<subj>RETURNED YOUR CALL.
<reply>
<>

<date>10/27/80
<name>AL BISSELL--ANY PROBLEMS WITH THE PHONE LINE OVER THE WEEKEND?
<tel#>
<subj>
<reply>
<>

DONE

<date>10/28/80
<name>DICK GONZALES--HIS FATHER DID PASS AWAY LAST WEEK. DICK ASKED IT BE KEPT QUIET AND THAT NOTHING BE DONE. THE FATHER WAS IN HIS LATE 70'S, SUFFERED A SHOCK AND WENT INTO A DEEP COMA FOR SEVERAL WEEKS. DICK'S HOME ADDRESS: 7 CAPPIVA, BERLIN, MA 01503
<tel#>
<subj>
<reply>
<>

<date>10/27/80
<name>JACK GILMORE'S MOTHER DIED LAST NIGHT--87 YEARS OLD OF AN ANEURISM (SP). She WILL BE WAKED FRIDAY: FUNERAL WILL BE SATURDAY AT 11:00A. NO SPECIAL FUNDS SET UP. (MRS. JULIA GILMORE). JACK'S HOME ADDRESS: GOVERNOR WENTWORTH ROAD, AMHERST, N.H. 03031

GORDON--THERE IS NO SYMPATHY LETTER IN THE FILE. WHY DON'T YOU DRAFT ONE (WE'LL PUT IN INDEX, & PRINT OUT ON YOUR CREAM STATIONERY).
<tel#>
<subj>
<reply>
<>
<date>10/31/80
<name>TW 5-YEAR AWARD LUNCHEON RAISED ITS HEAD AGAIN. LARRY SAYS HE DOESN'T HAVE TIME. WE NEED A POLICY DECISION HERE: 5-YEAR AWARD LUNCHEONS CAN BE HOSTED BY RESIDENT OOD MEMBER? YOU WENT TO THE LAST ONE HERE (WHICH LP SKIPPED). WANT TO TRY TO GO TO ALLLLLL?
<tel#>
<subj>
<reply>
<>

<date>10/31/80
<name>TED JOHNSON WOULD LIKE TO SEE YOU OVER THE WEEKEND--

GERI AND I LEFT IT THAT YOUWOULD CALL EACH OTHER SUNDAY.
<tel#>
<subj>
<reply>
<>

<date>10/31/80
<name>KOBYASHI--IN CALIFORNIA AND WILL NOT RETURN UNTIL MONDAY MORNING.
<tel#>
<subj>
<reply>
<>

<date>10/27/80
<name>HOWARD FINEMAN
<tel#>231-5954
<subj>CALLING AT RON SMART'S SUGGESTION RE GNP FIGURES YOU ARE LOOKING FOR--HE HAS MANY WAYS OF COMING AT IT AND WANTS A LITTLE MORE TO GO ON AS TO EXACTLY WHAT YOU ARE LOOKING FOR.
<reply>DONE
<>

<date>10/28/80
<name>JIM BELL IS LEAVING FOR CALIF. THIS SATURDAY SO THEY ARE PLANNING A LUNCH THURSDAY OR FRIDAY--U ARE AWAY.
<tel#>
<subj>
<reply>
<>

<date>10/27/80
<name>ROGER JACKSON, PERSONNEL, TW
<tel#>ASKING YOU TO ATTEND 5YR AWARD LUNCHEON--I ASKED HE COORDINATE WITH LARRY AND SPREAD IT AROUND.
<subj>
<reply>
<>

<date>10/27/80
<name>STEWART'S OFFICE CALLED: THE OFIS PROGRAM STRATEGY HAS BEEN MOVED FROM MC, NOV. 24, TO MC ON DEC. 8--YOU ARE SCHEDULED TO ATTEND.
<tel#>
<subj>
<reply>
<>

<date>10/28/80
<name>MARCI
<tel#>249-2072
<subj>TALKED WITH PHISTER. HE WILL BE HERE THURSDAY, WHICH MEANS YOU CAN'T MEET WITH HIM. PHISTER WOULD LIKE TO MEET WITH KEN--CHECKED WITH KO OFFICE AND HE PROBABLY WON'T BE IN THURSDAY EITHER.
<reply>TRY FOR SUNDAY BRUNCH, NOV. 2
<>

<date>10/24/80
<name>SI LYLE SAID YOU PROBABLY WANTED TO GET TOGETHER WITH HE AND JERRY BUTLER RE CSS--LOOKING AT COOPERATIVE GRAPHICS PROGRAM. WANT TO?
<tel#>
<subj>
<reply>I would also like Picott/haney and demmer/marshal (or whoever is doing the suvax graphics)
<>

<date>10/23/80
<name>MARK URICH
<tel#>223-2281
<subj>WOULD LIKE A COPY OF YOUR GEORGE BALL SPEECH--ARE YOU GIVING IT OUT? (PK3-1/P80).
<reply>Yes
<>

<date>10/23/80

<name>TOM HARRIS
<tel#>264-6779
<subj>BOUGHT A RADIO SHACK COLOR COMPUTER ($399). WANT TO SEE IT. HE SAYS IT IS REALLY SOMETHING, ESPECIALLY WITH THE ADDED OPTIONS.
<reply>Would like to see it when I'm up there.
<>

<date>10/24/80
<name>AL BISSELL--OUR TELEPHONE MAN--THEY DID FIND A BAD MODEM ON THE EMS END WHICH WOULD CUT YOU OFF. THE LINE HAS BEEN DISSABLED UNTIL A NEW ONE ARRIVES. THIS IS PROBABLY NOT YOUR WHOLE PROBLEM BUT IT COULD HAVE BEEN A BIG FACTOR. PLEASE BRING YOUR LOG IN.
<tel#>
<subj>
<reply>
<>

<date>10/20/80
<name>MICHAEL YOUNG
<tel#>262-5050
<subj>RE - CONFIDENTIAL
<reply>DONE--MANAGEMENT RECRUITERS
<>

<date>10/23/80
<name>MR. DELANEY
<tel#>391-8920
<subj>AT&T MAN RE YOUR PHONE
<reply>talked to him. Keep in touch.
<>

<date>10/23/80
<name>HADDAD
<tel#>914-686-4460
<subj>RE YOUR REQUEST FOR GUATELLI.
<reply>DONE--MJ CALLED AND SAID YOU WOULD SEE HIM IN WASH. + GUATELLI ISSUE SEEMS RESOLVED

<>

<date>10/20/80
<name>ROBERT GUARENTE
<tel#>3-9226
<subj>RE HIS MATHEMATICAL SYSTEM (YOU SAW HIM AT THE MUSEUM). YOU SAID YOU WOULD CALL.
<reply>
<>

<date>10/20/80
<name>DR. RON HARRIS (CALLED FRIDAY)
<tel#>752-7700 X249
<subj>FROM WORCESTER ST CHEMSITRY DEPT. HE IS LOOKING FOR A RESEARCH PROJECT HERE WHEREBY THE NATIONAL SCIENCE FOUNDATION WOULD PAY HIS SALARY UNDER THE FELLOWHSIP PROGRAM. HE IS LOOKING FOR SOMETHING CHEMISTRY RELATED. ARE WE INTERESTED? CONTACT?
<reply>DONE--GAVE MESSAGE TO RIGGLE
<>

<date>10/20/80
<name>JOE DELANEY
<tel#>391-8920
<subj>HE IS YOUR AREA MANAGER FROM AT&T--HOW IS YOUR PHONE?
<reply>DONE
<>

<date>10/20/80
<name>VINCE BASTIANI
<tel#>264-6420
<subj>RE A CONVERSATION WITH BJ REGARDING HIMSELF.
<reply>DONE
<>

<date>10/20/80

<name>MIKE SULLIVAN, IBM
<tel#>914-765-6416
<subj>RE GAUTELLI (SULLIVAN CALLED LATE FRIDAY - 10/17)
<reply>DONE
<>

<date>12/10/80
<name>ROGER REYNOLDS, U OF CAL
<tel#>714-755-8815
<subj>RE HIS REQUEST TO THE CONTRIBUTION COMMITTEE. WANTED FURTHER CLARIFICATION AND I PUT HIM IN TOUCH WITH MARY ANN BUREK (3-4277) WHO CORRESPONDED WITH HIM THAT WE COULD NOT HELP IN HIS REQUEST.
<priority>FYI
<reply>
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<date>12/10/80
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<tel#>714-998-0607
<subj>BUILDING A SET OF CONTROLLER CARDS THAT CONVERT A COMPUTER INTO A PABX. WOULD LIKE TO TALK TO YOU ABOUT IT. THE SWITCH SET IS LIKE A CONTROLLER BUT COMPUTER CAN DO OTHER THINGS AS WELL. HAVE DESIGNED THS FOR ONE COMPUTER BUS AND THEY COULD DO IT FOR THE PDP-11
<priority>ACTION--WHEN POSSIBLE
<reply>
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<date>12/10/80
<name>BILL AVERY (JEAN)
<tel#>231-6956
<subj>RE A MICROELECTRONICS PROPOSAL THAT WAS SENT TO YOU. BILL IS LOOKING FOR COMMENTS--DO YOU HAVE ANY COMMENTS?
<priority>ACTION--WHEN POSSIBLE
<reply>
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<date>12/9/80
<name>ANDY KNOWLES, SEC. SHARON
<tel#>231-6313
<subj>A MEETING WITH ED CRANCH, PRES OF WPI, TO TALK ABOUT ENGINEERING INTERFACE--TEACHING HELP; WHERE COMPUTER SCIENCE AND ELECTRICAL ENGINEERING ARE GOING; WANTS TO COMMUNICATE SOME OF THEIR PROGRAMS PLUS CONCERNS; LARGE 10 CUSTOMER. AK WOULD LIKE TO KNOW WHO YOU THINK SHOULD BE THERE?
<priority><u>ACTION--ASAP</u>
<reply>WILKES, GLORIOSO, TEICHER, FULLER, GB
<>

<date>12/9/80
<name>MR. MARK MCDONOUGH
<tel#>367-9200
<subj>POSTIONS, INC: HAS A CANDIDATE, SENIOR DESIGNER -- MASTERLESS AND CONTENTIONLESS COMMUNICATIONS ARCHITECTURE. WORKED FOR DG, TOOK OFF 6 MONTHS AGO AND DECIDED HE NEEDS A BIG COMPANY TO MARKET HIS IDEAS.
<priority><u>ACTION--ASAP</u>
<reply>MEYER, RODGERS, PEARSON, DEMMER--INTERESTED, MEYER PLS HANDLE 12/15/80 Mon 9:18
<>

<date>12/9/80
<name>AVRAM--WILL SEE YOU 9:15 ON THURSDAY TO BRING YOU IN SYNC ON THE GALACTIC ARCHITECTURE REVIEW MEETING AND TO REVIEW KEY ISSUES ON THE PRODUCT.
<tel#>
<subj>
<priority><u>FYI</u>
<reply>
<>

<date>12/8/80
<name>GUESS WHAT--IT IS CHRISTMAS CARD TIME AGAIN!!
<tel#>
<subj>
<priority><u>ACTION--WHEN POSSIBLE</u>

<reply>
<>

<date>12/8/80
<name>CHRISTY
<tel#>3-6110
<subj>RE FONZ CHIPS: 1)SILICON DYES OR 2)PACKAGED CHIPS?
<priority>ACTION--ASAP
<reply>
<>

<date>12/8/80
<name>TONY PELLS
<tel#>720-2030
<subj>CAN'T MAKE IT TOMORROW TO THE HOUSE FOR MEETING WITH GWEN
<priority>FYI
<reply>
<>

<date>12/8/80
<name>FRANK ZERESKI
<tel#>225-4816
<subj>SCORPIO REVIEW WILL BE HELD 1/16, SHERATON ROLLING GREEN, 8:30 TO 2:00. YOU CAN'T MAKE IT: ECKHOUSE' EXTERNAL RESEARCH MEETING AT THE TARA.
<priority>FYI
<reply>
<>

<date>12/5/80
<name>JIM WADE--DO YOU WANT TO SET UP A MEETING WITH BILL HANSEN, DEMMER, SI, WADE, LP, YOURSELF, RE EUROPEAN ENGINEERING? ONLY TIMES AVAILABLE: TUESDAY EVENING, YOUR HOUSE?, FRIDAY MORNING-BEST FOR YOU, OR THURSDAY MORNING.
<tel#>
<subj>
<priority>ACTION--ASAP

<reply>
<>

<date>12/5/80
<name>DANIEL ANDERSON
<tel#>713-483-5240
<subj>AN OLD FRIEND--PERSONAL
<priority><u>ACTION--WHEN POSSIBLE</u>
<reply>
<>

<date>12/5/80
<name>WES CLARK
<tel#>
<subj>THE TURING MACHINE IS AT CALTECH (CARVER MEAD) BEING USED IN A SURVEY COURSE. FYI--BOB ARNZER WAS CO-BUILDER, CHARLIE MOLNER AT WASH. U IS OWNER. WANT TO WRITE TO MEAD?
<priority><u>ACTION--WHEN POSSIBLE</u>
<reply>
<>

<date>12/5/80
<name>LARRY IS HAVING A RECAP WITH KO ON 12/10 (U R IN WASH. DC/NAE). LP WILL CALL YOU OVER THE WEEKEND, OR YOU CAN CALL HIM.
<tel#>
<subj>
<priority><u>ACTION--ASAP, ACTION--WHEN POSSIBLE, FYI</u>
<reply>
<>

<date>12/5/80
<name>GERHARD FRIEDRICH, DEC
<tel#>1883
<subj>RE PAUL STRASSMAN, VP OF INFORMATION PRODUCUTS, XEROX, CALLING HIM TO SEE IF YOU HAD ANY COMMENTS ON THE ENGLISH-FRENCH TRANSLATION MANUALS HE SENT. WE DO HAVE A LOG ENTRY FOR JULY SHOWING RECEIPT OF MAIL FROM STRASSMAN--DO YOU REMEMBER THEM? ANY COMMENTS?

<priority>ACTION--WHEN POSSIBLE
<reply>THANKS FOR SENDING, WE ARE LOOKING AT THEM, NO COMMENT.
<>

<date>12/5/80
<name>NANCY HIKE
<tel#>3431
<subj>ANY STOCK ACTIVITY FOR NOVEMBER?
<priority>ACTION--ASAP
<reply>NONE
<>

<date>12/5/80
<name>STAN OLSEN
<tel#>264-5000
<subj>HE'LL SEE YOU AT MC ON MONDAY--12/8
<priority>FYI
<reply>
<>

<date>12/5/80
<name>PROF ED FREDKIN
<tel#>412-621-6250
<subj>RE ETHERNET
<priority>ACTION--WHEN POSSIBLE
<reply>
<>

<date>12/3/80
<name>EMIL BERGER
<tel#>215-363-3072
<subj>QYX COMPANY, RE METAFONT--HE IS INTERESTED IN GETTING THE SW TO RUN ON A VAX.
<priority>ACTION--WHEN POSSIBLE
<reply>RICK FRIDAY PLS CALL 264-8022   12/15/80 Mon 8:49
<>

<date>12/3/80
<name>DEL THORNDIKE
<tel#>225-4741
<subj>HAVING A GOING AWAY PARTY FOR CRAIG, DEC. 16, 5:30 ANTONIOS, COCKTAILS. ASKED IF YOU WOULD KEYNOTE AFFAIR. I TOLD HER IT WAS PROBABLY MORE APPROPRIATE IF STEVE WAS THE HOST, AND THAT I WOULD CONFIRM BACK IF YOU WERE ABLE TO ATTEND. (IF YOU DO GO, I'M SURE YOU WOULD BE WILLING TO SAY A FEW WORDS???)
<priority><u>ACTION--WHEN POSSIBLE</u>
<reply>
<>

<date>12/3/80
<name>RAY WOOD, DEC WASHINGTON DC
<tel#>341-2000
<subj>CAPITAL CHILDREN'S MUSEUM--REQUEST FOR CONTRIBUTIONS COMMITTEE.
<priority><u>ACTION--ASAP</u>
<reply>
<>

<date>12/3/80
<name>HEFFNER
<tel#>
<subj>HOW ABOUT A DINNER FOR HUSTVEDT AS NEW SR. CONSULTING ENGINEER?
<priority><u>ACTION--WHEN POSSIBLE</u>
<reply>WILL DECIDE AT CONSULTING ENG TAS FORCE, 1/7/81
<>

<date>12/1/80
<name>HARRY GORALNICK
<tel#>3-7635
<subj>DCU--YOU ARE OVERDRAWN (HOW DOES 5K GRAB YOU?) I ASKED HIM TO PLEASE CARRY YOU UNTIL MONDAY...
<priority><u>ACTION--ASAP</u>
<reply>
<>

<date>12/1/80
<name>PROF. LEE
<tel#>253-2598
<subj>WANTS TO SEE YOU, BUT I TOLD HIM YOU WOULD CALL. HE HAS BEEN TEACHING REAL TIME COMPUTING FOR 2 YEARS USING THE 11/03. HE IS "TEACHING A UNIQUE WAY AND IS CONSIDERING WRITING A TEST BOOK AND WOULD LIKE TO DISCUSS THIS." WANTS TO USE THE 11/03 AS THE MACHINE AND THE RT11 AS THE OS. "DOES DEC HAVE ANY PLANS THAT MIGHT AFFECT THE LONGEVITY OF THE MACHINE?"
<priority>ACTION--WHEN POSSIBLE
<reply>
<>

<date>12/1/80
<name>HANK MAURER
<tel#>225-4223
<subj>RETURNED YOUR CALL OF 11/17.
<priority>ACTION--WHEN POSSIBLE
<reply>
<>

<date>12/1/80
<name>DEMMER GAVE YOU THE "ANDOVER II PROPOSAL" (AT THE LAST DINNER MEETING)--DO YOU HAVE ANY COMMENTS?
<tel#>
<subj>
<priority>ACTION--ASAP
<reply>NO COMMENT
<>

<date>12/1/80
<name>KEN REQUESTED THE DEC. 12 HALF-DAY WOODS MEETING BE CANCELLED--YOU, LP, KO AND SI.
<tel#>
<subj>
<priority>FYI

<reply>
<>

<date>11/25/80
<name>DOUG CLARKE
<tel#>247-2023
<subj>PERSONAL
<priority>ACTION--WHEN POSSIBLE
<reply>
<>

<date>11/20/80
<name>BOB EVERETT'S WIFE DIED MONDAY NIGHT OF CANCER. THE FUNERAL IS TOMORROW IN WINCHESTER AT 10:00A. KEN WILL BE GOING--HENCE, WE MOVED THE MORNING MEETING FROM 8:30 TO 8:00A AT YOUR HOUSE.
<tel#>
<subj>
<reply>
<>

<date>11/20/80
<name>TOM DOPRIAK CALLED FROM R&D--HE IS GOING TO CMU BUT THE MEETING WAS CHANGED FROM 11/19 TO 12/5.
<tel#>
<subj>
<reply>
<>

<date>11/18/80
<name>YOUR #'d PC DOCUMENT REQUESTS. OK TO GIVE TO: PAUL BAUER, Bob SAVELL (TW/B02)?
<tel#>
<subj>
<reply>YES
<>

<date>11/18/80
<name>KEITH UNCAPHER
<tel#>
<subj>RE HELPING ARPA GET $20M OF EQUIPMENT FUNDS

<reply>EARL HYTE, 231-4784, JOEL SCHWARTZ AREA, SAID HE WOULD CALL - 11/24/80
<>

<date>11/13/80
<name>WEINSTEIN--IMPLICATION TO BUILD A COOKIE CUTTER FOR THE BASE SYSTEM. 12% MARKET SHARE IN 1985 EQUALS ABOUT 135,000 UNITS SHIPPED.
<tel#>
<subj>
<reply>
<>

<date>11/13/80
<name>SHINLEVER
<tel#>231-6936
<subj>RE WAXMAN
<reply>
<>

<date>11/13/80
<name>GILMORE--STEWART GAVE JACK THE RESPONSIBILITY OF FOLLOWING UP ON THE MIT LETTER TO KEN. ROCHE IS SETTING UP A MEETING WITH MIT ON NOV. 19. ANDY AND MEANY ARE BEING APPRISED OF WHAT IS HAPPENING. CONFIDENTAIL MATERIAL WILL BE DISCUSSED WITH MIT.
<tel#>
<subj>
<reply>
<>

<date>11/10/80
<name>PLEASE TAKE A CHECK ON YOUR ITINERARY FOR EUROPE--ATTACHED--SO WE CAN MAKE ANY CHANGES.
<tel#>
<subj>
<reply>
<>

<date>11/10/80
<name>PROF. STRANG
<tel#>253-4383
<subj>MIT--RE CHINA
<reply>
<>

<date>11/6/80
<name>DOROTHY, DAN' SEC
<tel#>412-578-2619
<subj>DO YOU WANT TO SEE THE PAGE PROOFS--I THOUGHT WE HAD ALREADY SAID NO. RIGHT?
<reply>
<>

<date>11/14/80
<name>
<tel#>
<subj>
<reply>
<>

<date>11/6/80
<name>DENNY DOYLE
<tel#>621-2153
<subj>RE AN UPDATE ON SI'S VISIT.
<reply>
<>

<date>11/6/80
<name>JACK GILMORE CALLED TO THANK YOU FOR THE NOTE.
<tel#>
<subj>
<reply>
<>

<date>11/6/80
<name>LP IS INTERESTED IN GOING TO JAPAN WITH YOU--IF YOU WERE SERIOUS IN YOUR EMS, WHEN DO YOU WANT TO GO?
<tel#>
<subj>
<reply>
<>

<date>11/5/80
<name>FRANK SAWYER, MCGRAW HILL--SENDING OUT A TECHNICAL JOURNAL REVIEW--A MARKETING REPORT ON ENGINEERING TOMORROW. I SUGGESTED WE ASK YOU FIRST IF YOU WANTED TO REVIEW IT--HE SAID HE'D SEND IT ANYWAY AND IT WAS PERFECTLY ALL RIGHT IF YOU DIDN'T WANT TO--HE IS FULFILLING AN AGREEMENT TO SEND OUT N NUMBER FOR REVIEW.
<tel#>
<subj>
<reply>
<>

<date>11/5/80
<name>BOB SHINLEVER
<tel#>231-6936
<subj>RE THE WAXMAN AFFAIR.
<reply>
<>

<date>11/3/80
<name>JOHN SHEBELL
<tel#>3-3101
<subj>MGR. OF CORP. RAMP GROUP--RE SIEWIOREK. WILL DAN/DEC BE IN A COMPROMISING POSITION IF DAN GOES ON SABBATICAL AND DOES CONSULTING ON THE WEST COAST, I.E. INTEL? (JOHN IS ON EMS).
<reply>
<>

<date>11/3/80

<name>GILMORE WILL TALK TO YOU TOMORROW (AT SPIT BROOK) ABOUT MIT BEING A TEST SITE FOR EMS.
<tel#>
<subj>
<reply>
<>

<date>11/3/80
<name>WHO HAVE ATANASOFF DINNER?
<tel#>
<subj>
<reply>
<>

<date>11/3/80
<name>GONZALES IS NOW ON EMS.
<tel#>
<subj>
<reply>
<>

<date>11/3/80
<name>RE THE ACM: ALL SET FOR JAN 28, 7:00PM. FYI: 200-300 ATTENDEES, TECHNICAL, MANY HP PEOPLE. 1 HOUR TALK THEN QUESTIONS. HELD AT HP GEN. SYS. DIV. AUDITORIUM, CUPERTINO. HUANG SAID HE WOULD PICK YOU UP AT THE HOTEL, TAKE TO SEMINAR AND RETURN YOU TO HOTEL. CUPERTINO IS ABOUT 45 MIN. DRIVE FROM SF. WHERE DO YOU WANT TO STAY: SUNNYVILLE HILTON OR GREAT AMERICA--BOTH IN SANTA CLARA AND ENROUTE TO CUPERTINO. YOU LEAVE THE NEXT DAY AT 3:00ISH--WANT TO LEAVE OPEN? TALK: GENERATING COMPUTER GENERATIONS?
<tel#>
<subj>
<reply>
<>

<date>10/31/80
<name>DR. BROWN

<tel#>512-471-5023
<subj>WOULD LIKE A READING, ON THE PHONE, RE JACK LIPOVSKY BECOMING A FULL PROFESSOR.
<reply>
<>

<date>10/31/80
<name>ALLAN KENT
<tel#>3-8701 OR 247-2529
<subj>RE THE ENGINEERING ORIENTATION MANUAL--HOLMAN HAS ASKED ALLAN TO DELAY IT UNTIL JULY BECAUSE OF HOLMAN PENDING REORGANIZATION. ALLAN SAYS HE CAN HAVE IT OUT BY JANUARY (LAST ONE WAS JAN 80). I TALKED WITH JOHN AND IT IS BECAUSE OF PENDING REORGANIZATION OF ALL ENGINEERING THAT HE WOULD LIKE TO HOLD. ALSO JOHN SAID HE WOULD HANDLE IT.
<reply>
<>

<date>10/28/80
<name>RAY SORENSON
<tel#>206-682-0911
<subj>PERSONAL RE ENGINEERING--REFERRED TO YOU BY COLO
<reply>
<>

<date>10/28/80
<name>JOHN CSENGE
<tel#>535-5820
<subj>PERSONAL
<reply>
<>

<date>10/28/80
<name>ROGER BOROVOY,INTEL
<tel#>408-987-8192
<subj>INTEL RE MIT AND CLASS OF '56 GIFT CAMPAIGN
<reply>
<>

<date>10/27/80
<name>PLOWMAN
<tel#>247-2902
<subj>RETURNED YOUR CALL.
<reply>
<>

<date>10/27/80
<name>AL BISSELL--ANY PROBLEMS WITH THE PHONE LINE OVER THE WEEKEND?
<tel#>
<subj>
<reply>
<>

DONE

<date>10/28/80
<name>DICK GONZALES--HIS FATHER DID PASS AWAY LAST WEEK. DICK ASKED IT BE KEPT QUIET AND THAT NOTHING BE DONE. THE FATHER WAS IN HIS LATE 70'S, SUFFERED A SHOCK AND WENT INTO A DEEP COMA FOR SEVERAL WEEKS. DICK'S HOME ADDRESS: 7 CAPPIVA, BERLIN, MA 01503
<tel#>
<subj>
<reply>
<>

<date>10/27/80
<name>JACK GILMORE'S MOTHER DIED LAST NIGHT--87 YEARS OLD OF AN ANEURISM (SP). She WILL BE WAKED FRIDAY: FUNERAL WILL BE SATURDAY AT 11:00A. NO SPECIAL FUNDS SET UP. (MRS. JULIA GILMORE). JACK'S HOME ADDRESS: GOVERNOR WENTWORTH ROAD, AMHERST, N.H. 03031

GORDON--THERE IS NO SYMPATHY LETTER IN THE FILE. WHY DON'T YOU DRAFT ONE (WE'LL PUT IN INDEX, & PRINT OUT ON YOUR CREAM STATIONERY).
<tel#>
<subj>
<reply>
<>
<date>10/31/80
<name>TW 5-YEAR AWARD LUNCHEON RAISED ITS HEAD AGAIN. LARRY SAYS HE DOESN'T HAVE TIME. WE NEED A POLICY DECISION HERE: 5-YEAR AWARD LUNCHEONS CAN BE HOSTED BY RESIDENT OOD MEMBER? YOU WENT TO THE LAST ONE HERE (WHICH LP SKIPPED). WANT TO TRY TO GO TO ALLLLLL?
<tel#>
<subj>
<reply>
<>

<date>10/31/80
<name>TED JOHNSON WOULD LIKE TO SEE YOU OVER THE WEEKEND--

GERI AND I LEFT IT THAT YOUWOULD CALL EACH OTHER SUNDAY.
<tel#>
<subj>
<reply>
<>

<date>10/31/80
<name>KOBYASHI--IN CALIFORNIA AND WILL NOT RETURN UNTIL MONDAY MORNING.
<tel#>
<subj>
<reply>
<>

<date>10/27/80
<name>HOWARD FINEMAN
<tel#>231-5954
<subj>CALLING AT RON SMART'S SUGGESTION RE GNP FIGURES YOU ARE LOOKING FOR--HE HAS MANY WAYS OF COMING AT IT AND WANTS A LITTLE MORE TO GO ON AS TO EXACTLY WHAT YOU ARE LOOKING FOR.
<reply>DONE
<>

<date>10/28/80
<name>JIM BELL IS LEAVING FOR CALIF. THIS SATURDAY SO THEY ARE PLANNING A LUNCH THURSDAY OR FRIDAY--U ARE AWAY.
<tel#>
<subj>
<reply>
<>

<date>10/27/80
<name>ROGER JACKSON, PERSONNEL, TW
<tel#>ASKING YOU TO ATTEND 5YR AWARD LUNCHEON--I ASKED HE COORDINATE WITH LARRY AND SPREAD IT AROUND.
<subj>
<reply>
<>

<date>10/27/80
<name>STEWART'S OFFICE CALLED: THE OFIS PROGRAM STRATEGY HAS BEEN MOVED FROM MC, NOV. 24, TO MC ON DEC. 8--YOU ARE SCHEDULED TO ATTEND.
<tel#>
<subj>
<reply>
<>

<date>10/28/80
<name>MARCI
<tel#>249-2072
<subj>TALKED WITH PHISTER. HE WILL BE HERE THURSDAY, WHICH MEANS YOU CAN'T MEET WITH HIM. PHISTER WOULD LIKE TO MEET WITH KEN--CHECKED WITH KO OFFICE AND HE PROBABLY WON'T BE IN THURSDAY EITHER.
<reply>TRY FOR SUNDAY BRUNCH, NOV. 2
<>

<date>10/24/80
<name>SI LYLE SAID YOU PROBABLY WANTED TO GET TOGETHER WITH HE AND JERRY BUTLER RE CSS--LOOKING AT COOPERATIVE GRAPHICS PROGRAM. WANT TO?
<tel#>
<subj>
<reply>I would also like Picott/haney and demmer/marshal (or whoever is doing the suvax graphics)
<>

<date>10/23/80
<name>MARK URICH
<tel#>223-2281
<subj>WOULD LIKE A COPY OF YOUR GEORGE BALL SPEECH--ARE YOU GIVING IT OUT? (PK3-1/P80).
<reply>Yes
<>

<date>10/23/80

<name>TOM HARRIS
<tel#>264-6779
<subj>BOUGHT A RADIO SHACK COLOR COMPUTER ($399). WANT TO SEE IT. HE SAYS IT IS REALLY SOMETHING, ESPECIALLY WITH THE ADDED OPTIONS.
<reply>Would like to see it when I'm up there.
<>

<date>10/24/80
<name>AL BISSELL--OUR TELEPHONE MAN--THEY DID FIND A BAD MODEM ON THE EMS END WHICH WOULD CUT YOU OFF. THE LINE HAS BEEN DISSABLED UNTIL A NEW ONE ARRIVES. THIS IS PROBABLY NOT YOUR WHOLE PROBLEM BUT IT COULD HAVE BEEN A BIG FACTOR. PLEASE BRING YOUR LOG IN.
<tel#>
<subj>
<reply>
<>

<date>10/20/80
<name>MICHAEL YOUNG
<tel#>262-5050
<subj>RE - CONFIDENTIAL
<reply>DONE--MANAGEMENT RECRUITERS
<>

<date>10/23/80
<name>MR. DELANEY
<tel#>391-8920
<subj>AT&T MAN RE YOUR PHONE
<reply>talked to him. Keep in touch.
<>

<date>10/23/80
<name>HADDAD
<tel#>914-686-4460
<subj>RE YOUR REQUEST FOR GUATELLI.
<reply>DONE--MJ CALLED AND SAID YOU WOULD SEE HIM IN WASH. + GUATELLI ISSUE SEEMS RESOLVED

<>

<date>10/20/80
<name>ROBERT GUARENTE
<tel#>3-9226
<subj>RE HIS MATHEMATICAL SYSTEM (YOU SAW HIM AT THE MUSEUM). YOU SAID YOU WOULD CALL.
<reply>
<>

<date>10/20/80
<name>DR. RON HARRIS (CALLED FRIDAY)
<tel#>752-7700 X249
<subj>FROM WORCESTER ST CHEMSITRY DEPT. HE IS LOOKING FOR A RESEARCH PROJECT HERE WHEREBY THE NATIONAL SCIENCE FOUNDATION WOULD PAY HIS SALARY UNDER THE FELLOWHSIP PROGRAM. HE IS LOOKING FOR SOMETHING CHEMISTRY RELATED. ARE WE INTERESTED? CONTACT?
<reply>DONE--GAVE MESSAGE TO RIGGLE
<>

<date>10/20/80
<name>JOE DELANEY
<tel#>391-8920
<subj>HE IS YOUR AREA MANAGER FROM AT&T--HOW IS YOUR PHONE?
<reply>DONE
<>

<date>10/20/80
<name>VINCE BASTIANI
<tel#>264-6420
<subj>RE A CONVERSATION WITH BJ REGARDING HIMSELF.
<reply>DONE
<>

<date>10/20/80

<name>MIKE SULLIVAN, IBM
<tel#>914-765-6416
<subj>RE GAUTELLI (SULLIVAN CALLED LATE FRIDAY - 10/17)
<reply>DONE
<>

<date>10/16/80
<name>ARON INSINGA
<tel#>3-3762
<subj>(ML21-3/T40) ATTENDED YOUR TALK LAST NIGHT AND WOULD LIKE A COPY. Y OR N?
<reply>
<>

<date>10/16/80
<name>DAVE POTTER
<tel#>247-2380
<subj>WHAT IS GOING ON IN THE NI? HE HAS NOT BEEN ASKED TO THE MEETING TOMORROW AT TW. I TOLD HIM YOU WOULD EITHER CALL HIM OR STOP BY TOMORROW.
<reply>
<>

<date>10/15/80
<name>FYI--JACK GILMORE IS THE ONE WHO CAME UP WITH THE DETACHED (BACKGROUND) PROCESSING APPLICATION ON WPS.
<tel#>
<subj>
<reply>
<>

<date>10/15/80
<name>EVAN DEARDORFF, ADL
<tel#>864-5770 X2182
<subj>HAS A CLIENT WITH AN IMAGE DIGITIZER. WOULD WE BE INTERESTED IN SUCH A DEVICE, OR DISCUSSIONG APPLICATIONS?
<reply>
<>

<date>10/15/80
<name>BILL KEATING--CMU DID GET THE TAPE ON SATURDAY AND IT WAS READABLE. KEATING IS LEAVING ON AN EVENING FLIGHT AND WILL CALL YOU FROM THERE OR WHEN HE GETS BACK.
<tel#>
<subj>
<reply>
<>

<date>10/15/80
<name>BILL LONG IS GOING TO BRAZIL NEXT WEEK. HE ASKED FOR YOUR SPEECH AND I GAVE HIM THE "DISTRIBUTED PROCESSING AND LIMITS TO ITS GROWTH" ABSTRACT. HE IS NOW ASKING TO LOOK AT YOUR SLIDES--WANT TO BRING THEM IN?
<tel#>
<subj>
<reply>
<>

<date>10/14/80
<name>DR. GEORGE HEILMEIER, TI
<tel#>214-995-5975
<subj>WANTED TO LET YOU KNOW HE WAS BACK IN TOWN IN CASE YOU WANTED TO CONTINUE YOUR CONVERSATION. DO YOU?
<reply>
<>

<date>10/14/80
<name>JUNGLE--CUDMORE ASKED TO DRIVE YOU SO HE COULD DISCUSS: SEMICONDUCTOR ENGINEERING ORGANIZATION. YOU ARE SCHEDULED.
<tel#>
<subj>
<reply>
<>

<date>10/14/80
<name>PROF. WOODSON

<tel#>512-471-4262
<subj>RE THE HONORARIUM AND YOUR SOC. SEC. #--WANT TO DONATE THE MONEY TO THE COMPUTER SCIENCE DEPARTMENT OR ELECTRICAL ENGINEERING
<reply>
<>

<date>10/14/80
<name>DEAN GRAHAM ALLISON, SCHOOL OF GOVERNMENT, HARVARD
<tel#>495-1380 (ELIZABETH FAINSOID)
<subj>INVITATION TO DINNER ON FRIDAY, OCT. 24, AT HARVARD, WITH DR. ROBERT FROSCH. INTERESTED?
<reply>
<>

<date>10/14/80
<name>FYI FROM KEN--MARKETING COMMITTEE ON MONDAY NOW HAS A 2-HOUR TIME SLOT FOR WPS AND EMS. KEN WANTED TO TALK WITH YOU RE EMS PRIOR TO THIS MEETING--HOPEFULLY YOU CAN DO THIS IN THE CAR WEDNESDAY MORNING ON THE WAY TO THE WOODS.
<tel#>
<subj>
<reply>
<>

<date>10/14/80
<name>ROGER REYNOLDS, U OF CAL. SAN DIEGO--THEIR PROPOSAL WAS TURNED DOWN BY THE CONTRIBUTION COMMITTEE (DICK PASCAL)
<tel#>
<subj>
<reply>
<>

<date>10/13/80
<name>CHARLES HARWOOD
<tel#>408-746-3577
<subj>PRES OF SIGNETICS
<reply>
<>

<date>10/13/80
<name>TEICHER
<tel#>
<subj>RE LYNN CONWAY--415-494-4000 X4316. PAUL PENNINGTON, MIT HAS CONTACTED LYNN AND SAID THAT BOTH DEC AND MIT WOULD GIVE A JOINT OFFER. SHE SAID THAT SHE WANTED TIME TO THINK IT OER. MUDGE WILL BE SEEING HER 2 WEEKS FROM TOAY (10/27). THEY HAVE A JOB IN MIND FOR HER--VLSI ADVANCED DEVELOPMENT (POSSIBLY REPLACEMENT FOR CRAIG). THIS IS A TECHNICAL MANAGEMENT DIRECTION JOB. THERE ARE NO BUDGET PROBLEMS. STEVE WOULD LIKE YOU TO CALL HER TO ENCOURAGE HER TO COME FOR AN INTERVIEW--GOOD VLSI ENVIRONMENT.
<reply>
<>

<date>10/13/80
<name>ED SERVICES WOULD LIKE YOU TO WRITE A FORWARD IN THEIR COURSE SCHEDULE. THEY HAVE HAD A PIECE GHOST WRITTEN TO SAVE YOU TIME--IF YOU LIKE IT. DEADLINE IS 1ST WEEK IN NOVEMBER, OR FOR THE NEXT ISSUE IN FEBRUARY--OR OVER COMMITTED, COME BACK IN A YEAR.
<tel#>
<subj>
<reply>
<>

<date>10/13/80
<name>STEVE GUTZ
<tel#>264-8029
<subj>RE BLISS AND CMU
<reply>
<>

<date>10/13/80
<name>DAVE ROBINSON
<tel#>302-738-2405
<subj>RE A GOOD GUY LETTER AS HE IS UP FOR A PROMOTION AT THE

U OF DELAWARE. IF YES, SOME PAPERS WILL COME TO YOU AS A REFERENCE--OK? OR "NOT FAMILIAR ENOUGH WITH HIS WORK..."
<reply>
<>

<date>10/10/80
<name>BUZZ BROOKS
<tel#>264-5500
<subj>DO YOU KNOW A DR. GARY GOODMAN FROM EITHER CMU OR SCOTT INSTRUMENTS CO.? HE WANTS TO GET TOGETHER WITH DEC TO BUILD A PROTOTYPE VOICE-ENTRY TERMINAL FOR WP. PLEASE SEND AN EMS OR CALL BUZZ OVER THE WEEKEND. (HOME--603-673-1993)
<reply>
<>

<date>10/10/80
<name>AVRAM
<tel#>X9441
<subj>RE: HE HEARD THAT WAYNE ROSING CALLED DAVE SHANIN ABOUT A JOB OFFER. HE WANTED YOU TO KNOW THIS.
<reply>
<>

<date>10/10/80
<name>PITTS VISIT - HOTEL: THE EDGE IS NO LONGER. WHERE WOULD YOU LIKE TO STAY?
<tel#>
<subj>
<reply>
<>

<date>10/10/80
<name>DEMETRIOS--LATEST SCOOP RE COLORADO IN JANUARY. THEY HAVE HAD TO SCHEDULE A MANUFACTURING/ENGINEERING WOODS MEETING JAN 21 & 22. THERE WAS NO AWAY AROUND THE DATES. OPTIONS: WOULD LIKE TO ATTEND THEIR WOODS ON 1/22? THUS CANCELING THE REVIEW THAT MONTH, OR THEY CAN RESCHEDULE THE REVIEW ANY DAY THE FOLLOWING WEEK.
<tel#>

<subj>
<reply>
<>

<date>10/8/80
<name>DON'T FORGET TO CALL NEWELL (HOME:412-578-2601, CMU:412-421-3668) RE YOUR TRIP TO WASH./PITTS, 10/30 TO 11/1. YOU WILL BE IN PITTS 10/31, 4:33PM. THERE IS NO "EDGE MOTEL". WHO SEE 11/1, SATURDAY MORNING AT CMU? L PITT SAT AT 5:25P.
<tel#>
<subj>
<reply>
<>

<date>10/8/80
<name>12-1 SPACE STATUS: MEYER MOVES OUT NOV. 15. FLOOR WILL BE AT ITS EMPTIEST. AS OF NOW NO PLAN FOR 12-1. DECISION ON TO BLAST, JUST MOVE SI'S PEOPLE INTO MEYER AREA, WILL THEY HAVE TO MOVE OUT AGAIN BECAUSE OF LOBBY CONSTRUCTION ALL HUNG ON LOBBY PLAN. LOBBY PLAN STUCK SOME WERE BETWEEN HOLMAN AND KEN.

12B--QUESTION ON BILL LONG: 10 OF BILL'S PEOPLE ARE MOVING INTO 12B. THEY FEEL THIS IS THEIR'S AND CAN EXPAND. HOLMAN FEELS ALL OF BUILDING 12 IS ENGINEERING, BILL'S PEOPLE CAN USE 12B TEMPORARILY BUT MUST MAKE PLANS TO MOVE OUT. RIGHT?
<tel#>
<subj>
<reply>
<>

<date>10/8/80
<name>IT'S WORKING--DEAN KUH'S SEC., U OF CALIF.BERKELEY, CALLED RE YOUR NAE LETTER. HE IS IN MUNICH UNTIL 10/21. ASKED IF THEY COULD CALL YOU WITH THE TABULATIONS--I SAID SURE.
<tel#>
<subj>

<reply>
<>

<date>10/8/80
<name>CUDMORE IS ASKING FOR A MEETING WITH YOU AND LARRY RE SEMICONDUCTOR ENGINEERING ORG. THOUGHTS. NOTHING MATCHES ON THE 3 CALENDARS SO SUGGESTED HE MEET WITH LP FIRST, GIVE YOU THE RESULTS, AND IF NECESSARY YOU AND HE COULD THEN MEET.
<tel#>
<subj>
<reply>
<>

<date>10/8/80
<name>MAUREEN, SAM'S PERSONNEL REP--RE CONSULTING ENGINEER DINNER. SHE IS WONDERING ABOUT HOLDING IT IN THE MUSEUM? ABOUT 80 ATTENDEES. AND LOOKING FOR A POSSIBLE DATE OF 11/20? THIS IS THE NIGHT BEFORE YOU LEAVE FOR EUROPE.
<tel#>
<subj>
<reply>
<>

<date>10/8/80
<name>BILL MCBRIDE
<tel#>231-6906
<subj>RE IVAN DOBES.
<reply>
<>

<date>10/8/80
<name>JUST CALLED GERALD DAVIS TO LET HIM KNOW ABOUT THE "DETACHED PROCESSING" ROUTINE. HE SAID TO LET YOU KNOW HE IS WORKING FOR CMU AS A CONSULTING ON DESIGNING COURSES FOR NEXT YEAR AND HE IS GOING TO REQUIRE THE STUDENTS TO DO THEIR WORK ON WPS.
<tel#>
<subj>

<reply>
<>

<date>10/8/80
<name>RE TURING MACHINE--WAS IT WES CLARK WE GAVE THAT TO?
<tel#>
<subj>
<reply>
<>

<date>10/6/80
<name>ED FREDKIN
<tel#>412-621-6250
<subj>HE HAS 3 THINGS HE WANTS TO TALK ABOUT, ONE OF WHICH IS ZUSE. HE WANTS TO INVITE HIM TO A DOINGS AT MIT IN MAY--WISHES WE COULD CHANGE THE DATE.
<reply>
<>

<date>10/6/80
<name>KEN STOPPED BY--THERE IS A BUSINESS COMPUTER SHOW GOING ON IN BOSTON--HE IS GOING TO TRY TO GO TOMORROW AFTERNOON.
<tel#>
<subj>
<reply>
<>

<date>10/6/80
<name>PAUL CHAMBERS, PERSONNEL MGR, GIA, CALLED SHEL RE YOUR JAPANESE STAMPS. HE THOUGHT THEY MAY CAUSE SOME PROBLEMS WITH OUR JAPANESE EMPLOYEES.
<tel#>
<subj>
<reply>
<>

<date>10/6/80
<name>BOB STEWART

<tel#>247-2125
<subj>WHAT RADAR DETECTOR DID YOU GET?
<reply>ESCORT
<>

<date>10/3/80
<name>SIEKMAN - LOOKING FOR 11/05 ENGINEERINGS. HE IS CONTACTING TEICHER, AND BOB ARMSTRONG. THIS IS THE 1971 ERA--ANY COME TO MIND?
<tel#>
<subj>
<reply>
<>

<date>10/3/80
<name>MR. CHEBATOR, X3-4334, NE TELEPHONE MAN WITH A DEC EXTENSION WHO IS SUPPOSED TO BE TAKING CARE OF YOU. YOUR EMS PLUS THE GENERAL SITUATION HAS REALLY BEEN ESCALATED. ARTHUR DEAN, COPP'S MAN, IS GONG TO SEE ONE OF THE VP'S TODAY.
<tel#>
<subj>
<reply>
<>

<date>10/3/80
<name>MARGE POLLACH, SPECTRUM
<tel#>212-644-8093
<subj>RE REVIEW OF A PAPER, "COMPUTER SYSTEMS ARCHITECTURE" BY JEAN-LOUP BAER. I SAID YOU WERE OVER-COMMITTED, BUT IF ANY CHANGE I WOULD CALL THEM BACK ON MONDAY. OK?
<reply>
<>

<date>10/3/80
<name>SPITBROOK--DO YOU WANT THEN TO INSTALL A TELECONFERENCING UNIT LIKE THE ONE WE HAVE IN THE ENG. CR? $1500
<tel#>

<subj>
<reply>
<>

<date>10/2/80
<name>NANCY HIKE
<tel#>X3431
<subj>RE: STOCK ACTIVITY FOR THE MONTH OF SEPT. DID YOU HAVE ANY?
<reply>
<>

<date>9/30/80
<name>KURT FRIEDRICH IS TRYING TO SET UP A MEETING ON 9-MNTH BACKUP PROPOSAL??? OK? YOU, DALEY, DON JENKINS?
<tel#>
<subj>
<reply>
<>

<date>9/30/80
<name>STEVE PUTHUFF
<tel#>408-378-7000
<subj>FROM BRITAIN-LEE, MANUFACTURING DATA PROCESSORS. SAYS YOU KNOW HIM AND WOULD LIKE YOU TO CALL.
<reply>
<>

<date>9/30/80
<name>JERRY COX
<tel#>7795
<subj>YOU SUGGESTED HE DISTRIBUTE THE "TREES" WIDELY. OOD? OOD & DIRECT REPORTS?
<reply>
<>

<date>9/30/80

<name>MONICA POLOWY
<tel#>714-452-4383
<subj>RE THEIR (U OF CALIF AT SAN DIEGO--ROGER REYNOLDS AND DICK MOORE) LETTER ON A COMPUTER MUSIC PROJECT. HAS THERE BEEN ANY MOVEMENT FROM YOUR LETTER?
<reply>
<>

<date>9/30/80
<name>AVRAM--RE THE KO REQUEST. HE WILL HAVE IT BY 8:00 TOMORROW--WANTS TO TALK WITH CLAYTON TONIGHT.
<tel#>
<subj>
<reply>
<>

<date>9/30/80
<name>BRUCE STEWART
<tel#>264-7510
<subj>PLEASE CALL
<reply>
<>

<date>9/30/80
<name>PETER CONNELL--DEC TW WON AN ENERGY CONSERVATION AWARD TO BE PRESENTED FRIDAY AT THE STATE HOUSE. WE ARE 1 OF 14 VOMPANIES TO BE REPRESENTED. TOLD HIM YOU WERE OUT BUT TO CONTACT LP. I THINK BILL WILL BE GOING.
<tel#>
<subj>
<reply>
<>

<date>9/30/80
<name>BILL LONG--WANTED TO KNOW IF YOU WOULD SIT IN FOR AN HOUR ON HIS LSG STRATEGY TASK FORCE, YOUR THOUGHTS: TODAY, 1:00, SI OR LONG OFFICE
<tel#>

<subj>
<reply>
<>

<date>9/29/80
<name>MARY ANN NICHOLS--STAN PEARSON'S TEMP. SEC.
<tel#>X7181
<subj>MEETING ASAP--GB'S REQUEST (HALF DAY, RE: A) OUR ASSUMPTIONS ON DISTRIBUTED SYSTEMS & MARKETING FOR LATE '80, B) ADVANCED DEVELOPMENT ON THE ABOVE (A). ATTENDEES: DAVE RODGERS, TONY LAUCK, PETE NESBEDA, WAYNE ROSING, STAN, & GB.
<reply>
<>

<date>9/29/80
<name>MR. MICAHEL NACEY--BBN, CAMBRIDGE
<tel#>491-1850, X3284
<subj>HE TALKED WITH FRANK HART AT BBN AND FRANK THOUGHT GB MIGHT BE INTERESTED IN GIVING A SEMINAR. IT COULD BE SCHEDULED ANYWHERE FROM OCTOBER - MAY '81; TIME, 5-6:30 (USUALLY PRESENTED ON TUES., WED., OR THURS.); ATTENDANCE, 75-200; SUBJECT: DEVELOPMENTS IN COMPUTER ARCHITECTURE.
<reply>
<>

<date>9/29/80
<name>MIKE RIGGLE, IF HE HASN'T SEEN YOU AT HUDSON, MAY STOP THIS AFTERNOON RE THE AZTEC AGREEMENT UPDATE.
<tel#>
<subj>
<reply>
<>

<date>9/26/80
<name>SAM--TRYING TO SET UP A MEETING ON "WHAT TO DO ABOUT A CAD PROGRAM" YOU SHOULD GO TO THIS - Y OR N?
<tel#>
<subj>
<reply>
<>

<date>9/26/80
<name>DR. GEORGE HEILMEIER
<tel#>HOME: 214-386-4021
<subj>AS YOU KNOW HE HAS TRIED TO REACH YOU SEVERAL TIMES. I TOLD HIM YOU WOULD TRY OVER THE WEEKEND.
<reply>
<>

<date>9/26/80
<name>OLLIE STONE HAS ASKED FOR A MEETING WITH YOU: DISCUSSION OF TAILORABLE SOFTWARE, PEOPLE, ORGANIATION ETC. ATTENDEES: OLLIE, CLIFF NEER, TOM BARNET, KEITH REGGLY--NEW APPLICATION STRATEGY GROUP IN MK. TENTATIVELY SCHEDULED WHEN YOU ARE AT SPITBROOK--THEY WILL COME TO YOU. IS THIS MEETING NECESSARY?
<tel#>
<subj>
<reply>
<>

<date>9/26/80
<name>JEFF SCOTT
<tel#>6743
<subj>RE YOUR BRIEFING PMC ON KO PROJECT SPECS? PREMATURE?
<reply>
<>

<date>9/25/80
<name>DEMMER
<tel#>247-2111
<subj>RE A 1/2 DAY MEETING, "NI COMM". ATTENDEES: BERNIE, STAN P., JOHN ADAMS, PLOWMAN, JIM MARSHALL, ROSING, RODGERS, BRESLIN. IS THIS A MUST?
<reply>
<>

<date>9/25/80

<name>HENRY COURSE--OOD FY80 GOALS AND OBJECTIVES--STILL OK FOR FY81? ANYTHING NEW WRITTEN?
<tel#>
<subj>
<reply>
<>

<date>9/25/80
<name>HOLMAN
<tel#>
<subj>WILL BE TALKING WITH GEORGE LOWE, PRES. RPI. Do you HAVE ANY SPECIAL CONCERNS YOU WANT HIM TO PASS ON; I.E. "HOW THEY ARE GOING TO HELP OUR KIDS COMPETE WITH THE JAPANESE?"
<reply>
<>

<date>9/25/80
<name>ART WILLIAMS
<tel#>3954
<subj>SPOKE WITH HAROLD COHEN. WHAT KIND OF RELATIONSHIP DO YOU SEE WITH HIM?
<reply>
<>

<date>9/25/80
<name>I PRESUME YOU WANT TO CAR POOL TO THE MINARY (JUNGLE)
<tel#>
<subj>
<reply>
<>

<date>9/25/80
<name>STEVE SUR (JUDY)
<tel#>231-5083
<subj>THERE WILL BE A VENUS REVIEW 10/1, 2:00 TO 5:00, MARLBORO. INVITED: LP, SI, + ULF'S STAFF AND THE VENUS GROUP. ULF POSTPONED HIS OPERATING REVIEW AND THIS IS BEING SCHEDULED IN ITS PLACE. WHAT'S YOUR PLEASURE? GO - NO GO?
<reply>

<>

<date>9/25/80
<name>MAUREEN WHITE
<tel#>225-4455
<subj>INVITING YOU TO THE HUDSON OPEN HOUSE, 10/12, 1:00 TO 5:00, FOR ALL HUDSTON EMPLOYEES. GEARING UP FOR 3000. WANT TO/SHOULD YOU GO?
<reply>
<>

<date>9/25/80
<name>TOM CHISHOLM
<tel#>264-7657
<subj>RE DECMAIL
<reply>
<>

<date>9/25/80
<name>RE NAE VOTING SCHEDULE--A MAILING WILL GO OUT MIDDLE OF NEXT WEEK TO ALL MEMBERS ON YOUR COMMITTEE. IT WILL CONTAIN: PROCEDURES, CURRENT NOMINEE ASSIGNMENTS, AND SCHEDULE. AT THIS POINT WE DON'T HAVE TO DO ANYTHING IN ALERTING THE COMMITTEE OR SENDING THEM INFO.
<tel#>
<subj>
<reply>
<>

<date>9/23/80
<name>CHUCK KAMAN
<tel#>244-4791
<subj>HE IS ON A LEAVE OF ABSENCE. SAID HE HEARD YOU WERE INTERESTED IN THE PERSONAL COMPUTER AND HE HAS QUITE A BIT OF DATA AS HE PERUSED THE MARKET BEFORE HE BOUGHT HIS "APPLE". HE SAID YOU COULD CALL IF YOU WANTED TO CHAT ABOUT IT.
<reply>
<>

<date>9/23/80
<name>LARRY MANN (OLD FRIEND?)
<tel#>602-626-1149
<subj>PERSONAL
<reply>
<>

<date>9/23/80
<name>CONRAD VISSER, DEC-BRAZIL, STOPPED BY TO SAY HELLO.
<tel#>
<subj>
<reply>
<>

<date>9/23/80
<name>RE THE OCT. 7 BOSTON SALES TALK--DISTRIBUTED PROCESSING--YOU NEED A 35MM SLIDE PROJECTOR. ANYTHING ELSE?
<tel#>
<subj>
<reply>
<>

<date>9/22/80
<name>GRANT--DID YOU TAKE GIFTS TO JAPAN? I TOLD HIM YOU DID--ANY SUGGESTIONS NOW THAT YOU HAVE BEEN THERE?
<tel#>
<subj>
<reply>
<>

<date>9/22/80
<name>LARRY IS ASKING THAT DELAGI BE COPIED ON ALL OOD CORRESPONDENCE. DO YOU AGREE AS FAR AS MOST THINGS GO?
<tel#>
<subj>
<reply>
<>

<date>9/22/80
<name>BJ/FAITH--RE A MEETING--DEC 10/20 ENGINEERING STRATEGY. IS THIS READY FOR YOUR REVIEW OR SIT THIS ONE OUT?
<tel#>
<subj>
<reply>
<>

<date>9/22/80
<name>PERKINS CALLED RE THE IEEE ABSTRACT: GAVE HIM THE TITLE--GENERATING COMPUTER GENERATIONS. SAID HE COULD WAIT UNTIL WEDNESDAY MORNING FOR THE ABSTRACT.
<tel#>
<subj>
<reply>
<>

<date>9/19/80
<name>PAUL SAYRES
<tel#>225-4981
<subj>SAW A REPORT IN YOUR OFFICE--1980 IN DIGITAL, A MANAGEMENT OVER VIEW OF DIGITAL'S COMPUTER SYSTEMS, PRODUCTS AND SERVICES. DO YOU KNOW WHO PRODUCED IT SO HE CAN GET A COPY?
<reply>
<>

<date>9/19/80
<name>PROF. WOODSON, U OF TEXAS, ACCEPTED YOUR OFFER--IS DELIGHTED. WOULD LIKE A TITLE/ABSTRACT. THEY ALSO HAVE AN ARCHIVE/EXHIBIT AREA WITH OLD ELECTRONIC EQUIPMENT (SOME, IF NOT ALL, IS COMPUTER RELATED). I TOLD HIM THAT GWEN MIGHT BE INTERESTED IN SEEING IT. HE IS GOING TO PUT TOGETHER A PROPOSED SCHEDULE FOR THE DAY--JAN 30 AND SEND FOR YOUR APPROVAL.
<tel#>
<subj>

<reply>
<>

<date>9/17/80
<name>PROF. DERTROUZOS
<tel#>253-2145
<subj>RE: UPCOMING MEETING--WOULD APPRECIATE A CALL FROM GB ASAP.
<reply>
<>

<date>9/17/80
<name>MARGE POLLACK
<tel#>212-644-8093
<subj>IEEE SPECTRUM, NY--RE: REVIEW A BOOK BY JEAN-LOUP BAER "COMPUTER SYSTEM ARCHITECTURE
<reply>
<>

<date>9/17/80
<name>ERWIN GOODWIN
<tel#>202-389-6540
<subj>NATIONAL RESEARCH COUNCIL--RE: HE WOULD LIKE YOU TO REVIEW A REPORT ON COMPUTERS & COMMUNICATIONS
<reply>
<>

<date>9/17/80
<name>JOAN HENDRICKSON
<tel#>879-4502 (FRAMINGHAM)
<subj>CO: INTERFACE WEST, (LOS ANGELES), RE: SESSION ON OPERATING SYSTEMS
<reply>
<>

<date>9/16/80
<name>BOB DILL

<tel#>
<subj>LAST CHECK FOR THIS YEAR: PLEASE DATE 9/8/80, $9692.40, TO DIGITAL EQUIPMENT CORPORATION.
<reply>
<>

<date>9/16/80
<name>MARIO MUMMOLO
<tel#>
<subj>NEGROPONTE WANTS TO HEAR ABOUT COMET ON WEDNESDAY. THERE ISN'T TIME FOR A NONDISCLOSURE AGREEMENT. IF YOU AGREE WOULD YOU LET FURMAN KNOW AND WE WILL GET THE AGREEMENT SIGNED AFTER THE FACT.
<reply>
<>

<date>9/15/80
<name>NAT PARKE
<tel#>247-2039
<subj>RE STATE OF CAD TOOLS SYMPOSIUM TO BE HELD IN JAPAN. DO YOU HAVE A SUGGESTION FOR A SPEAKER WHO WOULD HAVE A GOOD HANDLE ON THE SUBJECT PLUS WOULD LIKE TO GIVE IT?
<reply>
<>

<date>9/15/80
<name>GRANT--CAN HE BORROW YOUR VOGEL BOOK? IF NOT, NEED TITLE, AND PUBLISHER.
<tel#>
<subj>
<reply>
<>

<date>9/15/80
<name>GENE JONES - HE IS LOOKING FOR A BOOK HE HAD-- "YOSHINA". BY ANY CHANCE DO YOU REMEMBER HIS LOANING IT TO YOU ABOUT A YEAR AGO? ALSO, RE YOUR EMS ON JAPAN: THE VOGEL BOOK. PLEASE LET ME KNOW THE TITLE AND PUBLISHER SO PEOPLE

CAN GET IT.
<tel#>
<subj>
<reply>JAPAN AS NUMBER ONE, LESSONS FOR AMERICA, EZRA F. VOGEL, HARVARD UNIVERSITY PRESS CAMBRIDGE, MA; LONDON, ENGLAND 1979.
<>

<date>9/15/80
<name>JOHN ANDERSON, AVIATION
<tel#>
<subj>KEN HAS ASKED FOR A CHOPPER TO TAKE HIM FROM BEDFORD TO MR THE TWO DAYS OF THE WOODS. KO ASKED JOHN TO SEE IF YOU WOULD LIKE A RIDE ALSO. BEING AS YOU PROBABLY WANT TO SPEND SOME TIME WITH COHEN ON WEDNESDAY AND YOUR OTHER FEELINGS, IS THE ANSWER NO TO BOTH DAYS?
<reply>
<>

<date>9/15/80
<name>NAGESH CHOWLA
<tel#>415-493-3100 X2496
<subj>A FORMER STUDENT OF YOURS CALLED RE GLEN LEEDY. CHOWLA IS FROM FAIRCHILD AND IT IS RE AN INTERNAL TRANSFER OF LEEDY FROM ONE JOB TO ANOTHER. WANT ME TO CALL NO COMMENT?
<reply>
<>

<date>9/15/80
<name>MARCUS
<tel#>264-5362
<subj>SOMETHING ABOUT PUTTING SOMEONE IN CHARGE OF OFIS IN EUROPE WHEN WE DIDN'T HAVE A MARKETABLE PRODUCT VIA THE LANGUAGES YET. PLEASE CALL.
<reply>
<>

<date>9/15/80

<name>ROGER CADY
<tel#>264-5045
<subj>RE MDC ENGINEERING
<reply>
<>

<date>9/12/80
<name>LP WILL NOT BE ATTENDING WILL'S OPERATING REVIEW ON MONDAY. SAID YOU WOULD UNDERSTAND AS HE WILL BE WORKING THE T&E BUDGET ISSUE. HOWEVER, IT THEN BECOMES IMPERATIVE THAT YOU DO GO TO THE REVIEW.
<tel#>
<subj>
<reply>
<>

<date>9/12/80
<name>SHEL CALLED TO SAY THANKS FOR THE FRUIT BASKET--HE WAS TRULY TOUCHED. (FOR THE LOWEST PRICE, $12, IT LOOKED BEAUTIFUL!)
<tel#>
<subj>
<reply>
<>

<date>9/12/80
<name>LARRY SPOKE WITH KEN--"EVERYTHING IS COOL; HE AGREES"
<tel#>
<subj>
<reply>
<>

<date>9/12/80
<name>TRAVEL PLANS--YOU ARE SCHEDULED IN WASH. D.C. NOVEMBER 6 FOR THE CS&TB. GWEN GOING? GO DOWN NIGHT BEFORE/MORNING OF? RETURN THAT NIGHT? THE FIRST OC ALL DAY LRP REVIEW IS NOVEMBER 7.
<tel#>
<subj>

<reply>
<>

<date>9/12/80
<name>TOM DAY, DEC LONDON
<tel#>637-5200
<subj>RE YOUR TRIP ENGLAND/INFOTECH. HE HAS SOME BIG ACCOUNTS--BANKS AND OTHER BUSINESSES--WHO SAW WHERE YOU WERE GIVING A LECTURE. TOM IS WONDERING IF YOU WOULD GIVE THE SAME LECTURE TO A GROUP OF HIS ABOVE CUSTOMERS? ANY DAY OF YOUR CHOOSING WHILE YOU ARE THERE?
<reply>
<>

<date>9/11/80
<name>HAROLD COHEN
<tel#>231-4036
<subj>RE ?
<reply>
<>

<date>9/11/80
<name>STOCKY WILL BE IN TOWN ON MONDAY--FYI. WE HAVE SET UP A TENTATIVE MEETING AT 4:00, IF YOU CAN STEP OUT OF OR ARE DONE WITH FULLER OPERATING REVIEW.
<tel#>
<subj>
<reply>
<>

<date>9/10/80
<name>DR. ABRAHAMSON
<tel#>512-684-5111
<subj>RE NAE INFO YOU WERE GOING TO GIVE TO HIM.
<reply>
<>

<date>9/10/80
<name>ART LARAMEE
<tel#>264-5069
<subj>RE Q REQUEST FROM WESTERN ELECTRIC FOR A SPEAKER AT A SYMPOSIUM THEY ARE HAVING ON THE FUTURE OF MINICOMPUTERS. DON'T WANT THE TALK TO BE DEC SPECIFIC, INDUSTRY IN GENERAL. THEY ARE ASKING CDC, IBM, DEC... TRENDS IN DP, CENTRALIZED PROCESSING, MICRO PROCESSORS. GOING TO BE HELD OCTOBER 21, 80, 30 NON-TECHNICAL. UP TO 2 HOURS. HELD--NORTH CAROLINA.
<reply>
<>

<date>9/10/80
<name>SLAGLE, NAVAL RESEARCH LAB--NOV. 5 WAS NOT GOOD. THEY ARE HOLDING A 3-DAY ROBOT SYMPOSIUM. SAID IF YOU WOULD LIKE TO DROP IN YOU WOULD BE WELCOME. I REALLY THINK YOU ARE OFF THE HOOK ON THIS TALK NOW.
<tel#>
<subj>
<reply>
<>

<date>9/9/80
<subj>COMPUTER SOFTWARE
<from>GILBERT, JULES
<to>BELL, GORDON
<date>80/7
<date rec>7/24/80
<log#>7-54
<dispo/date>SAM FULLER - 8/5/80
<message>WHAT'S THIS?
<name>JULES GILBERT CALLED RE THE ABOVE? DO YOU REMEMBER WHAT IT WAS? WANT TO CALL HIM?
<tel#>926-4730
<subj>
<reply>
<>

<date>9/9/80
<name>JIM BARCLAY

<tel#>264-7256
<subj>WOULD LIKE A SET OF YOUR SLIDES YOU USED AT STRATTON - "OVERVIEW OF PROCESSORS IN THE FUTURE". WANT TO GIVE A QUICK CONCISE PICTURE OF WHERE WE ARE GOING TO THE TELCO SALES MEETING. I TOLD HIM YOU DIDN'T GIVE OUT THE SLIDES, BUT PERHAPS BY SIGNING A SECURITY AGREEMENT HE COULD PREVIEW THE TAPE TAKEN AT STRATTON. WHAT YOU SAY?
<reply>
<>

<date>9/9/80
<name>DR. GEORGE HEILMEIER, TI
<tel#>214-995-5975
<subj>RE: OLD FRIENDS--AND WOULD LIKE TO TALK WITH YOU.
<reply>
<>

<date>9/9/80
<name>RANDY GRIFFIN
<tel#>264-7176
<subj>RE THE KO. AND A DEFINITION FO THE 11/50.
<reply>
<>

<date>9/9/80
<name>PHIL PETIT
<tel#>415-494-4423
<subj>RE HE IS FORMERLY FROM FOONLY AND CURRENTLY WITH XEROX. THE CALL HAS NOTHING TO DO WITH THE PRESENT WORKING ARRANGEMENTS WITH XEROX BUT WITH FOONLY???????
<reply>
<>

<date>9/9/80
<name>RICK SIEGEL
<tel#>312-641-6090
<subj>SENT SOME DOCUMENTATION THROUGH THE CHICAGO OFFICE--LEGAL SAYS IT IS NOW OK FOR YOU TO TALK WITH HIM.

<reply>
<>

<date>9/9/80
<name>KIRK - THE 3 278'S ARE OWNED BY:GARY COLE, OWEN FISKE, AND DICK FUNK.
<tel#>
<subj>
<reply>
<>

<date>9/9/80
<name>JAN J.
<tel#>3-7525
<subj>DO YOU STILL WANT THE SHUGART TAPE TRANSCRIBED FROM STRATTON--RE THE HISTORY OF MASS STORAGE? ALL OF IT OR JUST THE HISTORY PART?
<reply>
<>

<date>9/9/80
<name>WAYNE FURMAN
<tel#>231-6972 (PEGGY)
<subj>LOOKING FOR A LISDE (3 DIMENSIONAL) HE SAW YOU PRESENT ON: TECHNOLOGY VERSUS TIME VERSUS FUNCTIONALITY. SOUNDED LIKE A GENIGRAPHIC SLIDE--DO YOU KNOW WHICH TALK OFF HAND + DO YOU WANT TO GIVE IT OUT?
<reply>
<>

<date>9/9/80
<name>GARY PHILIPS
<tel#>617-383-6960
<subj>RE ? VERY PUSHY. SAYS I WOULDN'T UNDERSTAND BECAUSE IT IS TOO TECHNICAL.
<reply>
<>

<date>9/8/80
<name>GEORGE CHAMBERLAIN
<tel#>3-5305
<subj>RE SOUTHWEST PROPOSAL
<reply>
<>

<date>9/8/80
<name>TOM LONGO
<tel#>415-493-3100
<subj>RE THE CONF. IN N.Y.--ICCCS
<reply>
<>

<date>9/8/80
<name>BOB DILL
<tel#>URGENT URGENT URGENT--PLEASE MAKE OUT A CHECK FOR $9752.40 TO DIGITAL. DATE IT: 9/1/80
<subj>
<reply>
<>

<date>9/8/80
<name>CLAYTON
<tel#>3-3638
<subj>"RE ISSC TINY PAPER--SHIELDS IS IN EUROPE; ANCONA WILL BE AT MC. I WILL TRY TO GET HIM MONDAY MORNING. MACKEEN SUPPORTS THE PAPER, HENCE THERE SHOULD NO MC PRESSURE. WE SHOULD BE LOW KEY AND LET THE FS OBJECTION NEVER HAPPEN IF POSSIBLE. I WILL CONNECT WITH SI THIS MORNING BEFORE MC."
<reply>
<>

<date>9/8/80
<name>OH MY--SI WANTS TO KICK OUT ENGINEERING COMMITTEE FROM OUR CR FOR HIS STAFF MEETINGS--THURSDAY MORNINGS. PROBLEM IS, WE DID KICK THEM OUT ONCE FOR CHARLIE'S REVIEWS; THEY NEVER HAPPENED; WE JUST LET THEM BACK IN.
<tel#>

<subj>
<reply>
<>

<date>9/8/80
<name>FRANK URA
<tel#>415-857-2734
<subj>CALLED LATE FRIDAY: FROM HEWLETT PACKARD, PALO ALTO. RE ELECTRON BEAM LITHOGRAPHY SYSTEMS.
<reply>EMS TO CUDMORE TO RET THE CALL 9/18/80 Thu 16:28
<>

<date>9/8/80
<name>MARCUS' GREY BOOK YOU RECEIVED LAST FRIDAY--THIS IS A REVIEW COPY WHICH INCLUDES SOME UPDATES FOR FY81. THE 1ST THREE SECTIONS ARE INTACT FROM LAST YEAR--NO CHANGES. EVERYTHING PAST PAGE 24 HAVE BEEN UPDATED AND THEREFORE CONTAIN AREAS THAT ARE INCOMPLETE, TYPOGRAPHICAL ERRORS, AND STATEMENTS THAT HAVE NOT BEEN NECESSARILY AGREED UPON BY EVERYONE IN THE COMMERCIAL GROUP.
<tel#>
<subj>
<reply>
<>

<date>9/8/80
<name>SHOULD DARBELOFF SIGN A NON DISCLOSURE WHEN HE COMES TO SEE THE CR BUT REALLY FOR EMS?
<tel#>
<subj>
<reply>
<>

<date>9/4/80
<name>NEGROPONTE
<tel#>253-5981
<subj>CALLED RE: "MIT LAB SWITCHING TO DEC COMPUTERS" (I DIDN'T TAKE THE MESSAGE. THIS MORNING MUMMOLO CALLED SAYING

DEC IS ALMOST THERE IN THE BIG SALE, THEY WILL BE GETTING THEIR MONEY OCT. 1, HE LIKES TO RUB SOCIALLY WITH VP'S, HENCE YOU CAN BE A BIG HELP.
<reply>
<>

<date>TO: GORDON BELL DATE: TUE 2 SEP 1980 7:10 PM EDT
RICK GOLDBERG, 231-4336, CALLED RE USING THE PDP TREE POSTER IN THE ECS CAPABILITIES BROCHURE. HAVE THERE BEEN ANY CORRECTIONS? HE WILL SEND A MOCK UP OF THE BROCHURE BEFORE IT IS PRINTED.

FOR INSTANCE, THE 11/780 IS SHOWN AS AN EXTENSION OF 11/70.

. JOE SANTINI CANCELLED THE DIGITAL PRESS MEETING ON 9/19. SAID IT COULD BE COVERED WHEN OOD MEETS AT BEDFORD. WANT TO PURSUE?

. DR. ABRAHAMS CALLED--THROUGH AN OPERATOR NO MESSAGE, BUT PLS RET THE CALL: 512-684-5111 X2300

. BOB CARMICHAEL, DEC ELSEGUNDO--RICK CARLSON, USC, IS COMING THIS WAY 9/9 THRU 10 AND WANTS TO TALK WITH YOU AGAIN--THIS IS REGARDING THE RESEARCH FACILITY. DO YOU WANT TO SEE HIM? NOTHING TO TALK ABOUT? GIVE TO HOLMAN? 213-640-1830 X262 (BOB).

. DON HOOPER--I CANCELED HIM FOR 9/3 SO YOU COULD HAVE YOUR KO SESSION. TRIED TO GET HIM TO COME EARLIER IN THE DAY BUT HE COULDN'T. THIS IS ONE OF THOSE MEETINGS WHICH ARE PILING UP--WANTS TO TALK ABOUT FUTURE SYSTEMS. HOW ABOUT A PHONE CALL???

. GLORIOSO WANTS TO MEET FOR A 1/2 DAY: BOB, LARRY, ULF, AND SAM RE CORPORATE RESEARCH REVIEW. OK?

. YOU ARE SCHEDULED OUT 9/12 AND 26--OK TO BRING YOU IN FOR A 1/2 DAY EACH--AFTERNOON?

<date>8/29/80
<name>TLKED WITH HENRIETTA RE NAE AD HOC COMMITTEE--SHE SAID SHE HAD SPOKEN TO YOU AND THAT SHE DID UNDERSTAND YOU MIGHT NOT BE ABLE TO ATTEND THE MEETINGS BUT THAT SHE/YOU HOPED IF YOU HAD IDEAS YOU WOULD LIKE TO SUBMIT YOU WOULD DO SO: I.E. THE PROCEDURES FOR NOMINATING/INDUCTING NEW MEMBERS, THE PROCEDURES AND PROCESSES, THE SEARCH EFFORT, MORE/LESS PEER COMMITTEES, PROBLEMS IN GENERAL WITH THE ELECTION PROCESS TO THE NAE.
<tel#>
<subj>
<reply>
<>

<date>9/4/80 Thu 9:36
<name>
<tel#>
<subj>
<reply>
<>

<date>8/29/80
<name>RANDY KING FOR PERKINS (PRES. NAE)
<tel#>202-389-6658
<subj>RE OCT 30 NAE TECHNICAL SESSION--WOULD LIKE YOU TO BE ON THE PANEL. U R SCHEULED IN WASH. THAT DAY. THEY WOULD LIKE YOU TO SERVE ON A PANEL (1 OF 3--INDUSTRY VIEWS, UNIVERSITY VIEWS, GOVERNMENT VIEWS "ON ACADEMIC INDUSTRY AND GOVERMENT INTERACTION IN ENGINEERING EDUCATION. YOUR PANEL WOULD BE THE UNIVERSITY VIEWS. THIS PANEL WOULD MEET FROM 11:15 TO 12:30. PANELISTS WHO HAVE BEEN ASKED (NOT NECESSARYILY GOING TO BE THERE) SUTHERLAND, JOHN HANCOCK, ED DAVID-EXXON, GLOYNA-U OF TEXAS, KOERNER-SLOAN, YOURSELF. WHAT IS YOUR PLEASURE?
<reply>
<>

<date>8/29/80

<name>BILL MUNSON
<tel#>8-264-7436
<subj>AT STRATTON YOU NAMED 5 TYPES OF MACHINES: 1.MULTIPROCESSORS, 2.PROFESSION BASED, 3.HAND HELD, 4.STACKABLE, 5.? WHAT WAS THE FIFTH?
<reply>
<>

<date>8/29/80
<name>DON FROST
<tel#>231-7202
<subj>RE KEYNOTE SPEAKER AT DECUS IN AMSTERDAM--SEPT. 17. SUBJ: DIGITAL ARCHITECTURE IN THE 80S. HE HAS FOLLOWED YOUR SUGGESTIONS (OOD MEMBERS) AND ALL HAVE SAID NO. ANY OTHER SUGGESTIONS?
<reply>
<>

<date>8/29/80
<name>CMU, DISTINGUISHED LECTURE - YOU ARE SCHEDULED FOR MARCH 11, 3:00 THE TALK, 4:30 RECEPTION.
<tel#>
<subj>
<reply>
<>

<date>8/28/80
<name>WAYNE FURMAN
<tel#>231-5845
<subj>RE A SOFTWARE SPECIALIST IN DC IS CURRENTLY RECRUITING CHRIS HALL FROM OUR ORGANIZATION (BY SUMNER BLOUNT). CHRIS IS LINED UP TO DO NIH CONSULTING ($12M CONTRACT THAT THE OC ALLOWED US TO GO AFTER). HELP--PLEASE CALL TO SEE HOW TO HANDLE
<reply>
<>

<date>8/28/80

<name>SAM FULLER
<tel#>3-4562
<subj>RE INTEL 432.
<reply>
<>

<date>8/28/80
<name>STEVE TEICHER
<tel#>225-4900
<subj>RE CRAIG MUDGE
<reply>
<>

<date>8/28/80
<name>PAUL THORDARSON
<tel#>3-8978
<subj>RE A MEETING YOU ASKED FOR: SPEECH I/O. ATTENDEES: ROSING, KALIN, FULLER, RODGERS. DO YOU WANT THIS SET UP?
<reply>
<>

<date>8/28/80
<name>TALKED WITH RANDELL'S OFFICE THIS MORNING. HE WILL BE WRITING TO YOU, BUT NOV. 21 IS GOOD--MORE DETAILS WILL FOLLOW RE GIVING A TALK AND POSSIBLE PLANS FOR EVENING.
<tel#>
<subj>
<reply>
<>

<date>8/28/80
<name>ART FISHER
<tel#>3-3700
<subj>RE THE INTEL LETTER I TOLD YOU ABOUT. FOR SOME REASON IT IS NOT IN OUR LOG WHICH MAKES ME WONDER IF YOU EVER GOT IT; OR DAVE/KAUFMAN MIGHT HAVE HANDED IT TO YOU. LETTER ADDRESSED TO YOU AND DAVE, 3/4 OF A PAGE, DATED 7/10/80, FROM PHIL KAUFMAN, RE "DISCUSSION HELD 7/2/80. ART HAS ASKED THAT

WE DESTROY IT. IF YOU DO FIND IT PLEASE LET ME KNOW.
<reply>
<>

<date>8/28/80
<name>BERNIE--DO YOU KNOW WHERE KEN GOT THAT REPLICA OF THE VAX HE GAVE YOU?
<tel#>
<subj>
<reply>
<>

<date>8/27/80
<name>JACK MACKEEN
<tel#>231-5351
<subj>EMS MESSAGE YOU SENT. RE: TU58 INVENTORIES, THERE WAS A STATEMENT MADE TO REMOVE THE TU58'S FROM THE MARKET. HE WANTS TO KNOW WHO MADE THIS STATEMENT.
<reply>
<>

<date>8/27/80
<name>TOM STAMBAUGH
<tel#>3-5749
<subj>RE WORD 11 PERFORMANCE CONCERNS.
<reply>
<>

<date>8/26/80
<name>WAYNE FURMAN
<tel#>231-5845
<subj>RE A SOFTWARE SPECIALIST IN DC IS CURRENTLY RECRUITING CHRIS HALL FROM OUR ORGANIZATION (BY SUMNER BLOUNT). CHRIS IS LINED UP TO DO NIH CONSULTING ($12M CONTRACT THAT THE OC ALLOWED US TO GO AFTER). HELP--PLEASE CALL TO SEE HOW TO HANDLE
<reply>
<>

<date>8/25/80
<name>SORRY--THE EMS RAP SESSION ON PBS HAS NOT BEEN SET UP. LOOKS AS IF IT WILL HAVE TO BE VIA THE ENGINEERING NETWORK, SO WE PROCEED TO REACTIVATE YOUR ACCOUNT VIA R&D.
<tel#>
<subj>
<reply>
<>

<date>8/25/80
<name>JOANNE FALCO
<tel#>247-2932
<subj>DAVE RODGERS CALLED HER FROM EUROPE--DO YOU WANT HIM TO CONTACT SIEMENS ON THIS TRIP RE LOCAL AREA NETWORKS, INTERCONNECT PROGRAM, THINGS IN GENERAL? IF SO, WHO? HE WILL BE GOING TO EUROPE AGAIN BEFORE THE END OF THE YEAR SO IT NOT BE DONE NOW.
<reply>
<>

<date>8/25/80
<name>EMPLOYEE RELATIONS
<tel#>7615
<subj>RE SEPT. 3 STATE OF THE CORP. MEETING--YOU HAVE 9 ADDITIONAL INVITATIONS. THE 3 SR. CONSULTING ENG. HAVE BEEN ASKED (CUTLER, KOTOK, STRECKER)
<reply>
<>

<date>8/25/80
<name>PROF. LARRY MANN, U OF ARIZ--WILL CALL BACK.
<tel#>
<subj>
<reply>
<>

<date>8/21/80
<name>SUE LAWTON
<tel#>216-831-6000 X264 (DEC)
<subj>CLEVELAND TOEM SALES. SHE HAS ONE OF OUR CUSTOMERS WHO HAS REALLY BEEN JERKED AROUND--J. B. RICHEY, TECHNICARE. RICKEY WAS GIVEN MONEY TO SET UP A RESEARCH GROUP RE CATSCANING FIELD. HE IS A VERY BRIGHT ENGINEERING--GOT OUR FIRST RL BEFORE WE RELEASED IT, USES 11/34'S, IS LOOKING AT 11/24'S BUT WOULD REALLY LIKE 11/23'S . MOTOROLA AND RCA ARE ACTIVELY WOOING HIM. THE ONLY THE THING THAT IS SAVING US IS 11M. OK TO SET UP A "KEEP HIM WARM" MEETING HERE?
<reply>
<>

<date>8/21/80
<name>SUE YARGER
<tel#>264-7530
<subj>CALLED FOR BRUCE STEWART TO SET UP A 1/2 DAY OFFICE OF THE FUTURE USER CAPABILTIES MEETING. SEPTEMBER IS BOOKED UP. HOW QUICK DO YOU WANT IT? NEXT WEEK WHILE YOU ARE SCHEDULED OUT? 9/12 OR 26 WHEN YOU ARE SCHEDULED OUT?
<reply>
<>

<date>8/21/80
<name>MARIO MUMMOLO
<tel#>RE NEGROPONTE--THEY HAVE A LARGE SUM OF MONEY AND MARIO WOULD APPRECIATE YOUR NOT GIVING THEM A "HINT" OF WHAT WE MIGHT DO UNTIL WE KNOW WHAT "THEY WANT TO DO".
<subj>
<reply>
<>

<date>8/21/80
<name>CHASE DUFFY IS SENDING OVER THE OFFICE AUTOMATION BOOK FROM DP FOR YOUR REVIEW--MUST HAVE REVIEW IN BY 9/26. (249-2002)
<tel#>
<subj>

<reply>
<>

<date>8/21/80
<name>LOWELL BENSKY (FOR GERRY MOORE)
<tel#>264-7475
<subj>ASKED FOR YOU TO MEET WITH RPG TO GO OVER THE LONG RANGE PLAN. I HAVE SCHEDULED THIS IN SEPTEMBER 24. PLEASE ADVISE IF YOU DON'T WANT TO ATTEND.
<reply>
<>

<date>8/21/80
<name>DON GAUBATZ WILL BE AT A WOODS MEETING TONIGHT BUT WILL CALL YOU AT 9:00PM AT HOME.
<tel#>
<subj>
<reply>
<>

<date>8/20/80
<name>GB & GKB
<tel#>RE THE 2 REQS. BECAUSE OF THE "STATE OF THE CORP" WE HAVE TO ASK BY MEMO TO GO OVER THE BUDGET (MUSEUM) BY 10K. NANCY BERTRAND SAYS BECAUSE OF THE "STATE OF THE CORPORATION" IT MAY NOT GO THROUGH. HOWEVER, WE DO HAVE A PERSON BUDGETED IN 383 FOR FY81. BECAUSE OF ENGINEERING'S "STATE OF THE BUDGET" SHE DOESN'T THINK YOU, GORDON, OR LP WOULD WANT TO TRANSFER 10K OUT OF ENGINEERING (WHICH IS BUDGETED) INTO G&A. NO MATTER HOW YOU LOOK AT IT, THE IMPACT IS ON THIS OFFICE OR 383 SO SHOULD WE: NOT HIRE, GO AHEAD AND USE THE BUDGETED MONEY, ASK TO GO OVER BUDGET IN 69F, CUT SOMETHING ELSE IN 69F (I DON'T SEE HOW WITH THE LECTURE PLANS) TO ACCOMMODATE THESE REQS?

I VOTE TO HIRE 3 MONTHS, 383, AND GO FROM THERE. I MADE IT VERY CLEAR TO THE 2 I INTERVIEWED THAT THESE WERE UNFUNDED JOBS AFTER THE 3 MONTHS. THAT WE WERE GOING TO CLEAN UP THE BACKLOG AND SEE WHERE WE WERE. IT WAS POSSIBLE THEY WOULD

BECOME PERMANENT BUT THAT WOULD BE DETERMINED DURING OR AT THE END OF THE 3 MONTHS. IF THEY WANTED TO TAKE A FLYER WITH US, WE WOULD TAKE A FLYER WITH THE JOB.

<subj>
<reply>
<>

<date>8/20/80
<name>Dorothy Josephson called--she found 8 boxes and had them moved to her area. We'll talk about what/when to do.
<tel#>
<subj>
<reply>
<>

<date>8/20/80
<name>GWEN
<tel#>202-452-0655
<subj>SHEILA GRINELL, ASSOCIATION FOR SCIENCE TECHNOLOGY CENTERS, WILL BE ARRIVING BOSTON 8/29 AND WOULD LIKE TO SET UP AN APPOINTMENT WITH YOU. PLEASE CALL.
<reply>
<>

<date>8/20/80
<name>DAVE RODGERS
<tel#>247-2369
<subj>DAVE WILL STOP BY THURSDAY: FUYI XEROX WANTS TO MAKE A COUPLE OF CHANGES. DAVE THINKS THEY ARE OK BUT WISHES TO PASS IT BY YOU FIRST.
<reply>
<>

<date>8/20/80
<name>CUDMORE
<tel#>
<subj>RE YOUR EMS ON ALBQ ENG. AND SEMICONDUCTOR LOCATION--

WHAT DO YOU WANT HIM TO DO--ANYTHING PARTICULAR?
<reply>
<>

<date>8/20/80
<name>WILKINSON--CALLED HIM AND HE IS DEFINITELY PLANNING TO GIVE A LECTURE DURING THE WINTER QUARTER. HE WILL GET IN TOUCH WITH YOU LATE OCTOBER AS HE WILL BE TRAVELING UNTIL THEN AND COULD NOT FIRM HIS SCHEDULE BEFORE THAT TIME.
<tel#>
<subj>
<reply>
<>

<date>8/20/80
<name>GWEN: WILKINSON--CALLED HIM AND HE IS DEFINITELY PLANNING TO GIVE A LECTURE DURING THE WINTER QUARTER. HE WILL GET IN TOUCH WITH YOU LATE OCTOBER AS HE WILL BE TRAVELING UNTIL THEN AND COULD NOT FIRM HIS SCHEDULE BEFORE THAT TIME.
<tel#>
<subj>
<reply>
<>

<date>8/20/80
<name>GOLDSTEIN
<tel#>212-925-8580
<subj>CALLED RE WILKES--EVERYTHING DONE. WILKES HAS A DATE WITH THE EMBASSY ON 8/27 AT WHICH THEY WILL BE ISSUED A PERMANENT VISA. THIS WAS CONFIRMED BY A TELEGRAM GLORIOSO RECEIVED FROM WILKES--IN YOUR MAIL. GOLDSTEIN SUGGESTED WE WRITE PELTIER A THANK YOU LETTER, CC TO AMBASSADOR.
<reply>
<>

<date>8/20/80

<name>GWEN
<tel#>264-6779
<subj>RE TOM HARRIS AND MUSEUM VISITOR REGISTER. PLEASE MAKE UP A LIST OF FIELDS/QUESTIONS FOR THE REGISTER TO GIVE TO TOM. HE THINKS THIS IS WILL BE OK FOR 9/22 BUT WILL TELL US FOR SURE AFTER GETTING A COPY OF THE PROGRAM (HE IS HANDLING) PLUS A LIST OF THE FIELDS. HOW ABOUT SOME LIKE: NAME, REPRESENTING, ADDRESS, DATE, HOW HEARD ABOUT THE MUSEUM, WANT TO BE ON MAILING LIST FOR LECTURE?NEWSLETTER?..., COMMENTS ABOUT MUSEUM.
<reply>
<>

<date>8/20/80
<name>
<tel#>
<subj>
<reply>
<>

<date>8/20/80
<name>GWEN
<tel#>RE SPACE AT NORTHBORO--TALKED WITH CHARLIE DUCHARME. HE IS IN THE PROCESS OF PUTTING UP MORE RACKS ON THE BACK WALL, WILL MOVE ALL OF OUR STUFF THERE SO IT IS CONSOLIDATED. WHEN HE DOES THIS STAN SAID HE WOULD COME BECAUSE HE WANTED TO CHECK "ALL" THE BOXES TO SEE IF HE COULD FIND MORE TX0. OH MY. HOWEVER...BACK TO THE PURPOSE OF THE CALL. HE SAYS THERE WILL BE NO PROBLEM IF WE EXPAND BY HALF AS MUCH OR MORE OVER THE NEXT 3 YEARS. THAT IN THE WORKS WAS A NEW BUILDING FOR THE WAREHOUSE (DRAWING BOARD ONLY). I ASKED HIM IF THERE WAS SOMEONE WE SHOULD PLUG INTO AS WE SEE SPACE NEEDS DEVELOP--HE ASKED WE KEEP HIM POSTED. I AM NOT TOTALLY COMFORTABLE WITH THAT--BUT FINE FOR NOW.
<subj>
<reply>
<>

<date>8/20/80

<name>WILKES--GWEN MENTIONED YOU MIGHT WANT A PRESS RELEASE FOR WHEN HE ARRIVES--INTERNALLY ONLY?
<tel#>
<subj>
<reply>
<>

<date>8/18/80
<name>WAYNE ROSING
<tel#>247-2322
<subj>RE SEMICONDUCTORS
<reply>
<>

<date>8/15/80
<name>TOM SHINLIVER CALLED FROM LDP RE MICHAELS AND LLL: TOM AUSTIN, OUR ACCOUNT REP FOR LLL CONFIRMED AN OCTOBER SHIP DATE TO LLL. THIS HAS MOVED.
<tel#>
<subj>
<reply>
<>

<date>8/14/80
<name>YOUR REVIEW WITH KO AND WH HAS BEEN DELAYED UNTIL OCTOBER 20.
<tel#>
<subj>
<reply>
<>

<date>8/14/80
<name>RANDELL HOME PHONE: 0632-85584
<tel#>
<subj>
<reply>
<>

<date>8/14/80
<name>KO--DROPPED BY: IN THE OC PACKAGE IS A SHEL DAVIS REPORT CARD. KEN WANTS YOU TO BE SURE THAT ALL OF ENGINEERING'S ACCOMPLISHMENTS ARE LISTED.
<tel#>
<subj>
<reply>
<>

<date>8/14/80
<name>PROF. AND MRS. MCCLUSKEY WOULD BE DELIGHTED TO JOIN GWEN AT THE MUSEUM (3:30, 8/15)AND ALL OF YOU AT YOUR HOUSE FOR DINNER.
<tel#>
<subj>
<reply>
<>

<date>8/13/80
<name>SHELLEY BOILEN
<tel#>516-249-3018
<subj>RE KNUTH BOOK--HE READ THE PASSAGE YOU WROTE ON METAFONT. WANTS TO KOW IF ANYONE IS HANDLING THIS PRODUCT? HE IS FROM CHRYON CORP., MELVILLE, N.Y. (VIA SUE).
<reply>LEFT MESSAGE: NO, CALL KNUTH, 415-497-4367 MJ 8/18/80 Mon 11:37
<>

<date>8/13/80
<name>ED MCCLUSKEY
<tel#>3-5471
<subj>HE IS HERE AT DEC FOR A FEW WEEKS.
<reply>
<>

<date>8/13/80
<name>DAVE WELLER, BELL LABS

<tel#>201-582-6488
<subj>SAYS HE KNOWS YOU AND THAT HE WORKS FOR BELL LABS BUT THE PHONE APPEARED TO BE A PRIVATE NUMBER. ANYWAY HE WANTS TO KNOW WHAT DEC IS DOING FOR THE HANDICAPPED AND TO SEE IF THERE MAY BE ANY JOINT PROJECTS--THIS IS NOT FOR JOBS BUT FOR EQUIPMENT GEARED TO THE HANDICAPPED.
<reply>
<>

<date>8/13/80
<name>PATRICK BUFFET
<tel#>3-2453
<subj>RE MEETING AMD'S TECH DIRECT, SIMONSON. WOULD YOU BE INTERESTED IN HAVING PATRICK SET UP A MEETING WITH SIMONSON WHERE HIS COMPANY WOULD GIVE A PRESENTATION ON WHAT/WHERE/WHY/HOW THEY ARE DOING? SIMILAR TO THE ONE BEING GIVEN BY ZILOG THIS FRIDAY? IT COULD BE OUT A COUPLE OF MONTHS.
<reply>
<>

<date>8/13/80
<name>PROF. DERTOUZOS OFFICE
<tel#>253-5844 (PAULA)
<subj>RE THE MIT MEETING ON 9/23 THAT MARIO MUMMOLO HAS SET UP. PROF. D. IS ASKING IF YOU CAN STAY FOR LUNCH WITH HIMSELF AND PROF. WINSTON. THIS DAY IS BECOMING A PROBLEM. YOU ARE SCHEDULED AT MIT 9:00 TO 12:00, OC WAS CHANGED TO THIS DATE AT 12:00, AND YOU HAVE THE COHEN MUSEUM LECTURE AROUND 5:00. DO YOU WANT TO DO ALL 3 (NO LUNCH AT MIT) AND SHAVE EVERYTHING CLOSE? YOU MIGHT BE ABLE TO LEAVE MIT EARLY, 11:00ISH AND MAKE OC ON TIME.
<reply>
<>

<date>8/13/80
<name>MITCH FEDERMAN
<tel#>231-6684
<subj>RE INTEL PRESENTATION AT SHERATON BOXBORO. JACK

CARSTON WILL LEAD A GROUP FROM INTEL ON 8/26 AND 27. DICK CLAYTON IS RUNNING OUR END OF IT BUT MITCH WAS WONDERING IF YOU COULD AS A WELCOME AND WHAT OUR POSITION IS THE MORNING (9:00)OF 8/26 (RIGHT NOW YOU ARE SCHEDULED HOME WITH A CONFERENCE CALL AT 8:30 RE SEMI STRATEGY). THE SECOND DAY THEY WILL HAVE SIDE MEETINGS TO DISCUSS FUTURE BUSINESS PLANS. MITCH IS ALSO ASKING YOU TO ATTEND A DINNER ON 8/26. DO YOU WANT TO BE INVOLVED?
<reply>
<>

<date>8/13/80
<name>RE DAVE GLAZE--WE SENT THE INSTRUCTIONS AND CALLED. HE SAID THAT THINGS ARE GOING ALONG MUCH BETTER. (FOR FUTURE REFER: 303-497-3688)
<tel#>
<subj>
<reply>
<>

<date>8/12/80
<name>BILL ZIMMER
<tel#>4819
<subj>WHEN SHOULD YOU ALL GET TOGETHER FOR THE NEXT PBS SESSION? WANT ME TO SCHEDULE FOR MID-SEPTEMBER? ALSO NEED NAMES: CHERNOFF, ZIMMER, ?, ?,...
<reply>
<>

<date>8/12/80
<name>BARRY CHARTON ASKED TO MEET TO BRING YOU UP TO DATE ON WHAT YOU MISSED AT THE LAST WPS WOODS. ONLY TIME WE COULD COORDINATE WAS DINNER AT WATERVILLE VALLEY JUST PRIOR TO THE BEGINNING OF THE NEXT SESSION. (367-8100)
<tel#>
<subj>
<reply>
<>

<date>8/12/80
<name>BILL DEMMER WOULD LIKE YOU TO MEET HARRY VICKERS, INTERVIEWING FOR SUVAX PROGRAM MANAGER. WD, LP, SI, MARSHALL, LACROUTE ALL SAY IT IS A GO. VICKERS LIVES IN N.H. DEMMER IS READY TO MAKE AN OFFER. HOPEFULLY THIS WILL BE SCHEDULED FOR THIS FRIDAY (YOUR ONLY DAY IN THIS WEEK).
<tel#>
<subj>
<reply>
<>

<date>8/12/80
<name>TITELBAUM
<tel#>225-4942
<subj>RE THE T-11 PAPER AT SOLID STATE CONFERENCE IN FEB. HE SAID YOU HAD SEEN THE PAPER AND WANTS YOUR SUPPORT FOR THE INTERNAL APPROVAL.
<reply>
<>

<date>8/12/80
<name>DAVE CUTLER ASKED TO SEE YOU MONDAY, 10:00--PERSONAL. HE WIL BE TAKING HIS MOTHER TO THE AIRPORT SO COULD DROP BY THE HOUSE. OK? YOU ARE SCHEDULED AT HOME UNTIL TIME TO LEAVE FOR WATERVILLE VALLEY (L AT 4:00 FOR A 7:00 DINNER MEETING?)
<tel#>
<subj>
<reply>
<>

<date>8/12/80
<name>YOU ARE TENTATIVELY SCHEDULED TO MEET WITH CYERT ON 8/21. EBOD HAS BEEN CANCELLED YOU HAVE NOTHING ELSE THAT DAY. UNLESS YOU HAVE A BURNING DESIRE TO SEE CYERT I THINK YOU CAN GET OUT OF IT. HE IS COMING IN HIS CUSTOMER HAT--MEETING WITH KEN AND WIN AT THAT TIME, AS TO WHAT CMU SHOULD BE LOOKING AT. THE MEETING IS SCHEDULED FOR 2:30.
<tel#>

<subj>
<reply>
<>

<date>8/7/80
<name>CLAUDE SOURNAC--DEC PARIS
<tel#>
<subj>RELATIONSHIP WITH MR. BRUNO LUSSATO--YOU SHOULD TALK TO MARCY AND AGREE ON HOW WE CAN GET A GOOD RELATIONSHIP WITH BRUNO LUSSATO.
<reply>
<>

<date>8/7/80
<name>SUE
<tel#>
<subj>BEIGE BOOK--THE BEIGE BOOK THAT YOU HAVE AT HOME IS NOT UP-TO-DATE. PLEASE BRING IT IN AND GIVE TO MJ. RON CADIEUX, X7189, OR X8153 WILL PUT THE CORRECT PAGES IN. IT WILL ONLY TAKE 1 DAY.
<reply>
<>

<date>8/6/80
<name>JIM ROGERS--FORMERLY OF CASE WESTERN
<tel#>216-991-7283 (HOME)
<subj>HE ACCEPTED A POSITION IN DEC-MERRIMACK. HE WILL BE STARTING ON 8/25, AND IS LOOKING FOR A MOVE IN NEW HAMPSHIRE THE MIDDLE OF SEPT. HE WILL BE AT THE ABOVE NUMBER UNTIL HE STARTS ON 8/25.
<reply>
<>

<date>8/6/80
<name>BERT SUTHERLAND--XEROX
<tel#>415-494-4300
<subj>LETTER HE SENT YOU (SEE ATTACHED)
<reply>

<>

<date>8/5/80
<name>BRUCE DELAGI
<tel#>
<subj>BRUCE SAID HE ACCEPTS. LARRY HAS MORE DETAILS.
<reply>
<>

<date>7/30/80
<name>PROF. STAN HABIB CALLED FROM CCNY
<tel#>
<subj>REGARDING A PAPER ON NCC, HE WOULD LIKE YOU TO CALL SAM HUSSON OF IBM, 914-686-5688
<reply>
<>

<date>7/29/80
<name>ED VRABLIK
<tel#>303-469-1149
<subj>PAST EMPLOYEE OF DEC--WISHES TO TALK TO YOU.   HE WILL CALL YOU BACK.
<reply>
<>

<date>7/29/80
<name>MARCY KENAH
<tel#>
<subj>SHE CALLED TO LET YOU KNOW THEY ARE SENDING YOU A COPY OF THEIR FIRST MANUSCRIPT "OFFICE AUTOMATION". IT WILL BE COMING IN THE MAIL SOON.
<reply>
<>

<date>7/28/80
<name>JIM BELL--WILKES VISA WAS APPROVED TODAY.
<tel#>

<subj>
<reply>
<>

<date>7/28/80
<name>SIEWIOREK--STOPPED BY THE OFFICE AND WONDERED IF YOU WERE TRYING TO DISRUPT THE CMU RELATIONSHIP? HE SAID YOU HAD CALLED AN EE PROF AT CMU TO SEE IF HE WANTED TO TRANSFER TO COLO. PLUS A MUSEUM CONTACT FROM OTTOWA CONTACTED ANOTHER CMU FACULTY PERSON ABOUT GOING UP THERE. I TOLD HIM IF ANYTHING YOU WERE TRYING VERY HARD TO MAKE THE CMU RELATIONSHIP BETTER THAN EVER.
<tel#>
<subj>
<reply>
<>

<date>7/24/80
<name>DON FEDDERSON
<tel#>617-272-7070
<subj>PRES. OF APPLICON. NO SUBJECT.
<reply>
<>

<date>7/24/80
<name>PAUL BAUER--DID YOU GET SOME ANTIQUE IBM DISK DRIVES FROM AL SHUGART VIA CHUCK YOUSE? I DON'T RECALL ANY.
<tel#>
<subj>
<reply>
<>

<date>7/24/80
<name>GRANT
<tel#>3-9765
<subj>RE THE FORECAST SYSTEM USED IN STORAGE--WOULD LIKE HIM TO DISCUSS AT AN OOD MEETING WHERE LP AND SYSTEM GROUPS WOULD SEE IT AS WELL? WAIT UNTIL SEPT?

<reply>
<>

<date>
<name>
<tel#>
<subj>
<reply>
<>

<date>7/24/80
<name>STEVE TESTA
<tel#>716-924-9303
<subj>From Scientific Calculations. They have an agreemtn with DEC, a joint marketing agreement (SICCARD) with Bob Joseph and Pete Smith. However, he wanted an appointment with you re the feasibility of using their product to design PC boards using a VAX. Who would you like me to have call him back--Cudmore?
<reply>
<>

<date>7/24/80
<name>JAN J.--LOOKING FOR AN ARTICLE WE SENT COPIES OF: THE NEW INDUSTRIAL AGE BY ALVIN TOFFLER. CAN YOU REMEMBER THE PUBLICATION IT CAME FROM?
<tel#>
<subj>
<reply>
<>

<date>7/24/80
<name>GEORGE THISSELL WOULD LIKE A COPY OF THE INTEL SLIDES--PLEASE BRING THEM IN.
<tel#>
<subj>
<reply>
<>

<date>7/23/80
<name>RICHARD SELTZER
<tel#>3422
<subj>EDITOR FOR DECWORD. HE IS INTERESTED IN KOWING THE MOST IMPORTANT MILESTONES AND MAJOR ACCOMPLISHMENTS IN ENGINEERING IN FY80; ALSO ANY REORGANIZATIONS--NAMES AND TITLES. WANT HIM TO TALK WITH LARRY?
<reply>
<>

<date>7/23/80
<name>RON CADIEUX
<tel#>7189
<subj>RE SETTING UP BEIGE BOOK REVIEW FOR CSD, 1/2 DAY. HE IS LOOKING FOR AUGUST 20 AND 21. YOU ARE GONE ALL BUT 2 DAYS IN AUG--CAN THEY BE DONE WITHOUT YOU OR WAIT UNTIL SEPT.?
<reply>
<>

<date>7/23/80
<name>RICHARD SIEGAL
<tel#>312-641-6090
<subj>AUTOMATIC COMPUTER CO, CHICAGO, RE THE FIRST PRACTICAL COMPUTER INPUT TO MICROFILM, AND A COMPUTER THAT READS HUMAND HAND LETTERING, THE 5TH GENERATION.
<reply>
<>

<date>7/23/80
<name>PHIL VILLERS
<tel#>273-4340
<subj>PRES. AUTOMATIX, RE A PRIOR CONVERSATION WITH YOU CONCERNING ROBOTICS.
<reply>
<>

<date>7/23/80
<name>JAN JAFERIAN
<tel#>3-7525
<subj>RE BILL DEMMER STOPPING HER IN THE HALL AND SAYING SHE SHOULD CHECK WITH YOU ABOUT A PROJECT. DO YOU WANT TO TALK WITH HER? PHONE? OFFICE?
<reply>
<>

<date>7/23/80
<name>NAT PARKE
<tel#>247-2039
<subj>RE SUVAX--WANT'S TO TALK TO YOU RE SUVAX.
<reply>
<>

<date>7/23/80
<name>PROF ROSE
<tel#>216-368-2800
<subj>RE RESEARCH WORK
<reply>
<>

<date>7/23/80
<name>GRANT'S SEC JUST CALLED--ARE YOU PLANNING TO GO TO JAPAN WITH HIM IN SEPT?
<tel#>
<subj>
<reply>
<>

<date>7/23/80
<name>BILL MCBRIDE
<tel#>231-6906
<subj>PLEASE CALL RE HOOPER--BILL WILL STAY IN HIS OFFICE AROUND NOON TIME IN CASE YOU CAN CALL HIM. HE IS GOING TO CALL HOOPER AND WANTS TO TALK WITH YOU FIRST.
<reply>

<>

<date>7/23/80
<name>ANDY
<tel#>231-6312
<subj>PLEASE CALL TODAY.
<reply>
<>

<date>7/22/80
<name>DR. ABRAHAMSON
<tel#>512-684-5111 X2300
<subj>RE NAE NOMINATIONS
<reply>
<>

<date>7/21/80
<name>MIKE TOMASIC
<tel#>6536
<subj>RE INTEL: SHOULD HE COME TO THE MEETING TOMORROW (RATIO IS 6 DEC TO 4 INTEL); PLUS YOU WERE GOING TO GIVE HIM SOME ALL CORRESPONDENCE.
<reply>
<>

<date>7/21/80
<name>PLS BRING IN SALARY/STOCK STUFF FOR LARRY RE WD MEETING TUESDAY AFTERNOON.
<tel#>
<subj>
<reply>
<>

<date>7/18/80
<name>DAVE CANE
<tel#>3-7004
<subj>RE JOHN PEATMAN--HE IS COMING HERE AUGUST 14 AND 15.

DO YOU WANT TO SEE HIM IF IT CAN BE SCHEDULED?
<reply>
<>

<date>7/18/80
<name>RE GEORGE MICHAELS AND LLL: MICHAELS CONTACT HERE IN MAYNARD, JACK KAY, HAS LEFT THE COMPANY. TOM AUSTIN HAS THE ACCOUNT HERE: THE ORDER PLACED IN JAN FOR 120 DAY DELIVERY WAS PUT ON DEC. 1980 DELIVERY. CUSTOMER WAS TOLD THIS IN FEB. BILL CIBULSKI, LLL ACCOUNT REP IN CALIF, CONFIRMED THIS. HE IS TRYING FOR AN EARLY SLOT, SAYS THEY NEED IT IN SEPTEMBER, BUT NO LUCK SO FAR AND SAYS IT DOES NOT LOOK PROMISING. CIBULSKI: 415-635-3000, TOM AUSTIN: 3-5526.
<tel#>
<subj>
<reply>
<>

<date>7/17/80
<name>BILL MCBRIDE WILL STOP BY MONDAY JUST BEFORE MC TO BRIEF YOU ON HIS PRESENTATION AT SAME.
<tel#>
<subj>
<reply>
<>

<date>7/17/80
<name>C.J. CONSIDINE
<tel#>653-9398
<subj>FROM CONSIDINE COMPUTER SERVICES, WORKING ON AN 11/23 AND IS LOOKING FOR DEFINITION OF BOARD SEMANTICS, ISP, I.E. MEMORY MANAGEMENT ABORT AREA. BARBACCI OR WOULDN'T WE GIVE IT OUT?
<reply>
<>

<date>7/17/80
<name>BRUCE HOLBEIN

<tel#>3-8918
<subj>RE PARTICIPATING IN 1ST PUBLIC AFFAIRS SEMINAR. GEORGE BALL WILL BE THE GUEST SPEAKER; TAKES PLACE IN BOSTON.
<reply>
<>

<date>7/17/80
<name>RON SCHULER
<tel#>264-5974
<subj>VIA GLENN REYER RE FOREIGN LANGUAGES--DOCUMENT ETC.
<reply>
<>

<date>7/16/80
<name>JACK BUCHANAN
<tel#>495-6750
<subj>RE A NEW/MAJOR DEVELOPMENT IN AUTOMATING THE LEGAL OFFICE.
<reply>
<>

<date>7/16/80
<name>STU WECKER
<tel#>3-4366
<subj>WOULD LIKE TO SEE YOU--HOW ABOUT A PHONE CALL?
<reply>
<>

<date>7/16/80
<name>BOB LANE RETURNED YOUR CALL
<tel#>264-6069
<subj>
<reply>
<>

<date>7/16/80
<name>BJ CAN'T ATTEND INTEL SLIDE SHOW--WOULD YOU SHOW THEM

TO HIS STAFF?
<tel#>
<subj>
<reply>
<>

<date>7/14/80
<name>BOB HUBERFELD
<tel#>341-2025
<subj>RE YOUR DISCUSSION WITH FRANK CARR (GSA).
<reply>
<>

<date>7/14/80
<name>BURT SUTHERLAND
<tel#>415-494-4300
<subj>XEROX--RE SMALL TALK
<reply>
<>

<date>7/14/80
<name>HENK SCHALKE
<tel#>3-7103
<subj>RE SCORPIO CLARIFICATION
<reply>
<>

<date>7/14/80
<name>PLEASE TELL GWEN--BEFORD TO OTTOWAY, COMPANY PLANE: $80 ONE WAY.
<tel#>
<subj>
<reply>
<>

<date>7/14/80
<name>JACK BUCHANAN

<tel#>495-6750
<subj>
<reply>
<>

<date>7/11/80
<name>RON SMART
<tel#>3-7011
<subj>RE YOUR COMMENTS ON HIS NOTE.
<reply>
<>

<date>7/11/80
<name>LP--THE QTR 4 NUMBER IS COMING DOWN SLOWLY--DON'T PANIC. WE WON'T BE HEROES BUT WON'T BE AS BAD AS IT FIRST LOOKED.
<tel#>
<subj>
<reply>
<>

<date>7/11/80
<name>USE K/F TO EXIT YOUR SPECIAL WULF/NEWELL MESSAGE FILE. FILES WILL NOT BE DELETED.
<tel#>
<subj>
<reply>
<>

<date>7/11/80
<name>IS YOUR 1200 BAUD WORKING AT HOME?
<tel#>
<subj>
<reply>
<>

<date>7/10/80

<name>NAT SOKAL
<tel#>862-8998
<subj>RE HIS NOTE--I STILL SHOW THAT YOU HAVE IT ALTHOUGH I COULD HAVE SWORN WE PASSED IT ON TO SOMEONE ELSE.
<reply>CALL JOHN HOLMAN 7/11/80
<>

<date>7/10/80
<name>PAT COHNLE, ZILOG
<tel#>273-4222
<subj>CALLED RE A MEETING PAT BUFFET WILL BE SETTING UP WITH YOU AND THEIR MGR OF COMPONENT ENGINEERING AND THE ARCHITECT FOR THE 8000. IT IS TENTATIVELY BOOKED FOR 8/15. ARE YOU INTERESTED OR DO YOU NOT WANT TO BE INVOLVED?
<reply>
<>

<date>7/10/80
<name>ULF--DIDN'T WANT TO CALL YOU AT HOME TODAY.
<tel#>
<subj>
<reply>
<>

<date>7/10/80
<name>JOE ZEH
<tel#>225-4041
<subj>INTERESTED IN ATTENDING THE INTEL MEETING WITH ANDY GROVE 7/22. WHAT YOU SAY?
<reply>
<>

<date>7/10/80
<name>MIKE TOMASIC COMING TO SEE YOU NEXT FRIDAY RE INTEL SLIDES. FIRST OF ALL HE WOULD LIKE A COPY. WOULD YOU LIKE OTHERS TO COME TO THAT MEETING RE THE MATERIAL IN THE SLIDES?
<tel#>
<subj>

<reply>
<>

<date>7/9/80
<name>BOB LANE
<tel#>264-6069
<subj>RE WEINSTEIN
<reply>
<>

<date>7/9/80
<name>DR. PAUL THOMAS
<tel#>416-684-7201 X424
<subj>WOULD LIKE YOUR ISP DEFINITION FOR PDP-11. SAW YOUR BOOK BUT IT DID NOT GO AS FAR AS THE -11. DEPT. OF CS, BROCK U., ST. CATHERINES ONTARIO, CANADA L2S3AI
<reply>MARIO BARBACCI KEEP OF ISP - 412-578-2000 7/11/80 Fri
<>

<date>7/9/80
<name>BARBARA CHAPIN
<tel#>231-5030
<subj>PM FOR ESG ON ENG. WORK STATIONS. PETE SMITH SUGGESTED SHE MEET WITH YOU. OK? ANYTHING SHE SHOULD READ BEFORE COMING OR IN LIEU OF COMING? SHE ATTEND YOUR SESSIONS AT STRATTON.
<reply>
<>

<date>7/9/80
<name>PHIL KAUFMANN
<tel#>408-987-7289
<subj>RETURNING YOUR CALL.
<reply>
<>

<date>7/9/80

<name>PDT150--FRANK HOLLAND, MATERIAL STOCK ROOM FOR SAME: HAS THEM IN STOCK. DO YOU WANT ONE? OR ARE YOU LOOKING TO HOW THEY ARE DOING--I.E. HOW MANY IN INVENTORY ARE SOLD?
<tel#>
<subj>
<reply>
<>

<date>7/9/80
<name>JACK SHIELDS - RE YOUR WEEKEND EMS. CONCERNED THAT YOU ARE CONCEREND AND FEELS THE ISSUES YOU RAISED SHOULD BE ADDRESSED. TELECONFERENCING WAS ONLY THE VEHICLE TO BRING OUT YOUR FRUSTRATION, AND IF YOU ARE THAT CONCERNED THAT WE ARE DOING DUMB THINGS (AND YOU HAD MANY VALID POINTS) HE DOESN'T WANT THEM TO BE DROPPED JUST BECAUSE THE TRIGGERING ISSUE GETS SETTLED. RE THE DAVE CUTLER ISSUE, HE IS TALKING TO BUSIEK TODAY.
<tel#>
<subj>
<reply>
<>

<date>7/8/80
<name>JOE ZEH WOULD LIKE A COPY OF THE INTEL SLIDES.
<tel#>
<subj>
<reply>
<>

<date>7/8/80
<name>THURSDAY, 7/10--DINNER AT 5:30: LARRY, ERIC, JOAN, JOHN AND JAN--ALL YES.
<tel#>
<subj>
<reply>
<>

<date>7/7/80

<name>JIM ROACH, DEC WALTHAM
<tel#>221-5302
<subj>WANTED TO ALERT YOU TO A POSSIBLE CALL FROM DERTOUZOS. DEC HAVE STOPPED THEIR FS DISCOUNTS. MIT ENJOYED A 20% DISCOUNT ON FS WHICH WILL BE PHASED OUT OVER A 3-YEAR PERIOD.
<reply>
<>

<date>7/7/80
<name>MARY PAYNE
<tel#>3-2939
<subj>DO YOU HAVE A THESIS RON KRONENBERG SENT YOU A COPY OF: DELUGISH, U O FILL. ON "CLASS OF ALGORITHMS FOR EVALUATIONS FOR CERTAIN ELEMENTARY FUNCTIONS IN A BINARY COMPUTER"?
<reply>
<>

<date>7/7/80
<name>Sam needs the modem you have at home (the one Kotok first gave you was a loaner) by Thursday morning.
<tel#>
<subj>
<reply>
<>

<date>7/7/80
<name>ULF
<tel#>231-6408
<subj>
<reply>
<>

<date>7/7/80
<name>PROF. GLASSER
<tel#>253-4677
<subj>FROM MIT
<reply>
<>

<date>7/3/80
<name>JAN BUNKER
<tel#>264-5899
<subj>FROM WORD PROCESSING OSP (OFFICE OF SALES PROGRAMS). HEARD YOU WANTED TO VISITED A FEW WPS200 CUSTOMER SITES--WOULD LIKE TO TALK IT OVER WITH YOU.
<reply>
<>

<date>7/3/80
<name>RANDEL GRIFFIN
<tel#>264-7176
<subj>PRODUCT MANAGER IN OFFICE SYSTEMS, RECENTLY WORKED AT WANG, AND HEARD YOU WERE LOOKING FOR WANG INFO.
<reply>
<>

<date>7/3/80
<name>MR. KAUFMANN, INTEL
<tel#>408-987-7289
<subj>RE ETHERNET
<reply>
<>

<date>7/2/80
<name>JEFF WILSON
<tel#>6117
<subj>TEXTSET 720 IS COMING UP AGAIN AT OC NEXT MONDAY. THEY WOULD STILL LIKE YOUR THOUGHTS ON THE SUBJECT. JEFF WILSON IS ALSO ON EMS.
<reply>
<>

<date>7/2/80
<name>RUSS O'NEIL, INTEL, CHELMSFORD
<tel#>667-2464
<subj>HAS BOOKED A MEETING WITH YOU AND ANDY GROVE, HERE, 7/22 (TUESDAY). HE WILL BE A SENDING A LETTER RE THIS

MEETING, AT WHICH TIME YOU CAN LET ME KNOW IF YOU WOULD LIKE OTHERS FROM DEC TO ATTEND.
<reply>
<>

<date>7/2/80
<name>DID YOU NOTICE YOU ARE NOT ELIGIBLE TO 2ND/BE A REFERENCE FOR BILL BLAAUW.
<tel#>
<subj>
<reply>
<>

<date>6/27/80
<name>SCHEDULING PROBLEM: BUZZ' FIRST 2-DAY MEETING IS JULY 28 AND 29 (MONDAY AND TUESDAY). HE KNOWS YOU HAVE TO LEAVE BY 12:00 TO GET YOUR 3:00P PLANE FROM BEDFORD TO COLO. HOWEVER, THE MEETING IS IN WATERVILLE VALLEY (OR IS THAT WATERVALLIET? sp?)--THAT PLACE IN N.H. YOU CAN'T GET TO/BACK FROM. RICK LESLIE ASKED IF YOU WOULD LIKE TO GO UP ON SUNDAY? WOULD YOU AND GWEN LIKE TO GO UP EARLY ON SUNDAY, YOU SUNDAY NIGHT? WANT TO DRIVE ONE WAY? BOTH WAYS? STAY JUST MONDAY? UGH!!
<tel#>
<subj>
<reply>
<>

<date>6/26/80
<name>BOB CHEN, BOSTON SALES OFFICE
<tel#>224-2223
<subj>RE THE METRO BOSTON DISTRICT MANAGERS MEETING IN AUG. WOULD LIKE YOU TO SPEAK TO THE GROUP ON FUTURE OF COMPUTERS. WOULD MAKE DATE SUITABLE TO YOU. HELD EVERY QUARTER. ABOUT 33 ATTENDEES HELD AT WALTHAM. INTERESTED IN AUG.? EVER?
<reply>
<>

<date>6/26/80

<name>HENRIETTA NELSON, NAE
<tel#>
<subj>RE THE AD HOC COMMITTEE MEETING ON HOW TO RUN THE ELECTION IN THE FUTURE. LEIBOWITZ IS CHAIRMAN. DO YOU WANT TO SERVE ON THE COMMITTEE: 1 DAY IN WASH. SOMETIME IN AUG.
<reply>
<>

<date>6/26/80
<name>MARTY BONN
<tel#>221-5272
<subj>SALES DECATHLON (DEC 100 AWARD PEOPLE) MEETING IN BURMUDA OCT 2 THRU 7--INTERESTED IN GOING?
<reply>
<>

<date>6/26/80
<name>JEFF RUDY
<tel#>264-6680
<subj>EDITOR
<reply>
<>

<name>6/27

9:00 Van Dam

Arranged by DEC: Jim Suyo, Providence Office

Brown: Prof. Van Dam, Chairman of the CS Dept.

Tom Doeppner, Associate Prof.

Bob Sedgewick, Associate Prof.

DEC:
Gordon Bell, Jim suyo, Pete Jansen (ECS),

Dick Eckhouse, Herb Shanzer, Picott, Clayton

3:00 PDT50 Architecture
Called by: Herb Shanzer
Attendees: Dick Clayton, John Kirk, Avram Miller and GB
Objective: To acquaint you with the short term plans of the product and resolve some of the key issues and get your input on the key issues. Herb hopes to have a list of what he considers to be the key issues before the meeting.

5:00 Senator Tsongas' Research Revitalization Act
Explain what it is and if we want to get involved.
Called by: Bruce Holbein, DEC Gov. relations specialist.
Attendees: Bill Modahl, DEC Tax Department

<>

<date>6/25/80
<name>DR. BOB RITCHIE
<tel#>206-543-0069/545-1376/HOME:206-525-7922
<subj>RE POSSIBLE JOINT PROJECT; AFTERMATH OF YOUR VISIT TO BERKELEY.
<reply>
<>

<date>6/25/80
<name>FEIGENBAUM SEC, SUZAN
<tel#>415-497-2266
<subj>RE YOUR SOC SEC # FOR A $500 HONORARIUM. THEY ARE PAYING YOUR TRAVEL EXPENSES. DO YOU WANT THE HONORARIUM TO BE DONATED TO THE COMPUTER SCIENCE DEPARTMENT, OR?
<reply>
<>

<date>6/25/80
<name>WAYNE ROSING
<tel#>HOME:617-851-3395
<subj>WILL ALSO TRY TO CALL YOU AS HE HAS A BUSY EVENING AHEAD.
<reply>
<>

<date>6/25/80
<name>WILKES - HE, MRS., & DAUGHTER WOULD BE HAPPY TO HAVE DINNER WITH YOU ON FRIDAY NIGHT, 6:30ISH. FRIDAY THEY ARE MOVING INTO A BOSTON HOTEL FOR THE WEEKEND, PRIOR TO LEAVING. THEY COULD CAB IT TO YOUR HOUSE OR MEET YOU IN BOSTON. THEY WILL BE STAYING AT THE LENNOX HOTEL FRIDAY AND WE ARE TO CALL AND LEAVE A MESSAGE. JIM BELL IS AWAY UNTIL NEXT WEEK.
<tel#>
<subj>
<reply>
<>

<date>6/25/80

<name>STAN O.
<tel#>264-5000
<subj>NO MESSAGE.
<reply>
<>

<date>6/25/80
<name>JIM BELL
<tel#>7687
<subj>RE THE WILKES--LEAVING ON SATURDAY. DO YOU WANT TO HAVE THEM FOR DINNER TOMORROW (THURSDAY) OR FRIDAY OR WAIT UNTIL THEY COME BACK IN SEPTEMBER. THEY KNOW YOU ARE TRAVELLING SO SHOULD BE NO PROBLEM IN WAITING.
<reply>
<>

<date>6/25/80
<name>WAYNE ROSING
<tel#>247-2322
<subj>RE SUVAX AND U OF BERKELEY. DAVE PATTERSON IS COMING THURSDAY AND WAYNE WOULD LIKE YOUR THOUGHTS ON THE SUBJECT PLUS FEEDBACK FROM YOUR MEETING.
<reply>
<>

<date>6/25/80
<name>JACK STEWART, BOSTON COMPANY
<tel#>722-7178
<subj>RE REFERENCE FOR COMPUTER POWER SYSTEMS WHO ARE LOOKING FOR INVESTMENT CAPITAL. I TOLD HIM YOU GENERALLY TAKE A POSITION OF NO COMMENT BUT WOULD ASK YOU.
<reply>
<>

<date>6/25/80
<name>HARRY SHERSHOW
<tel#>617-232-5470
<subj>ASSOCIATE EDITOR DIGITAL DESIGN MAG (SEE ATTACHED). HE

MET YOU AT FORRESTER LECTURE. AUGUST ISSUE WILL BE DEDICATED TO DEC COMPATIBLE DEVICES AND WOULD LIKE TO DISCUSS WITH YOU, VIA THE PHONE, WHERE 2ND SOURCE PEOPLE ARE GOING. WANT TO TALK WITH HIM OR LET HENRY FIELD THE QUESTION?
<reply>
<>

<date>6/25/80
<name>RE FUTURE OC AGENDA ITEM: KO REQUEST TO YOU RE PRODUCTS 3 YEARS FROM NOW. DO YOU WANT ITEM REMOVED OR ARE YOU PLANNING TO DISCUSS IT? QUESTION IS FROM COLEMAN SEC, VIRGINIA.
<tel#>
<subj>
<reply>
<>

<date>6/25/80
<name>FYI - PATRICK BUFFET CALLED RE PRES. OF ZILOG COMING TO VISIT ON THURSDAY--NO WAY TO FIT INTO YOUR SCHEDULE. HE IS CHECKING WITH CROUSE PLUS THEY MAY BE BACK IN THE AREA IN A COUPLE OF WEEKS.
<tel#>
<subj>
<reply>
<>

<date>6/25/80
<name>ED VRABLICK
<tel#>303-469-1149
<subj>
<reply>
<>

<date>6/25/80
<name>BERUBE
<tel#>3-3046
<subj>DO YOU WANT THEIR OLD 8/L WITH DECTAPE FOR THE MUSEUM?

<reply>
<>

<date>6/25/80
<name>DAVE POTTER
<tel#>247-2380
<subj>RE ETHERNET CHIP--DID YOU LEARN ANYTHING ABOUT WHAT INTEL IS DOING HERE?
<reply>
<>

<date>6/19/80
<name>MIKE WEINSTEIN
<tel#>3163
<subj>RE JOBS
<reply>
<>

<date>6/19/80
<name>PAUL STEIN - VISUAL PRODUCTS SCALE MODEL PLANNING CATALOG--DID YOU GET IT?
<tel#>
<subj>
<reply>YES WE RECEIVED IT 7/2/80
<>

<date>6/19/80
<name>TOM SHERMAN--URGENT--DO YOU AGREE WITH THE 44 DELIVERY STATUS STATEMENT (THE LANGUAGE)? WIN IS WAITING ON YOUR OK BEFORE RELEASE.
<tel#>
<subj>
<reply>
<>

<date>6/19/80
<name>PATRICK BUFFET - MET WITH INTEL YESTERDAY AND LEFT THE

FOLLOWING MESSAGE:

We (Pat Buffet and Don Gaubatz) MET WITH JACK CARSTON YESTERDAY. I (Pat) would like Gordon to mention make versus buy to Carston. Carston is impatient about our ethernet RFQ. He would like the details at our end. Intel would like to exchange ideas about voice recognition. We could influence many Intel projects. Carston committed to make us aware of new chip definitions and ongoing chip designs. We could participate in Intel chip definitions and logic implementations as we see fit.
<tel#>
<subj>
<reply>
<>

<date>6/18/80
<name>ARTHUR MELMD
<tel#>202-254-7147
<subj>RE A VISIT WEEK OF JULY 7 RE CONSIDERING THE NEED FOR A FEDERAL POLICY IN AREA OF TECHNOLOGY AND EDUCATION APPLICATIONS.
<reply>
<>

<date>6/17/80
<name>FRED BROOKS
<tel#>919-933-2148
<subj>WOULD YOU BE WILLLING TO SERVE AS A REFERENCE FOR BLAAUW FOR THE NAE NOMINATION?
<reply>
<>

<date>6/16/80
<name>WALT KELLY, LAKE SYSTEMS
<tel#>244-6881
<subj>RE OUR AWARDING THE CONTRACT FOR THE TELECONFERENCING EQUIPMENT. HE CALLED QUITE AGITATED THAT HE HEARD THE CONTRACT WAS GOING TO BE AWARD MOMENTARILY, AND HE WANTED YOU TO KNOW: 1)HE FELT THE CO WE WERE GOING TO GIVE THE CONTRACT

TO IS A BAD BUSINESS RISK, 2)WE REQUIRED A BOND OF THEM IN CASE OF FAILURE, 3)LAKE SYSTEMS WAS LOW BIDDER 4)HE KNOWS THE OTHER SUGGESTED BETTER EQUIPMENT 5)THEY COULD GIVE BETTER EQUIPMENT BUT WERE TOLD TO KEEP BID LOW.

I TOLD KELLY THE CONTRACT WAS NOT BEING AWARDED TODAY AND I WOULD SEE YOU RECEIVED THE MESSAGE.
<reply>
<>

<date>6/16/80
<name>JERRY WEINER
<tel#>415-494-3942 X277
<subj>RE HIS VISIT HERE.
<reply>
<>

<date>6/16/80
<name>CHRIS KURIS
<tel#>312-726-3732
<subj>THEY ARE A HIGH TECHNOLOGY EXECUTIVE SEARCH FIRM--WHAT ARE YOU DOING/NEED IN THE WAY OF RESEARCH PEOPLE? WANT MEYER TO RETURN THE CALL?
<reply>ARMAND LAVALLE PLEASE RETURN THE CALL 7/1/80. ARMAND SAID HE TRIED ON 7/8 AND 7/14, LEFT WORD BUT KURIS HAS NOT CALLED BACK--7/16/80
<>

<date>6/16/80
<name>BRUCE DELAGI
<tel#>231-6627
<subj>
<reply>
<>

<date>6/16/80
<name>JUD LEONARD
<tel#>231-6839

<subj>RE THE RUMOR ABOUT NEW CHIP STRUCTURE AT MR--NEEDS MORE INFO FROM YOU IN ORDER TO CHASE IT DOWN.
<reply>
<>

<date>6/12/80
<name>TED JOHNSON
<tel#>
<subj>PEOPLE KEEP ASKING HIM (SALES TRAINEES, SALES TALKS, ETC) HOW IS DEC REALLY DIFFERENT AS A VENDOR? WHAT SHOULD HE SAY TO OUR PEOPLE ABOUT WHERE WE ARE GOING? WANTS TO BE ABLE TO BUILD A TALK AROUND THIS--PRODUCT FUTURES AND TRENDS. WOULD LIKE A LIST OF KEY POINTS--HOME COMPUTING TO NETWORKING TO MINIATURIZATION.
<reply>
<>

<date>6/12/80
<name>GARY APORTA
<tel#>415-344-0365 / 572-8580
<subj>FROM SI MADDOX SEARCH FIRM, HAS DONE WORK FOR GRANT. HAS A "GIANT" IN THE FIELD WHO AFTER 25 YEARS HAS DECIDED TO LEAVE IBM (ON THE QT OF COURSE)--MR. AL HOAGLAND. INTERESTED?
<reply>
<>

<date>6/12/80
<name>DICK STOPPED BY YESTERDAY RE AK AND PDT50--HE LIKE TO TALK TO YOU ABOUT IT. (X3-3638)
<tel#>
<subj>
<reply>
<>

<date>6/12/80
<name>LORRIN
<tel#>

<subj>IS HAVING ANOTHER GANDOLF LINE PUT IN THE ENG. CR - ARE YOU WILLING TO PAY FOR IT--$125 INSTALLATION, + $100 PER MONTH. OR, IT CAN BE BURIED IN CROWTHER'S OVERHEAD (OF COURSE EVERY CUSTOMER'S RATE WOULD GO UP A FEW CENTS.
<reply>
<>

<date>6/11/80
<name>KNUTH CONFIRMATION--SAT. 6/21, 9:00A--OK
<tel#>
<subj>
<reply>
<>

<date>6/11/80
<name>BUZZ
<tel#>264-5500
<subj>RE MARKETING CO ITEM FOR MONDAY--THEY ARE STILL GATHERING DATA. WOULD IT BE OK TO POSTPONE TILL A FUTURE DATE?
<reply>
<>

<date>6/11/80
<name>OWEN FISK
<tel#>264-8746
<subj>A FEW THINGS HE IS CONFUSED ABOUT THAT YOU'RE DOING NOW.
<reply>
<>

<date>6/11/80
<name>STEVE COLEMAN
<tel#>3-4778
<subj>DO YOU STILL WANT LEO BENNET RE PRODUCT NOMENCLATURE ON THE MARKETING COMMITTEE AGENDA--IT HAS BEEN ON THE BACKLOG SINCE DEC?
<reply>

<>

<date>6/11/80
<name>WRITE A THANK YOU LETTER TO FORRESTER IN WHICH HIS $500 HONORARIUM WILL BE ENCLOSED.
<tel#>
<subj>
<reply>
<>

<date>6/10/80
<name>JAN JAFFERIAN WOULD LIKE A MEETING ON THE NEXT STRATTON WITH BILL HANSON AND HITTELL. OK? +HOLMAN, ???
<tel#>
<subj>
<reply>
<>

<date>6/10/80
<name>FORRESTER CALLED AND WOULD LIKE TO GET 20 COPIES OF THE WW BOOK--IMPLIED HE WOULD LIKE GRATIS BUT SAID HE WOULD ORDER IF WE COULD TELL HIM WHERE--WANT TO GIVE HIM 5 AND ALSO WHERE THEY CAN BE ORDERED, OR MORE?
<tel#>
<subj>
<reply>
<>

<date>6/10/80
<name>LLOYD DICKMAN
<tel#>3-6159
<subj>LEAVING 6/13 FOR BERKELEY HOUSE HUNTING PLUS PLANS TO VISIT INTEL THE FOLLOWING WEEK. SEVERAL OTHER DEC PEOPLE ARE GOING NEXT WEEK ALSO, I.E. PAT BUFFET. WANT THEM TO WAIT AND COORDINATE WITH YOUR VISIT, OR GO AHEAD WITH THEIR PLANS AND YOU YOURS?
<reply>
<>

<date>6/10/80
<name>WIN IS AT HOME WITH A BAD BACK--GLAD TO TALK WITH YOU RE OC WOODS AGENDA: 369-5896.
<tel#>
<subj>
<reply>
<>

<date>6/9/80
<name>OWEN FISKE
<tel#>264-8746
<subj>RE WPS SOURCE CODE--HAS NOTHING TO HIDE BUT WOULD LIKE TO DISCUSS HIS VIEWPOINT.
<reply>
<>

<date>6/9/80
<name>SCHNEIDER WILL BE THERE TOMORROW NIGHT. THIS MEANS: BOB TRAVIS, JOHN MARTIN, AND DICK, G&G, DAVIS'S = 7.
<tel#>
<subj>
<reply>
<>

<date>6/9/80
<name>JIM BELL
<tel#>3-2764
<subj>RE WHAT IS THE STATUS OF THE SRI (DAVID NITZNER?) ROBOT GIFT TO THE MUSEUM. JIM WILL BE SEEING AND TALKS WITH THEM QUITE OFTEN--WANT HIM TO DO ANYTHING?
<reply>
<>

<date>6/9/80
<name>WILLIAM EWALD
<tel#>202-387-7783 ROOM 417
<subj>RE A FUNDED NSF PROJECT FOR TELEVISION AND COMPUTERS

USING LSI-11/23 WITH IMAGE PROCESSOR, SPECIFIED THE HARDWARE TO USE COLOR GRAPHIC DISPLAY, 6-12 PEOPLE. HE WILL BE IN THER AREA 6/20 AND WOULD LIKE TO SHOW IT TO DEC TO SEE IF WE WOULD BE INTERESTED IN WORKING ON IT. I TOLD HIM YOU WOULD TRY TO GET BACK TOMORROW MORNING.
<reply>
<>

<date>6/9/80
<name>BILL WARD
<tel#>305-587-2900 X6300
<subj>RE AN IEEE CONFERENCE IN VAIL, COLORADO, JUNE 20 THRU 24. I GAVE YOUR REGRETS (A SPEAKER HAD TO BACK OUT AT THE LAST MINUTE).
<reply>
<>

<date>6/9/80
<name>RE PEATMAN--HE IS TENTATIVELY SCHEDULED TO GIVE A TALK AUGUST 14 AND 15, EITHER TW, MR, OR MY.
<tel#>
<subj>
<reply>
<>

<date>6/9/80
<name>KNUTH LETTER--WHAT IS THE STATUS--TOM EGGERS (247-2095)
<tel#>
<subj>
<reply>
<>

<date>6/9/80
<name>ROBERT MARTEL
<tel#>DTN:232-2268
<subj>RE TECHNICAL ARTICLE HE SUBMITTED--IS IT OK?
<reply>
<>

<date>6/5/80
<name>LARRY TRYING TO SET UP THE SYSTEM MANAGEMENT MEETING--YOU CAN'T DO IT UNTIL JULY SO LARRY IS GOING AHEAD WITHOUT YOU.
<tel#>
<subj>
<reply>
<>

<date>6/5/80
<name>HEIDI--YOU MAY GET A CALL FROM PROF CHU, U OF MARYLAND. HE IS ALL UPSET ABOUT DP AND HIS BOOK. DP DOESN'T LIKE THE BOOK AND ARE TRYING TO GET HIM TO FIX IT, EVEN POSSIBLE THEY MIGHT NOT PRINT IT. YOU CAN CALL FOR DETAILS.
<tel#>
<subj>
<reply>
<>

<date>6/5/80
<name>BILL LONG--HE HAS BEEN ASKED BY GIA TO GO TO BRAZIL TO ATTEND THE CONFERENCE YOU ADDRESSED LAST YEAR. BILL ASKS: "IS THIS WORTHWILE FOR A WEEK OF HIS TIME? WHAT DO YOU THINK ABOUT HIS GOING?"
<tel#>
<subj>
<reply>
<>

<date>6/5/80
<name>YOU HAVE TO GO TO TWO NAE MEETINGS: 10/31 (YOU WERE SCHEDULED TO GO TO COLO REVIEW), AND 12/10 (WILL HOLD).
<tel#>
<subj>
<reply>
<>

<date>6/5/80
<name>NICK SCAVONE
<tel#>3-3489
<subj>ANY STOCK ACTIVITY FOR MAY?
<reply>
<>

<date>6/5/80
<name>BETTY MORAN, DIGITAL CREDIT UNION
<tel#>3-6735
<subj>THERE ARE NO FUNDS AS OF YET BECAUSE OF AN ERROR IN AUTOMATIC PAYROL DEDUCTION--YOU ARE ON A DIFFERENT SYSTEM WITH A ONCE-A-MONTH PAYCHECK. PROBLEM HAS BEEN RECTIFIED BUT NO MONEY WAS DEPOSITED FOR APRIL AND MAY--YOUR FIRST DEPOSIT WILL OCCUR IN JUNE. HENCE, NO MONEY TO COVER THE CHECKS YOU HAVE WRITTEN. THEY ARE HOLDING THE CHECKS PENDING YOUR DEPOSIT OF MONEY FOR APRIL AND MAY.
<reply>
<>

<date>6/5/80
<name>VINCE BASTIANI
<tel#>264-6420
<subj>RE HIMSELF.
<reply>
<>

<date>6/5/80
<name>JANE STIEN
<tel#>253-7441
<subj>RE YOUR GIVING A LECTURE FOR PROF. VERCOE'S CLASS ON DIGITAL SOUND SYNTHESIS. DID YOU AGREE TO THIS? UNFORTUNATELY I DON'T THINK IT MATTERS--DATES: 6/17 THRU 6/26. POSSIBLE 6/17 IN THE MORNING.
<reply>
<>

<date>6/5/80

<name>DAVIS DINNER 6/10--JOHN MORGAN - Y (1), N-STEWARTS, Y-TRAVIS(1) ,DALEY
<tel#>
<subj>
<reply>
<>

<date>6/5/80
<name>DEBBIE KRAMER--HAS A CASE OF CALIFORNIA WINE YOU WANTED. PICK UP AT THE HOUSE (ACTON)?
<tel#>
<subj>
<reply>
<>

<date>5/29/80
<name>VAN DAM MEETING ATTENDEES: ECKHOUSE, MEANY, PICOTT, CLAYTON, SHANZER, SUYO (DEC CONN.), YOURSELF AND VAN DAM.

<tel#>
<subj>
<reply>
<>

<date>5/22/80
<name>CHUCK ROSE
<tel#>216-368-2800
<subj>N.mPC
<reply>
<>

<date>5/22/80
<name>RE DAVIS VISIT--WILL HIS WIFE JOIN HIM AT MK? EITHER WAY, HOW ABOUT MY PICKING HIM UP AT THE MUSEUM AND TAKING HIM TO MK (I WOULD LIKE TO HEAR WHAT HE HAS TO SAY, PLUS GET A LITTLE ADVICE ON THE WAY UP AND BACK) BRING HIM BACK TO MR TO GET THE CAR SO HE CAN GO TO YOUR HOUSE, OR WHEREVER YOU WOULD ME TO DROP HIM.

<tel#>
<subj>
<reply>
<>

<date>5/22/80
<name>BRIAN HARVEY WILL SEND ALONG THE PATCH CARDS FOR ANALOG DEVICE ASAP.
<tel#>
<subj>
<reply>
<>

<date>5/21/80
<name>ROY DUDLEY
<tel#>415-566-2794
<subj>RE A PLUG COMPATIBLE PRODUCT THEY MAKE YOU MIGHT BE INTERESTED IN.
<reply>
<>

<date>5/21/80
<name>LYNN SHIRLEY
<tel#>408-737-2500
<subj>FROM MASSTOR SYSTEMS
<reply>
<>

<date>5/21/80
<name>CHRIS KURIS
<tel#>312-726-3732
<subj>HITE CHICAGO, HIGH TECH SCIENTIFIC SEARCH FIRM. DYKES FROM HARRIS SUGGESTED HE CALL YOU.
<reply>
<>

<date>5/21/80

<name>Mike McCarthy is conducting a 3-day raft trip in August--interested? DTN:522-3242
<tel#>
<subj>
<reply>
<>

<date>5/20/80
<name>PROF. ADAMS
<tel#>201-648-5239
<subj>RUTGER U, N.J. RE A CONFERENCE ON COMPUTERS IN SMALL BUSINESS. ASKING YOU TO PARTICIPATE--NOV. 6 & 7 (OPEN)
<reply>
<>

<date>5/19/80
<name>DR. ROBERT HENDRICH
<tel#>615-574-4535
<subj>FROM OAKRIDGE NATIONAL LAB, RE A STAFF POSITION AT DEC.
<reply>
<>

<date>5/19/80
<name>LARRY ROUT
<tel#>312-648-7709
<subj>AN ARTICLE ON AUTOMATED OFFICE (CRAWFORD SUGGESTED HE CALL YOU). WHY NOT MENTION THE FORRESTER LECTURE, TOO.
<reply>
<>

<date>5/19/80
<name>RALPH VAWTER
<tel#>213-552-6005
<subj>INDUSTRY CONSULTANT, EASTMAN & BEAUDINE RE ANALOG AND HIGH DENSITY DIGITAL TAPE RECORDERS.
<reply>
<>

<date>5/19/80
<name>2 NAE FROM XEROX: NEW MEMBER--DR. ESTHER MARLY CONWELL, PRINCIPAL SCIENTIST, XEROX CORP., XEROX SQUARE W114, ROCHESTER, N.Y. 14644; RETIRED--DR. J. H. DESSAUER (IN NAE BOOK)
<tel#>
<subj>
<reply>
<>

<date>5/19/80
<name>ROBERT ROBINSON
<tel#>518-457-1895
<subj>DIR. OF COMPUTING AT STATE U OF N.Y., ALBANY. TRYING TO GET A WORKING PARTY ON OPTIONS FOR HIGHER EDUCATION IN THE NEXT DECADE. WANTS TO GET INDUSTRY INVOLVED IN DEVELOPING A SEQUENCE OF OPTIONS AND HOW TO CHOOSE BETWEEN THESE VARIOUS OPTIONS. SAID DEC PRESS WAS PUTTING TOGETHER CASE STUDIES OF WHICH THIS MIGHT BE THE INTRODUCTION. COMMITTED ARE: JIM EMERY, MCCREDIE, PETER PATTEN, TAD PINKERTON, ROBERT SCOTT, ROBERT GILLESPIE... WANTS TO BOUNCE THIS OFF YOU.
<reply>
<>

<date>5/19/80
<name>AMES ASKED YOU TO CALL DEMMER RE THE M. POWELL INCREASE--HE IS HOLDING UNTIL HE HEARS FROM YOU.
<tel#>
<subj>
<reply>
<>

<date>5/19/80
<name>MARY BRESLIN
<tel#>3-7535
<subj>
<reply>
<>

<date>5/19/80

<name>MARCI
<tel#>249-2072
<subj>NO MORE INFO ON BUDGET SITUATION SINCE YOU LAST TALKED. PLUS, IF YOU HAD A CHOICE ON THE SUBJECT: BUSSING AND INTERFACE TECHNOLOGY FOR MICRO-COMPUTING, WHICH AUTHOR WOULD YOU PICK--STONE, WITH A 1ST DRAFT BY SEPTEMBER; OR LEVY WHO HAS AN OUTLINE?
<reply>
<>

<date>5/16/80
<name>BUZZZ BROOKS
<tel#>264-5500
<subj>RE MIKE TOMASIC
<reply>
<>

<date>5/16/80
<name>KEN MCNAUGHTON
<tel#>3151
<subj>LOOKS LIKE NANCY MARTIN IS A LOST CAUSE. ENGINEERING CAN'T COME UP WITH THE OMEY--MANUFACTURING CONTRIBUTED $30K--STILL NEEDED $60K TO 70K.
<reply>
<>

<date>5/16/80
<name>DAVE RUSSELL
<tel#>703-471-3345
<subj>SATELLITE BUS SYSTEMS (RESTON, VA) RE DECNET AND DEC PRESENTATION ON DECNET. HE SAID YOU MIGHT REMEMBER HIM THROUGH ARPA SEVERAL YEARS AGO.
<reply>
<>

<date>5/16/80
<name>BRUCE LOUGHLIN
<tel#>3-3484/2151

<subj>RE FROM DISK ENGINEERING AND WANTS TO TALK ABOUT EMPLOYMENT IN N.H.
<reply>
<>

<date>5/16/80
<name>DID YOU GET BRUCE ARDEN?
<tel#>609-452-4640
<subj>
<reply>
<>

<date>5/16/80
<name>DAVE KNOLL
<tel#>2900
<subj>RE GETTING DENNIS O'CONNOR ON OOD.
<reply>
<>

<date>5/16/80
<name>FOR GWEN----PLEASE CALL MICHAEL PRECOURT. WANTS TO MAKE SURE HE UNDERSTANDS YOUR INSTRUCTIONS ON THE TABLE TOP: 443-6717
<tel#>
<subj>
<reply>
<>

<date>5/16/80
<name>Did YOU GET DR. GEORGE PAKE? XEROX
<tel#>415-494-4010
<subj>
<reply>
<>

<date>5/9/80
<name>PAUL BONINI
<tel#>3-6800
<subj>CAN HE HAVE A COPY OF THE PACKAGING HIERARCHY CHARTS

YOU GAVE AT YOUR LAST TALK AT STRATTON?
<reply>
<>

<date>5/9/80
<name>BILL HAZEN
<tel#>4679
<subj>WAS WONDERING IF YOU WERE GOING TO WRITE A LETTER ON THE STRATTON AWARDS--JUST LISTING YOUR NAMES FOR THE AWARDS AND THE RECIPIENTS WOULD DO--THEY COULD ALL GET THE SAME NOTE. I.E. HIS WAS THE LORD CALVIN.
<reply>
<>

<date>5/9/80
<name>STAN OLSEN
<tel#>264-5000
<subj>
<reply>
<>

<date>5/9/80
<name>THORPE
<tel#>
<subj>RE SORRY MONDANI AND O'CONNER CAME DOWN. FURTHER THEY ARE DISTURBING FOCUS ON TIGER TEAM. THEY DO NOT REPRESENT MANUFACTURING. THORPE SUPPORTS ENGINEERING'S POSITION ENTIRELY. HE IS GETTING RID OF WIRES AND MODULES.
<reply>
<>

<date>5/8/80
<name>ED FREDKIN--FOUND OUT MORE ABOUT LSIP FOR VAX. PROJECT IN FACT IS MOVING ALONG VERY WELL. IF YOU WANT MORE INFO, TALK TO JOHN WHITE AT MIT: 253-7834.
<tel#>
<subj>
<reply>

<>

<date>5/8/80
<name>CLYDE FEYRER
<tel#>503-227-0600
<subj>FROM MULTI-PATH INC., RE THEIR DATA BANK COMPUTER--HAVE FILED FOR SOME PATENTS. SUGGESTED HE WRITE--DIDN'T WANT TO. WANT LARRY TO CALL?
<reply>
<>

<date>5/8/80
<name>DR. RITCHIE, U OF WASH.
<tel#>206-545-1376, HOME: 206-525-7922
<subj>RE SUMMER COMPUTER SCIENCE MEETING AND COOP RESEARCH IN THEIR DEPT.
<reply>
<>

<date>5/8/80
<name>CUTLER--GOOD NEWS--HEINEN IS STAYING!!!
<tel#>
<subj>
<reply>
<>

<date>5/8/80
<name>CROUSE
<tel#>2610
<subj>RE METZGER--NO HE IS NOT LEAVING.
<reply>
<>

<date>5/8/80
<name>RICHARD CASE
<tel#>264-7307
<subj>HAS AN IBM 5120 COMING. WILL HAVE IT DELIVERED HERE

FIRST SO YOU CAN SEE IT.
<reply>
<>

<date>5/8/80
<name>JACK SHIELDS - HE WAS AT WPI YESTERDAY WITH PROF. RAY SCOTT. THEY HAVE A PDP-7, WHICH RUNS, NOT USING IT. WOULD YOU LIKE IT FOR THE MUSEUM?
<tel#>
<subj>
<reply>
<>

<date>5/8/80
<name>Puffer HEARD FROM WILL T. THAT YOU WERE A BIT FRUSTRATED WITH A RECENT MEMO OF HIS (BOB'S). HE WAS CALLING TO SEE IF HE COULD HELP. X2863
<tel#>
<subj>
<reply>
<>

<date>5/7/80
<name>BOB GREY
<tel#>264-5874
<subj>WORKING ON A SYSTEM PRODUCT ASSURANCE PLAN. WHAT PROJECT IN DEC WENT WELL AS A MODEL? VAX 11/780, VT100?
<reply>
<>

<date>5/7/80
<name>MARIO MUMMOLO
<tel#>221-5460
<subj>DERTOUZOS WOULD LIKE TO TALK WITH YOU - 253-2145. MARIO WILL SET UP THE MEETING AT MIT (DERTOUZOS WANTS IT AT MIT--OK?) THIS IS REGARDING FUTURE COMPUTATIONAL NEEDS AT MIT. MARIO WOULD LIKE SUGGESTIONS FOR DEC ATTENDEES:

HOW ABOUT: JIM BELL, GLORIOSO, SOMEONE FROM NEW VAX, THE 20/80, NETWORKING-DECNET?
<reply>
<>

<date>5/7/80
<name>FISHER
<tel#>
<subj>DID YOU DISCUSS THE BUSINESS ETHICS MANUAL WITH YOUR STAFF--WAS THE QUESTION.
<reply>
<>

<date>5/6/80
<name>TOM HARRIS
<tel#>264-6779
<subj>RE THE UNIVAC MANUALS--THEY ARE FOR UNIVAC 2 NOT 1--DO YOU STILL WANT THEM.

ALSO, HE ATTENDED A GIGI PRESENTATION AND THEY HAVE A DIFFERENT BASIC THEN THE REST OF DEC--HE WILL SEND MORE INFO.
<reply>
<>

<date>5/6/80
<name>JOHN FISHER
<tel#>3-2084
<subj>RE BUSINESS ETHICS POLICY MANUAL--OK TO PRINT?
<reply>
<>

SUBJECT: MESSAGES - TUESDAY 5/6

1. PLEASE CALL SHEL ASAP - 3-2838

2. PLEASE CALL BOB DILL - ASAP X5213
   RE WITHHOLDING TAX DUE ON 5/14

3. TALKED WITH GWEN ABOUT GERALD DAVIS INPUTS ON WORK

STATION. WILL NOT HAVE TERMINAL THAT CAN PULL DOWN. PLEASE BRING IN ANY PICTURES OR CHARTS IF DAVIS SENDS THEM TO THE HOUSE.

4. GEORGE HITZ IS REMOVING HIS EQUIPMENT THIS PM FROM STRATTON STUFF--THEIR 2-MAN OPERATION IS GETTING WAY BEHIND. HE RAISED A CONCERN: A RATHER GENERAL LARGE AUDIENCE IS COMING TO VIEW THE DEMOS. HOPES THAT WE AREN'T SHOWING TOO MANY TOO SOON.

5. PLEASE CALL WIN OR LET ME KNOW: WH CALLED WITH THE CONCERN THAT YOU WON'T BE HERE FOR THE 5/14 AFTERNOON SALARY REVIEW--LARRY'S COMES UP. X3-2338

6. LET ME KNOW WHAT YOU WANT TO DO ABOUT FORRESTER?

<date>5/5/80
<name>PLEASE DELETE OR FILE THE MESSAGES IN YOUR 5 MAILBOXES AS YOU READ THEM.
<tel#>
<subj>
<reply>
<>

<date>5/5/80
<name>bj tried to reach you today--can it wait until the Jungle?
<tel#>
<subj>
<reply>
<>

<date>5/5/80
<name>
<tel#>
<subj>
<reply>
<>

<date>5/5/80
<name>DON GILMORE, OUR DRS DATABASE PERSON, JUST JOINED A NEW ORGANIZATION AND IS VERY BUSY. HASN'T BEEN ABLE TO DO ANYTHING. I REALLY DON'T THINK HE EVER WILL.
<tel#>
<subj>
<reply>
<>

<date>5/5/80
<name>JIM BELL
<tel#>3-2764
<subj>RE GERALD DAVIS QUESTIONS.
<reply>
<>

<date>5/5/80
<name>JOE CHENAIL
<tel#>2421
<subj>RE PRINTED WIRE BOARD DESIGN FUNDING.
<reply>
<>

<date>5/5/80
<name>GENE MONDANI
<tel#>2933
<subj>RE CONDITION OF THE BOARDS ON THE 11/44--ASAP
<reply>
<>

<date>5/5/80
<name>OOD DINNER ON 21 IS CANCELLED: LARRY, SI, CLAYTON, BJ CANNOT ATTEND. THE NEXT ONE, JUNE 10, IS WHEN YOU WERE THINKING OF HAVING IT AT YOUR HOUSE.
<tel#>
<subj>
<reply>

<>

<date>5/5/80
<name>WALLY FEURZIG--SENT REGRETS FOR THE LECTURE BUT WAS VERY HIGH IN HIS PRAISE THAT YOU WERE SPONSORING SUCH A THING. ALSO, HE HAS BEEN SPEAKING WITH PETER JANSEN AND G. FINNERTY RE LOGO ON DEC SYSTEMS. HE THINKS THEY MAY BE MAKING PROGRESS AND THANKS YOU FOR YOUR SUPPORT.
<tel#>
<subj>
<reply>
<>

<date>5/5/80
<name>PLEASE ASK GWEN TO BRING IN THE DESK (SO THEY CAN INSTALL THURSDAY) FOR YOUR OFFICE--WILL IT FIT IN YOUR CAR? IF NOT, WHEN THE GUYS COME TO PICK UP THE COUCHES THEY CAN BRING IT IN.
<tel#>
<subj>
<reply>
<>

<date>5/5/80
<name>MARCI - WOULD LIKE YOU TO GIVER HER A CALL TOMORROW AFTER MIT IF YOU GET A CHANCE.
<tel#>
<subj>
<reply>
<>

<date>2/6/80
<name>PETER CONNELL
<tel#>3-2775
<subj>RE THE NY TIMES COMING FOR INTERVIEWS FOR THEIR STORY ON MANAGEMENT. IT IS THE DAY AFTER YOUR TRIP TO DALLAS SO I DON'T HAVE YOU SCHEDULED IN UNTIL 10:00 (YOU GET IN AT MIDNIGHT THE NIGHT BEFORE). THE REST OF TUESDAY IS CRISIS

MEETINGS RE BUDGET AND SI LYLE APPROVAL MEETING. TOM HAYES WILL BE TLKING WITH SHEL, ANDY, SHILEDS, HINDLE. I SAID NO--UNLESS YOU WANT TO COME IN AT 9:00--FEB 12.
<reply>
<>

<date>3/12/80
<name>PETER CONNELL--WE JUST UP AN HOUR INTERVIEW WITH YOU AND JIM BRINTON, OF ELECTRONICS (BOSTON BUREAU MANAGER) RE TRENDS IN TECHNOLOGY FOR THE NCC ISSUE--MARCH 17, 10:00 TO 11:00.
<tel#>
<subj>
<reply>
<>

<date>5/2/80
<name>THE TRADE PRESS AND EDITORS WHO HAVE INTERVIEWED YOU (IN CASE YOU WANT TO ASK TO FORRESTER AFFAIR):

BERT KIRCHNER,
MANAGEMENT EDITOR
ELECTRONIC DESIGN
1/4/79
? ELECTRONIC
ENGINEERING TIMES
11/20/72
? ELECTRONICS,
8/28/72
STEPHEN E. SCRUPSKI
COMPUTERS EDITOR,
ELECTRONICS 1/22/76
C. J. MOSBACHER,
EDITOR R/D 5/76

LOUISE MELTON
PROFESSIONAL ENGINEER
2/79

TONY DURNIAK MCGRAW

<tel#>
<subj>
<reply>
<>

<date>5/5/80
<name>JOE DODD, DEC-NJ, CALLED WITH THE FOLLOWING SCHEDULE FOR AT&T:

MAY 13:	CORPORATE OVERVIEW	JIM WEEKS
	PRODUCT SPECTRUM	BOB MAGUIRE
	OFFICE OF THE FUTURE	PETER JANKA
	EMS DEMO AND SLIDE SHOW	CLAIRE MESSIER
	PARTICIPANT IN EMS DEMO + LUNCH	VLACH/CHISSOLM
	EMS DEMO AT WECO (WESTERN ELECTRIC, N.C.)	

THEY HAVE SIGNED NON-DISCLOSURE AGREEMENTS, TELCO PRODUCT LINE IS HOST. MR. LOVE IS INOLVED IN THIS MEETING, HOWEVER MEETING WAS ALREADY SCHEDULED AND HE IS JOINING.
<tel#>
<subj>
<reply>
<>

<date>5/2/80
<name>PETER JESSEL
<tel#>264-7207
<subj>
<reply>
<>

<date>5/2/80
<name>MARKETING COMMITTEE, MONDAY--YOU ARE SCHEDULED FROM 12:10 TO 12:30.
<tel#>
<subj>
<reply>
<>

<date>4/30/80
<name>PROF. ED FEIGENBAUM, STANFORD
<tel#>415-497-4079
<subj>CAN YOU COME TO THE COMPUTER SCIENCE DEDICATION, 6/20?
<reply>
<>

<date>4/30/80
<name>BOB MARSHALL, DEC, CONN
<tel#>255-2339
<subj>DO YOU WANT THE PDP-6. (GWEN HAS THE CONFIGURATION; YES, IT RUNS.)
<reply>
<>

<date>4/30/80
<name>WARD DAVIDSON, SALES, CHICAGO
<tel#>
<subj>RE YOUR TALKING TO MONSANTO, NEW ORLEANS, MAY 13--SAID, SORRY, NOT THIS TIME.
<reply>
<>

<date>4/30/80
<name>LEONARD KLEINROCK, UCLA
<tel#>213-476-9747
<subj>RE YOUR BEING THE GUEST SPEAKER, NOV. 20, AT THE JAMES MARTIN SEMINAR--THEME:PRODUCTIVITY AND THE DATA PROCESSING REVOLUTION. TOPIC IS YOUR CHOISE, $500 HONORARIUM, 2 HOUR TALK, ABOUT 175 PEOPLE, HYATT REGENCY, BOSTON. (HAL LEVIN ALSO CALLED RE THE ABOVE.)
<reply>
<>

<date>4/30/80
<name>DEL THORNDIKE FOR TEICHER
<tel#>3-7667
<subj>CARVER MEAD IS COMING 6/16 TO 18. DO YOU WANT HIM OUT TO DINNER? WHO SHOULD HE TOUCH BASE WITH WHILE HERE?

<reply>
<>

<date>4/30/80
<name>HIRO WATANABE WAS IN YESTERDAY AND SAID TO SAY HI. ALSO LEFT MACNAMARA'S BOOK TRANSLATED INTO JAPANESE.
<tel#>
<subj>
<reply>
<>

<date>4/30/80
<name>TREVOR PORTER
<tel#>247-2262
<subj>LEARNED THAT HERB JACOBS WAS NOT INVITED TO THE VAX PARTY AND HAS CAUSED QUITE A BIT OF ANGUISH. TREV SAID HERB WAS WITH VMS SINCE THE FALL OF '75 (WITH DEC 3 YEARS PRIOR TO THAT). WONDERED IF YOU MIGHT WRITE A LETTER.
<reply>
<>

<date>4/28/80
<name>HEFFNER CALLED: ROGER HEINEN IS TALKING ABOUT LEAVING. IF YOU CAN PLEASE CALL HIM TOMORROW (ROGER IS RETURNING WITH CUTLER FROM CHICAGO LATE TONIGHT). HOME PHONE: 617-433-9883; WORK PHONE FROM STRATTON: 617-851-5071 X2939
<tel#>
<subj>
<reply>
<>

<date>4/25/80
<name>CHARLIE WILLIAMSON
<tel#>916-363-2395
<subj>A SCREW BALL WHO SAW YOUR COMMENT IN KNUTH'S BOOK RE TEX. HE IS VERY INTERESTED IN TEX. HE IS NOT FROM A COMPANY, DOESN'T REALLY KNOW WHAT HE WANTS, MIGHT LIKE TO GET TEX WORKING ON OUR MACHINES BUT IS NOT LOOKING FOR A JOB. CAN I JUST TELL HIM WE AREN'T DOING ANYTHING WITH TEX IN THE FORSEEABLE FUTURE?
<reply>

<>

<date>4/23/80
<name>RE MIKE MORGANSTERN'S REQUEST FOR A LUMP SUM PAYMENT FROM THE RETIREMENT PLAN--FROM SHEL'S OFFICE, "NO THEY ARE NOT GOING TO DO ANY MORE--MIKE'S LETTERS HAVE BEEN SENT TO THE WESTERN PERSONNEL MANAGER REQUESTING HE SET UP AN APPOINTMENT WITH MIKE."
<tel#>
<subj>
<reply>
<>

<date>4/23/80
<name>MRS. BORRAS
<tel#>202-467-4471
<subj>FROM AAAS: RE YOUR ACCEPTING NOMINATION TO BE CHAIRMAN ELECT OF SECTION M.
<reply>
<>

<date>4/23/80
<name>WAYNE ROSING
<tel#>
<subj>MAXIMA IS RUNNING ON NEBULA.
<reply>
<>

<date>4/22/80
<name>LEO TIERNAN
<tel#>3-2663
<subj>RE RESEARCH THAT YOU MAY KNOW ABOUT (SIMULATION).
<reply>
<>

<date>4/22/80
<name>MR. RABBAT
<tel#>914-897-8126
<subj>FROM IBM REQUESTING YOU TO BE THE MAIN SPEAKER AT THE ICCC80 CONFERENCE, OCT 1 THRU 3, N.Y. WOULD ASK YOU TO SPEAK EARLY AFTERNOON 10/2. THEME: CIRCUITS AND COMPUTERS FROM

HARDWARE TO SOFTWARE WITH VLSI AND LSI.
<reply>
<>

<date>4/22/80
<name>WE HAVE TO RESCHEDULE YOUR WPS/EMS ETC. SEMINAR IN MERRIMACK--2 REASONS--DECUS MEETS THAT WEEK, AND THAT MORNING THEY HAVE A SESSON ON OA THAT ALMOST EVERYONE YOU WOULD WANT IS ALREADY COMMITTED TO DECUS (AT THE SHERATON BOXBORO) + THERE IS A CONFLICT IN CRAWFORD ORGANIZATION. WILL TRY FOR MAY 23.
<tel#>
<subj>
<reply>
<>

<date>4/18/80
<name>MICHAEL GLANCE
<tel#>3-9645
<subj>LOOKING FOR A POLICY STATEMENT ATTRIBUTED TO YOU RE 8085 DESIGN: WILL NOT DEVELOP MACHINES THAT OPERATE ON ANY NON-DEC PROCESSORS SENT OVER THE TELEPHONE LINE?
<reply>
<>

<date>4/18/80
<name>BRUCE DAWSON
<tel#>3-2787
<subj>RE EMACS/RICHARD STALLMAN--WANTS TO SET UP A MEETING. OK?
<reply>
<>

<date>4/16/80
<name>JOHN KEVILL
<tel#>408-496-0916
<subj>COMING EAST AND FIGURES HE OWES YOU A DINNER.
<reply>

<>

<date>4/16/80
<name>LINDA, SEC AT CASE
<tel#>216-368-2800
<subj>RE YOUR SOC SEC # FOR AN HONORARIUM. QUESTION: DO YOU WANT IT, OR ASK FADEL OF SOME WORTHY CAUSE AT CASE IT COULD BE APPLIED TO?
<reply>
<>

<date>4/16/80
<name>NAT SOKAL
<tel#>WORK:862-8998, HOME:862-2388
<subj>"I AM MAKING MY ANNUAL TELEPHONE CALL TO RATTLE THE BARS OF YOUR CAGE ABOUT POSSIBLE CONSULTING ASSISTANCE, OR DESIGN, OR DESIGN REVIEW AT DEC."
<reply>
<>

<date>4/16/80
<name>JULES GILBERT
<tel#>617-926-4730
<subj>WANTS TO SELL SOFTWARE--I ASKED IF IT WAS IN DESIGN PHASE AND HE COUNTERED HE DIDN'T WANT TO WORK THROUGH LAWYERS.
<reply>
<>

<date>4/15/80
<name>IS GWEN PLANNING ON JOINING YOU AT THE PDP-11 BIRTHDAY?
<tel#>
<subj>
<reply>
<>

<date>4/15/80

<name>GEORGE MICHAEL--SPOKE WITH AGAIN. THE ONLY TIME YOU BOTH WOULD BE FREE WOULD BE DINNER FRIDAY NIGHT, MAY 2. YOU SHOULD BE EXHAUSTED BY THEN SO YOU MIGHT NOT WANT TO COMMIT. DON'T FORGET THE NIGHT BEFORE IS WILD--L STRATTON ABOUT 4:00PM FOR PDP-11 DINNER, AND RETURN THAT NIGHT BY 11:00.
<tel#>
<subj>
<reply>
<>

<date>4/15/80
<name>DELAGI
<tel#>
<subj>VT132--TPG IS GUILTY AS CHARGED. COULD WORK OUT A PROMISE THEY WOULD NEVER SHOW UP ON DEC SYSTEMS. VT131--COST REDUCTION OF 132, HAS SAME SPEC. VT132--WELCOME AND ENCOURAGE YOU TO BE PART OF THE SPECING PROCESS. RE THE VT/LA200 MEETING--HE WOULD LIKE TO ATTEND AND CONTRIBUTE.
<reply>
<>

<date>4/15/80
<name>PROF ROGERS
<tel#>216-368-2034
<subj>PLEASE CALL
<reply>
<>

<date>4/15/80
<name>SHATTUCK, MR.
<tel#>366-1442
<subj>REPRESENTS AN R&D FIRM DOING FIBER OPTICS & WANTS TO TELL YOU WHAT THEY ARE DOING.
<reply>
<>

<date>4/15/80
<name>GEORGE MICHAEL

<tel#>415-422-4239
<subj>CALLED YESTERDAY. WOULD IKE TO MEET WITH YOU MAY 1ST (YOU ARE AT STRATTON) RE COMPUTER HISTORY, ULTRA HI SPEED COMPUTING. I TRIED ONCE TO GET HIM--PROBABLY TOO EARLY--TO SEE IF THERE WAS ANOTHER DATE HE COULD MAKE IT.
<reply>
<>

<date>4/15/80
<name>JOHN PEATMAN
<tel#>404-894-2950 WORK, 404-457-6133 HOME
<subj>RE A BOOK HE IS WRITING AND A SHORT COURSE THAT HE WOULD LIKE TO OFFER INHOUSE-DEC THIS SUMMER. FROM GEORGIA TECH
<reply>
<>

<date>4/15/80
<name>BOB MARSHALL, DEC-MERIDEN, CT
<tel#>255-2339
<subj>A CUSTOMER HAS A PDP-6. ARE YOU INTERESTED?
<reply>
<>

<date>4/15/80
<NAME>DR. GEORGE PAKE
<tel#>415-494-4010
<subj>FROM XEROX
<reply>
<>

<date>4/14/80
<name>MARIO MUMMOLO
<tel#>221-5460
<subj>RE AD HOC COMMITTEE AT MIT--FUTURE COMPUTATIONAL NEEDS.
<reply>
<>

<date>4/14/80
<name>STEVE GRAY
<tel#>516-829-5880 X312
<subj>FROM INFORMATION SYSTEMS IN NY. DOES DEC HAVE ANY PROBLEMS WITH RF RADIATION?
<reply>
<>

<date>4/14/80
<name>WENDY KLOSS
<tel#>273-3020
<subj>FROM FORTUNE
<reply>
<>

<date>4/14/80
<name>Jack MacKeen stopped by--we will ship our 1 millionth LSI-11 next month.
<tel#>
<subj>
<reply>
<>

<date>4/14/80
<name>SANDER SCHOICHET
<tel#>253-5845
<subj>RE RESEARCH FOR THE NATIONAL ACADEMY OF SCIENCE AND POLICIES AT DEC.
<reply>HE CALLED AGAIN AND WE GAVE HIM TO ULF AS IT WAS R&D AREA HE WANTED. 4/15/80
<>

<date>4/10/80
<name>DAVID BRANDON
<tel#>302-678-4254
<subj>HE IS DIRECTOR OF ECONOMIC DEVELOPMENT FOR STATE OF DELAWARE. HE IS CALLING AT THE SUGGESTION OF DAVE ROBERTSON.
<reply>
<>

<date>4/10/80
<name>JIM O'LOUGHLIN
<tel#>2472110
<subj>RE YOUR SOLAR HOUSE--JIM IS ALSO GOING THIS WAY WITH A HOUSE ON THE CAPE. WOULD LIKE AN ADDITIONAL INPUT.
<reply>
<>

<date>4/10/80
<name>JOHN HSIA
<tel#>617-594-5118
<subj>OLD FRIEND OF YOURS, SAYS HE HAS AN APPLICANT YOU ALSO KNOW (ZALESKY) WHO IS LOOKING FOR A JOB. WANTS TO TALK WITH YOU ABOUT IT.
<reply>
<>

<date>4/10/80
<name>ARMAND'S MEMO ON COLLEGE HIRING, AND FIGURES RE CASE--HE WOULD LIKE IT BACK--IT WAS THE ORIGINAL.
<tel#>
<subj>
<reply>
<>

<date>4/10/80
<name>ANDY K
<tel#>231-6312
<subj>DO YOU WANT A PDP-11/20 (SECOND ONE SHIPPED) FOR THE MUSEUM?
<reply>
<>

<date>4/10/80
<name>MR. LOVE, AT&T
<tel#>201-631-1512
<subj>MR. BAFA ATTENDED A MEETING IN WASH.D.C. A FEW WEEKS AGO AND SOMEONE FROM DEC TALKED ABOUT EMS. LOVE WANTS TO

ARRANGE A MEETING FOR A COUPLE OF HIS PEOPLE, NOT HIMSELF, TO COME TO TALK WITH DEC ABOUT EMS--HOPEFULLY MAY 13. (U R FLORIDA)
<reply>
<>

<date>4/10/80
<name>WHO HAD THE VAX SIMULATOR?
<tel#>
<subj>
<reply>
<>

<date>4/8/80
<name>JOHN SCHOEMEHL, DEC ST. LOUIS
<tel#>314-872-8540
<subj>RE RUSS HARRISON, N.E. MISSOURI STATE, KIRKSVILLE. HE IS LOOKING AT A VAX AND WANTED TO CHAT WITH YOU--PROBABLY RE DELIVERY. NO ORDER HAS BEEN PLACED, JOHN TALKED GENERALLY 7-8 MONTHS. HARRISON SAID HE WAS AN OLD FRIEND OF YOURS, AND JOHN SAID HE WOULD LET YOU KNOW OF HIS VAX INTEREST AND THAT YOU MIGHT CALL: HARRISON--816-665-5121.
<reply>
<>

<date>4/8/80
<name>LIPOVSKI
<tel#>512-471-1952
<subj>CONLAN GROUP WILL MEET IN NASHUA, N.H., MAY 27 ON THE INDUSTRIAL EVALUATION OF CONLAN. (5/27--U HAVE MARKETING COMMITTEE).
<reply>
<>

<date>4/8/80
<name>SAUL, IBM, CALLED BACK--SAID YOU SHOULD CALL DALLAS BOOTHE-- (404-238-3643) RE PERMISSION/SIEWIOREK.
<tel#>
<subj>

<reply>
<>

<date>4/8/80
<name>JAMIE--BOB GAURANTEE (THE NUMBERS GUY THIS MORNING) CALLED HER. HOW WOULD YOU LIKE HER TO PURSUE?
<tel#>
<subj>
<reply>
<>

<date>4/8/80
<name>JAN J.
<tel#>3-7525
<subj>WE HAVE SET UP A TAPING FOR A STATEMENT BY YOU ON JAPAN. THIS WILL BE APRIL 23, YOUR OFFICE. OK IF JAN AND GENE MONDANI FEED YOU QUESTIONS AS WELL AS YOUR GIVING A STATEMENT. HOPE TO COME OUT OF IT WITH 20 MIN OF ROUGH FOOTAGE. JAN WILL GIVE YOU A LIST OF QUESTIONS THEY COULD ASK.
<reply>
<>

<date>4/7/80
<name>KEITH COYE, DEC
<tel#>
<subj>RE RALPH GORIN, COMPUTER CENTER MANGR FOR STANFORD. GORIN IS GOING TO CALL THIS WEEK TO SEE YOU TO DISCUSS WHAT THEY ARE DOING AT STANFORD. THEY HAVE 3 2060'S, A VAX, AN IBM 4330, PLUS MISC. EQUIPMENT. HE IS INVOLVED IN THE PROJECT TO LINK VARIOUS COMPUTERS ON CAMPUS WITH ETHERNET--HE IS WORKING WITH XEROX ON THAT PROJECT. HE WANTS TO 1) DISCUSS IN GENERAL NETWORK ACTIVITIES HE IS PLANNING AT STANFORD, 2) ENTERING INTO NEW DEVELOPMENT WORK AND IS PLANNING ON BUYING ANOTHER SYSTEM FROM US--A 2060 THIS QUARTER.
<reply>
<>

<date>4/7/80

<name>JEFF SEBRING
<tel#>264-6426
<subj>CSS--RE THEY ARE TRYING TO SELL DIMOND TO BELL TELL LABS FOR ACS NETWORK. JEFF HAS BRIEFED GERRY BUTLER AND GERRY WANTS TO GET YOUR APPROVAL TO RELEASE THIS TECHNOLOGY TO THE MARKETPLACE. OK?
<reply>
<>

<date>4/7/80
<name>Tom Dundon
<tel#>8305
<subj>Y or N to ALTO at Stratton?
<reply>
<>

<date>4/7/80
<name>Dave Orbitz
<tel#>9222
<subj>FYI re Floating Point Systems meeting - April 22. Interested? I said it didn't look as if you could make it.
<reply>
<>

<date>4/7/80
<name>Keith Coye, DEC Santa Clara
<tel#>521-2383
<subj>Re Xerox Ethernet agreement
<reply>TALK WITH DAVE RODGERS 4/23/80 Wed

<date>12/23/81
<name>Iann Barron
<tel#>
<subj>Will you be able to introduce him at the seminar he is giving in the A.M. on 2/4. You and Gwen are scheduled to have dinner with him that nite...details to come. **YOUR CALENDAR IS OPEN ON 2/4**
<arc>Y
<priority>FYI

<reply>
<>

<date>12/21/81
<name>Bill Wulf
<tel#>412/621-2210
<subj>please call when you return
<arc>Y
<priority>WHEN POSSIBLE
<reply>
<>

<date>12/18/81
<name>OFFICE OF JOHN LACEY - VP at CDC
<tel#>612-853-5355
<subj>WOULD LOVE TO HAVE YOU ATTEND THE BOD MEETING THEY WILL BE HOLDING IN FLORIDA 2/18/82, THEY HAVE SENT A LETTER TO KEN INVITING HIM AND A COLLEAGUE. WOULD LIKE TO HEAR FROM YOU AS SOON AS POSSIBLE.
Do you want to go? Shall I follow up with Ken?
<arc>Y
<priority>ACTION--WHEN POSSIBLE
<reply>
<>

<date>12/18/81
<name>PATTY/MITCH
<tel#>
<subj> Will you leave your work/papers with Mark Scott for delivery/pick up by him/us?

<date>12/17/81
<name>John Lacey
<tel#>home # 612/941-4250
<subj>He is VP of Technology and Planning at CDC. (At your request I had called Bob Price to let him know that we did not receive an invitation to the MEI CDC Price mtg. Feb. 23 in Fla.) Bob Price directed me to a Mr. Norris and Mr.

Norris directed Mr. Lacey to contact you. You may call him at home this evening if you wish.
<arc>Y
<priority>FYI
<reply>
<>

<date>12/16/81
<name>ED FIGENBAUM (STANFORD)
<tel#>415/493-5618
<subj>HE WAS CALLING RE: THE DATE OF HIS VISIT IN JAN. I DIRECTED HIM TO RICK PEEBLES/SAM FULLER. HE ALSO ASKED TO BE REMEMBERED TO YOU AND GWEN AND WISHED YOU A NICE HOLIDAY.
<arc>Y
<priority>FYI
<reply>
<>

<date>12/16/81
<name>Mr. Arneson - VP at Control Data
<tel#>612/853-4700
<subj>wants to speak with you re: micro electronic enterprises
<arc>Y
<priority>WHEN POSSIBLE
<reply>
<>

<date>12/15/81
<name>HENRY OWENS
<tel#>312/621-6521
<subj>RE: SUGGESTION BY DAN SIEWORIEK TO CALL YOU TO FIND OUT IF THERE IS ANY COMMERCIAL WHETSTONE SOFTWARE AVAILABLE? I ASKED HIM TO SEND HIS REQUEST IN WRITING.
<arc>Y
<priority>FYI
<reply>
<>

<date>12/14/81
<name>FRANK HAAGEE
<tel#>527-7944
<subj>FROM CANON CORP. RE: A REQUEST FOR INFO. WILL BE SENDING IT TO YOU IF ANY QUESTIONS PLEASE CALL HIM.
<arc>Y
<priority><u>FYI</u>
<reply>
<>

<date>12/14/81
<name>DEBRA FLANAGAN
<tel#>212/997-6096
<subj>RE: YOUR REQUEST TO ASSIGN ROYALTIES TO CMU - SHE MUST HAVE AN ANSWER ASAP. DO YOU STILL WANT TO DO THIS? EVENTHOUGH THIS MEANS YOU WILL STILL BE LIBEL INCOME TAX WISE.
<arc>Y
<priority><u>ASAP</u>
<reply>
<>

<date>12/14/81
<name>ED FRIEDKIN
<tel#>212/997-6096
<subj>RE: HIS PHONE CONVERSATION WITH YOU THIS WEEKEND AND A PROPOSAL FOR A GRANT. SOMETHING WILL BE COMING IN THE MAIL TO YOU THIS WEEK. SCHULEMBERGER WILL DO HALF OR $9,000. IF DEC CAN DO THE OTHER HALF THEN THEY ARE ALL SET.
<arc>Y
<priority><u>FYI</u>
<reply>
<>

<date>12/14/81
<name>GEORGE MICHAEL
<tel#>415/422-4239
<subj>RE: LAWRENCE LIVERMORE LABS NEW VAX SYSTEM AND TO

ALERT YOU THAT A ROGER ANDERSON WILL BE HERE THIS WEEK AND WILL TRY TO GET IN TOUCH WITH YOU RE: POSSIBLE JOINT TOPICS OF INTEREST.
<arc>Y
<priority>FYI
<reply>
<>

<date>12/14/81
<name>Iann Hugo
<tel#>Reading office: 734-586408 or Home: 734-61424
<subj>re: his letter to you and Magazine "Idea Newser" - do you have an unofficial opinion?
<arc>Y
<priority>WHEN POSSIBLE
<reply>
<>

<date>12/11/81
<name>Jud Leonard
<tel#>415/497-4013 or 3845
<subj>tried all day but no answer
<arc>Y
<priority>FYI
<reply>
<>

<date>12/11/81
<name>Ed Friedkin
<tel#>253-5904
<subj>from MIT - may call you at home tonight
<arc>Y
<priority>FYI
<reply>
<>

<date>12/11/81
<name>Professor Gerald Holton

<tel#>617/495-4474 or Home 617/862-3273
<subj>Professor Holton from Harvard calling you at the suggestion of W.O. Baker.
<arc>Y
<priority>WHEN POSSIBLE
<reply>
<>

<date>12/10/81
<name>MJ
<tel#>
<subj>MJ called this morning: The following are comments she heard at DECUS. Otherwise she is having a ball! 4,000 registration!

"A lot of controversey over DECWORD for example:

o Why just running RSTS?

o What about VAX and RSX11M?

o We know you have a 2 yr contract with DPD what are you going to do when that runs out?

o Word 11 first urged us Word 11 users to go to DEC. Now they are saying they are going to enhance their product and we feel we are caught in the middle knowing full well you have this 2 yr contract.

o When I say a lot of controversy I mean it is a BIG HASSLE here. Really putting us on the spot and not too gently!

o Many, many requests for a hard disk on DEC MATE. One OEM from Australia is holding up a big order hoping for word that the hard disk will come along otherwise he is going to have to sell them a WANG.

<date>12/8/81
<name>Yves Sarrazin
<tel#>9+011+33+6+0778292

<subj>re: new technology you should know about. Yves is the Marketing Manager in the Paris Dist. Office.
<arc>Y
<priority>WHEN POSSIBLE
<reply>
<>

<date>12/3/81 Thu 15:47
<name>MIKE FLYNN
<tel#>415-497-1450
<subj>ANY LEADS OF POTENTIAL CANDIDATES FOR COMPUTER SCIENCE AND EE PROFESSORS FOR STANFORD.
<arc>Y
<priority>ACTION--WHEN POSSIBLE
<reply>
<>

<date>12/2/81 Wed 10:09
<name>ISSAC AUERBACH
<tel#>609-662-2070
<subj>HAS AN IDEA HE WOULD LIKE TO DISCUSS WITH YOU AND THINKS IT IS OF VALUE TO DEC IN PENETRATING NEW MARKETS. HE IS ALSO GOING TO CALL TJ. WOULD LIKE TO MEET WITH YOU BOTH THE NIGHT OF 12/9. HE IS CALLING TED SO I THINK A PHONE CALL FROM YOU WOULD BE SUFFICIENT UNLESS YOU WANT TO DO MORE.
<arc>Y
<priority>ACTION--WHEN POSSIBLE
<reply>
<>

<date>11/24/81
<name>ALLEN BURGESS
<tel#>655-9020 (SEQUOIA)
<subj>RE: FIELD SERVICE PROBLEMS - I SPOKE WITH CUSTOMER SERVICE (ELAINE NAVADONSKY) REGARDING HIS DIFFICULTIES....A MR. SAMSON FROM THIER DEPT. WILL BE TALKING WITH MR. BURGESS AND MR. SAMSON WILL LET US KNOW WHAT IS BEING DONE TO ALLEVIATE THE SITUATION.
<arc>Y
<priority>ACTION--FYI

<reply>
<>

<date>11/24/81
<name>MRS. GRAZDA/IEEE SPECTRUM
<tel#>212/644-7569
<subj>KEN'S OFFICE SUGGESTED SHE CONTACT YOU RE: YOUR REVIEWING AN ARTICLE FOR IEEE SPECTRUM SPECIAL JAN ISSUE DEALING WITH MINI COMPUTERS AND MAINFRAMES. WANT TO?
<arc>Y
<priority>ACTION--ASAP ACTION
<reply>
<>

<date>11/19/81
<name>DEBRA FLANAGAN
<tel#>212/997-6096
<subj>MCGRAW-HILL CALLED RE: YOUR REQUEST TO ASSIGN ROYALTY PAYMENTS TO CMU COMPUTER SCI DEPT. THEY WISH TO MAKE YOU AWARE THAT IF YOU ASSIGN THESE TO CMU THEY WILL STILL HAVE TO REPORT THE ROYALTIES AS INCOME TO YOU. THE INCOME TAX LIABILITY CAN CHANGE OVER ONLY WHEN THE BOOK(S) HAVE NOT BEEN PUBLISHED. THEY WILL WAIT FOR YOUR O.K. ON THIS ASSIGNMENT. NEED TO KNOW WITHIN 2 WEEKS IN ORDER TO MAKE THE ASSIGNMENT EFFECTIVE FOR FEB TO CMU.
<arc>Y
<priority>ACTION--WHEN POSSIBLE
<reply>
<>

<date>11/18/81 \par <name>KEN O.
<tel#>
<subj>MESSAGE FROM KEN: "IS IT CONVENIENT TO ARRANGE A MTG ON FRI. ON THE NEW SUVAX. COULD YOU GET 1 OR 2 PEOPLE FROM SUVAX - AVERY, FORRESTER - FROM DISPLAYS - YOU AND I AND VERY, VERY FEW OTHERS AND LAYOUT ALTERNATE ALTERNATIVES FOR NEXT MAY ANNOUNCEMENT. I AM FAIRLY OPEN ALL DAY FRI." WANT TO DO IT?
<arc>Y N

<priority>ACTION--ASAP ACTION-
<reply>
<>

<date>11/18/81
<name>JOHN KOLB
<tel#>HOME: 201/652-7016 or Office: 201/652-0321
<subj>Kolb was in charge of Engineering for ITT w/ John Ackley - used 1st PDP-1. He is calling you re: Some interesting equipment you might be interested in re: major hole in electrical and electronics area where DEC equipment would ideally fit. Needs 5 mins. with you on the phone to exlain. Have him paged at his office #....he will be there between 5 and 7 tonight or call him at home #.
<arc>Y
<priority>ACTION-WHEN POSSIBLE
<reply>
<>

<date>11/17/81 Tue 15:28
<name>AUDI INFORMATION
<tel#>IN WELLESLEY 237-5759 AND NATICK # 655-5010
<subj>ANNIS PORSCHE/AUDI, INC. IS LOCATED ON RT. 9 (960 WORCESTER RD.) IN NATICK. THIS IS THE ONLY AUDI DEALER CLOSE TO YOU OTHER THAN PASS & CO. IN BURLINGTON. ANNIS DOES GOOD WORK I UNDERSTAND FROM A PORSCHE OWNER. IF YOUR AUDI IS STILL IN WARRANTY OTHER VW DEALERS WOULD PREFER YOU TO GO TO AN AUDI DEALER. IF NOT IN WARRANTY THERE ARE VW DEALERS NEAR YU. WANT SOME NAMES?
<arc>Y N
<priority>FYI
<reply>
<>

<date>11/16/81
<name>Prof. Hugh T. Richards
<tel#>Office: 608/262-3092 and Home: 608/238-1914
<subj>Prof Richards from U. of Wisc. re: your suggestion to Murray Thompson to give honorary degree to Atanasoff. They

had heard he was deceased. Is he?
<arc>Y
<priority>ACTION--WHEN POSSIBLE
<reply>
<>

<date>11/12/81
<name>WILL SHERWOOD
<tel#>225-4316 OR AT HOME 481-3941
<subj>RE: HIS LEAVING THE COMPANY - WILL WOULD LIKE TO TALK WITH YOU ABOUT THIS. HE WILL BE AT HOME TONIGHT AFTER 10:00 P.M. OR IN HIS OFFICE TOMORROW.
<arc>Y
<priority>ACTION--ASAP
<reply>
<>

<date>11/11/81
<name>Ray Peterson
<tel#>408/730-3295
<subj>re: his resume (Peter Christy suggested he call you direct to discuss) **I have requested another copy of Peterson's resume from Peter Christy as the one you had was routed to Will, Clayton, etc. It should be in our hands tomorrow.**
<arc>Y
<priority>WHEN POSSIBLE
<reply>
<>

<date>11/9/81 Mon 17:02
<name>DAVID STROLL
<tel#>264-5977/4774
<subj>RE CAFS FAST INTELLIGENT FILE SERVER ENGINE (WHEN YOU WERE IN EUROPE)--THEY WOULD LIKE TO MEET WITH YOU TO DISCUSS THIS FEATURE BEFORE ANY STAFF EMBARK ON DETAILED WORK. WILMOT WILL BE COMING TO THE STATES SOON. DO YOU WANT TO MEET OR WHO?
<arc>Y

<priority>ACTION--WHEN POSSIBLE
<reply>
<>

<date>11/6/81
<name>MARLENE MARTIN WITH USER GROUP CORP.
<tel#>415/961-9602
<subj>HER LETTER RECEIVED AND YOU HAVE RE: DEC 10 & 11 BOSTON MTG (YOU ARE SCHEDULED AT THIS TIME FOR NAT RESEARCH COUNCIL BOARD MTG IN WASH, DC
<arc>Y
<priority>ACTION--WHEN POSSIBLE
<reply>
<>

<date>11/5/81
<name>Steve Frick
<tel#>800/792-5102
<subj>re: AUDI - Frick is the adjuster who looked at the Audi. If you want to speak with him as to his opinion on the damage, etc. you can reach him tomorrow in the office or leave a message from him to call you. The supervisor who handled the claim is Roger Thompson...you also might ask for him.
<arc>Y
<priority>ACTION--ASAP ACTION
<reply>
<>

<date>11/5/81
<name>Charley Wyckoff
<tel#>305/652-6841
<subj>re: speaking engagement on DEC 4 w/universities of So.Fla
<arc>Y
<priority>ACTION--WHEN POSSIBLE
<reply>
<>

<date>11/5/81
<name>Ray Peterson
<tel#>408/730-3295
<subj>re: his resume/Peter Christy suggested he call u direct
<arc>Y
<priority>ACTION--WHEN POSSIBLE
<reply>
<>

<date>11/4/81
<name>Henry Owen
<tel#>312/621-6521
<subj>from GATX Corp. (Corp. Info. Systems), 120 S. Riverside Plaza, Chicago, IL 60606 - was referred by Dan Sieworiek concerning "commercial whetstone software". Can you help him?
<arc>Y
<priority>FYI
<reply>
<>

<date>11/4/81
<name>BILL CONGLETON - PALMER
<tel#>423-4355
<subj>SAYS YOU KNOW HIM. NEEDS SOME ADVICE
<arc><date>11/4/81 Wed 10:31
<priority>ACTION--WHEN POSSIBLE
<reply>
<>

<date>11/3/81
<name>DR.
RADHA
<tel#>601/634-2182 OR 2530
<subj>FROM CORP OF ENG. WATERWAY EXPERIMENT STATION - RE: REQUEST YOU TO SPEAK AT A SEMINAR NEXT YEAR ON DATA BASE MANAGEMENT - PLEASE CALL

<arc>Y
<priority>WHEN POSSIBLE
<reply>
<>

<date>11/2/81 Mon 16:57
<name>DR.WOLFGANG R. HABBEL - CHAIRMAN OF THE BOARD OF MANAGEMENT (WHICH IS EQUAL TO OUR TITLE OF PRESIDENT)
<tel#>
<subj>ADDRESS: AUDI NSU AUTO UNION AG, P.O. BOX 220, 8070 INGOLSTADT, FEDERAL REPUBLIC OF GERMANY
<arc>Y
<priority>FYI
<reply>
<>

<date>11/3/81
<name>JAMES W. MCLERNON (PRES. & CHIEF OF VOLKSWAGEN OF AMERICA, INC.-WHICH IS THE PARENT COMPANY OF THE SUBSIDIARY - PORSCHE AUDI IN U.S. (TOP PERSON AT PORSCHE-AUDI IN U.S. IS VP JAMES R. FULLER
<tel#>313/574-3300
<subj>THE ADDRESS FOR BOTH IS 27621 PARK VIEW BLVD, WARREN MICHIGAN, 48092
<arc>Y
<priority>FYI
<reply>
<>

<date>11/3/81
<name>BETTER BUSINESS BUREAU
<tel#>482-9190 (CUSTOMER COMPLAINTS)
<subj>PROCEDURE FOR FILING A COMPLAINT = they will send you a form on which you will describe your complaint, return to them, they will contact Pass for you and then respond to you by mail.
<arc>Y
<priority>FYI
<reply>

<>

<date>10/30/81
<name>FRANK HEART (BBN)
<tel#>497-3470
<subj>WANTED TO MEET WITH YOU FOR 15 MINS ASAP...PERHAPS A CALL WOULD DO. WOULD NOT LEAVE A SUBJ. SAID IT WAS TOO COMPLICATED TO GO INTO.
<arc>Y
<priority>ACTION--WHEN POSSIBLE
<reply>
<>

<date>10/30/81
<name>WARREN DAVIS (DIRECTOR OF GOVERNMENT AFFAIRS)
<tel#>408/255-3522
<subj>RE: SIA ANNUAL MTG.....HOPES YOU PLAN TO ATTEND. PLEASE CALL MON TO DISCUSS. HE UNDERSTANDS YOU GAVE ERICH BLOCH A PROMISE THAT YOU WOULD BE AT HIS (BLOCH'S MTG ON MON).
<arc>Y
<priority>ACTION--ASAP ACTION
<reply>
<>

<date>10/30/81
<name>ALLEN BURGESS - OLD FRIEND FROM MIT
<tel#>655-9020
<subj>PEROSNAL
<arc>Y
<priority>ACTION--WHEN POSSIBLE
<reply>
<>

<date>10/29/81
<name>BOB ARMSTRONG
<tel#>HOME 413/625-2216 OR 227-0685 TERMINAL PHONE AT HOME DEC X

<subj>RE: PEOPLE LEAVING - FROM PETE STRAKA
<arc>Y
<priority>ACTION--WHEN POSSIBLE
<reply>
<>

<date>10/28/81
<name>OLIVER SELFRIDGE
<tel#>HOME: 862-5438, OFFICE: 497-3536
<subj>RE: PROF. ARTHUR SAMUEL. SELFRIDGE HAS ASKED HIM TO GIVE A TALK ON NOV. 6. AT N.E. ARTIFICIAL INTELLIGENCE SOCIETY.YOU AGREED TO PICK UP TRANSPORTATION (SELFRIDGE WILL CALL BACK MON. TO SEE WHAT YOU WANT TO DO ON THIS.) WILL YOU JOIN THEM FOR DINNER OR GO TO THE TALK?
<arc>Y
<priority>ACTION--WHEN POSSIBLE
<reply>
<>

<date>10/28/81
<name>TONY RALSTON - ENCYCLOPEDIA OF COMPUTER SCIENCE
<tel#>716/831-3065
<subj>AN ARTICLE YOU CO-AUTHORED WITH JIM BELL RE: DEC. HE IS GOING OVER GALLEY PROOFS AND NEEDS TO UPDATE SOME INFO. (SUCH AS: "AS OF 1979 THE NUMBER OF PDP-10'S DELIVERED WERE....", "THE VAX FAMILY WILL EVOLVE.....", ETC.
<arc>Y
<priority>ACTION--WHEN POSSIBLE
<reply>
<>

<date>10/28/81
<name>RON CADIEUX
<tel#>3-7189
<subj>ENG. DESIGNER LECTURE SERIES - WHAT HE NEEDS FROM YOU RIGHT NOW IS AN ANSWER TO THE FOLLOWING:

<date>10/27/81 Tue 16:44
<name>Mike Cappelletti (worked with you 15 yrs.ago under Ben Gurley(?)
<tel#>202/633-4636
<subj>He now works for the Justice Dept. About a yr ago they ordered 9 PDT's...on a 5 yr pay out plan.....it was decided they did not need all the equipment and made arrangements to return some but not all....Dec now says they cannot keep all the portions they want to keep. To him it seems that what

they are asking is logical and in the "old days" it could have been done! Can you help or point him to a person who could help.
<arc>Y
<priority>ACTION--WHEN POSSIBLE
<reply>
<>

<date>10/27/81 Tue 16:37
<name>Bob Gillespie - U. of Wash
<tel#>206/543-0070
<subj>re: copies of the report you wrote together. Jack Schwartz suggested that you write a 1/2 page letter and send with copies of report to Jack Blackburn (Computer Sci. Board) who will in turn distribute. How many copies do you need as he has additional.
<arc>Y
<priority>ACTION--WHEN POSSIBLE
<reply>
<>

<date>10/23/81 Fri 10:56
<name>Mrs. Marger of IRCAM
<tel#>
<subj>RE: Visit from IRCAM individuals from their Systems Dept. (Jean Pierre Amande, Mr. Barra, and Mr. DiGiugno). DEC Paris has set up the visit for Nov. 12 and 13 (Mr. Dampiere-DEC Paris handled) with LCG and ESG to review all IRCAM equipment and choose equip. to replace their PDP-10. Is their anyone else you think they should see? She will call back prior to their visit to see if you have any suggestions. You had mentioned Joel Schwartz when she was here.
<arc>Y
<priority>ACTION--WHEN POSSIBLE
<reply>
<>

<date>10/23/81 Fri 9:38
<name>Russ Ner (VP at AMP)

<tel#>
<subj>to close the loop for Hal McInnis and let you know they are having a design review on Nov. 19 with DEC people. Everything will be worked out....they are completely open to do all they can to make this process workout. Bernie LaCroute and Rick Seifert are tuned in to this.
<arc>Y
<priority>FYI
<reply>
<>

<date>10/22/81 Thu 14:13
<name>Barry Ferranti
<tel#>02-977-3289 or office 02-438-3624 or 3625
<subj>re: per your request I called Andy K and G. Witmore with following message: "a friend of yours from Sidney, Australia highly recommends a competent individual to headup DEC-Australia. Definately worthwhile for Andy to see and/or talk with...and for Gerry to talk with him. ....pw
<arc>Y
<priority>ACTION--FYI
<reply>
<>

<date>10/20/81 Tue 4:28
<name>Harold Cohen (artist for museum murals)
<tel#>714/452-4766
<subj>leaving for Europe tomorrow please call after 7:00 his time as he needs to speak with you re: your suggestion that he contact the corp. contributions committee.
<arc>Y
<priority>-ASAP ACTION
<reply>
<>

<date>10/20/81 Tue 2:48
<name>del thorndike
<tel#>
<subj>Thanks!!!!You were great yesterday!

<arc> N
<priority> FYI
<reply>
<>

<date>10/20/81 Tue 13:16
<name>
<tel#>
<subj>mj or mj/pw will make a mail run tomorow
<arc> N
<priority> FYI
<reply>
<>

<date>10/20/81 Tue 10:51
<name>Bruce Delagi
<tel#>
<subj>will not be attending jungle as he is in Japan
<arc> N
<priority> FYI
<reply>
<>

<date>10/20/81 Tue 10:35
<name>Mark Conrad of Texas Instruments
<tel#>713/778-6527
<subj>workshop invitation in Hawaii - Jan 6&7 - needs to know if you are participating asap re: his letter of Oct 5
<arc>Y
<priority>ASAP ACTION
<reply>
<>

<date>10/19/81 Mon 16:57
<name>geo. hoff
<tel#>
<subj>venus review   thurs 1-5

<arc> N
<priority>FYI
<reply>
<>

<date>10/19/81 Mon 16:54
<name>
<tel#>
<subj>Where do you need an Avis rental...mj has a car in albuquerque
<arc> N
<priority>-ASAP ACTION
<reply>
<>

<date>10/19/81 Mon 16:01
<name>DPD
<tel#>
<subj>Shall we go ahead and ask the DPD people to come or wait a couple of weeks?
<arc> N
<priority>ACTION--WHEN POSSIBLE FYI
<reply>
<>

<date>10/19/81 Mon 10:43
<name>
<tel#>
<subj>Eng. Headquarters Review w/Win is Dec. 18. Larry will present and you are scheduled.
<arc> N
<priority> FYI
<reply>
<>

<date>10/16/81 Fri 16:38
<name>Dottie Hauck
<tel#>3039
<subj>mtg w/ bill thompson, ed sawyer, liz aberdale re: CE controllership and acting person - suggested they speak with you at jungle mtg. as you are booked solid.
<arc> N
<priority><u>FYI</u>
<reply>
<>

<date>10/16/81 Fri 16:29
<name>Jeff Kalb
<tel#>
<subj>director candidates for SRC. Unable to break from mtg to give an answer...left message to have him call you over the weekend with the information.
<arc> N
<priority><u>FYI</u>
<reply>
<>

<date>10/16/81 Fri 15:59
<name>Ed Donaldson
<tel#>
<subj>Will call you back: Wants to talk with you about and individual who gave a presentation to you and staff. The company he was representing is not going thru with plans and he is interested in other opportunities....is a very hi level person
<arc> N
<priority><u>FYI</u>
<reply>
<>

<date>10/16/81 Fri 15:54
<name>Arnie Goldfein
<tel#>Home: 408/923-6641 at INTEL: 408/987-8080
<subj>I spoke with Steve Teicher's sec. asked her to tell Steve, if he spoke with Arnie, to have Arnie call you here or at home.
<arc>Y
<priority>ACTION--WHEN POSSIBLE
<reply>
<>

<date>10/16/81 Fri 15:46
<name>Dr. Tsugio Makimoto
<tel#>
<subj>Here is the rundown for Mon. afternoon:
12:00 Buffet lunch in ML21-1 (Mill Pond Conf Rm)
Don Nelson will be attending lunch and will leave at 1:00 with Makimoto for Hudson. Don was planning to introduce him before the lecture but you may do so if you wish.
Refreshments will be served at 1:30 in the Hall of the White Mists (Hudson I) Lecture at 2:00, Tour at 3:15 and a reception at 4:30 in the Museum. The lunch is being held under Dave Dutton's auspices as is the dinner. I told them you would not be at the dinner. Understand that Dick Clayton is going.
<arc> N
<priority>FYI
<reply>
<>

<date>10/16/81 Fri 14:46
<name>Barbara Schizkoske sec. to Bill Ormerod - Kanata
<tel#>621-2532
<subj>He wrote Sept. 10 re CIPS Nat. conference in May of 82 in Saskatchewan. Would you or a delegate be interested in

presenting a paper at mtg.
<arc>Y
<priority>ACTION--WHEN POSSIBLE
<reply>
<>

<date>10/16/81 Fri 14:44
<name>Rols Goertner
<tel#>
<subj>with BBC - Germany - is at MIT Sloan School with Ed Schein. Would like to talk about doing a study/project. Will try to reach you at home this weekend
<arc>Y
<priority> FYI
<reply>
<>

<date>10/16/81
<name>PAUL STERN
<tel#>313-972-7324
<subj>FROM BURROUGHS. LEE SHEVEL TOLD HIM TO CALL YOU RE: OPTICAL STORAGE SYSTEMS.
<arc>Y
<priority>ACTION--WHEN POSSIBLE
<reply>
<>

<date>10/16/81
<name>DAN HARMON
<tel#>212/558-7483
<subj>HE IS WITH NEW YORK METROPOLITAN USERS GROUP - WANTS YOU TO TALK NEXT MONTH ON HISTORY OF COMPUTERS (SAME TALK YOU DID AT DECUS) THE DATE IS FLEXIBLE. **HAVE TO TAKE A RAIN CHECK TOTALLY OVERCOMMITTED. BUT THANKS.** Called 10/16/81 Told him of overcommittment...understands....
Would like GB to do this the first of the year...please write to him at 25 East Moore Rd, Denville, NJ 07834.......Patty

<arc>Y
<priority>ACTION--WHEN POSSIBLE
<reply>
<>

<date>10/14/81 Wed 17:16
<name>HAL LAZAR AGAIN
<tel#>H:213-541-4680 B:415-494-4770
<subj>HE HAS ALSO BEEN OUT BUT HOPES YOU CAN CATCH UP WITH HIM OVER THE WEEKEND. ALL DAY FRIDAY HE CAN BE REACHED AT THE OFFICE NUMBER OR AT HOME OVER WEEKEND.
<arc>Y
<priority>ACTION--ASAP
<reply>
<>

<date>10/13/81
<name>ED DAVIDSON - U. OF ILLINOIS
<tel#>217-333-6124
<subj>IS WORKING WITH SOME PEOPLE TO ESTABLISH A NEW COMPUTER JOURNAL AND WOULD LIKE TO TALK TO YOU AS TO WHETHER YOU MIGHT WANT TO BE ON THE ADVISORY BOARD FOR THE JOURNAL. IT WILL BE HEAVY ON INDUSTRY AND LIGHT ON ACADEMIC. Mitch
<arc>Y
<priority>ACTION--WHEN POSSIBLE
<reply>
<>

<date>10/8/81 Thu 16:24
<name>GEORGE CHAMPINE
<tel#>H:264-4353 UP TILL MIDNIGHT
<subj>RETURNED YOUR CALL.
<arc>Y
<priority>ACTION--WHEN POSSIBLE
<reply>
<>

<date>10/8/81 Thu 13:49
<club>MJ
<message>LEE SHEVEL - WOULD LIKE TO TALK TO YOU BEFORE HE TALKS TO G RE: INTRODUCING A SUBJECT AND A PERSON OVER THE PHONE; THE SUBJ: OPTICAL MEMORY
<tel#>313-972-7586
<taken by>ML
<>

<date>10/8/81 Thu 14:01
<name>LEE SHEVEL
<tel#>313-972-7586
<subj>SHEVEL HAS SUGGESTED PAUL STERN GIVE YOU CALL TO DISCUSS INTEREST IN A JOINT VENTURE RELATED TO OPTICAL MEMORIES. SHEVEL WOULD BE GLAD TO TALK TO YOU FIRST, OR CALL STERN DIRECT: 313-972-7324. WANT GRANT TO HANDLE?
<arc>Y
<priority><u>ACTION--WHEN POSSIBLE</u>
<reply>
<>

<date>10/6/81
<name>HAL LAZAR FOR DAVE LIDDLE
<tel#>213-615-6258
<subj>ETHERNET SYMPOSIUM - AND GENERAL DISCUSSION ON SPECS
<arc>Y
<priority><u>ACTION--WHEN POSSIBLE</u>
<reply>
<>

<date>10/1/81 Thu 16:29
<name>BARBARA SMITH FOR WARREN DAVIS
<tel#>408-255-3522
<subj>RE THE NEXT SIA MEETING IN PALO ALTO. THEY ARE LOOKING AT OCT 12 OR 27--OH BROTHER.
<arc>Y
<priority><u>ACTION--ASAP</u>
<reply>
<>

Telephone Messages -- September 21

1. Neil Dadd, (Insurance Product Line) 8-264-5473 in Merrimack, called. Re: A customer visit (Connecticut General) on the 28th in Merrimack. He wants to know if you would be available to give a 1/2 hr. presentation on "Computers in the Future". You have a 10:00 staff that morning and two meetings in the afternoon at 2:00 and 4:00.

Also, there is a follow-up meeting on the 28th from 2:00 to 5:00 in the R&D conference to last Tuesday's meeting which you are invited to attend if you get a chance.

2. Jan (John Leng's secretary) called. There is no chance to schedule you for tomorrow morning's meeting. It has been left as it was for the 6th of October.

3. FYI -- Sam Fuller called to let you know that Tom Knight (from MIT) will be in Tewksbury tomorrow at 1:30 to discuss the CHAOSnet.

4. Ralph Drury, 426-0130 (Boston) called to discuss Systems Engineering with you. He will call back Tuesday if you don't get a chance to call him between now and then.

5. Do you need to see/sign the United Way memo written for you by John Meyer before it goes out?

6. Dr. Bruce Merrifield, VP of Technology for Continental (Can) Group, called. Re: a personal matter. (212) 551-7321 -- New York

7. Bruce Arden (609) 452-4640 called. Re: 1980 IFIPS.

MJ -- Messages

Sept. 21

1. Ann in TOPAZ X3-2442 called to confirm Gordon's trip arrangements. They are as follows:

October 1
TWA flight 117
Leave Boston 7:45 AM
Arrive Denver 11:11 AM

October 3
United flight 743
Leave Denver 6:30 PM
Arrive SF 7:53 PM

October 5
TWA flight 32
Leave SF 8:30 AM
Arrive Boston 4:40 PM

The tickets can be picked up at the mill on September 27th and the Hotel information (directions, etc.) will be attached.

The Hotel reservation is a guaranteed late arrival at the Holiday Inn in Livermore. It is $26 a day plus tax and subject to change as of October 1.

2. Please call Ann Peskin -- no message.

Messages 9/22

1. Pete van Roekens (8-247-2603). Re: Needs your approval for a job offer to a software person for Hydra.

2. Tom Hastings 8-264-6767 in Merrimack. (Home phone (617) 646-5098.)
Re: Would like make a job offer to a software engineer (Steve Lionel) for the VAX Common Run Time Group to do the Library Project Fortran Release. He has been interviewed by the

Fortran group and by Tom and they all have good feelings about hiring him. There are already four people in the group doing basic and cobol and this person would do the Fortran.

3. Dawn Boyd (Denver office (303) 773-6535, X205). Re: Needs to know if "The PDP-11 Family and the VAX11/780 for a Large Address Space" is the right topic for your speech there. Needs to know by Monday.

MJ -- Messages

Sept. 22

1. Gene Gross X4834. Re: Needs to set up a meeting (30-45 minutes) with Gordon to discuss Service Function Management.

2. Tom Hastings 8-264-6767. Re: Susan Jackson did all the typing for Tom's group while they were in the mill. When the group transferred to Merrimack, she didn't want to go so she's looking for a job here in the mill. Any suggestion? Tom said she's very good on the word processor and also knows runoff.

PAT HAMEL IN TOME STOCKEBRAND'S OFFICE - 552-2518 - CALLED REGARDING
A VIDEOTAPE DESCRIBING THE COLONEL - SHE WAS TOLD THAT YOU WOULD KNOW
WHERE IT IS - NEEDS A COPY OF IT BACK.

ALAN KOTOK RETURNED GORDON'S CALL OF YESTERDAY. WILL BE AT 231-7381
AFTER 2:30

JANET IN PURCHASING AT 2618 WANTS YOU TO CALL HER BACK

<date>12/30/80
<name>JANET STRAZZULLA
<tel#>264-5429
<subj>JULIUS IS BRING IN BOB DOYLE, INVENTOR OF THE MICRO TERMINAL, SOMETIME IN THE NEXT FEW WEEKS. DOYLE IS LOOKING FOR VENTURE CAPITAL OF ABOUT $1M. JANET SENT YOU SOME INFO AROUND DEC 5 ON THIS TERMINAL INCLUDING DOYLE ADDRESS. THE MANUAL IS COMING.
<arc>Y
<priority>FYI
<reply>COPY OF MANUAL PLEASE
<>

<date>12/19/80
<name>Prof. Ballantyne
<tel#>607-256-4109
<subj>Cornell--wants to ask Sam Fuller to be part of the Visiting Committee in Engineering. Would entail 1 meeting/year.
<arc>Y
<priority>ACTION--WHEN POSSIBLE
<reply>OK HERE TO EXTEND THE INVITATION
<>

<date>12/10/80
<name>ROGER REYNOLDS, U OF CAL
<tel#>714-755-8815
<subj>RE HIS REQUEST TO THE CONTRIBUTION COMMITTEE. WANTED FURTHER CLARIFICATION AND I PUT HIM IN TOUCH WITH MARY ANN BUREK (3-4277) WHO CORRESPONDED WITH HIM THAT WE COULD NOT HELP IN HIS REQUEST.
<priority>FYI
<reply>
<>

<date>12/10/80
<name>WIN HODGE
<tel#>714-998-0607
<subj>BUILDING A SET OF CONTROLLER CARDS THAT CONVERT A COMPUTER INTO A PABX. WOULD LIKE TO TALK TO YOU ABOUT IT. THE SWITCH SET IS LIKE A CONTROLLER BUT COMPUTER CAN DO OTHER THINGS AS WELL. HAVE DESIGNED THS FOR ONE COMPUTER BUS AND THEY COULD DO IT FOR THE PDP-11
<priority>ACTION--WHEN POSSIBLE
<reply>
<>

<date>12/9/80
<name>MR. MARK MCDONOUGH
<tel#>367-9200
<subj>POSTIONS, INC: HAS A CANDIDATE, SENIOR DESIGNER --

MASTERLESS AND CONTENTIONLESS COMMUNICATIONS ARCHITECTURE. WORKED FOR DG, TOOK OFF 6 MONTHS AGO AND DECIDED HE NEEDS A BIG COMPANY TO MARKET HIS IDEAS.
<priority>ACTION--ASAP
<reply>
<>

<date>12/5/80
<name>DANIEL ANDERSON
<tel#>713-483-5240
<subj>AN OLD FRIEND--PERSONAL
<priority>ACTION--WHEN POSSIBLE
<reply>
<>

<date>12/5/80
<name>WES CLARK
<tel#>
<subj>THE TURING MACHINE IS AT CALTECH (CARVER MEAD) BEING USED IN A SURVEY COURSE. FYI--BOB ARNZER WAS CO-BUILDER, CHARLIE MOLNER AT WASH. U IS OWNER. WANT TO WRITE TO MEAD?
<priority>ACTION--WHEN POSSIBLE
<reply>
<>

<date>12/5/80
<name>PROF ED FREDKIN
<tel#>412-621-6250
<subj>RE ETHERNET
<priority>ACTION--WHEN POSSIBLE
<reply>
<>

<date>12/3/80
<name>EMIL BERGER
<tel#>215-363-3072
<subj>QYX COMPANY, RE METAFONT--HE IS INTERESTED IN GETTING THE SW TO RUN ON A VAX.

<priority>ACTION--WHEN POSSIBLE
<reply>RICK FRIDAY PLS CALL 264-8022   12/15/80 Mon 8:49
<>

<date>12/1/80
<name>HANK MAURER
<tel#>225-4223
<subj>RETURNED YOUR CALL OF 11/17.
<priority>ACTION--WHEN POSSIBLE
<reply>
<>

<date>11/18/80
<name>KEITH UNCAPHER
<tel#>
<subj>RE HELPING ARPA GET $20M OF EQUIPMENT FUNDS
<reply>EARL HYTE, 231-4784, JOEL SCHWARTZ AREA, SAID HE WOULD CALL - 11/24/80
<>

<date>11/10/80
<name>PROF. STRANG
<tel#>253-4383
<subj>MIT--RE CHINA
<reply>
<>

<date>11/5/80
<name>FRANK SAWYER, MCGRAW HILL--SENDING OUT A TECHNICAL JOURNAL REVIEW--A MARKETING REPORT ON ENGINEERING TOMORROW. I SUGGESTED WE ASK YOU FIRST IF YOU WANTED TO REVIEW IT--HE SAID HE'D SEND IT ANYWAY AND IT WAS PERFECTLY ALL RIGHT IF YOU DIDN'T WANT TO--HE IS FULFILLING AN AGREEMENT TO SEND OUT N NUMBER FOR REVIEW.
<tel#>
<subj>
<reply>
<>

<date>11/5/80
<name>BOB SHINLEVER
<tel#>231-6936
<subj>RE THE WAXMAN AFFAIR.
<reply>
<>

<date>10/28/80
<name>ROGER BOROVOY,INTEL
<tel#>408-987-8192
<subj>INTEL RE MIT AND CLASS OF '56 GIFT CAMPAIGN
<reply>
<>

<date>10/23/80
<name>HADDAD
<tel#>914-686-4460
<subj>RE YOUR REQUEST FOR GUATELLI.
<reply>DONE--MJ CALLED AND SAID YOU WOULD SEE HIM IN WASH. + GUATELLI ISSUE SEEMS RESOLVED
<>

<date>10/20/80
<name>MIKE SULLIVAN, IBM
<tel#>914-765-6416
<subj>RE GAUTELLI (SULLIVAN CALLED LATE FRIDAY - 10/17)
<reply>DONE
<>

<date>10/14/80
<name>DR. GEORGE HEILMEIER, TI
<tel#>214-995-5975
<subj>WANTED TO LET YOU KNOW HE WAS BACK IN TOWN IN CASE YOU WANTED TO CONTINUE YOUR CONVERSATION. DO YOU?
<reply>
<>

<date>10/14/80
<name>PROF. WOODSON
<tel#>512-471-4262
<subj>RE THE HONORARIUM AND YOUR SOC. SEC. #--WANT TO DONATE THE MONEY TO THE COMPUTER SCIENCE DEPARTMENT OR ELECTRICAL ENGINEERING
<reply>
<>

<date>10/14/80
<name>DEAN GRAHAM ALLISON, SCHOOL OF GOVERNMENT, HARVARD
<tel#>495-1380 (ELIZABETH FAINSOID)
<subj>INVITATION TO DINNER ON FRIDAY, OCT. 24, AT HARVARD, WITH DR. ROBERT FROSCH. INTERESTED?
<reply>
<>

<date>10/13/80
<name>CHARLES HARWOOD
<tel#>408-746-3577
<subj>PRES OF SIGNETICS
<reply>
<>

<date>10/13/80
<name>DAVE ROBINSON
<tel#>302-738-2405
<subj>RE A GOOD GUY LETTER AS HE IS UP FOR A PROMOTION AT THE U OF DELAWARE. IF YES, SOME PAPERS WILL COME TO YOU AS A REFERENCE--OK? OR "NOT FAMILIAR ENOUGH WITH HIS WORK..."
<reply>
<>

<date>10/8/80
<name>DON'T FORGET TO CALL NEWELL (HOME:412-578-2601, CMU:412-421-3668) RE YOUR TRIP TO WASH./PITTS, 10/30 TO 11/1. YOU WILL BE IN PITTS 10/31, 4:33PM. THERE IS NO "EDGE MOTEL". WHO SEE 11/1, SATURDAY MORNING AT CMU? L PITT SAT AT

5:25P.
<tel#>
<subj>
<reply>
<>

<date>10/6/80
<name>ED FREDKIN
<tel#>412-621-6250
<subj>HE HAS 3 THINGS HE WANTS TO TALK ABOUT, ONE OF WHICH IS ZUSE. HE WANTS TO INVITE HIM TO A DOINGS AT MIT IN MAY--WISHES WE COULD CHANGE THE DATE.
<reply>
<>

<date>10/3/80
<name>MR. CHEBATOR, X3-4334, NE TELEPHONE MAN WITH A DEC EXTENSION WHO IS SUPPOSED TO BE TAKING CARE OF YOU. YOUR EMS PLUS THE GENERAL SITUATION HAS REALLY BEEN ESCALATED. ARTHUR DEAN, COPP'S MAN, IS GONG TO SEE ONE OF THE VP'S TODAY.
<tel#>
<subj>
<reply>
<>

<date>10/3/80
<name>MARGE POLLACH, SPECTRUM
<tel#>212-644-8093
<subj>RE REVIEW OF A PAPER, "COMPUTER SYSTEMS ARCHITECTURE" BY JEAN-LOUP BAER. I SAID YOU WERE OVER-COMMITTED, BUT IF ANY CHANGE I WOULD CALL THEM BACK ON MONDAY. OK?
<reply>
<>

<date>9/29/80
<name>MR. MICAHEL NACEY--BBN, CAMBRIDGE
<tel#>491-1850, X3284
<subj>HE TALKED WITH FRANK HART AT BBN AND FRANK THOUGHT GB

MIGHT BE INTERESTED IN GIVING A SEMINAR. IT COULD BE SCHEDULED ANYWHERE FROM OCTOBER - MAY '81; TIME, 5-6:30 (USUALLY PRESENTED ON TUES., WED., OR THURS.); ATTENDANCE, 75-200; SUBJECT: DEVELOPMENTS IN COMPUTER ARCHITECTURE.
<reply>
<>

<date>9/26/80
<name>DR. GEORGE HEILMEIER
<tel#>HOME: 214-386-4021
<subj>AS YOU KNOW HE HAS TRIED TO REACH YOU SEVERAL TIMES. I TOLD HIM YOU WOULD TRY OVER THE WEEKEND.
<reply>
<>

<date>9/17/80
<name>MARGE POLLACK
<tel#>212-644-8093
<subj>IEEE SPECTRUM, NY--RE: REVIEW A BOOK BY JEAN-LOUP BAER "COMPUTER SYSTEM ARCHITECTURE
<reply>
<>

<date>9/17/80
<name>ERWIN GOODWIN
<tel#>202-389-6540
<subj>NATIONAL RESEARCH COUNCIL--RE: HE WOULD LIKE YOU TO REVIEW A REPORT ON COMPUTERS & COMMUNICATIONS
<reply>
<>

<date>9/17/80
<name>JOAN HENDRICKSON
<tel#>879-4502 (FRAMINGHAM)
<subj>CO: INTERFACE WEST, (LOS ANGELES), RE: SESSION ON OPERATING SYSTEMS
<reply>
<>

<date>9/12/80
<name>TOM DAY, DEC LONDON
<tel#>637-5200
<subj>RE YOUR TRIP ENGLAND/INFOTECH. HE HAS SOME BIG ACCOUNTS--BANKS AND OTHER BUSINESSES--WHO SAW WHERE YOU WERE GIVING A LECTURE. TOM IS WONDERING IF YOU WOULD GIVE THE SAME LECTURE TO A GROUP OF HIS ABOVE CUSTOMERS? ANY DAY OF YOUR CHOOSING WHILE YOU ARE THERE?
<reply>
<>

<date>9/10/80
<name>SLAGLE, NAVAL RESEARCH LAB--NOV. 5 WAS NOT GOOD. THEY ARE HOLDING A 3-DAY ROBOT SYMPOSIUM. SAID IF YOU WOULD LIKE TO DROP IN YOU WOULD BE WELCOME. I REALLY THINK YOU ARE OFF THE HOOK ON THIS TALK NOW.
<tel#>
<subj>
<reply>
<>

<date>9/4/80
<name>NEGROPONTE
<tel#>253-5981
<subj>CALLED RE: "MIT LAB SWITCHING TO DEC COMPUTERS" (I DIDN'T TAKE THE MESSAGE. THIS MORNING MUMMOLO CALLED SAYING DEC IS ALMOST THERE IN THE BIG SALE, THEY WILL BE GETTING THEIR MONEY OCT. 1, HE LIKES TO RUB SOCIALLY WITH VP'S, HENCE YOU CAN BE A BIG HELP.
<reply>
<>

<date>8/20/80
<name>GOLDSTEIN
<tel#>212-925-8580
<subj>CALLED RE WILKES--EVERYTHING DONE. WILKES HAS A DATE WITH THE EMBASSY ON 8/27 AT WHICH THEY WILL BE ISSUED A PERMANENT VISA. THIS WAS CONFIRMED BY A TELEGRAM GLORIOSO RECEIVED FROM WILKES--IN YOUR MAIL. GOLDSTEIN SUGGESTED WE

WRITE PELTIER A THANK YOU LETTER, CC TO AMBASSADOR.
<reply>
<>

<date>8/14/80
<name>RANDELL HOME PHONE: 0632-85584
<tel#>
<subj>
<reply>
<>

<date>8/6/80
<name>JIM ROGERS--FORMERLY OF CASE WESTERN
<tel#>216-991-7283 (HOME)
<subj>HE ACCEPTED A POSITION IN DEC-MERRIMACK. HE WILL BE STARTING ON 8/25, AND IS LOOKING FOR A MOVE IN NEW HAMPSHIRE THE MIDDLE OF SEPT. HE WILL BE AT THE ABOVE NUMBER UNTIL HE STARTS ON 8/25.
<reply>
<>

<date>8/6/80
<name>BERT SUTHERLAND--XEROX
<tel#>415-494-4300
<subj>LETTER HE SENT YOU (SEE ATTACHED)
<reply>
<>

<date>7/29/80
<name>ED VRABLIK
<tel#>303-469-1149
<subj>PAST EMPLOYEE OF DEC--WISHES TO TALK TO YOU.   HE WILL CALL YOU BACK.
<reply>
<>

<date>7/24/80

<name>DON FEDDERSON
<tel#>617-272-7070
<subj>PRES. OF APPLICON. NO SUBJECT.
<reply>
<>

<date>7/23/80
<name>PROF ROSE
<tel#>216-368-2800
<subj>RE RESEARCH WORK
<reply>
<>

<date>7/18/80
<name>RE GEORGE MICHAELS AND LLL: MICHAELS CONTACT HERE IN MAYNARD, JACK KAY, HAS LEFT THE COMPANY. TOM AUSTIN HAS THE ACCOUNT HERE: THE ORDER PLACED IN JAN FOR 120 DAY DELIVERY WAS PUT ON DEC. 1980 DELIVERY. CUSTOMER WAS TOLD THIS IN FEB. BILL CIBULSKI, LLL ACCOUNT REP IN CALIF, CONFIRMED THIS. HE IS TRYING FOR AN EARLY SLOT, SAYS THEY NEED IT IN SEPTEMBER, BUT NO LUCK SO FAR AND SAYS IT DOES NOT LOOK PROMISING. CIBULSKI: 415-635-3000, TOM AUSTIN: 3-5526.
<tel#>
<subj>
<reply>
<>

<date>7/17/80
<name>BILL MCBRIDE WILL STOP BY MONDAY JUST BEFORE MC TO BRIEF YOU ON HIS PRESENTATION AT SAME.
<tel#>
<subj>
<reply>
<>

<date>7/17/80
<name>C.J. CONSIDINE
<tel#>653-9398

<subj>FROM CONSIDINE COMPUTER SERVICES, WORKING ON AN 11/23 AND IS LOOKING FOR DEFINITION OF BOARD SEMANTICS, ISP, I.E. MEMORY MANAGEMENT ABORT AREA. BARBACCI OR WOULDN'T WE GIVE IT OUT?
<reply>
<>

<date>7/17/80
<name>BRUCE HOLBEIN
<tel#>3-8918
<subj>RE PARTICIPATING IN 1ST PUBLIC AFFAIRS SEMINAR. GEORGE BALL WILL BE THE GUEST SPEAKER; TAKES PLACE IN BOSTON.
<reply>
<>

<date>7/17/80
<name>RON SCHULER
<tel#>264-5974
<subj>VIA GLENN REYER RE FOREIGN LANGUAGES--DOCUMENT ETC.
<reply>
<>

<date>7/16/80
<name>JACK BUCHANAN
<tel#>495-6750
<subj>RE A NEW/MAJOR DEVELOPMENT IN AUTOMATING THE LEGAL OFFICE.
<reply>
<>

<date>7/16/80
<name>STU WECKER
<tel#>3-4366
<subj>WOULD LIKE TO SEE YOU--HOW ABOUT A PHONE CALL?
<reply>
<>

<date>7/16/80
<name>BOB LANE RETURNED YOUR CALL
<tel#>264-6069
<subj>
<reply>
<>

<date>7/16/80
<name>BJ CAN'T ATTEND INTEL SLIDE SHOW--WOULD YOU SHOW THEM TO HIS STAFF?
<tel#>
<subj>
<reply>
<>

<date>7/14/80
<name>BOB HUBERFELD
<tel#>341-2025
<subj>RE YOUR DISCUSSION WITH FRANK CARR (GSA).
<reply>
<>

<date>7/10/80
<name>PAT COHNLE, ZILOG
<tel#>273-4222
<subj>CALLED RE A MEETING PAT BUFFET WILL BE SETTING UP WITH YOU AND THEIR MGR OF COMPONENT ENGINEERING AND THE ARCHITECT FOR THE 8000. IT IS TENTATIVELY BOOKED FOR 8/15. ARE YOU INTERESTED OR DO YOU NOT WANT TO BE INVOLVED?
<reply>
<>

<date>7/3/80
<name>MR. KAUFMANN, INTEL
<tel#>408-987-7289
<subj>RE ETHERNET
<reply>
<>

<date>6/25/80
<name>DR. BOB RITCHIE
<tel#>206-543-0069/545-1376/HOME:206-525-7922
<subj>RE POSSIBLE JOINT PROJECT; AFTERMATH OF YOUR VISIT TO BERKELEY.
<reply>
<>

<date>6/25/80
<name>FEIGENBAUM SEC, SUZAN
<tel#>415-497-2266
<subj>RE YOUR SOC SEC # FOR A $500 HONORARIUM. THEY ARE PAYING YOUR TRAVEL EXPENSES. DO YOU WANT THE HONORARIUM TO BE DONATED TO THE COMPUTER SCIENCE DEPARTMENT, OR?
<reply>
<>

<date>6/25/80
<name>HARRY SHERSHOW
<tel#>617-232-5470
<subj>ASSOCIATE EDITOR DIGITAL DESIGN MAG (SEE ATTACHED). HE MET YOU AT FORRESTER LECTURE. AUGUST ISSUE WILL BE DEDICATED TO DEC COMPATIBLE DEVICES AND WOULD LIKE TO DISCUSS WITH YOU, VIA THE PHONE, WHERE 2ND SOURCE PEOPLE ARE GOING. WANT TO TALK WITH HIM OR LET HENRY FIELD THE QUESTION?
<reply>
<>

<date>6/18/80
<name>ARTHUR MELMD
<tel#>202-254-7147
<subj>RE A VISIT WEEK OF JULY 7 RE CONSIDERING THE NEED FOR A FEDERAL POLICY IN AREA OF TECHNOLOGY AND EDUCATION APPLICATIONS.
<reply>
<>

<date>6/16/80
<name>JERRY WEINER
<tel#>415-494-3942 X277
<subj>RE HIS VISIT HERE.
<reply>
<>

<date>5/21/80
<name>Mike McCarthy is conducting a 3-day raft trip in August--interested? DTN:522-3242
<tel#>
<subj>
<reply>
<>

<date>5/20/80
<name>PROF. ADAMS
<tel#>201-648-5239
<subj>RUTGER U, N.J. RE A CONFERENCE ON COMPUTERS IN SMALL BUSINESS. ASKING YOU TO PARTICIPATE--NOV. 6 & 7 (OPEN)
<reply>
<>

<date>5/19/80
<name>DR. ROBERT HENDRICH
<tel#>615-574-4535
<subj>FROM OAKRIDGE NATIONAL LAB, RE A STAFF POSITION AT DEC.
<reply>
<>

<date>5/19/80
<name>LARRY ROUT
<tel#>312-648-7709
<subj>AN ARTICLE ON AUTOMATED OFFICE (CRAWFORD SUGGESTED HE CALL YOU). WHY NOT MENTION THE FORRESTER LECTURE, TOO.
<reply>
<>

<date>5/19/80
<name>RALPH VAWTER
<tel#>213-552-6005
<subj>INDUSTRY CONSULTANT, EASTMAN & BEAUDINE RE ANALOG AND HIGH DENSITY DIGITAL TAPE RECORDERS.
<reply>
<>

<date>5/19/80
<name>2 NAE FROM XEROX: NEW MEMBER--DR. ESTHER MARLY CONWELL, PRINCIPAL SCIENTIST, XEROX CORP., XEROX SQUARE W114, ROCHESTER, N.Y. 14644; RETIRED--DR. J. H. DESSAUER (IN NAE BOOK)
<tel#>
<subj>
<reply>
<>

<date>5/19/80
<name>ROBERT ROBINSON
<tel#>518-457-1895
<subj>DIR. OF COMPUTING AT STATE U OF N.Y., ALBANY. TRYING TO GET A WORKING PARTY ON OPTIONS FOR HIGHER EDUCATION IN THE NEXT DECADE. WANTS TO GET INDUSTRY INVOLVED IN DEVELOPING A SEQUENCE OF OPTIONS AND HOW TO CHOOSE BETWEEN THESE VARIOUS OPTIONS. SAID DEC PRESS WAS PUTTING TOGETHER CASE STUDIES OF WHICH THIS MIGHT BE THE INTRODUCTION. COMMITTED ARE: JIM EMERY, MCCREDIE, PETER PATTEN, TAD PINKERTON, ROBERT SCOTT, ROBERT GILLESPIE... WANTS TO BOUNCE THIS OFF YOU.
<reply>
<>

<date>5/16/80
<name>DID YOU GET BRUCE ARDEN?
<tel#>609-452-4640
<subj>
<reply>
<>

<date>5/16/80
<name>Did YOU GET DR. GEORGE PAKE? XEROX
<tel#>415-494-4010
<subj>
<reply>
<>

<date>5/8/80
<name>DR. RITCHIE, U OF WASH.
<tel#>206-545-1376, HOME: 206-525-7922
<subj>RE SUMMER COMPUTER SCIENCE MEETING AND COOP RESEARCH IN THEIR DEPT.
<reply>
<>

<date>4/30/80
<name>PROF. ED FEIGENBAUM, STANFORD
<tel#>415-497-4079
<subj>CAN YOU COME TO THE COMPUTER SCIENCE DEDICATION, 6/20?
<reply>
<>

<date>4/30/80
<name>LEONARD KLEINROCK, UCLA
<tel#>213-476-9747
<subj>RE YOUR BEING THE GUEST SPEAKER, NOV. 20, AT THE JAMES MARTIN SEMINAR--THEME:PRODUCTIVITY AND THE DATA PROCESSING REVOLUTION. TOPIC IS YOUR CHOISE, $500 HONORARIUM, 2 HOUR TALK, ABOUT 175 PEOPLE, HYATT REGENCY, BOSTON. (HAL LEVIN ALSO CALLED RE THE ABOVE.)
<reply>
<>

<date>4/23/80
<name>MRS. BORRAS
<tel#>202-467-4471
<subj>FROM AAAS: RE YOUR ACCEPTING NOMINATION TO BE CHAIRMAN ELECT OF SECTION M.
<reply>

<>

<date>4/22/80
<name>MR. RABBAT
<tel#>914-897-8126
<subj>FROM IBM REQUESTING YOU TO BE THE MAIN SPEAKER AT THE ICCC80 CONFERENCE, OCT 1 THRU 3, N.Y. WOULD ASK YOU TO SPEAK EARLY AFTERNOON 10/2. THEME: CIRCUITS AND COMPUTERS FROM HARDWARE TO SOFTWARE WITH VLSI AND LSI.
<reply>
<>

<date>4/16/80
<name>JOHN KEVILL
<tel#>408-496-0916
<subj>COMING EAST AND FIGURES HE OWES YOU A DINNER.
<reply>
<>

<date>4/16/80
<name>NAT SOKAL
<tel#>WORK:862-8998, HOME:862-2388
<subj>"I AM MAKING MY ANNUAL TELEPHONE CALL TO RATTLE THE BARS OF YOUR CAGE ABOUT POSSIBLE CONSULTING ASSISTANCE, OR DESIGN, OR DESIGN REVIEW AT DEC."
<reply>
<>

<date>4/15/80
<name>SHATTUCK, MR.
<tel#>366-1442
<subj>REPRESENTS AN R&D FIRM DOING FIBER OPTICS & WANTS TO TELL YOU WHAT THEY ARE DOING.
<reply>
<>

<date>4/15/80
<name>GEORGE MICHAEL

<tel#>415-422-4239
<subj>CALLED YESTERDAY. WOULD IKE TO MEET WITH YOU MAY 1ST (YOU ARE AT STRATTON) RE COMPUTER HISTORY, ULTRA HI SPEED COMPUTING. I TRIED ONCE TO GET HIM--PROBABLY TOO EARLY--TO SEE IF THERE WAS ANOTHER DATE HE COULD MAKE IT.
<reply>
<>

<date>4/15/80
<name>JOHN PEATMAN
<tel#>404-894-2950 WORK, 404-457-6133 HOME
<subj>RE A BOOK HE IS WRITING AND A SHORT COURSE THAT HE WOULD LIKE TO OFFER INHOUSE-DEC THIS SUMMER. FROM GEORGIA TECH
<reply>
<>

<date>4/15/80
<NAME>DR. GEORGE PAKE
<tel#>415-494-4010
<subj>FROM XEROX
<reply>
<>

<date>4/10/80
<name>MR. LOVE, AT&T
<tel#>201-631-1512
<subj>MR. BAFA ATTENDED A MEETING IN WASH.D.C. A FEW WEEKS AGO AND SOMEONE FROM DEC TALKED ABOUT EMS. LOVE WANTS TO ARRANGE A MEETING FOR A COUPLE OF HIS PEOPLE, NOT HIMSELF, TO COME TO TALK WITH DEC ABOUT EMS--HOPEFULLY MAY 13. (U R FLORIDA)
<reply>
<>

<date>4/10/80
<name>WHO HAD THE VAX SIMULATOR?
<tel#>
<subj>
<reply>

<>

<date>4/8/80
<name>JOHN SCHOEMEHL, DEC ST. LOUIS
<tel#>314-872-8540
<subj>RE RUSS HARRISON, N.E. MISSOURI STATE, KIRKSVILLE. HE IS LOOKING AT A VAX AND WANTED TO CHAT WITH YOU--PROBABLY RE DELIVERY. NO ORDER HAS BEEN PLACED, JOHN TALKED GENERALLY 7-8 MONTHS. HARRISON SAID HE WAS AN OLD FRIEND OF YOURS, AND JOHN SAID HE WOULD LET YOU KNOW OF HIS VAX INTEREST AND THAT YOU MIGHT CALL: HARRISON--816-665-5121.
<reply>
<>

<date>4/8/80
<name>LIPOVSKI
<tel#>512-471-1952
<subj>CONLAN GROUP WILL MEET IN NASHUA, N.H., MAY 27 ON THE INDUSTRIAL EVALUATION OF CONLAN. (5/27--U HAVE MARKETING COMMITTEE).
<reply>
<>

<date>4/8/80
<name>SAUL, IBM, CALLED BACK--SAID YOU SHOULD CALL DALLAS BOOTHE--(404-238-3643) RE PERMISSION/SIEWIOREK.
<tel#>
<subj>
<reply>
<>

<date>4/8/80
<name>JAMIE--BOB GAURANTEE (THE NUMBERS GUY THIS MORNING) CALLED HER. HOW WOULD YOU LIKE HER TO PURSUE?
<tel#>
<subj>
<reply>
<>

<date>4/8/80
<name>JAN J.
<tel#>3-7525
<subj>WE HAVE SET UP A TAPING FOR A STATEMENT BY YOU ON JAPAN. THIS WILL BE APRIL 23, YOUR OFFICE. OK IF JAN AND GENE MONDANI FEED YOU QUESTIONS AS WELL AS YOUR GIVING A STATEMENT. HOPE TO COME OUT OF IT WITH 20 MIN OF ROUGH FOOTAGE. JAN WILL GIVE YOU A LIST OF QUESTIONS THEY COULD ASK.
<reply>
<>

<date>4/7/80
<name>KEITH COYE, DEC
<tel#>
<subj>RE RALPH GORIN, COMPUTER CENTER MANGR FOR STANFORD. GORIN IS GOING TO CALL THIS WEEK TO SEE YOU TO DISCUSS WHAT THEY ARE DOING AT STANFORD. THEY HAVE 3 2060'S, A VAX, AN IBM 4330, PLUS MISC. EQUIPMENT. HE IS INVOLVED IN THE PROJECT TO LINK VARIOUS COMPUTERS ON CAMPUS WITH ETHERNET--HE IS WORKING WITH XEROX ON THAT PROJECT. HE WANTS TO 1) DISCUSS IN GENERAL NETWORK ACTIVITIES HE IS PLANNING AT STANFORD, 2) ENTERING INTO NEW DEVELOPMENT WORK AND IS PLANNING ON BUYING ANOTHER SYSTEM FROM US--A 2060 THIS QUARTER.
<reply>
<>

<date>4/7/80
<name>JEFF SEBRING
<tel#>264-6426
<subj>CSS--RE THEY ARE TRYING TO SELL DIMOND TO BELL TELL LABS FOR ACS NETWORK. JEFF HAS BRIEFED GERRY BUTLER AND GERRY WANTS TO GET YOUR APPROVAL TO RELEASE THIS TECHNOLOGY TO THE MARKETPLACE. OK?
<reply>
<>

<date>4/7/80
<name>Tom Dundon
<tel#>8305
<subj>Y or N to ALTO at Stratton?
<reply>

<>

<date>4/7/80
<name>Dave Orbitz
<tel#>9222
<subj>FYI re Floating Point Systems meeting - April 22.
Interested? I said it didn't look as if you could make it.
<reply>
<>

<date>4/7/80
<name>Keith Coye, DEC Santa Clara
<tel#>521-2383
<subj>Re Xerox Ethernet agreement
<reply>TALK WITH DAVE RODGERS 4/23/80 Wed

GB0003/33

| **d** | **i** | **g** | **i** | **t** | **a** | **l** | **interoffice memorandum**

Subject: **Metrication - Where are we?**

To: Phil Tays, ML11-4/E53
CC: Dick Clayton, ML12-2/E71
Helmuth Coqui, MU
Dick Schneider, ML11-4/E53
Jim Wade, RA

Date: May 29, 1979
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

Follow Up: 6/15/79

On a recent trip to Europe Helmuth made the following observation:

"We seem to be backing away from metrication...inch by inch".

What's the story? Don't we want to more aggressive in going forward?

GB:swh

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Dick Clayton	ML12-2/E71	Helmuth Coqui	MU
Dick Schneider	ML11-4/E53	Phil Tays	ML11-4/E53
Jim Wade	RA		

February 6, 1980

Dear Professor Metropolis,
Los Alamos

I was intrigued reading your article in the January issue of the ANNALS and want to make a few comments. You will note that I haved signed the letter with two titles -- I am in fact enjoying my role as the "keeper" of the Digital Computer Museum. We plan to document as much history as possible so that it will become somewhat real to the new generations of computer specialists and users who did not know early machines. We have TX-O up as it looked at MIT in the late 50s, parts of Whirlwind, a collection of pre-computing devices, and benchmark DEC machines. When you are in this area, I would be delighted to arrange a tour of the Museum for you. (You might keep in mind a museum lecture by George Stibitz on May 8 and our "opening" September 22.)

Bell and Newell is now being revised and I would like to apologize to you for the MANIAC mistakes. It should be caught in this next edition. I particularly enjoyed reading the section on MANIAC and would very much like to have some parts and copies of early photographs of the installation for the Museum. Perhaps you could help me in locating and acquiring some.

I particularly liked figure l, and the taxonomic tree of the evolution of program control modes. I was wondering however, why you credit the Manchester Mark I prototype as one of the first computers to be run with a dynamically modifiable stored program?

Although you omitted reference to Atanasoff, it was clear to the patent office that he did have something to do with computation. Do you have a good reference or historical evidence as to just what his contributions were either to the stored program concept or to circuitry? Similarly, references to Dirks were missing. Any reference works here?

Again, I enjoyed your article.

Cordially,

Gordon Bell
Vice President, Engineering
Keeper, Digital Computer Museum

GB1.S1.57
00 BURT DECGRAM ACCEPTED S 24148 O 03 27-JUL-80 11:20:48

****
* d i g i t a l *
****

TO: STEVE COLEMAN   DATE: SUN 27 JUL 1980
11:16 AM EDT
    SHEL DAVIS   FROM: GORDON BELL
    WIN HINDLE   DEPT: OOD
    LARRY PORTNER   EXT: 223-2236
    JACK SMITH   LOC/MAIL STOP: ML12-
1/A51

SUBJECT: MANUFACTURING/ENGINEERING SEGMENTATION AND COUPLING. WHAT NEXT?

I got sort of a weak approval and support to pursue the thinking
on segmentation that I gave at the OC Woods. Shel was to be a moderator/catalyst with Jack and I. Jack, Larry and I met on this once and given that Jack is moving toward a similar segmentation, we agreed to be supportive on two fronts:

Bill Hanson is most likely to do the Systems job, now spread across the request commit, cpu, general manufacturing and FAT organizations. As such, our various systems by size managers will work on how to best align and support. Given that there are 3 of them, then one of us will act as a focal point. Now,
Pete Van Roekens is working on a list of our joint problems and
how to best connect (clear, still seperated, but aligned, and have knowledge of what the other group is and what their processes
are).

We are giving a clear message to Thompson and Holman to get their collective acts together with respect to what belongs in manufacturing engineering (processes, CAM), in engineering (products and technology and CAD), and what is in the specific
product engineering groups and what belongs in the plants.

Have read Jack's notes on how he is proposing to organize and find there is really pretty good agreement of what I proposed as a segmentation (really aligned with product).

Smith proposed org.	Bell model
Components	Semiconductors and Physical Interconnect
Mass store	Mass store divison with direct sales
Terminals	Terminals and terminal based systems with direct sales
	A group to handle comm and networks
Systems	Small, medium and large groups
Staff and brain trust	
Far East	
External mfg.	

Fundamentally, I support the two changes and want us to push forward on the coupling of terminals and terminals based systems among manufacturing, engineering and appropriate parts
of the marketing groups. Also, I would hope that they can be encouraged to relocate out of NE in the long term, starting
a co-location soon as a method of encouraging coupling and segmentation.

There is also a question of helping take some of the load off manufacturing so that we can get organized to be a high volume
supplier. Currently, we have a number of low volume and special
products and the Field Service plant mixed in with the high volume part. Given that the Japanese are coming, I think it is essential to at least put these in a seperate categorie so that the Components, Terminals, Mass Storage and Systems groups
are pure, lean and mean! Traditionally, these other efforts simply take time (say only 5 or 10%) that might better be used
in longer range planning. Perhaps a better writing of CSS and
TPL charters to handle this in what could also be a total business context is certainly appropriate. Given that Stan is so pro-division, then having him manage these as divisions might make sense (take over some of the low volume graphics, PDP-8 systems, and other low volume specials). We ought to look at what the best way to manufacture the PL low volume products too! (Perhaps a place in a FAT plant or even outside).

In this same regard, I am now scared to death of what we are doing/planning in a total manufacturing plant (1/4 billion in '81) because I don't understand how it relates to what we expect our revenue stream to be in the future. I know that we plan our engineering on the basis of future projections of revenue and it appears: OUR PROJECTIONS AND ACTUAL SHIPS ARE COMPLETELY MISALIGNED. That is, we spend engineering on

the basis of projections and we actually ship other things!
But this is minor compared to what we induce in
manufacturing.
Therefore, it is essential to spend the summer trying to get this segmentation because, let's face it the manufacturing plant and inventory is really where the money goes and we had better align by group to segment this, rather than getting
this one big ball of wax once a year that we have no understanding of in terms of how capacity and business are related.

There were a series of questions that the OC members had which
I would like to get from Steve's minutes. These ought to be incorporated in a working document which explores this set of changes. Jack has done an excellent job of listing what he
wants to preserve and what some of the goals are for what he is proposeing. Likewise, I want to state goals, constraints, and what we are trying to maximize/minimize (the objective function) in any kind of change. Currently, I hope to spend time on this in August.

Shel, I think you could also help here.

Do we want to proceed?

SECOND DOCUMENT
I spend a lot of time trying to structure what we do. For the last few years, I've been using this 4 dimensional space of: Level of integration (the what), the size (scale) of what we build; where we are in the life of what it is we are building; and the activity (or what it is we do).

SEGMENTATION DIMENSIONS
Note the 4 dimensions, which we need to continually refine and hold as our segmentation for engineering and manufacturing organizations:

Level of integration:

H/S-chips, chip carrier, module, backplane, box, cabinet, hardware system/ operating system (including files and communications), language, generic tools, application;

Hardware price of the things (components or systems) we sell:

(hand held .4-1, Terminal based 2.5-6.25, stackable 6.25-16, cabinet(s) 16-40, 40-100, interconnected cabinet 100-250-625, multiple computers using CI 250-625-1.6M);

Phase (life-time):

Basic research, Research, Advanced development, Development, Support, Enhance, and Obsolescence;
Activity:

.Component design, sometimes we call it the technology (the thing- whether it be a chip or a word processing system. We must stick with the notion that one person's system is another person's component... hence we only make components.),

.Engineering Process (how can designers use it as a component in the next highest level a design),

.Manufacturing Process (how do you make it?),

.Manufacturing test process (how do you know it works?),

.Maintainence Process (How can it be made to work over its lifetimea?),

.Market process (How do we define it during its various phases and sell it?),

.Management processes (how do we organize, manage and interface to one another to get the work done?)

TOP-DOWN APPROACH (MFG./ENG./MKT. SEGMENTS)

The taxonomy is only useful if it allows us to segment our activities. We are extremely lucky in having growth, because it is comparatively trivial to manage charters. On the other hand, left alone, there will be overlaps and underlaps in an area where the new product opportunities abound (eg. WPS, voice on packet switching networks, small systems growing into terminals). I think we ought to use the remainder of the summer to sort this out. Let me suggest two approaches: top down- we look at a cleaner manufacturing/engineering divisional structure; bottom-up, we look at overlap, underlap, and new opportunities.

Significant manufacturing-engineering (and occasionally marketing coupling). I don't want to muck in the divisional space, all I want is to STREAMLINE each group's charter and to have a clear relationship with all other groups as a buyer or seller.

This is the background thinking that led to the organizational proposal today.

GB1.S6.10
00 BURT DECGRAM ACCEPTED S 19333 O 15 25-JUL-80 08:27:11

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* d i g i t a l *
****

TO: JACK SMITH
8:26 AM EDT

cc: LARRY PORTNER

DATE: FRI 25 JUL 1980

FROM: GORDON BELL
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: MANUFACTURING ENGINEERING SEGMENTATION PITCH TO YOUR STAFF

Want me to send the memo to your staff (Cudmore, Thompson and Hanson have it already)?

Also, how about a better drawn flip chart identical to the one
I gave at OC woods? (I'll provide, but let me know as I'm leaving town for 2 weeks.)
(o be used if you want it as a discussion point for your staff.)

Had a nice talk with Bill. Wonder if you want to have 3 request commit systems: let pl's buy from Systems, from mass storage (ADD-ONS ONLY), and terminals (ADD-ON's only)? Or, what about a seperate organization that is telephone, computer
only that order's stuff and tells where to ship systems, terminals,
disks etc sold as a system from the point of manufacture places
or to ship add ons. No inventory or assembly capacity... just
shipping labels making at a distance. Ultimately, this gets folded back into pls (or maybe always run as a matrix).

GB1.S6.8
00 BURT DECGRAM ACCEPTED S 9960 O 111 04-JUN-80 10:59:16

****
* d i g i t a l *
****

TO: JACK SMITH
DATE: WED 4 JUN 1980
10:48 AM EDT
FROM: GORDON BELL
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: MANUFACTURING/ENGINEERING WOODS 6/30 - 7/1

FYI.

ATTACHED: MEMO;44

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION
DATE: WED 4 JUN 1980
10:47 AM EDT
FROM: GORDON BELL
cc: SHEL DAVIS
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: MANUFACTURING/ENGINEERING WOODS 6/30 - 7/1

From: Gordon Bell/Jack Smith

LP1/S4/56EMS

We view clearing the air, and establishing requirements for a long-term relationship between Manufacturing and Engineering an activity of major importance. The working relationship between our two groups must be tighter and more effective particularly in the areas of strategic and operational planning.

We have planned a Woods Meeting to begin to work this set of problems
and to understand better the areas of highest impact for our joint ef
forts. This first meeting will be to frame the problem and to get
todays issues out on the table.

The meeting will be held at the Natick Hilton and will start at 4:00
p.m. Monday, June 30 and end at 4:00 p.m. Tuesday, July 1. Rooms have
been reserved for everyone but Shel Davis who only plans to stay for
the first evening.

Would you please work this meeting into your schedule?

/ma

"TO" DISTRIBUTION:

JIM CUDMORE	BILL DEMMER	BILL HANSON
JOHN HOLMAN	JOHN MEYER	WILL THOMPSON

GB1.S5.2

FROM: GORDON BELL   DATE: MON 7 JAN 1980 2:41 PM EST
DEPT: OOD
EXT: 223-2236
TO: WILL THOMPSON @CLEM
cc: LARRY PORTNER
    JOHN HOLMAN

SUBJECT: REVIEW OF FY80 MFG./ENG. CHARTER/GOALS/OBJECTIVES

GB1.S1/8/EMS

Let's have the 4 of us meet and discuss the above. These were done for all OOD in September and we should get yours included. Let's start with the contract you have with Jack. After we've screened and commented on these, they should be presented to all of OOD.

This meeting has already been scheduled for February 1, 8:30 a.m.

GB:swh
00 BURT DECGRAM ACCEPTED S 1757 O 01 14-JUL-80 00:27:18

****
* d i g i t a l *
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TO: JACK SMITH
DATE: SUN 13 JUL 1980 11:24 PM EDT

FROM: GORDON BELL
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

cc: OOD:
OPERATIONS COMMITTEE:

SUBJECT: A BETTER? SEGMENTATION OF MFG/ENG/MKT(IN SOME INSTANCES)

It feels like we could have a cleaner coupling between manufacturing and engineering. Also, we need a better segmentation of product flow among the plants. There is an assumption that each major product grouping is quite vertically integrated, at least back to include modules and special packaging. Since we are stressing point of manufacture and field integration, the organization is set up to focus on this.

Although this structure is focused mainly on the Manufacturing Engineering coupling. In several cases it could conveniently extend to couple to the product lines, such that it would be possible to have a segmented business unit of manufacturing, engineering, and one or more product lines. In nearly all cases, products sold on the open market would also be sold internally as part of larger systems (eg. terminals). Note these groupings:

Group name	Customers	Suppliers
Semiconductors	MS, T, S, M, L	Ext. too
Phys. interconnect	"	
Microprocessors	Ext., S, M	Semis, Phys. I/C
Mass store (MS)	Ext.?,T, S, M, L	Semis, PIC
Communications and networks	Ext.?,PLs	Semis, PIC
Terminals and T-based systems	Ext, PLs	Semis, Phys. I/D, MS
Small	PLs	Micros, MS,
Medium	"	Semis, PIC, MS
Large	"	"

Semiconductors (M/E)
Behavior is like a semiconductor supplier! Supplies chips and occasionally a set of chips carrying out a well defined function and mounted in a single or multi-chip carrier.
.The big issue is how to segment this to get the necessary charter protection among MOS, Bipolar TTL, and Bipolar ECL?
.Also, how do we tradeoff between manufacturing and engineering resources (product ships versus new products)?

Physical Interconnect and Packaging (M/E)
This group would develop and sell this components (chip carriers, boards, modules, and back planes) to both develop groups and

to
plants. It would operate a manufacturing facility in which automation is tested and it would work on leading edge processes
that are not done in a specific product group. This might include: very low cost PI or PIP, the high performance packaging
needed in Venus/2080, and chip carriers. It would have: component development, cad development, process development, and
test development. I would like to see us try to segment this effort and see whether such a group could exist. Some questions:
.What would it include?
.How does it couple to the plants?
.To the groups it serves?
.How is it funded? (The measures of this technology are quite
clear!)
.How much of power?
.How much of packaging?
.How much is in the higher level-of-integration groups? ETC.
This is very important to look at, but very tough to do (assuming
the people are not emotional about looking at it.)

Microprocessor board and box-level components (M/E/Mkt)
Fundamentally this group would develop module-level components
for higher level systems sold through the PL. It would also sell
its components so that a Small systems group could build conventional End user and OEM products complete with disks, comm., etc. Other systems groups would buy modules.
.Should we look at it, given the opportunity of it all coming together in Hudson?

Mass Storage (M/E)
Clearly a seperate entity.
.With the purchase of new board shop, is there a way to further
clean up the interface so that modules are in their purview

too,
i.e. how can we get them to a fully stand-alone vertically integrated division and out of the rest of the M/E planning, etc.?
.Should the low end be part of the Terminals activity? (probably not, given the work needed to deal with better video, comm., intelligence and sw).
.I'm still convinced that it is desirable and maybe even necessary to sell disks on the open market to be truly good here,
.How can we get a look at this objectively?
.How can we get a better interface between disk and the systems groups to avoid building expensive, segmented sub-systems (ala floppy)?
.Getting right DM package ala the RL's?
.Dealing with what I describe as Type IV packages (where all the stuff is in one cab. and we currently need FAT)?
.Why aren't these built into the disk instead of a CPU plant?
.Taking advantage of the HSC such that this is also the high end 11 system rather than returning it to NE for FATing?

Communications and Networks
With the new interconnect structure and the increased focus on networking, it would be very good to have a strong emphasis again on these products within all parts of the organization, including the field. In some ways, the product strategy lessens the product focus need because all products must have built in connections. There will be more emphasis in terms of: communications concentrators ala Mercury (part of Hydra and other products), Hydra itself is structured this way, Gateways to IBM, x.25, and the phone companies, and voice switching. Electronic

mail systems per se might be sold through this channel. This group would supply standards to other systems and products per
se.
.What is the best way to provide this focus?
.What is its product charter?
.How are M and E coupled?
.Is there a need for a better PL focus?

Terminal and Terminal Based Systems (M/E/MKT)
This one is clear I hope. I'm deadly afraid of seperating dumb
and smart and intelligent, cause they are just a few Kilobytes of
RAM away from one another and differ by whether there is secondary memory or not. In the not too distant future, I see
the convergence of all our current dumbs to have local intelligence and sufficient secondary memory, versus being all
dumb. This follows the Xerox and Datapoint models to a certain
extent. At any rate, the customers are: all systems, Terminals
PL, most of WPS, and Retail.
.How can these best be coupled to form a business unit?
.How to segment into various price and function ranges? .
.How to integrate the base software?
.The applications software?
.Is there a need to have the mass store as part of the group?

System groups (M/E)
Currently this is a disaster by every conceivable measure:
inventory, cost, time to get something to market, forecasting,
order processing. Jack's edict that we are not going to have any
more FAT, but instead are going to ship from point of manufacture
beginning in year ?, is the beginning of what should bring about
this change. We still must deal with the turning of the

corner
of what we produce as components and what some customers and
PL's, believe is an ala carte approach to building systems.
The
interconnect fully supports this approach! Some of the
questions:
.How many, and what is the segmentation? (by type, $-amount,
architecture, technology?)
.How is the corner turned so that PL's "feel" their
inventory?
.What are the rules to deal with "specials" ... which I think
are
minimum?
.How to plan the transition associated with the products and
back
up if there are any slips?

Diagrammatically, the product flow, through the various M/E
and
possible M/E/Mkt groups to PLs would be as follows:

```
Semis    PIP (lead technology only, not dominate supplier)
!        !
--------------------
!        !         !
MS+PL?-x Micro+PL-x!
!        !         !
----------------------------------------
!        !         !         !         !
T+PL?-x  C/N+PL?-x S         M         L
!        !         !         !         !
----------------------------------------
         !
         OEM and End user PL
         !
         x
```

x = customer

This is hardly meant to be final, but is rather something we
might
discuss from. I think it would acccomplish better interfaces

and
more autonomy among the groups.

What you folks think?

Hopefully it might help in the Woods discussion on
Wed./Thur.,
although it only deals with trying to segment a small part of our world. Again, please don't take it as final. (There is another memo that deals with the various dimensions I use to work on segmentation.)

GB1.S5.53
April 23, 1984

Mr. Michel Gouilloud
Schlumberger Ltd.
277 Park Avenue
44th Floor
New York, New York 10172

Dear Michel:

The Clipper Chip discussed at the April 11 meeting, at Fairchild, with Howard Sachs and Tony Ley is extremely impressive and may have the potential to make Fairchild a significant, microprocessor supplier. The group has rightly returned to a simple, hardwired design versus relying on a complex Instruction-set Architecture, requiring a large microprogram. This is a result of increased primary memory speeds relative to logic speed, microprogram memory and cache memories. The design is along the lines of the IBM 801, Berkeley RISC, Stanford MIPS, Pyramid, Ridge and other efforts. Since other semicomputer manufacturers have apparently not reached this conclusion yet, it is essential that Fairchild continue in utmost secrecy until the chip is much further along with first silicon!

Their estimate of a factor of 4.8 x a VAX 780 is quite conservative. Speedup variability will be experienced with benchmarks because of the long pipeline and comparatively slow floating point. Simple benchmarks will be much faster and floating point intensive benchmarks such as Whetstones may have less speed-up because the floating point is not proportionately faster than a 780.

The design is along the lines of designs I've been discussing with two potential Encore companies, including the notion of an onchip ROM for more diagnostics and often used subroutines. In this regard, it is vital to have a much, much closer look including the behavior of the pipeline with the compiler produced benchmarks, before the design is fully completed. Howard and I have been discussing the memory management structure, which I hope can be made identical to the I/O computing channel. This would end up more like VAX and better support UNIX.

I am also excited about Encore exploiting the chip for systems. It would be totally complementary to Fairchild, thereby increasing the probability of success of the chip in the marketplace. I would like to move as soon as possible on the company while a systems user can still act to check and potentially simplify, the chip.

Sincerely,

Gordon Bell
Chief Technical Officer

CC: Kenneth G. Fisher, Anthony J. Ley, Howard Sachs

GB9.37
00 BURT DECGRAM ACCEPTED S 1519 O 137 02-DEC-81 04:30:57
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* d i g i t a l *
****

TO: see "TO" DISTRIBUTION DATE: TUE 1 DEC 1981 11:08 PM EST

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION

DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-

1/A51

SUBJECT: TASK FORCE ON A COMPETITIVE MICROPROCESSOR

Several of us met today and outlined this scenario:

The strategy of waiting for the VAX to come down in cost to meet
the 11 is basically inadequate because the 11 is also too large
and uncompetitive with the 68,000. Unfortunately, the 68,000 is
rapidly emerging as the 32-bit standard. Thus there is a
non-converging gap in time and price! Using VAX as Scorpio
constrains us to a "chip cost" of over $1K in '85 or $200 in '84
with an 11. Anyone will be able to have a "better than 11"
system right now at much less cost, thereby causing erosion of
the 11 base. At the same time, in 85 the 68000 will have evolved
to be competitive with VAX, but at 1/10 the cost.

INDUSTRY OVERVIEW IN THE MID-'80'S
There are an emerging set of industry standard micros and
peripheral chips which are virtually identical to the Unibus
options of the previous decade, including: communications, mass
storage, voice i/o, analog signal processing, raster scan video,
etc. that will enable ANY garage shop to put together a specific
collection to solve a particular problem and hence address any
market as a systems supplier. Systems for every conceivable
function will proliferate in much the same what that there are a
plethora of hand held calculators for accounting, bio-rhythmns,
computing, dieting, ... etc. Furthermore, our OEM business will
be in jeprody as customers try to become independent of any

ISP
and use commodity hardware (NI, 68,000, Wini's, etc.) and commodity, portable software (UNIX, CP/M, etc. Also, conventional systems are shrunk to a small number of chips.

OUR ALTERNATIVES

0. Hope It Goes Away (Flat Micros Business). We remain basically uncompetitive at the board level, we ignore the chips business (except perhaps licensing others to build it, the result would mostly be to target our base), and we only worry about the 11 for existing users. VAX is used for larger systems.

1. License the industry and standardize a new MicroVAX chip. Time to market of 2 years to the chip. Instant availability of development systems in the form of present VAX systems. This is a subset of the VAX ISP that is constrained to fit on one chip and drive industry standard peripherals. It would be built by one or more semiconductor companies. It would be suitable for us to build systems and anyone to build a controller at any level they chose. Software would be the control mechanism to prevent system competitors.

2. Defacto strategy. Do nothing and little by little adopt the 68,000 for various applications and eventually evolve into full support of user programmable systems.

2A. Aggressive, defacto strategy. Embrace the 68,000 and work with Motorola to get it to be the DEC 68,000 with full

support of
VAX data types such that we could provide a VMS environment for
programs and data to not know the difference.

Which one we chose depends on what we want to be in the '80's.
Rather than worrying about this end, we must develop what
products would look like in scenarios 1, 2, and 2A. In all three
of these scenarios, I have no worry about our viability or what
we sell. (Scenario 0 and 2 may preclude us from some businesses,
however.) Scenario 1 and 2A could be quite supportive of our
product strategy which is:

"A range of compatible products such that a user can chose to
compute at a personal, departmental or mainframe level without
reprogramming. This means compatible files (data types),
languages, human interfaces, etc. all interconnected."

Roy is going to head a task force of Dave Cutler, Bill Strecker,
and Bob Supnik to examine the two main alternatives in terms of
the ability to be compatible with existing VAX software, the
competitiveness of the chip and board components, the design
effort and time, what the MicroVAX subset would actually be (or
what a DEC 68,000 would be), and put together the skeleton of the
two scenarios.

"TO" DISTRIBUTION:

BOB SUPNIK DAVE CUTLER ROY MOFFA
BILL STRECKER

"CC" DISTRIBUTION:

JIM CUDMORE BILL DEMMER SAM FULLER
BILL JOHNSON STEVE TEICHER

GB3.S2.45

To: Stan Olsen
Jim Willis

Date: 29 SEP 76
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

F/U 10/6

Stan has (correctly, I believe) suggested that the DS31 (i.e., Stan's name for VT52 with 16K CMOS 8 in base with floppy) only be sold for fixed applications where there is absolutely NO Programming outside of the first time...and the system is wholly defined by a user manual of say less than 25 pages (including how it's diagnosed). Reading this manual and/or sales brochure (if there be one) should let the buyer see if he wants one...or wants to try one. The program should be in DIBOL and be less than 10 pages. The use of the system has to be significantly easier to learn than DS310W! There should be 0, 1, or 2 options.

In visiting Kodak to look at their Xerography technology, we found what seems like a great application currently (marginally) served by an $8K Olivetti dual tape system. Either Kodak would sell the system OEM or they would give them our brochure (to order by mail).

The application provides the index for one or more rolls of microfilm (3,000 images) so that it may be somehow retrieved. Such a device is an absolute necessity, although people have used paper systems. Thus, the market is defined by several hundred thousand microfilm reader systems in existence plus the new ones Kodak and others sell. Mary Jane has such a system for my own microfilm files, but it runs on a 10 (with no 10 time), and ends up on paper which I search, versus asking the computer.

To remind you of the microfilm system modus operandi:

1. Documents are first microfilmed sequentially with a seq.#. At this time any indicees are built. The most useful are: source, destination(s), title, date, keyword(s) and one can have many indicees.

Here the computer sits next to the camera, and the operator enters the relevant fields per document. (One could envision having the computer control the camera so that sequence # errors don't occur.)

2. The microfilm is developed and the original documents flushed.

3a. One sits at computer CRT, and does a retrieval by typing in the relevant fields. Normally this is by a secretary (since bosses can't or won't admit they type). If there are multiple hits, then there may be either hard copy of the microfilm at the reader/printer; or the operator may give out a possible hard copy (optional) of the hits, so the end user may further select before hard copying the film. (In the later case, a VT52 with copier or LA36 is useful.) On modern microfilm units the computer can also direct the reader-printer.

3b. The process is the same except that there is no hard copy, and the whole thing is more interactive.

4. There may be "reports" i.e., listings of each area or film if a hard copy unit exists.

5. There may be utilities to merge subject/date indicees so that the system works across many rolls of film. One floppy holds about one roll. This would not be needed with the simplest system. But it would require two floppies instead of one.

How does this approach sound?

How could these "applications" be done and sold?

How do the above rules for fixed applications sound?

GB:ljp

CC: OOD
Buzz Brooks
Jack Brown
John Clarke
Ed Corell
Jack Gilmore
Len Halio
Irwin Jacobs
Ken Olsen
Don White

Marketing Committee
Jim Bell
Peter Christy
Gary Cole
Ed Fauvre
Bob Glorioso
John Holman
Bill Munson
Steve Teicher
Jim Willis

GB3.S14.14

FILM #	MASTER/SECURITY	CONDITION
400	MASTER	GOOD
401	MASTER	GOOD
402	MASTER	GOOD
402	SECURITY	GOOD
500	MASTER	GOOD
500	SECURITY	GOOD
650	MASTER	GOOD
650	SECURITY	GOOD
712	MASTER	GOOD
712	SECURITY	GOOD
713	MASTER	GOOD
713	SECURITY	GOOD
714	MASTER	GOOD
714	SECURITY	GOOD
715	MASTER	GOOD
715	SECURITY	GOOD
716(LETTERBOOK)	MASTER	GOOD
716(LETTERBOOK)	SECURITY	NOT TO GOOD
716(MICROPROGRAMMING)	MASTER	GOOD

716(MICROPROGRAMMING)	SECURITY	GOOD
717	MASTER	GOOD
717	SECURITY	GOOD
718(LETTERBOOK)	MASTER	GOOD
718(LETTERBOOK)	SECURITY	NOT TO GOOD
718(DISPLAY)	MASTER	GOOD
718(DISPLAY)	SECURITY	GOOD
890	MASTER	GOOD
890	SECURITY	GOOD
919	MASTER	GOOD
919	SECURITY	GOOD
946	MASTER	GOOD
946	SECURITY	GOOD
1028	MASTER	GOOD
1028	SECURITY	BAD
1030 (JEGA'S DRAGON FILE)	GOOD	
1050	MASTER	GOOD
1050	SECURITY	FAIR
1051	MASTER	FAIR
1051	SECURITY	POOR

GB3.S14.14

FILM #	MASTER/SECURITY	CONDITION
400	MASTER	GOOD
401	MASTER	GOOD
402	MASTER	GOOD
402	SECURITY	GOOD
500	MASTER	GOOD
500	SECURITY	GOOD
650	MASTER	GOOD
650	SECURITY	GOOD
712	MASTER	GOOD
712	SECURITY	GOOD
713	MASTER	GOOD
713	SECURITY	GOOD
714	MASTER	GOOD
714	SECURITY	GOOD
715	MASTER	GOOD
715	SECURITY	GOOD
716(LETTERBOOK)	MASTER	GOOD
716(LETTERBOOK)	SECURITY	NOT TO GOOD

716(MICROPROGRAMMING)	MASTER	GOOD
716(MICROPROGRAMMING)	SECURITY	GOOD
717	MASTER	GOOD
717	SECURITY	GOOD
718(LETTERBOOK)	MASTER	GOOD
718(LETTERBOOK)	SECURITY	NOT TO GOOD
718(DISPLAY)	MASTER	GOOD
718(DISPLAY)	SECURITY	GOOD
890	MASTER	GOOD
890	SECURITY	GOOD
919	MASTER	GOOD
919	SECURITY	GOOD
946	MASTER	GOOD
946	SECURITY	GOOD
1028	MASTER	GOOD
1028	SECURITY	BAD
1030 (JEGA'S DRAGON FILE)	GOOD	
1050	MASTER	GOOD
1050	SECURITY	FAIR
1051	MASTER	FAIR
1051	SECURITY	POOR

GB0004/11

d i g i t a l **i n t e r o f f i c e m e m o r a n d u m**

Subject: **Interaction with the MPD Staff**

To: Peggy Wesley, WZ2
Joe Zeh, WZ2

CC: Dick Clayton, ML12-2/E71
Jim Cudmore, ML1-5/E30
Bill Demmer, TW/D19
George Hoff, MR1-2/E78

Date: 7/12/79 Thu
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

I enjoyed the interaction with the MPD Staff and I was pleased to see the exchange with Dick and Bill too. The group should be congratulated for getting expertise quickly so that we can build great products. Although the glamour is mostly with FONZ and COMET, the chips for the disks will really help us competitively.

I look forward to continued productivity there. Hopefully, we can continue and get better coupling so as to do the right products in a timely fashion.

GB:swh

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Peggy Wesley	WZ-2	Joe Zeh	WZ-2
Dick Clayton	ML12-2/E71	Jim Cudmore	ML1-5/E30
Bill Demmer	TW/D19	George Hoff	MR1-2/E78

DECgram not delivered - Unknownerror1474,67879
****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION

DATE: SUN 6 DEC 1981 6:43 PM EST

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: RILEY'S COMMENTS ON THE 11, 16- AND 32-BIT MICROS

Note Jim's comments via Roy. We had Jim make this survey and it should be distributed and presented to both PEG and the OC.

There are 3 scenarios beyond our usual do nothing now and then panic or wring our hands when it's too late. They are:

0. Do nothing. Make our stand in the systems business; don't plan on a big chip and board business.

1. Build a VAX subset that will fit on a chip that could be available in two years. This could be used in chip and board market, but a version of VMS could also run on it.

2. Get Motorola to modify the 68000 to support our data types so that a compatible system could be made that would run our languages, file systems and give the same result.

3. Steve believes we can make a smaller and earlier than Scorpio product. He wants to look at this.

Engineering has asked Roy to lead a task force to examine these 3 alternatives as to functionality, time to market, price, competitiveness, etc. Dave Cutler, Supnick and Strecker are

"TO" DISTRIBUTION:

DAVE CUTLER JEFF KALB ROY MOFFA
OPERATIONS COMMITTEE: PEG: BILL STRECKER

ATTACHED: MEMO;140

****
* d i g i t a l *
****

TO: GORDON BELL DATE: FRI 4 DEC 1981 4:30 PM EST
ANDY KNOWLES FROM: ROY MOFFA
DEPT: LSI MARKETING
EXT: <225-4760>
LOC/MAIL STOP: HL1-1/<R02>

SUBJECT: NOTES FROM RILEY DEBRIEFING

Jim Riley summarized what he thought were some of the key points from the interview assignment.

PDP-11

1. Software is the big advantage. No software, little interest.

2. The primary customer from a semiconductor vendor standpoint would be the current DEC customer base.

3. PDP-11 is an old architecture and is not competitive for new design wins.

4. Unanimous comment that the 32 bit prospects are exciting and a totally different ball game than 16 bits.

5. Almost a general consensus that DEC selling PDP-11 chips would be a non-event in the semiconductor industry. The industry would understand the need to protect the current PDP-11 base. This move on DEC's part would have minimal impact on our current relationships with our semiconductor suppliers.

6. All agreed that the PDP-11 was anywhere from 2-5 years late to compete in the 16 bit chip market.

7. Does DEC really want to feed potential DEC system competitors by selling at the chip level? Would it be worth it?

8. Not clear what the upgrade path would be from 16 to 32 bits.

Some of the minutes from the general discussion are as follows.

Independent of DEC or the semiconductor industry the 8086 will become the industry 16 bit software standard. The single event to make this happen is the IBM personal computer. Jim indicated that Dataquest knows of 16 Japanese firms that are preparing to produce IBM look-a-likes for the personal computer. Therefore, the entrepreneural software community will be driven to write software for the 8086 because it will have the highest number of machines in the field.

The discussion of potential 16 bit partners really centered on Harris, G.E., maybe Synertek. In general most of the 16 bit affiliations have been made. Fairchild is uncommitted but Jim feels they may be ineffective. A key decision on selecting a partner is what does DEC expect. The alternatives are to go for a company that has a strong aggressive sales force or one that is strong technically and could provide additional development dollars. That's DEC's decision to make.

Jim's opinion is that DEC probably could market the 16 bit machine by itself. He does not think that a second source is required if DEC markets the chip due to the security of DEC as a corporation. This approach would allow DEC to technically control the market and gain some practical experience that could potentially be applied to a decision to market 32 bit chips.

In terms of design wins, Dataquest believes that there are approximately 500 per month 16 bit new design wins. Currently they feel that there is a 3 to 1 advantage towards the Intel 8086. T.I. seems to be holding steady at about 25 per month.

The 32 bit market is completely a new ball game. Some of the quotes from the interviews are: 1. "DEC can be a standard", 2. "32 bits is an explosive opportunity", 3. "Intel could be wiped out", 4. "The window is 2 years to make a decision".

Jim feels there is a definite linkage between 16 bits and 32 bits. If DEC declares itself to eventually be in the 32 bit chip market the 32 bit ball game would be over. In addition, by announcing DEC's intention to be solidly in the chip microprocessor marketplace, with both 16 bit and 32 bit follow-ons, many customers would elect to go with the PDP-11 and wait for the VAX versus selecting the 68000. This could be a key factor to maintaining the 16 bit market.

Jim's opinion is that the Japanese are squarely aimed at dominating the 32 bit market at the chip, board and system level. He feels this is a 20 year project on the part of Japanese, and the U.S. industry (semiconductors and systems) have to get together to head off this threat. This represents the most compelling motivation for a major U.S. semiconductor supplier and systems company to join forces.

If DEC elected to market 32 bits at a chip level, our vendor selection is anyone we want except Intel and T.I. It is quite conceivable that Motorola would be a willing partner in the 32 bit marketplace with DEC, and would make an unbeatable combination.

In terms of controlling the marketplace from a brokering

dilemma,
it's generally agreed that the controlling factor is software.
However, in Jim's opinion, no one has developed a good second source arrangement to control software licensing. This would be new ground. There are few symetrical joint ventures between a world class systems company and world class semiconductor company.

There was considerable discussion about hardware independent software. The question being; what advantage is a unique hardware architecture, if indeed the trend is to develop software applications that are transportable from one 32 or 16 bit machine to another. It's the writer's opinion that the concept of totally transparent hardware and migratable software is not a reality. Particularly in the 32 bit market where there are no hardware or software standards established (VAX being the most notable exception). A single company controlling both the hardware architecture and software architecture is a decided advantage. There will continue to be significant optimization between hardware architecture and software architecture in the 32 bit domain, which can best be managed in a timely way by single company.

There was no identified follow-up activities. General concensus is what's missing is a way to model a strategic decision to sell chips (16 and 32) against the potential implications to DEC's long term business.

GB3.S2.47

11 MICROS

MESSAGE

THE LSI MINI

THE PROTECTION AGAINST HOARDS OF 21+ BIT INVADING MICROS.

MARKET

1. PROTECT CURRENT SYSTEMS AGAINST LOW END SYSTEMS BUILT ON 21-BIT

MICROS (8086).

2. EXTEND SYSTEMS INTO TERMINALS (I.E., PDT'S).

3. ALLOW 11'S FOR CONTROLLER AND SMALL TERMINAL APPLICATIONS SO WE

AND OUR USERS CAN HAVE 1 ISP.

BASIC HARDWARE

(SEE MARKET)

BASIC OPERATING SYSTEMS (FOR 3 MARKETS)

1. USE UNIBUS SOFTWARE.

2. GET BACK TO SINGLE USER SOFTWARE AND THEN "ROM IT" TO GET COST,

USEABILITY. GET OUT OF COMPLEX MULTI USER BUSINESS.

3. DEVELOP SUPPORT TOOLS.

<u>LANGUAGES/APPLICATIONS</u>

. ALLOW SINGLE USER PROGRAMS AT TERMINAL (DOWN LINE AND STAND-ALONE)

. GET COMPATIBILITY WITH 8 AND FOR PROGRAM MIGRATION TO 11'S AND VAX

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*****************
* d i g i t a l *
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TO: OPERATIONS COMMITTEE: DATE: MON 17 MAY 1982 7:09 AM EDT

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION DEPT: ENG STAFF

EXT: 223-2236

LOC/MAIL STOP: ML12-1/A51

SUBJECT: MICROVAX... THE BOTTOM LINE

The big reasons to do it are to give a boost to the micros business, in fact to continue to make it viable by providing the first 32-bit board product.

AND

To offer the first, 32-bit Personal Computer... even though the 68,000 next version will be hyped as a 32-bit computer.

"CC" DISTRIBUTION:

JOE CARCHIDI BILL DEMMER BILL
JOHNSON
JEFF KALB BILL STRECKER BOB SUPNIK
STEVE TEICHER

GB3.S5.37
to: moffa, cudmore, bj,
cc: smith, strecker, hustvedt, demmer, croxon, learoyd, fuller, cutler, olsen, lipcon

subject: qbus MicroVAX PC (modular vc100) with seahorse I FCS

STATE OF WORKSTATIONS AND PC TODAY
The bad thing about getting well is that although my body's better, my pshyche takes over. Thinking about how we've spent the last 3 or 4 years getting a decent PC based on the 11 and VAX is the most depressing thoughts one can have about our engineering. Getting a competitive Workstation or Personal Computer based on MicroVAX appears well outside our technical or managerial capability.

I've had time to read about our architecture in the terminals and workstation areas, and I'm concerned. The VS100 clearly gets a runner-up PARC East Award (greatest contribution to science and least to the company). The PRO should also get one too. I'm pretty sure that neither of these devices are going to provide cost-effective, highly interactive, Personal Computer capability. The PRO is simple and cheap enough, but the address space and overhead to transfer data from applications to it is unacceptably SLOW... alas very low performance/cost! The VS100 is not cheap, and its performance just has to be the pits, based on:
.layers of host overhead including various terminal emulators
.a thin link to transfer data between the host and big, dumb terminal
 (This will really go to hell when one thinks about a color version.)
.the inability to couple an application directly to the terminal in a
 responsive fashion
.a generally roccocco hardware and software architecture requiring

massive interpretation and memory (mainly affects cost)

We seem to have taken every idea from communications protocols on layering and used them. We have gone around the wheel of reincarnation twice.

Bottom Line
Unfortunately, this means we will not be able to compete either on a cost or performance basis with: Apollo, PERQ, Masscomp, Sun Workstations, IBM's 9000, HP's 9000 and 9825, Silicon Graphics, etc. all of which give a Nebula-Comet class computer and offer high resolution graphics with fast response between the application and the screen. Many of these offer both black and white and color. This will be a direct loss in the technical market.

OUR RESPONSE
Wait for MicroVAX to build the bounded VC100 (a 1-2Mbyte, Microvax, bit map graphics, etc. terminal coupled to Ethernet). Use Low Cost Nebula with the one board version of the VS100.

MY PROPOSAL
Assume the VC100 will be a key product for personal computing for the technical and business (analyst) user.

Build a Qbus CRT controller that will be used with Seahorse I and II and allows us to get a small, low cost PC/Workstation on the market in the shortest time.

This is essential to build now because:
.We must define a suitable architecture for graphics that couples the
 user programs to the screen. VS100 ain't it, although we can learn
 from it! We are building Personal Computers, NOT one user computers
 which have dumb terminals connected to them!
.We must build something NOW, before we try to build the ultimate, bounded product, the VC100. We will want both bounded and unbounded (Qbus) versions for the market. This is one of the errors on PRO.

.Bounded products are neat, but somehow our customers want flexibility
 to add storage (and use it stand alone), real time i/o, printers, etc. Rarely are bounded products successful, however.
.Low Cost Nebula and the one board VS100 are still a factor of two
 more expensive than what I'm proposing based on Seahorse I.
.I don't believe Low Cost Nebula and the VS100 will be very much
 better than a VS100 with a fiber optic link in terms of performance,
 even if our customers will pay the high price.
.I want a PC that looks like a PC. LCN is neat, but still a big box.
.We need the hardware now to get the software ready for the high volume that could materialize (if we have the software).
.We have to have a product now, given the ones we are fielding. I
 want to have this a year+ earlier than the VC100!
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TO: see "TO" DISTRIBUTION   DATE: TUE 15 FEB 1983 10:55 AM EST

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5191028986

SUBJECT: 68,000 LANDSLIDE, AND THE MICROVAX WINDOW

GB4.S1.30

I talked with several customers (and friends) on a West Coast trip which caused several concerns:

1. Both the computational user (labs, business, universities) and AI user believe the game's over, and the 68,000's won. Apple, HP, IBM, Sunworkstation, Apollo, Masscomp, Charles River, Fortune, etc. etc. are all providing PC's. A new company starts up every day to build another one. HP has a great product set, for example. The 68020 with paging will be the final blow. UNIX is/will be the operating system just like CP/M was in the low end.

2. I said we'll win with MicroVAX because we have an upward compatible range and all the systems. People are skeptical because:

    . UNIX is free or low cost. VMS is not.
    . There are many more possibilities for products and DEC can't do them all.
    . DEC isn't in the PC business and won't be able to respond.
    . VMS compatibility will not let us move fast enough.
    . Our past performance is poor. they don't see us.

I really would like to win and MicroVAX is the only shot I see at getting a leadership product. Specifying and managing our MicroVAX products just has to be Engineering's Number 1 product problem if we want to preserve our traditional market and get any new market.

Alternatively, we can wait for IBM to make a good PC here using

the
68,000 and then provide the same capability later and rely on our
manufacturing and marketing strength. Also pray that TI and the big
Japanese firms don't cut the price.

"TO" DISTRIBUTION:

BILL AVERY	JIM CUDMORE	EMC:
BARRY JAMES FOLSOM	WIN HINDLE	ED KRAMER
WARD MACKENZIE	AVRAM MILLER	ROY MOFFA
KEN OLSEN	MAHENDRA PATEL	JACK SMITH
BILL STRECKER		

WPS USERS - Leave HP mode and type <CR>

00 CORE DECGRAM ACCEPTED S 000393 O 41 03-APR-83
18:16:18

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TO: KEN OLSEN   DATE: SUN 3 APR 1983
6:10 PM EST

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION

DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

MESSAGE ID:
5195710512

SUBJECT: A MICROVAX PLAN TO TAKE CARE OF CUSTOMERS?

GB5.27

Your question:
"Can we take care of our customers' needs for 32-bit
machines with
your new conglomeration of micro-VAXs?"

We have no choice, but it's tight. Note the product
schedule:
Seahorse I (Cutler's machine) 1/84
Seahorse II (Jesse's microVAX) Q285
BI (Q3 85 is the earliest... 2 years from now)

I think we need all of these systems to come off on schedule,
and then
we have a chance of meeting our customers' needs. The Qbus
CRT
controller to make Seahorse I a PC is absolutely critical, so

I'm
delighted that we have a responsible person now.

The original complaints of building the Seahorse I are diminishing, as
people see the early time to market as critical to both holding the
base and going after new 32-bit users. I hear complaints that the
machine is too slow, but I'm not worried (because I think these
systems are disk limited anyway) given that MicroVAX is coming and the
fact that we can tie this into a network of VAXen for higher
performance processing.

MICROVAX PC ON THE QBUS (1/84)
Being able to ship a MicroVAX PC in 1 year is critical because it is
what is really going to make us compete with Apollo, HP (9000 and
their 68,000-based system), IBM Lab PC (68,000), their evolving Intel
based PC, and the machine they may market based on their proprietary
801. A MicroVAX should be able to compete nicely with these.

The critical component that's been added, but is not yet fully spec'd
is a Qbus CRT that we drafted Cathy Learoyd and Stocky to do, because
it allows us to build a MicroVAX PC/Workstation (whatever the
difference is). It's critical both as a diskless and RD52 base
because it gets VAX down in physical size, form factor and noise level
to fit into an office and become a PC psychologically... somethin we
can't do with our usual Rack/Stack Cabinets. (Note my VAX PC in
building 12.)

The other reason it's critical to get a MicroVAX PC out is the
software. We should have learned our lesson from the PRO... it's non
trivial to take a shared operating system and convert it into a PC
based system. So far, I like the plan and thoughts that Dick Hustvedt
has produced, so we have a chance. Anyway, there's OUR software: the
PC part, the distributed function that lets a PC really tightly
connect to a service or another PC. AND there's USER software:
migraton of an application into a PC, and the distribution over a
network to the degree it's not transparent. Here we want a PC to
access a compute server because that's what we have to sell that's
unique.

I think this PC is what our Technical users, including OEMs want.
It's a nicely matched PC with expansion capability to do control,
robotic, vision, etc. applications. (It's bus is awfully light duty
to be competitive, but that'll have to do for now.)

MICROVAX AS A SHARED MACHINE
We aren't really doing very well selling these machines now (Micro 11,
the low end 11's, and the 730), so I'm not sure how this will fare.
It just may be that the market it responding favorably to the PCs and
is demanding what looks like a more responsive machine with a
flashier, larger screen. I've made suggestions on how to make a 240
"appea" more like a PC in terms of responsiveness.

MICROVAX/SEABOARD FOR REAL TIME and OEMS

Cutler will produce a super product. This should get us back into the board and real time market. OEMs should love it, and some of our applications Product groups could make nice products too.

SHORT ANSWER

Jesse Lipcon, the QBUS MicroVAX Project Engineer has written down a Q-bus MicroVAX Vision/Strategy that encompasses the critical customer needs. Now that we're on target to get a PC based on MicroVAX (and Cutler's Seahorse I), we address what I think is the most critical need. We should review the overall plan and Roy Moffa should embrace and broadcast it as the product direction. We should all swear that we're going to deliver our respective pieces, and then we should all simply do it.

The BI is also quite critical to get us a modern, high performance, high reliability, large address space, competitive bus to beat Intel and Motorola. The Qbus (circa 74) will have to hold us until then.

"CC" DISTRIBUTION:

JIM CUDMORE	WIN HINDLE	BILL JOHNSON
JACK SHIELDS	JACK SMITH	

00 CORE DECGRAM ACCEPTED S 000267 O 20 01-MAY-83 12:37:29

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TO: see "TO" DISTRIBUTION   DATE: SUN 1 MAY 1983
12:15 PM DST

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION   DEPT: ENG STAFF

EXT: 223-2236

LOC/MAIL STOP: ML12-
1/A51

MESSAGE ID:
5198556833

SUBJECT: QBUS CONTROLLERS FOR MICROVAX (AND PRO?) PC'S

GB5.28

Several of us met last week and came to the following agreement regarding getting a MicroVAX PC based on Seahorse, and what the VC100 might look like. We had several areas of concern (i.e.) disagreement and voids.

We're going to meet on Thursday and make sure that we're in sync to get this hardware (Bob, I trust you'll be there). I'll be away in May, and have incredible expectations that the detailed design will get worked out. Also, we need a meeting scheduled for review in early June, because I want to make sure we're going to make it with the product.

The 3 days of meeting were both frustrating (there's not a common set of terms), but productive (if we follow through).

AGREEMENT ABOUT HARDWARE AVAILABILITY

0. We must have a Qbus CRT controller option from the terminals group
to make a Seahorse I based Personal Computer at FCS, Jan.

1984.

1. The first pass definition of VC100 is:
    . it's a terminal that computes, replacing the VT100 in popularity. Should be on everyone's desk and cost <1,000
    . MicroVAX chip, 1 Megabyte; optional memory of 1 to 2 Megabytes;
    . 15" crt with 480 x 800 pixels; a pointing device
    . NI, no mass storage
    . Area copy and any other display functions that fall out of display processor chips;
    . direct bit map addressing by MicroVAX

2. A simple, bit map board will be made available to the VMS group ASAP for implementing (breadboarding) WGA/SDA as part of VMS. The board should be useful too as the PRO PC video.

    . 15" CRT with 480 x 800 piexels; a pointing device
    . direct bit map addressing by Seahorse I over the Qbus
    . any options such as area move, but without impacting schedule

3. A VS100 compatible board, but only necessary for use in driving a low resolution CRT as described above. This would permit the current software in the 68,000 and VAX to be used directly thereby providing the WGA without the need for the software rewrite in VMS.

In addition, the board will provide bit map addressing from the host!

4. We must get experience and provide a user base now with VS100, VS300 and LCN/WS. Currently it is similar to PRO as a non-performer due to the time to call system functions. In addition, it

has many
software layers and interpreters (see below).

Brian Croxon will provide a VS100 to the VMS group by May 9, 1983 so
they can evaluate the VS100 and begin to assist in the implementation
that will improve performance, modifying WGA/SDA as needed.

AGREEMENT ABOUT ARCHITECTURE AND STANDARDS

0. We need a basic architecture whereby all applications run on all
implementations, although physical limits will impose certain limits
on applications. There appears to be a significant investment in
terminal and architectural interface software being done on WGA/SDA:

- SDA/WGA- applications programs can call them directly
- VT100 emulator- a virtual display can be a VT100
- REGIS - DEC's very own line graphics standard used as a guideline for implementing the VT125, Gigi and VT240 (I hope)
- TEKTRONIX 4014- very old line drawing crt
- GKS (Graphic Kernel System) - Draft international standard. This is the level above NAPLPS, a device level standard.
- PLP/NAPLPS (for the device)- Presentation-Level Protocol (or North American version)- Is probably what will end up for PC's
- Sig-graph's CORE standard- Another attempt at a standard. Not clear where it is with respect to use or needs.

1. WE HAVE A WORKING AGREEMENT THAT THE USER INTERFACE IS WGA/SDA,
(Hank, please explain the relationship of the two)
WORKSTATION GRAPHIC

ARCHITECTURE/ SYSTEM DISPLAY ARCHITECTURE.

DGA WILL BECOME WGA/SDA.

WGA/SDA CAN BE MODIFIED USING THE NORMAL ARCHITECTURE CONTROL PROCESS!
(Hank is the holder of them.)

2. A competitive PC must have a window orientation with the ability to
have multiple processes drive seperate Virtual Displays.

PROBLEMS THAT REQUIRE RESOLUTION (I.E. A VOID OR CONFLICT)

0. Who is the system manager for MicroVAX PC around Seahorse I? the
VC 100? (It's not too early to think about this, but we don't need the
usual gargantuan staff.)

1. The structure for a PC with respect to:
    1. Hardware to do area copy (probably no argument); area copy with
       special functions;
    2. Extra processor to actually interpret display commands versus
       having the user's processor do them directly in a PC; This is
       why two Qbus boards are being built at this time.
    3. Access by an applications program for it to generate true
       images; This implies or requires that the host processor be
       able to access the various images (i.e. Virtual Displays and
       physical Frame Buffers) directly.
    4. Applicability of various specialized chips in light of need to
       have memory access to the physical image;
    5. How to do color; and need for color option in the PC or VC.

2. Can we possibly offer and support all the protocols and architectures? Won't this will totally confuse and difuse the applications writers? Can't this be lead under Jim Cudmore now that the Workstations hardware group is there?

3. I'm quite concerned about the large number of layers of software, resulting in incredible overhead and loss of performance. In the case of the VT100, one more, non-trivial translator operates. For example:

- a VS100 application program generates a text string for a VT100
- the string is translated to a WGA/SDA compatible string
- the operating system is called as a QIO
- the string is moved to the VS100
- the string is interpreted by the VS100 and output

We must really get the performance (load) understood in each of these translators, interpreters and system calls. There's NO DATA!

NEXT STEP
We're going to meet on Thursday at 2, in the museum, for further resolution and ratification of the specifications and schedule.

I would like to invite Jim, Bob and Sam. Can you come?

"TO" DISTRIBUTION:

SAM FULLER BOB HUETTNER DICK HUSTVEDT
CATHY LEAROYD HANK LEVY NED FORRESTER AND CATHY
RICK SPITZ

"CC" DISTRIBUTION:

BRIAN CROXON	JIM CUDMORE	DAVE CUTLER
BILL HEFFNER	BILL JOHNSON	KEN OLSEN
JACK SMITH		

<name>Carlton Amdahl
<address>ACSYS Inc.
5150 Great American Parkway
Santa Clara, CA 95050
<sal>Carl
<date entered>4/10/81
<>

<name>Gene Amdahl
<address>ACSYS Inc.
5150 Great American Parkway
Santa Clara, CA 95050
<sal>Gene
<date entered>4/10/81
<>

<name>Gerrit A. Blaauw
<address>Chairman, Vakgrop Digitale Techniek
Afdeling Electrotechniek
Technische Hogeshool Twenty
P.O. Box 217
7500 AE
Enschede, NETHERLANDS
<sal>Gerrit
<date entered>4/10/81
<>

<name>Lewis M. Branscomb
<address>Vice President and Chief Scientist
IBM Corporation
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Armonk, NY 10504
<sal>Lewis
<date entered>5/15/81
<>

<name>Fred P. Brooks Jr.

<address>University of North Carolina
Chapel Hill, NC 27514
<sal>Fred
<date entered>4/10/81
<>

<name>John Cocke
<address>IBM T J Watson Research Center
P.O. Box 218
Yorktwon Heights, NY 10598
<sal>John
<date entered>4/10/81
<>

<name>Robert G. Evans
<address>Vice President, Engineering,
Programming and Technology
IBM Corporation
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Armonk, NY 10504
<sal>Bob
<date entered>5/15/81
<>

<name>Professor Ed Feigenbaum
<address>Stanford University
Computer Science Department
Stanford, CA 94305
<sal>Ed
<date entered>5/15/81
<>

<name>Dave Fisher
<address>Western Digital Corp.
3128 Red Hill Avenue
Newport Beach, CA 92663
<sal>Dave
<date entered>4/10/81
<>

<name>Ed Fredkin
<address>4742 Centre Street; Apt. 304

Pittsburgh, PA 15200
<sal>Ed
<date entered>4/10/81
<>

<name>George H. Heilmeyer
<address>Texas Instruments Inc.
P.O. Box 225474, M.S. 400
Dallas, TX 75265
<sal>George
<date entered>4/10/81
<>

<name>Robert F. Johnston
<address>Floating Point Systems Inc.
6100 Executive Blvd., Suite 308
Rockville, MD 20852
<sal>Mr. Johnston
<date entered>5/29/81
<>

<name>Dr. Robert Kahn
<address>ARPA
1400 Wilson Blvd.
Room 730
Arlington, VA 22200
<sal>Bob
<date entered>5/15/81
<>

<name>Niel R. Lincoln
<address>Control Data Corp.
4201 North Lexington Avenue
Arden Hills, MN 55112
<sal>Niel
<date entered>4/10/81
<>

<name>Professor Carver Mead
<address>California Institute of Technology
Computer Science Department
256-80

Pasadena, CA 91125
<sal>Carver
<date entered>5/15/81
<>

<name>Robert N. Noyce
<address>Intel Corp.
3065 Bowers Avenue
Santa Clara, CA 95051
<sal>Bob
<date entered>4/10/81
<>

<name>Bernard M. Oliver
<address>Vice President, Research & Development
Hewlett-Packard Company
1501 Page Mill Road
Palo Alto, CA 94304
<sal>Bernie
<date entered>5/15/81
<>

<name>David Packard
<address>Chariman of the Board
Hewlett-Packard Company
Hewlett-Packard Company
1501 Page Mill Road
Palo Alto, CA 94304
<sal>David
<date entered>5/15/81
<>

<name>Bob Price
<address>Control Data Corp.
8100 34th Avenue South
Minneapolis, MN 55440
<sal>Bob
<date entered>5/6/81
<>

<name>Daniel P. Siewiorek
<address>Carnegie-Mellon University

Computer Center
Schenley Park
Pittsburgh, PA 15213
<sal>Dan
<date entered>4/10/81
<>

<name>Dr. Bruce Wald
<address>Code 7000
Naval Research Laboratory
Washington, DC 20375
<sal>Dr. Wald
<date entered>5/28/81
<>

<name>Lowell Wood
<address>Lawrence Livermore Laboratory
University of Califonia
P.O. Box 808
Livermore, CA 94550
<sal>Lowell
<date entered>4/10/81
<>
May 29, 1981

Robert F. Johnston
Floating Point Systems Inc.
6100 Executive Blvd., Suite 308
Rockville, MD 20852

Dear Mr. Johnston:

Jack Lynch of Burroughs, Ed Fredkin of MIT, and I drafted the following to be sent to the Secretary of Defense. A number of computer scientists and engineers have signed this. You might also want to send it to a congressman. If you feel like signing it, please do so, and I'll put together a composite copy with all signatures to be returned to you.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:swh
GB2.S5.9

if <date entered>=5/29/81
then process record
May 15, 1981

<name>
<address>

Dear <sal>:

Jack Lynch of Burroughs, Ed Fredkin of MIT, and I drafted the following to be sent to the Secretary of Defense. A number of computer scientists and engineers have signed this. You might also want to send it to a congressman. If you feel like signing it, please do so, and I'll put together a composite copy with all signatures to be returned to you.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:swh
GB2.S5.9

00 BURT DECGRAM ACCEPTED S 29013 O 408 15-JAN-81
18:41:37

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION   DATE: THU 15 JAN 1981
6:41 PM EST

FROM: GORDON BELL

cc: DICK ECKHOUSE   DEPT: OOD

EXT: 223-2236

LOC/MAIL STOP: ML12-
1/A51

SUBJECT: CLEAN UP THE MILL CAMPAIGN!

Ken's probably right on here. The environment does have a lot to do about thinking. Si, maybe you made a mistake in not moving to Hudson. I feel the same engineers work better there... but it may be my imagination. The mill was great at one point before it got messy and when we were young, lean, and mean and had to prove to the world that you didn't have to be IBM to build computers... or there was another way to compute. Lately, the high technology image is shiny buildings
(Del Thorndike commented we probably couldn't hire engineers in Silicon valley if they had to live in the old Mtn. View disk facility.)

Given that you are already changing the way people view their job, let's surprise Ken by working this environmental question. I'll come around some Friday afternoon if we want to have a house cleaning. Let's give all the old terminals and computers and test equipment to Dick Eckhouse to give to the universities. It seems the old 8 lab is probably the worst, but Larry and I should walk through the mill and write notes to the various persons. Alternatively, we might have a general clean up one day complete with posters.

MJ,
Please get the clean up campaign rolling.

"TO" DISTRIBUTION:

MARY JANE FORBES SI LYLE BILL PICOTT
LARRY PORTNER

ATTACHED: MEMO;33

****
* d i g i t a l *
****

TO: GORDON BELL DATE: MON 5 JAN 1981
2:34 PM EST
JACK SMITH FROM: KEN OLSEN
DEPT: ADMINISTRATION
EXT: 223-2301
LOC/MAIL STOP: ML10-2/A50

SUBJECT: JAPANESE/QUALITY

Everything we read about the Japanese says that they are primarily interested in quality. Everytime you see a picture of their facilities, they are absolutely immaculate. Maybe one way to emphasize quality would be to get our facilities clean; insist on them being clean and absolutely immaculate. Some parts of this mill are a disgrace. The first floor of building one looks like a pig pen. Some of the Engineering facilities, particularly in the Terminals area, are a disgrace. How could we get good engineering, good manufacturing, and in any way, emphasize quality, when our facilities are so dirty, so messy, and so unbusinesslike.

KHO/er
KO1:S1.79

GB2.S4.13

GBE.S10.8

00 CORE DECGRAM ACCEPTED S 002924 O 114 03-NOV-82
15:15:15

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! d ! i ! g ! i ! t ! a ! l !        I n t e r o f f i c e
M e m o
!___!___!___!___!___!___!___!
```

TO: see "TO" DISTRIBUTION DATE: WED 3 NOV 1982
9:43 AM

FROM: GORDON BELL
cc: EMC: DEPT: ENG STAFF
KEN OLSEN EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

MESSAGE ID:
5180664601

SUBJECT: MILL WALK-THROUGH

We should do this once a year at every site. There were lots of
really good projects, but I'll focus on the problems:

POOR A/D FLOW MANAGEMENT

I'm scared about our "technology" development centers. I never liked
the concept and the results are disastrous, since the use is decoupled
from the development which is done in a vacuum. Note, Henk and Will
who both pushed the concept are "long gone from the crime."

I must insist that no A/D be done outside a development group when a
single manager has the responsibility of both A/D + D. The PS A/D
group has no way to flow results into the various PS groups -- just
feet away because organizationally they're 6 - people away!

The acoustics group seems decoupled and is likely to be completely out
of it in Andover.

Why do we have both Sci Cards and Applicon for Analog? (This seems
crazy) Is the CAM support Group, independent of Dick Gonzales? Is
there too much support?

Let's go back and have two (not three) packaging groups: for
everything except large systems; and for MR + Nebula. This would get
more resources if Dick managed it. Here, Gonzales has great desk and
underdesk packaging the Scorpio and Nebula retry should use. . . to be
compatible with our nifty furniture.

Do we have enough coupling in our CRT work across: ALB, ML,
Workstations, CRA, and CSS?

"TO" DISTRIBUTION:

BILL DEMMER — WALTER HANSTEIN — BILL JOHNSON

DON METZGER — JACK SMITH

EMS 27-NOV-78

21:49:21 220 1

To: Dick Clayton, Bill McBride
CC: Stanton Pearson
From: Gordon Bell
Date: MON 27-NOV-78 21:49:21 EDT
Subject: Priorities in systems and minc

Having heard the minc presentation and at the same time reading and having
read the blurbs about the HP products I conclude that we have higher priority
products than toby becaause: 1. WE have a sales problem in this area anyway
and a bit lower cost won't do a hell of a lot for us, particualrly in the PLs
where we sell only 1's. They want functionality. 2. Minc needs higher
performance and 3. Extensions for signal processing but mainely 4. a BASIC
that can support > 65K or multiple proceswses note that HP basicas all go to
a larger address space and they alsll 5.Have their operating systems in ROM
6. Mainly we need graphics so baasd that even our customers are asking for it
and even our marketing people are asking you, so we know we need it and the
then we need 7. all graphics has to have a hard coyp I?O system and
possibley a 8Digitizer and of course while these are stand alone computers,
the one thing to segment us from the riff-raff is 9. High sped
interconnections so that we can network and pre-process in a nice fashion.
Even our customers are saying that too. I want a very high speed one so as to
handle the LDP problem. 10 Getting the RL02 and successors on the system is
needed too. Alternatively we could go down, based on some caching on a tu 58.

Given that the lifetime of the products we are working with

is only oing to be
a couple of years, I say it i{s essential to use the q bus at 128K and then
even evolve it to beyond this size and to get the products out quickly in
bound systems , based on a et of mo set of modules, not a particular new
scheme for interconnect that will a have to be changed for every
product/generaltion. While you say do TOBY (the answer to the questionI
asked as to what it looks like is given in the pages of the document you gave
to me) I question why we can blow this kind of money except to keep the
commercial group happy and to find your cpu packaging people something that is
easy to do and provides a challenge. I wish they ere challenged by items
1-11 above. I would like to minimize our proliferation of new interfaces
here , not like we have done with the Q (although now I certainly say build
on the dual or quad system and go.

If you really think there is some nice systems to bind, then package some of
the collection of options on a couple of quads in a compativle way...to save
interface cost. The green blocks aren't the problem and they will turn out to
be your friend

Give me some more data and let's talk.

Command:

FROM: GORDON BELL   DATE: WED 16 JAN 1980
8:54 AM EST

DEPT: OOD
EXT: 223-2236
TO: ALLAN WALLACK @MR16
    BILL MCBRIDE @MR16
cc: WIN HINDLE
    ANDY KNOWLES
    DAVE KNOLL @CLEM
    DENNIS O'CONNOR @CLEM
    JOE COSGROVE @CLEM
    JOHN F SMITH @CLEM

SUBJECT: CONGRATULATIONS ON DROP SHIPPING MINC FROM WF

And the FAT reduction by getting it out of WM. I appreciate all the effort that went into changing the manufacturing organization so that this was possible. I trust our customers are happier too, with higher quality products.

I must admit that I didn't think this was possible...and even though we didn't write down a bet, I certainly owe you and the key people in Manufacturing some sort of celebration.

GB:swh
GB1.S1.15

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+---------------------------+                    GB0002/19
|   |   |   |   |   |   |   |
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|   |   |   |   |   |   |   |
+---------------------------+
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Date: 4/12/79 Thu
From: Gordon Bell

Minnow: Let's Go Ahead. Central Engineering Is Stopping It Now. -- **NOT SENT**

From a marketing, business, strategy viewpoint, my position has not changed on Minnow. It is still painfully clear that we shouldn't, especially since the forecasts have dropped and that the 2020 doesn't seem to be bought. I assume, however, that we will do it because it will be coupled to the Data Services business, which will have a very high revenue forecast. Furthermore, we have never passed up incremental businees, or left a customer stranded when we implied a commitment.

I like Minnow! There are concerns about its boundnesss and our ability to say with certainty that a tape, or some other option won't be required that will force continued changes to it and the system software it requires. These problems can be corrected, and it will approach looking like a 2020, but it can still be a good money maker.

The issue which I have unsuccessfully communicated is that we, Central Engineering, do not have the resources, charter, or will take the responsibility for this product. We implement high volume products within the strategy. Minnow is neither high volume, nor within the strategy.

Effective now, I have instructed Ulf to spend no more engineering effort on Minnow. However, we will make available people who will help in the transfer of the design, or transfer people to design Minnow to any product line or product group who wants to engineering, manufacture, or market it. Since it is proposed as a single product line product, it might be wise to have it part of their organization, especially since the customer base expects follow on products. TPL has done a fine job in making the PDP-14 successful, and this would be a clear moneymaker for CSS. I would support either of these groups in taking on the work.

We are aggressively working on high end 32 and 36 bit machines in Marlboro so that they become a mainline, high volume engineering group. Their charter is to continue the relatively constant price, higher performance follow-on line, until it is more effective to use VAX. Our priorities are to improve the reliability of the KL, to move and establish the design of 32 bit products in Marlboro, and to define the structure of the KL replacement built around the common base VAX components. The charter does not include doing, product line specific, high or low volume, low cost systems. Any incremental effort spent on tangential work now detracts from this main charter and mission.

```
+---------------------------+                             ID#361
|   |   |   |   |   |   |   |
| d | i | g | i | t | a | l |   i n t e r o f f i c e   m e m o r
```

a n d u m

```
|   |   |   |   |   |   |   |
+---------------------------+
```

Subject: **Minnow, No No/Dolphin 10/20/VAX Sooner**

To: Minnow Task Force

CC: Bob Puffer

Date: 21 NOV 78
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

follow up 12/4/78

While we're fooling around here, blowing hardware and software resources in the mini territory with Minnow, indications are that IBM will be coming in with its hot, new series to regain territory from Amdahl and the new low end 370 plus-compatible vendors. But more important to us, they could get back the low end 370's:

1. the 10/20 displace; and

2. the central control that VAX threatens by having either much more cost-effective 370's (e.g., 20 M.PS for $1.8 M) or hot low end 370's to use as distributed computing the way that VAX/780 is used.

Let's use our scarce hardware/software resources for the gate array 10/20/VAX and for the CAD to bring it in in time!

GB:ljp

<u>Minnow Task Force</u>
Gordon Bell, ML12-1/A51
Bill Demmer, TW/D19
Ulf Fagerquist, MR1-2/E78
Bob Flynn, ML12-2/E81
Bill Kiesewetter, MR1-1/M81
Andy Knowles, ML10-2/A52
Si Lyle, MR1-1/M42
Larry Portner, ML12-3/A62
Mike Tomasic, ML12-2/E71

EMS 11-APR-79
22:04:01 360 1
To: Jan Lounsbury, Ulf Fagerquist
From: Gordon Bell
Date: WED 11-APR-79 22:04:01 EST
Subject: Today

Thanks for the presentation. I hope we atr slmost there. I am sorry to be
s so adamant about the postition as to why we are not doing just one more
project (ie Minnow). It is quite simple. It is another 10% to manage these
u next 2 years, and I am not going to let us do it. We are committing to a
much more aggressive machine/schedule and much better than Dolphin. Also, it
has a big software component. Although these constitute a major program,
the VENUS project was just (possibly erroneously) moved to be done in
Marlboro...making Marlboro responsible for a major part of the corporate
revenue. (more than when we decided to do it...which at that time only
included Minnow, and no follow-on 10/20 for 2060.
Already, I heard than
George had to ask wheteher we cold get x, out of a 2020.
This is nonsense.
The VENUS team is still up in the air. He has one

responsibliilty!

There seems to be some ambiguity about my posititonin this.
How can I
clarify it further?

Command:

```
+---------------------------+
|   |   |   |   |   |   |   |
| d | i | g | i | t | a | l |          i n t e r o f f i c e
|   |   |   |   |   |   |   |            m e m o r a n d u m
+---------------------------+
```

SUBJ: **RE: 11 FEB 80 MINUTES**

TO: Ed Paderson, ML3-2/E41

CC: Microprocessor Focus Group
(See Distribution)

Date: 2/19/80 Tue
From: Gordon Bell
Dept: OOD
MS: ML12-1/A51 Ext:
223-2236

EMS: @CORE

Follow Up: 2/29/80

You ignored TI. Note the TMS1000 is a 16-bit machine <u>AND</u> they have the commodity market. Their stuff goes in cars, games, appliances at the lo end. Should we watch them?

What's Taurus? D-LART?

Why aren't BI chips in your MOS list?

Are you really benchmarking chips from the outside? What's a system based on 8086/8087 cost (in chips) vs. F-11??

Are you really <u>broadcasting</u> what the possible buyout peripheral chip possibilities are? For example, could you look at cost-effectiveness, use, etc. of PUSART vs. Standard Comm?

Do you find out the new chips before they are publicly announced? Can you act as a collector/broadcaster for this? It seems like you can to much more here.

GB:swh
GB1.S2.3

Distribution:

Keith Amundsen, ML1-2/E60
Don Gaubatz, ML3-2/E41
Glen Larson, MK1-1/M37
Jim McGuiness, ML5-3/E12
Russ Moore, ML1-2/E60
Rich Olsen, ML1-2/E65
Hampton Saler, ML1-2/H26
Ranjait Singh, ML5-5/E97
Fred Zeraski, WZ2
Don Dodson, ML1-3/E62
Jim Grochmal, TW/B14
Roy Lomicka, ML5-3/E12
Tom McIntyre, ML5-5/E76
Tom Northrup, WZ
Al Rainha, LM
Joe Schmidt, MK1-1/M37
Norm Field, ML1-3/E58

****
* d i g i t a l *
****

TO: LARRY PORTNER
DATE: SUN 13 JUL 1980 11:08 PM EDT

FROM: GORDON BELL
cc: JOHN MEYER
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: CONFIDENTIAL MINUTES OF 7/10/80 MTG.

Minutes of Bell, Portner, Meyer Meeting 7/10/80

Strategic Planning Manager Definition
Focus on longer time frame to aid A/D and help establish questions for each of the areas. More than technical: includes
tradeoffs between machines, people and make/buy. Si deals 0-3
years. This is longer (maybe out to 90). Again, doesn't do the

work, but gets the responsible groups to do it. Would try to work the Japan problem. (The Gallactic Product Strategy). Note that in writing this up, I generated the memo on the Four Dimensions to Segment our Products and Work on them. Also, the memo on the Organization Structure Proposal.

We discussed each of the organizations. This yielded some thoughts on how much time we are requiring from each member and how much they have to really do work. I did a time analysis that showed that I have only 20% discretionary time, the rest is all used up with what are either explicit or implicit meetings. This does not include my time for reading or writing or any more than a few non-scheduled meetings. WE ALL HAVE A PROBLEM HERE! The matrix organized people just have to be hurting bad. I suggest we get everyone to do a time analysis. I'll send mine around as an example. All OOD member organizations are too wide in a conventional span of control sense. Our relationship where 2 people run things in a somewhat segmented way may be necessary.

STATUS OF VARIOUS GROUPS
BJ-very wide, what's Dockser do?, should some of the systems work be with the systems groups?

MK- job scope is bigger than performance, we want more than just control, we want educator, intellectual and tool builder

Holman-coupling to Mfg? Space planning is a bitch!

SF-growing well, all used up though. Any way to get back to

technical review role? Could be valuable in A/D of new machines?
Architecture is happening.

Cudmore-group is building nicely, need a push to address some of
questions in Intel memo

Clayton-overlap with mid, needs focus on chips, and terminal
systems, opportunity to couple T and T-based Small Systems, I'd
like help in Semi strategy wrt Intel, needs architecture, A/D,
should software be in here more?, better coupling to Delagi
possible?

Demmer-lots on the plate, overlap with Small, Lots of money and
not enough output, maybe too much complexity among Hydra and
Pearson and Rodgers, who's doing MLK to 780?

Ulf-sucked A/D dry, research management, now into execution with
risks abounding, problem of interfacing to mid and to
interconnect to get the right product components, problem in the
Suvax and PBS area that frustrates GB

Grant-things seem to be happening the right way.

ORGANIZATIONAL TOPICS:
.Organizational tuning is needed: who does what wrt stategy?

.Can we better structure MSD and I/C better by breaking apart?)

.Should we put all CPU-based systems together?

.How can we better align with Mfg? (note org. proposal)

.Should we seperate all the systems planning from development to avoid the milling effect? (Can we do it without losing the commitement? How can we do it with fewer people and get better results? The situation vis a vis J is awful!

STRATEGY REVIEW

.When is the next OOD wide Program Review?

.The Rosing REview of strategy with 20-25 technical leaders is strongly recommended!

.GB discussed a System Strategy Review body to look at all Product plans wrt strategy. (Per, Rodgers, Husvedt, Sam and/or Strecker, Rosing and Jud)

.Strategy needs to be re-evaluated, in light of today's conditions of slips, etc. i.e. how are we coming?

BETTER MANAGEMENT

.No knowledge of how we tradeoff among expenses, capital, labor, space and equipment. We need to build much better tools to aid managers!

.What is job definition of Direct Report?

.What is site, function and product space decsions to fit strategy requirements?

.How can we interact with OOD members to find out what they are doing and what they need from us and how they are really doing?
LP/GB will have an organization review which is now being scheduled. Includes: space, resources, budget, organization, projects, phase transitions, EBOD/SPU interaction. Assumes Win looks at operational issues of schedules, budgets of projects.

ORGANIZATIONAL DISCUSSION

Gordon and Larry (2)

Line developement (6-8)
Semis (dotted)
Mass storage
Software
Terminal and Terminal based systems
(Small)
Mid
(Communications and Networks)
Large

Functional organization (6-8)
Personnel
Finance
(Administraton)

Tech Direct
(Strategy mgr)
TOPS
Manufacturing Engineering (dotted)
Product management and marketing

Note the potentially large size of the group: 14-18. Even the
development portion is getting awfully large. The inevitablity
of an even larger staff function is assured!

GB1.S5.51
TELEPHONE NUMBERS: 467-4443 Geri Rogers
4862 Debbie Sterling
4084 David Bromfield
7570 Chris Rudomin
4743 Jamie Parker
7076 Gregor Trinkaus-Randall
7331 Store
4036 Main Museum number
5004 Gwen Bell

481-8342 External number-Boston, Marlboro directories

Dial only last four numbers for in-house calls.

WHAT REFERENCE MANUAL SHOULD CONTAIN.

How everything gets done.
A book that is divided into functions.

MAJOR AREAS
Director
Programs
Functions
Accounting
Secretarial
Store
Membership-Fundraising
Other?

Fuzzy areas:Who does store report to? Gwen? David? for approval, problems? Discuss with Carol.

Bulk Mailings--whose responsibility? (1000 at a time) Discuss with Gwen how bulk mailings should be handled.

Business manager's job: can it be done by a good bookkeeper since the planning and policy is done by Gwen.

Discuss with David: Bills--what happens to invoices: when paid, filing system, etc.

Discuss with David: Checking accounts

Discuss with David: job description for photographer--what equipment has he bought, stored where, etc.

If anyone leaves a job Manual will provide the following information:

Job description; responsibilities
How job is accomplished
Where things are stored
Who they report to
Routine tasks
Other

Miscellaneous information:

Big goal to own facility elsewhere.
IEEE (Institute of Electrical and Electronic Engineers) may donate $50,000 per year.
Future plans include audio-visual room and library for papers, etc.

Corporate members	$125
Founder	$250
Corporate Founder	$2500

From DEC $275,000
Phones, rent, mail (except bulk mailings)
$60,000 yearly Cost Center # 20E (Geri)

Procedures for compiling manual:

DecemberCompose and distribute questionaire for each job
.

Set up interview appointments.

Interview in conference room--get very detailed information.

Write up notes on each interview. Allow interviewee to go over notes to pick up on any errors or omissions or fuzziness.

JanuaryFirst draft of notes to Gwen early January.

Do an organization chart.

Second draft.

FebruaryProduce a Reference Manual for the Computer Museum that is divided into functions, eliminating personalities.

GB3.S10.23

00 CORE DECGRAM ACCEPTED S 000734 O 137 20-NOV-82 11:40:46

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.___.___.___.___.___.___.___.
!   !   !   !   !   !   !   !
! d ! i ! g ! i ! t ! a ! l !        I n t e r o f f i c e
M e m o
!___!___!___!___!___!___!___!
```

TO: JAY HAIRE
11:13

DATE: SAT 20 NOV 1982

cc: see "CC" DISTRIBUTION

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5182396508

SUBJECT: RE: MIT

Agreed, things went well. But on the next visit it's more than a non-disclosure. They want a commitment of $'s.

I heard the dean say 8-10 experiments per year of heavy duty kind where they provide the resources and we supply a lot of the capital for machines. In order to get 2K machines there in 5 years, or what amounts to 10M-20M investment.

Corby said we could expect a factor of 4 price reduction in 4 years, then, we should look at price differentials of 1/4th sales price for now.

They want 100 machines there in September.

What our strategy ought to be:
Get the network business by providing an environment for internetting all their current machines so they can get started on the social aspects of computing. This would get Corby moving and get his support.

Allow that there will be a plethora of different sizes, brands, etc. The world is never going to be homogeneous ... unless we want to really try to promote VAX in a way bigger than DEC (and we're not about to do this) OR Motorola becomes a defacto standard! Thus, get them to accept this fact of life.

Sell them our brand of computing, but failing this, be open and say try before you buy. Bring in several systems and try several experiments. Coherence is a bitch, but get it through the network, not at a machine level.

Get the act structured before we get them in again.

"CC" DISTRIBUTION:

SAM FULLER	WIN HINDLE	TED JOHNSON
BILL JOHNSON	KEN OLSEN	JIM PITTS
KEN VONASEK		

February 18, 1980

Joel Moses
Associate Head for Computer Science and Engineering
MIT
Department of Electrical Engineering and Computer Science
Room NE43-514
Cambridge, MA 02139

Dear Joel:

I've known Tom since a freshman at Carnegie-Mellon. In his freshman year he single handed wrote and invented all the concepts of logic simulation. During the summer of his freshman year he came to DEC with the simulator that has become the basis of our logic simulators. He's consulted with us on CAD since then.

The work on the S-1 design and the associated CAD is superb. I've backed this work.

MIT would be lucky to get him.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:swh
GB1.S2.10

GB3.S10.19

00 CORE DECGRAM ACCEPTED S 000148 O 109 16-NOV-82
0:35:08

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!   !   !   !   !   !   !   !
! d ! i ! g ! i ! t ! a ! l !         I n t e r o f f i c e
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!___!___!___!___!___!___!___!
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TO: see "TO" DISTRIBUTION   DATE: MON 15 NOV 1982
8:42

FROM: GORDON BELL

cc: BILL JOHNSON   DEPT: ENG STAFF

EXT: 223-2236

LOC/MAIL STOP: ML12-
1/A51

MESSAGE ID:
5181887078

SUBJECT: MIT PC

Ken just called about what MIT wants in their PC... suprise, the want it now and they want a 68,000... and they apparently want a diskless version and they want it on a LAN.

This seems to be exactly what everyone else wants... to get rid of the ridculous fiber optics and to interconnect via EN. Someday, someone is going to have to tell me how to get the speed using this contraption.

Anyway, when could we deliver a VS100 connected this way?
What's the largest memory?
How do you connect a disk to it? or do you?

What you think of this approach?

(MIT would be on their own for PC software used this way.)

Since we're having dinner with various MIT folks TODAY (when you read this on 11/16), I'd like a phone response quick as to whether we even say anything at all.

"TO" DISTRIBUTION:

GEORGE CHAMPINE BRIAN CROXON SAM FULLER
BILL STRECKER
July 20, 1982

Shirley M. Picardi
The Alumni Center
Massachusetts Institute
of Technology
Cambridge, MA 02139

Dear Ms. Picardi:

Thank you for the honor of nominating me for an alumni representative on the MIT Corporation Visiting Committee for the Mathematics Department.

I'm sorry, but I cannot accept this nomination because I'm already over committed with other projects, including a visiting committee at Harvard. In the future I would like to be reconsidered for such a position.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:pef

JUNE 29, 1981

Professor Michael L. Dertouzos
MIT Laboratory for Computer Science
NE43-105
Cambridge, MA   02139

Dear Mike:

The MIT Industrial Liaison book on Personal Computers, Networks and Office Automation was quite informative.

I was surprised to find the machines we described on a non-disclosure basis in the report. This seems like another example of why we don't have a very good relationship with the Laboratory for Computer Science.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:mal
GB2.S6.62

cc: Ken Olsen

+---------------+
! **d i g i t a l !   i n t e r o f f i c e   m e m o r a n d u m**
+---------------+

Subject: **M.I.T. Program**

To: Shel Davis

CC: Salary Review Committee
Bill Demmer, Sue Lotz,
Bob Puffer

Date: 19 JUNE 78
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

follow up 7/3/78

Bill Demmer would like to go to the M.I.T. program next winter.

I assume this is okay. I'm encouraging him. Sue Lotz, is this the best place?

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST:	Shel Davis	PK3-1/C21	Bill Demmer	TW/D19
	Sue Lotz	NQ	Bob Puffer	ML12-2/E38
	Al Bertocchi	PK3-2/A56	Win Hindle	ML5-2/A53
	Ted Johnson	PK3-2/A55	Andy Knowles	MR2-2/A52
	Ken Olsen	ML12-1/A50	Stan Olsen	MK
	Jack Smith	ML1-4/F31	Bill Thompson	ML12-1/F41

00 BURT DECGRAM ACCEPTED S 21023 O 17 28-SEP-80 16:44:42

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*****************
* d i g i t a l *
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TO: see "TO" DISTRIBUTION DATE: SUN 28 SEP 1980 4:42 PM EDT

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION

DEPT: OOD

EXT: 223-2236

LOC/MAIL STOP: ML12-1/A51

SUBJECT: PLEASE CHANGE THE ABYSMAL MIT INTERFACE

Our meeting there was appalling... and typical of a poor job on both our parts. We gave them a VAX to do LISP and we got nothing. They are producing results for Zenith, which will allow them to introduce a very, very nice personal computer which will compete with Personal VAX, assuming we ever decide that our technical computer users need a real computer and not toys.

Also, they are doing first rate work in the office research area funded by EXXON! What I heard sounded better to me than anything I had heard in this area. Clearly they are about 5 years ahead of our thinking in research in this area.

They would like something in the network area... that is, some funds to put in a net.

I don't know what to do in this area, but I couldn't be more frustrated. Let me offer some alternatives:
1. do nothing, as we've done in the past, be prepared to compete with their products as they emerge
2. get closer and track what others are doing (Zenith and Exxon so as to utilize the research) ... this would be worth doing, here, I say trade-off at least one researcher in the PBS to get this!
3. 2 + sponsor some work like the networks. Get co-ordinated about selling/research/interacting
4. 2 + get consulting from their key people and start to migrate graduate students and personnel here to help in this area.

I would like you guys to propose a plan, based on a significantly
better assessment of the situation.

"TO" DISTRIBUTION:

DICK ECKHOUSE ULF FAGERQUIST KEN OLSEN
DICK SNYDER

"CC" DISTRIBUTION:

BOB GLORIOSO ANDY KNOWLES JOE MEANY
RICK PEEBLES DAVE RODGERS JOEL
SCHWARTZ

GB1.S7.21

GB3.S10.4

00 CORE DECGRAM ACCEPTED S 005045 O 772 01-NOV-82
22:35:03

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!   !   !   !   !   !   !   !
! d ! i ! g ! i ! t ! a ! l !        I n t e r o f f i c e
M e m o
!___!___!___!___!___!___!___!
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TO: see "TO" DISTRIBUTION

DATE: MON 1 NOV 1982
9:05 PM

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

cc: KEN OLSEN
JACK SMITH

MESSAGE ID: 5180461724

SUBJECT: AN OPPORTUNITY WITH MIT WE PROBABLY CAN'T STAND

Dertouzous at MIT said that Western Digital is probably going to default on the plan to make the MIT computer NU. This is the second default after Zenith! The computer is built on a special multibus type thing and has 4 large boards along the SUN workstation lines and is Appollo size, costing 30K which MIT gets for 20K with 20Mbytes and 2 Mbytes primary memory and a 1000 x 1000 line display. The LM2, LISP machine can also plug into the backplane. This one has an Ethernet interface and of course, you guessed it, runs UNIX.

Adler of DG fame is thinking of buying them out to make it with some other company.

He asked if we wanted to make it. I said I'd get back. While it's pretty clear we probably wouldn't be interesting, there might be some useful ideas. We might have to go to LA to look at one though.

Do we want to even look or should I say thanks but no thanks?

"TO" DISTRIBUTION:

BILL AVERY BILL JOHNSON ANDY
KNOWLES
AVRAM MILLER
April 21, 1981

Joel Moses
Associate Department Head
Massachusetts Institute of Technology
Headquarters Office
Room 38-401
Cambridge, MA 02139

Dear Joel:

Enclosed are some comments on Maurice.

What are his main achievements?
He is known for microprogramming (with Stringer), building EDSAC, writings on Timesharing, the first programming book, head of Cambridge department - doing the "ring", CAP.

What is his standing in Computer Science?
Highly regarded - note NAE member, McDowell Award winner.

Is he still active in research, in your opinion?
Yes. Moderately as a collaborator and support person.

Are his public lectures clearly presented?
Yes. Very clear.

Please comment, if you can, on his teaching and direct involvement with students. Students have very high regard for him as mentor and teacher.

I believe the adjunctship might have a benefit in better communication between MIT and Digital.

I know Maurice is very keen on doing this as he misses the academic environment.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:swh
GB2.S5.36

00 CORE DECGRAM ACCEPTED S 004715 O 592 20-OCT-82 20:03:00

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION
DATE: WED 20 OCT 1982
6:09 PM EDT

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

cc: OWEN FISK
AVRAM MILLER
KEN OLSEN

MESSAGE ID: 5179242373

SUBJECT: MIT MEETING TO PROPOSE A PERSONAL COMPUTER PLAN

Mike Dertouzous wants the four of us to come and present a plan as to how we would equip all of, or some part of MIT with PC's. He would like to have us discuss the financing of such a venture and any quid pro quos ... because they are discussing a similar plan with IBM and HP and he thinks we ought to have some inherent synergy by being close... I concur.

Dertouzous will bring Joel Moses, Steve Ward and Corbato (the person responsible for their networking).

Could we meet together on this, prior to the meeting which is in the process of being set up?

We really need to get into some relationship like this.
MIT is one of the possible places.

"TO" DISTRIBUTION:

SAM FULLER   WIN HINDLE   BILL JOHNSON

GB3.S8.72

00 CORE DECGRAM ACCEPTED S 002713 O 347 11-OCT-82
14:11:04

****
* d i g i t a l *
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TO: see "TO" DISTRIBUTION   DATE: MON 11 OCT 1982
1:05 PM EDT

FROM: GORDON BELL

cc: WIN HINDLE   DEPT: ENG STAFF
KEN OLSEN   EXT: 223-2236

LOC/MAIL STOP: ML12-
1/A51

MESSAGE ID:
5178324298

SUBJECT: NEC IN NE; AND OUR POOR MIT HIGH LEVEL RELATIONSHIP

My friends at MIT continue to be impressed with Kobayashi, chairman of NEC. Kobayashi has been on other panels there and has given many insights ranging from technology to managment.

At the recent celebration of the 100th anniversary of the ee/cs
department, Dr. Kobayashi sat through the whole day and celebration, taking notes. There was discussion about the need
for engineers who could compete with the Japanese. John

Young, an MBA gave a few words I forget and left. The reason was to
demonstrate the close relationship with MIT and HP.

NEC is building a major facitity for R and D here, and I believe
they'll hire a really competent group of engineers in this area, as well as do a much better job in coupling to the MIT research
programs.

WE GOTTA DO BETTER
The key is to have very, very many troop-level working relationships such as the one between Glasser and Doberpuhl, not try to work it at the policy level with the head folks (eg. me)
who clearly aren't making it better. I did agree with Joel Moses that we would like to be a test for their Continuing Education program, but I assume neither of us will do anything. We can work with the Signal Processing Laboratory (Alan Oppenhiem) to do basic work in architecture and get another link. Similary, there's a possiblity to get the AI lab to microcode LISP to get much more out of VAX. Right now, VAX is not thought of as a particularly good AI machine, whereas the 10 still is
thought to be the best AI machine until the Lisp machine companies get enough products out.

"TO" DISTRIBUTION:

SHARON KEILLOR PEG: RAD:
DEL THORNDIKE

GB3.S8.65
Command >
July 28, Friday

Margaret (Bruno Durr's office) called. X2752 Re: A Data Pro excerpt Gordon sent to Bruno -- Bruno would like a copy of the entire article -- I couldn't find it.

Mike Riggle will keep a video tape from Sony an extra week or two so Gordon can see it when he returns.

July 31, Monday

Please call Susan in Treasury Services. X3431 Re: She wants to know if there was any stock activity the month of July.

(FYI) Mark Steincrouse (PMR Industrial Relations Dept.) X7182 needs a figure off the June Monthy Personnel Report for the FY 78 annual report. What he needs is the number of engineering employees -- he said he would get it elsewhere.

August 1, Tuesday

Malcolm Conway from Energetics called Gordon about some research work that Gordon was interested in -- I transferred the call to Jim Bell's office (see note 8/2/78 from Jim).

David Baker from ??DAR?? Corporation called Gordon. They are Materials Manufacturers and are in the process of buying a DEC computer -- he said the salesman suggested he call Mr. Bell because it was concerned with Research & Development. I suggested he call Jim Bell and explained who Jim is and that he was probably the Mr. Bell the salesman was referring to in the first place.

Please call Terry Potter, X9749 Re: Conference in Boston on Performance Analysis (2 1/2 days) October 24, 25, 26.

Please call Connie Schooler 8-522-2101 in Colorado Springs -- Re: memo sent a while back inviting Gordon, Lon Beaupre, and Ken Olsen to the open house there on Oct. 1 from 12-4 (Manufacturing, Engineering, Sales, and Diagnostics). Will Gordon be attending?

Please call Rich Perrin (238-2266 in Westboro) Re: He would like to set up a meeting with himself, Bill Green, Joe Zeh, Bob Kusik and Gordon to discuss the HMOS Gate Array. 1 1/2 hours would be needed sometime the week of Sept. 4th.

August 2, Wednesday

Mr. Uythoven called Re: Software Conference Speech in October -- wants GB to speak. He's going to talk to the person who recommended Gordon and see if he'll recommend someone else. If not, he'll get back to us.

Please call Dennis Kulsick, X6827 from the Corporate Sales Office.
Re: Agenda for 4 visitors from LLL Thursday, September 14 -- they would like to know if Gordon would be free for about an hour that day to see the people from LLL.

August 3, Thursday

(FYI) Gene Rosov from the Apple Hill School wanted to get in touch with Gordon -- I told him that Gordon's secretary was out and I wasn't sure of his location -- only that he was away on a business trip -- Mr. Rosov said he was going to call his home.

(FYI) Tony James from Reading England DEC office called Gordon -- he asked to be transferred to Dick Clayton and I transferred the call.

Alan Silver X2067 stopped by to inform me that Gordon, you and I will be transferring to CC 383 in one or two weeks. He'll be getting back to you about it.

Chuck Grutzius from the Washington, D.C. GIS Sales Office called Ann to set up a meeting with Grace Hopper, Gordon and Ken on October 19th. He'll be calling again when you get back to discuss it with you and Ann. (341-2279) Grace is anxious to visit as soon as possible and since Ken is away most of September, October 19th was her first free date after September.

August 4, Friday

Please call Phil Locke X5549 (MK)
Disk Products Development
Re: Official Corporate Standard -- Base Product Obsolesence vs Layered Product Obsolesence

August 7, Monday

Jim Lacey X6867 (MR) attended the Intel Seminar -- he is a senior engineer in the Peripherals Group reporting to George Hoff.

Yolanda called (8-246-2279) re: Business Product Line Untested Equipment. We have some mail regarding this -- She had a meeting with Leo Shipz and Carl Janzen. Leo will be looking into the reason why quality control is so poor in PL 41. Carl Janzen is the GIA General Manager.

Barbara Wagner X7725 needs a copy of the data quest report referred to in a memo dated June 23 from Sam Fuller to GB. (Bill Johnson's secretary)

Please call Jill in R&D -- X7682. Re: She would like to set up a meeting with a visitor from a North Holland Pubilishing Company (Wilhelm Dijkhuis) on October 30 from 9:30 to 10:30 with Jim Bell, Del Lippert, Marcie Kenah and GB. (We have mail from Jim Bell in regard to this person.)

August 8, Tuesday

Clarence Marshall from Rockwell called Gordon -- He'll call again when Gordon returns.

Susan Sacko X6778 (MR) called. She would like to set us a 15 minute phone conversation with Ed Kramer and Gordon -- is possible for him to reach Gordon before he returns?
1/24/79 Messages

1. Barbara Wollan (MIT) Re: They will be delivering the chalk board today (it is 4'x6') at about 1 or 1:15. If you have any questions, her number is 253-4665.

2. Barbara Taylor (Dartmouth College) called. Re: She would like a current abstract of Gordon for use with his presentation at the April Symposium "An

Innovation/Technology Recession?" -- Any recent awards, highlights, etc. you think he might like mentioned. I told her we could send her a current abstract but she wants the information over the phone as well.

(603) 646-2352 Dartmouth College
Thayer School of Engineering
Hanover, N.H. 03255

3. Eleanor (Don Alusic's sec.).
Re: Don would like to know "since Gordon cannot be at the Friday morning DuPont Task Force meeting, who can discuss for Gordon at that meeting his concept of the future as it relates to distributed processing and DuPont?" Would Rich Peebles be OK since he attending the meeting anyway? 264-5188

4. Shirley (Grant Saviers sec.).
Re: Can it be arranged for Gordon to meet with Grant and John on Friday from 8-9 to discuss SDC? I told her he had an 8:30 meeting but you'd get back to her. (303)576-5970 X245.

5. Mac Harris (Public Relations)
Re: Review of a paper authored by Louise Milton that Gordon is doing. He has the corrected copy for Gordon's final review. I told him to put it in the mail and if there were any questions we'd get back to him. X2857 Parker St.

6. The Feb. 7 CSD 2 hr. presentation has been changed from the CSD CR to the R&D CR. (via Joyce Gray)

7. Doris Covey -- no need to call her back -- she'll be over later.

L

Document Number	Subj/to/disk Name	Created	Modified	Size	Version
14	ACCOMMODATION - WALTER ROWE - A JOB WELL DONE/MJF001				

5/17/79 5/17/79 3:31 4 8

37 AGENDA--MUSEUM/7/9/79/MJF001

7/9/79 7/11/79 3:28 6 4

48 BELL PICNIC INVITATION IF YOU ARE GOING TO POPS/MJGB12

5/4/79 5/4/79 0:54 1 1

56 BELL TIME CHART--SEPT/OCT/NOV/DEC 1978/MJGB12

5/14/79 5/24/79 4:20 4 3

38 BRITISH SCIENCE MUSEUM REQUEST FOR POSTERS/MJF002

10/22/79 10/23/79 13:47 4 4

35 COMPUTER CLASSICS - INVENTORY/MJF002

10/17/79 10/17/79 14:13 2 1

20 DARTMOUTH COLLEGE/MJF001

6/5/79 6/5/79 0:03 2 2

19 DARTMOUTH COLLEGE CONFERENCE CENTER/KELLY/MJF001

6/5/79 6/5/79 2:48 2 1

50 DEC OLD MANUAL INDEX/MJF001

10/1/79 10/1/79 0:01 1 1

9 DEC OLD MANUAL INDEX

8 DISTRIBUTION LIST CREATION GUIDELINES--WHO RECEIVE/CUT/MJF001

1/30/79 5/14/79 0:56 17 2

36 DISTRIBUTION LISTS--FYI ENGINEERING WORLD/MJF002

10/18/79 11/26/79 15:16 4 15

15 DTW MUSEUM ANNOUNCEMENT

8/28/79 10/3/79 16:01 2 2

16 EBOD SCHEDULE--WHICH CAN I DELETE/MJGB12

2/23/79 2/23/79 1:15 5 2

41 EMS-5 DAY SAMPLE/GB,TRAVIS,CRAWFORD,COOPER/MJGB12

4/10/79 4/10/79 5:24 11 5

27 EMS COMMAND MODE MANUAL--MJF VERSION/MJF002

10/8/79 10/30/79 0:04 41 20

42 EMS FEEDBACK--NEED TO BE ABLE TO DO/FEEDBACK../MJF002

10/29/79 10/29/79 4:08 6 6

50 EMS FORM/MJF002

11/12/79 11/20/79 16:26 1 5

7 EMS FORM--REQ BY OOD MEMBER(USER,MS,LDP,COMET,ADD,WAIT)/MJF002

9/11/79 11/20/79 16:26 2 7

8 EMS FORM TOTAL FOR CE (USER,OOD,MS,LDP,COMET,ADD,WAIT)/MJF002

```
                         9/11/79 8/13/79 4:59  2     6
  41   EMS--LDP SYSTEM--RESULTS OF 1ST TRY/MJF001
                         6/13/78 7/27/79 2:12  6     3
  14   EMS LIST BEING SENT TO MAYERS FOR ENG FORM/MJF002
                         8/15/79 11/15/79 0:18 2     5
  28   EMS MANUAL WITHOUT PRINT CONTROLS FOR TRANSFER TO
EMS/MJF002
                         10/8/79 10/8/79 14:01 24    2
  32   EMS - OOD DISTRIBUTION LISTS--PROPOSAL/GB,LP/MJF002
                         10/15/79 10/15/79 4:42     3        3
  26   EMS QUESTION SESSION -- HELP US/MJF002
                         9/27/79 9/27/79 5:57  5     3
  37   EMS QUESTIONNAIRE/USE REPORT /GB & MJ/MJGB12
                         3/28/79 4/4/79 7:48   7     21
  10   EMS SIGN UP COVER CHART/MJF002
                         8/13/79 8/13/79 8:23  4     4
  31   EMS SIGN UP FOR OC SECS/OC SECS/MJGB12
                         2/16/79 2/23/79 6:17  5     5
  4    EMS SIGN UP FORM--NAME ONLY/MJF002
                         8/10/79 10/9/79 0:17  1     5
  48   EMS SIGN UP FORM--NAMES ONLY/MJF001
                         8/9/79  8/9/79 12:57  2     2
  47   EMS SIGN UP LIST/MJF001
                         8/9/79  8/10/79 3:22  46    15
  2    EMS SIGN UP LIST/MJF002
                         8/10/79 11/20/79 16:24     77       65
  49   EMS SIGN UP SPEC /MJF001
                         8/9/79  9/21/79 6:04  1     2
  3    EMS SIGN UP SPEC/MJF002
                         8/10/79 11/30/79 3:11 1     128
  40   EMS TO WPS/MJGB12
                         4/9/79  4/9/79 8:57   3     9
  21   EMX
                         9/14/79 10/15/79 2:38 1     2
  52   ENGINEERING SUBSCRIBERS DIST. LIST/MJF002
                         11/12/79 11/13/79 0:12     7        4

  4    FILING MANUAL--APPENDIX/HINTS/KEYWORDS/SORT TIPS  /MJF001
                         1/30/79 10/24/79 5:19 18    2
  5    FILING MANUAL--PART 1 ("RETRIEVAL" SUPERSEDES) /MJF001
                         1/30/79 1/30/79 16:45 57    1
  6    FILING MANUAL--PART 2 RUNNING SORT PROGRAM /MJF001
                         1/30/79 10/26/79 9:20 22    2
  7    FILING MANUAL--PART 3 RUNNING LIST PROCESSING /MJF001
                         1/30/79 1/30/79 16:47 4     1
```

18 FILING/RETRIEVAL USING WPS INDEX /CHARTS/MJGB12
2/23/79 5/24/79 3:26 56 16
45 FOLLOW UP LOG FOR MJ--FORM/MJGB12
4/17/79 4/25/79 4:13 1 3
44 FOLLOW UP LOG FOR MJ--SPEC/MJGB12
4/17/79 4/17/79 5:47 1 1
43 FOLLOW UP LOG--STARTING 4/17--FOR MJ/MJGB12
4/17/79 4/30/79 5:36 8 12
15 FORM LETTER FOR FILM TO PHOTO LAB/PARKS/MJF001
27/20/?3 6/63/{55 10:01 1665 66
11 F/U NOTICE - BLANK /MJGB12
11/30/78 3/13/79 6:40 2 19
44 FUJITZU LETTER OF TRANSMITTAL /HIRO WATANABE/MJF001
8/6/79 8/8/79 12:58 7 6

25 GORDON THANK YOU TO DIMMICK /MJGB12
3/5/79 3/5/79 16:02 3 1

13 HOPPER VISIT SCHEDULE /MJGB12
12/19/78 1/22/79 13:54 2 8

4 INDEX FROM CI FOR DISKETTE:MJGB12 /MJGB12
5/25/79 12/4/79 0:33 19 9
13 INDEX FROM CI FOR DISKETTE:MJF001 /MJF001
5/16/79 12/4/79 9:36 17 26
13 INDEX FROM CI FOR DISKETTE:MJF002 /MJF002
8/15/79 12/4/79 5:28 21 11
9 ITINERARY--9/19-9/21/79--CMU/CHICAGO/MJF002
8/22/79 10/3/79 16:03 3 4
29 ITINERARY ALBQ/COLO FEB 26-3/2/79 MJGB12
2/25/79 2/23/79 6:14 7 7
39 ITINERARY, BERLIN, MAY 1979/MJGB12
4/5/79 5/2/79 2:03 5 8
46 ITINERARY - CMU VISIT, 4/28/79 - 4/30/MJGB12
4/23/79 4/23/79 6:33 2 1
33 ITINERARY - COLORADO, 1/21 TO 1/25/MJF002
10/16/79 10/17/79 14:23 2 4
31 ITINERARY--NAE PEER GROUP, WASH.D.C. 11/2/MJF002
10/11/79 10/16/79 10:27 1 2
36 ITINERARY NJ, BELL LABS VISIT, MARCH 29&30,79 /MJGB12
3/27/79 3/27/79 12:57 2 1
32 ITINERARY NY, VISIT LEDERLE LABS, MARCH 12&13,1979 /MJGB12
3/8/79 3/8/79 3:23 2 1
51 ITINERARY--PURDUE/WASH. D.C.--12/13/79
11/12/79 11/12/79 7:44 3 2

46 ITINERARY--SOUTHWEST TRIP 11/15 THRU 11/24/MJF002
11/8/79 11/8/79 12:10 5 4

20 JUNGLE ARRANGEMENTS - JANUARY COPLEY PLAZA/OOD/MJGB12
1/9/79 2/19/78 1:34 5 3
26 JUNGLE CONFIRMATION--JULY 18 & 19/KELLY (DARTMOUTH)/MJF001
6/29/79 6/29/79 14:53 6 8
29 JUNGLE ITINERARY INSTRUCTIONS 7/18 & 19/79 MINARY CR.CTR./OOD/MJF001
6/29/79 7/2/79 3:58 10 6
30 JUNGLE MINARY CONFERENCE CENTER 4/25 & 26/79 /MJGB12
3/7/79 4/9/79 0:00 11 10
28 JUNGLE ROUTINE FOR NEW MEMBERS/JH,GS,MK,SF/MJF001
6/29/79 6/29/79 13:32 5 3
50 JUNGLE THANK YOU - MINARY CONFERENCE CENTER/MOONEY/MJGB12
5/4/79 5/4/79 1:35 2 1
39 JUNGLETTE FYI PRESENTATION 7/18/79 AT TW/MJF001
7/17/79 7/17/79 2:13 2 2

9 KO2 + 12-1 RENOVATION--ESTIMATE FOR FOLLOWING WORK/MURPHY/MJGB12
11/29/78 1/26/79 12:27 7 8
12 KO2 + 12-1 RENOVATION--PHASE I&II FURNITURE/EQUIP.LAYOUT/MJGB12
12/13/78 2/19/78 1:37 4 12
17 KO2 CR DETAILED WORK REQUEST /PUFFER,BELL/MJGB12
1/2/79 1/22/79 13:52 8 3
15 KO2 RENOVATION--TIME/WORK SCHEDULE/MITCHELL/MJGB12
1/26/79 2/19/78 1:31 10 4

45 LDP/EMS DIRECTORY
8/8/79 8/8/79 17:03 15 1
30 LENG RESIGNATION ANNOUNCEMENT--EMS/OOD/MJF002
10/11/79 10/18/79 13:51 4 4
35 LOUISE LETTER OF RECOMMENDATION/MJGB12
3/20/79 3/22/79 2:53 3 7
47 LQP CABINET FOR OFFICE ENVIRONMENT/ZIMMER,GRAY,GILMORE/MJGB12
5/4/79 5/4/79 0:53 3 1

8 MESSAGE FORM /MJGB12
11/22/78 NO/DA/TE 1 3
10 MESSAGE FORM/MJF001
5/14/79 7/17/79 1:31 1 6
6 MESSAGE LIST /MJGB12

11/21/78 10/30/79 6:31   163   160
2   MESSAGE LIST/MJF001
5/14/79 10/30/79 5:58 96   155
12   MESSAGE LOG/MJF002
8/13/79 11/30/79 3:11 87   121
7   MESSAGE SPEC /MJGB12
11/22/78 5/14/79 3:31 2   80
3   MESSAGE SPEC/MJF001
5/14/79 8/9/79 16:21 2   41
37   MILL CAFETERIA--SHOWCASE/MJF002
10/22/79 10/22/79 10:37   2   1
25   MILL HISTORY SLIDE SHOW/TURO/MJF001
6/14/79 6/14/79 5:16 3   4
28   MILL HISTORY, USED FOR BROCHURE/MJGB12
2/2/79 2/2/79 12:06 30   2
46   MILL PICTURE REQUEST/TURO/MJF001
8/8/79 8/8/79 14:41 4   1
53   MILL RENOVATION GUIDELINES/FOR OUTSIDE REQUESTS/MJGB12
5/14/79 5/24/79 4:37 15   3
55   MILL RENOVATION GUIDELINES FOR OUTSIDE-TRANSMITTAL LTR/MJGB12
5/14/79 5/14/79 3:33 7   2
49   MILL RENOVATION SLIDE REQUEST/GAMZON/MJGB12
5/4/79 5/9/79 0:37   3   3
26   MIT VISIT OF 4/3/79/ATTENDEES/MJGB12
3/15/79 3/15/79 13:04 4   4
17   MJ FY79 GOALS ACCOMPLISHED/MJF001

47   MUSEUM ANNOUNCEMENT RE JAMIE PARKER/MJF002
11/9/79 11/21/79 2:18 4   8
61   MUSEUM BUDGET FOR JAMIE/MJF002
11/30/79 11/30/79 2:48   9   4
44   MUSEUM BUDGET FY80,81,82/MJF002
10/31/79 11/19/79 9:29   13   17
29   MUSEUM BUDGET/SPENDING TO DATE--10/9/79/MJF0002
10/9/79 11/19/79 10:08   9   21
59   MUSEUM CHARGE NUMBERS/MUSEUM WORKERS/MJF002
11/13/79 11/13/79 4:25   3   2
43   MUSEUM CURATOR JOB DESCRIPTION/MJF002
10/31/79 11/6/79 1:34 5   7
60   MUSEUM--INDUSTRIAL DESIGN BUDGET/MJF002
11/30/79 11/30/79 2:44   5   4
23   MUSEUM MINUTES OF 7/12/79, HELD IN MARLBORO /MJF001
7/13/79 7/20/79 4:11 14   11
45   MUSEUM MISC. INFO

11/7/79 11/7/79 2:25 1 1

48 MUSEUM--NEW CHARGE NUMBERS
11/9/79 11/9/79 1:50 2 1

43 MUSEUM NOTES DURING/AFTER 7/27 MEETING/MJF001
8/1/79 8/1/79 4:30 8 8

20 MUSEUM--PASSES FOR LECTURE SERIES--WILKES 9/24/79/MJF002
9/12/79 9/12/79 5:53 8 2

11 MUSEUM--PICTURES OF PRODUCTS FOR MR LOBBY
8/13/79 8/16/79 0:12 2 2

32 MUSEUM TASK SCHEDULE FORMAT FOR SUMMER OF 79
7/2/79 10/26/79 9:32 2 19

31 MUSEUM TASK SCHEDULE LIST FOR SUMMER OF 79 (RUSS&BRIG)/MJF001
7/2/79 10/26/79 9:33 15 26

33 MUSEUM TASK SCHEDULE SPEC FOR SUMMER OF 79
7/2/79 10/26/79 9:33 1 5

39 MUSEUM THANKS--DICK VENNE, BRIAN HARVEY/MJF002
10/22/79 10/23/79 13:44 6 2

57 MUSEUM WORKERS DISTRIBUTION FORM/MJF002
11/13/79 11/13/79 3:18 1 6

58 MUSEUM WORKERS DISTRIBUTION LIST
11/13/79 11/13/79 3:21 5 6

54 MUSEUM WORKERS FORM/MJF002
11/13/79 11/13/79 2:40 1 2

53 MUSEUM WORKERS LIST/MJF002
11/13/79 11/13/79 2:35 8 12

56 MUSEUM WORKERS RESULT/MJF002
11/13/79 11/13/79 2:40 8 8

55 MUSEUM WORKERS SPEC/MJF002
11/13/79 11/13/79 1:27 1 1

51 NAE LETTER TO REFERENCES FOR ALLEN NEWELL/MJGB12
5/9/79 6/6/79 1:06 3 10

52 NAE NEWELL NOMINATION FORM/MJGB12
5/9/79 5/11/79 1:01 18 4

18 NATIONAL TRUST/HISTORICAL PRESERVATION--SLIDE REQUEST/FIALA/MJF002
8/30/79 8/30/79 1:03 4 3

41 OC MINUTES OF 10/29/79/MJF002
10/25/79 10/25/79 11:39 7 1

17 OFFICE SCHEDULE--MJ VACATION/MJF002
8/30/79 8/30/79 3:15 9 4

34 OOD & DIRECT REPORTS DIST LIST/MJF002
10/17/79 10/17/79 12:49 3 3

```
  12   OOD STAFF LIST/MJF0001
                         6/20/79 6/20/79 0:56  4     2
  42   ORGANIZATION CHART REVIEW MEMO/OOD/MJF001
                         7/31/79 7/31/79 8:27  3     2

  27   PHOTOS FOR THE EXHIBIT/PARKS/MJF001
                         6/26/79 6/27/79 2:13  3     2
  19   PICTUREPHONE HOUSE ORGAN MESSAGE/COSTEL/MJF002
                         8/30/79 8/31/79 1:19  2     2
  24   PROBLEM LIST (GORDON) ARRANGED BY # CODE/MJGB12
                         1/18/79 6/5/79 1:35   15    5
  23   PROBLEM LIST, TALK FORM/MJGB12
                         1/16/79 7/24/79 1:35  1     6
  22   PROBLEM MASTER LIST/TALK SCHED BY LETTER CODE/MJGB12
                         1/16/79 7/24/79 2:04  14    43

  19   RECYCLE--CANS + MONEY GIVEAWAY/KRUEGER/MJGB12
                         1/3/79  2/19/78 1:34  2     2
  3    RECYCLE PROGRAM STATUS 11/20/78/PUFFER, KRUEGER /MJGB12
                         11/20/78 1/29/79 0:03 10    9
  18   REQUEST-DISTRIBUTED PROCESSING/SETHI/MJF0001
                         6/5/79  6/5/79 0:08   4     6
  5    RESULT/MJF002
                         8/10/79 11/30/79 3:13 2     134
  11   RESULTS/MJF001
                         5/14/79 8/9/79 16:21  2     82

  40   SECRETARIAL VIEWS--10/79
                         10/24/79 11/2/79 0:39 11    14
  24   SECRETARIAL VIEWS/CHORNEY,CYBULSKI/MJF001
                         6/13/79 6/13/79 16:16 2     4
  33   SONY VISIT (MEMO PLUS LETTER)/ATTENDEES + SCHULOFF/MJGB12
                         3/15/79 3/23/79 14:32 8     10
  21   STRATEGY PRESENTATIONS LOG--DATES/GROUPS/ATTENDEES--MJGB12
                         2/12/79 2/22/79 9:48 5      3
  16   STRATTON TRAVEL ARRANGEMENTS/BJ,DEMMER,PEARSON,DUBE/MJF001
                         5/22/79 5/22/79 3:31  4     4
  6    SUBLIST/MJF002
                         9/11/79 9/11/79 1:38  1     1
  40   SUBSCRIPTION LIST/MJF001
                         7/20/79 10/26/79 9:42 8     66

  38   TELEPHONE DIR. FOR OC & DIRECT REPORTS
(BLUE)UPDATE/SOLLENNE/MJF001
                         7/16/79 7/16/79 6:32  4     3
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```
  36   TEMP
                          7/9/79  7/16/79 6:34  2    3
  21   TEMP--LOG FORM/CHECK OUT OF STRATEGY TAPES/MJF001
                          6/6/79  6/6/79 3:05   17   4
  22   TERADYNE MEETING - CONFIRMATION/MJF001
                          6/12/79 7/11/79 12:03 3    6

  2    VISITS TO BE SCHEDULED FILE/MJGB12
                          4/11/79 7/24/79 2:08  15   38
  27   VITA-ARCHITECTURAL ACTIVITIES OF GORDON BELL/MJGB12
                          2/1/79  5/24/79 4:28  7    9

  22   WILKES AGENDA FOR 9/22,23,&24/MJF002
                          9/18/79 9/20/79 1:00  7    12
  24   WILKES--INTERVIEW SCHEDULE FOR 9/24
                          9/19/79 9/19/79 6:09  3    2
  23   WILKES--LECTURE/RECEPTION/DINNER
SCHEDULE,9/24/ATTENDEES/MJF002
                          9/19/79 NO/DA/TE      5    5
  25   WILKES SCHEDULE FOR THE WILKES-9/22/23/24/MJF002
                          9/20/79 9/21/79 2:23  5    3
  16   WILKES--TWX RE POSSIBLE SCHEDULE/MJF002
                          8/28/79 9/21/79 1:25  2    5
  34   WPS TO EMS TEST
                          7/5/79  7/5/79 12:28  5    1
  35   WPS TO EMS TRANSMISSION FILE/MJF001
                          7/6/79  7/6/79 17:43  1    3
  42   WPS/EMS WISH LIST/TRAVIS/MJGB12
                          4/12/79 4/23/79 7:09  4    3
  49   WPS USER SUPPORT--EMS/GIGER/MJF002
                          11/9/79 11/9/79 3:58  6    3


<n>BELL OFFICE CONFERENCE TABLE ORDERING INFO/GB1.S8.63
                          3/20/80 3/20/80 9:04  2    2     <>

<n>BURROUGHS--OLD OFFICE INFO NEEDED/GB1.S8.52
                          3/3/80  3/5/80 11:01  3    4     <>

<n>CHRISTMAS CARD/GB1.S8.8
                          12/21/79 3/12/80 12:41    1        7
       <>

<n>DEC-10 INSTRUCTIONS GB AREA/GB1.S8.47
                          2/19/80 2/19/80 15:32 2    1     <>
```

<n>DESK DRAWER DIRECTOR--MJ/GB1.S8.58
3/13/80 4/24/80 13:13 9 4 <>

<n>DICTAPHONE CORPORATION/GB1.S8.16
12/28/79 1/16/80 12:56 3 8
<>

<n>DIGITAL PRESS BOOK REVIEW--INTRODUCTION TO OA/GB1.S9.71
9/29/80 9/30/80 12:57 18 13 <>

<n>DOC HANLDER/GB1.S8.11
12/26/79 12/26/79 13:18 4 1
<>

<n>EMS ARCHIVING--WHAT I WOULD LIKE/GB1.S9.37
7/14/80 10/1/80 14:45 5 4 <>

<n>EMS COOKBOOK - GB & MJ/GB1.S8.54
3/6/80 10/24/80 9:04 7 13 <>

<n>EMS COOKBOOK - LABELS ONLY FOR PRINTING/GB1.S8.55
3/7/80 10/24/80 9:04 11 4 <>

<n>EMS COOKBOOK--HOW TO USE GUIDELINES/GB1.S8.51
2/29/80 10/24/80 14:57 33 29
<>

<n>EMS ENGINEERING SUBSCRIBERS - BUDDY SYSTEM/GB1.S9.32
6/18/80 9/16/80 13:56 9 16 <>

<n>EMS TIME TEST (GB+MJ)/GB1.S9.19
5/20/80 5/20/80 15:23 2 1 <>

<n>EMS--GROUPS ON INSTEAD OF INDIVIDUAL USER/GB1.S8.50
2/27/80 10/24/80 14:56 6 7
<>

<n>EMS/OFFICE AUTOMATION--COMING TO GRIPS /GB1.S8.37
2/7/80 3/24/80 14:44 7 10 <>

<n>EMS/OFFICE PROCEDURE RE MAILBOX.33
1/24/80 2/12/80 13:35 3 3 <>

<n>ENGINET INSTRUCTIONS FOR MAIL/GB1.S9.65

9/8/80 10/1/80 15:06 23 7 <>

<n>FIRST REVENUE SHIP CHANGES--COPY /GB1.S8.25
1/10/80 1/14/80 11:16 13 6 <>

<n>FIRST REVENUE SHIP CHANGES--original/GB1.8.24
1/10/80 2/6/80 10:26 34 53 <>

<n>FOLLOWUP FORM/GB1.S9.12
5/5/80 10/1/80 14:25 2 7 <>

<n>HISTORICAL TECHNOLOGY ORDER FOR 12/79 /GB1.S8.7
12/20/79 9/2/80 13:50 5 10 <>

<n>IDECUS DEMO TEAM SET UP/GB1.S9.73
9/30/80 10/29/80 15:54 4 7
<>

<n>INDEX--WORKING FILES/GB1.S8.20
12/31/79 3/10/81 2:19 4 3 <>

<n>INTEL/DEC ATTENDEES 7/22/80 /ATTENDEES/GB1.S9.45
7/22/80 7/22/80 11:39 2 5 <>

<n>ITINERARY - 3/3-4/80 - WASH. D.C. (GB&GKB)/GB1.S8.34
2/7/80 2/25/80 14:10 2 2 <>

<n>ITINERARY - COLORADO JUNGLE (1/21-1/25/79)/GB1.S8.5
12/12/79 7/28/80 13:41 4 6
<>

<n>ITINERARY - EUROPE NOV.21 THRU 12/6/80 /GB1.S9.58
9/12/80 2/10/81 14:34 12 22 <>

<n>ITINERARY - GORDON/GWEN - CALIF--6/19-25/GB1.S9.31
6/18/80 7/30/80 16:46 6 10 <>

<n>ITINERARY - SYRACUSE UNIVERSITY APRIL 9, 1980/GB.S9.3
4/7/80 11/26/80 9:35 2 7 <>

<n>ITINERARY - WASH. DC, 12/10/80 FOR NAE ELECTION/GB1.S9.50
12/8/80 12/8/80 9:09 1 1 <>

<n>ITINERARY - WASH.DC, GORDON/GWEN, 6/3-5/80 /GB1.S9.17
5/20/80 6/2/80 8:30 3 4 <>

<n>ITINERARY--CLEVELAND (CASE WESTERN)/GB1.S8.62
3/18/80 3/20/80 9:55 3 2 <>

<n>ITINERARY--PHOENIX, MOTOROLA 3/31/80/GB1.S8.64
3/28/80 3/28/80 15:15 2 1 <>

<n>JUNGLETTE/EMS/OOD SECS/GB1.S8.22
1/8/80 1/11/80 9:25 9 3 <>

<n>KEYS TO ENGINEERING COMPOUND (ASSIGNMENT)/GB1.S8.61
3/17/80 3/17/80 11:39 3 1 <>

<n>LIBRARY--CIRC."THE SECRETARY"/CANE/GB1.S9.49
12/1/80 12/1/80 16:56 4 3 <>

<n>MEETING PROCESS--SECRETARIES PART/GB1.S9.35
6/25/80 11/5/80 14:45 6 5 <>

<n>MESSAGE FORM/GB1.S8.4
12/12/79 7/28/80 13:41 1 5
<>

<n>MESSAGE LOG/GB1.S8.2
12/12/79 9/2/80 14:24 111 202 <>

<n>MESSAGE SPEC/GB1.S8.3
12/12/79 4/3/80 14:29 1 69 <>

<n>MICROFILM FILE INDEX FROM CIRCA '59 - TO 12/31/79/GB1.S9.2
3/21/80 12/11/80 12:16 4 20
<>

<n>MJ # OF WORKING PILES/GB1.S9.25
6/12/80 10/1/80 14:31 3 6 <>

<n>MUSEUM BUDGET -LABOR CHARGES/GB1.S9.27
6/12/80 10/1/80 14:39 8 2 <>

<n>MUSEUM BUDGET FY81--YEAR-TO-DATE ACCRUAL SHEET/GB1.S9.41
7/17/80 7/24/80 17:31 5 7 <>

<n>MUSEUM BUDGET REQUEST/GB1.S8.48
2/21/80 2/21/80 9:29 2 2 <>

<n>MUSEUM CAP BUDGET PREDICTION/GB1.S9.40
7/17/80 7/18/80 11:07 3 3 <>

<n>MUSEUM CURATOR JOB DESCRIPTION/SALARY RANGES/GB1.S9.43
7/17/80 7/17/80 14:43 1 1 <>

<n>MUSEUM DIRECTORY--HOW CAN WE ZIP IT UP/GB1.S8.44
2/15/80 2/15/80 13:05 5 4 <>

<n>MUSEUM INVOICE FORM/GB1.S9.46
7/24/80 10/1/80 14:51 3 5 <>

<n>MUSEUM JOB DESCRIPTION INQUIRIES--AAM/GB1.S9.38
7/14/80 7/14/80 15:14 3 3 <>

<n>MUSEUM OFFICE BLURB/GB1.S8.59
3/13/80 5/15/80 12:16 12 20 <>

<n>MUSEUM OVERRUN--WHERE IS IT/BERTRAND GWEN/GB1.S9.42
7/17/80 10/1/80 14:48 4 4 <>

<n>MUSEUM--LEGAL--GOING INTO A NEW LEAGUE/GB1.S8.45
2/15/80 2/15/80 4:58 3 3 <>

<n>NAE 18TH ELECTION STATUS FORM/GB1.S9.22
5/23/80 10/1/80 14:30 2 13 <>

<n>NAE 18TH ELECTION TABULATION FORMS/GB1.S9.5
10/22/80 10/27/80 14:07 25 8
<>

<n>NAE FORM LETTER OF TRANSMITTAL/GB1.S9.16
5/19/80 10/1/80 14:29 2 18 <>

<n>NAE SPEC/GB1.S9.23
5/23/80 9/10/80 13:32 1 9 <>

<n>NAE TABULATION/RANKING/GB1.S9.24
10/27/80 10/29/80 11:01 13 13
<>

<n>OC WOODS AGENDA FOR 1/15 & 1/16/80/GB1.S8.27
1/12/80 1/12/80 11:26 6 3 <>

<n>OCE - FORM FOR HOW MY DAY IS SPENT/GB1.S8.23

1/9/80 1/14/80 11:16 6 7 <>

<n>OCE - TIME CHARTS/GB1.S8.29
1/17/80 1/23/80 13:56 3 5 <>

<n>OFFICE FURNITURE, A&SG, TRIP REPORT/GB1.S9.20
7/3/80 7/3/80 14:12 8 3 <>

<n>OFFICE OF THE FUTURE SEMINAR RESULTS/GB1.S8.12
12/26/79 12/26/79 4:14 4 5
<>

<n>OFIS - DIRECTORY OF WHO IS DOING WHAT AT DEC/GB1.S8.65
3/31/80 4/2/80 11:20 1 2 <>

<n>ORG CHART TEST FOR CLARITY/GB1.S8.15
12/27/79 12/28/79 11:21 10 13
<>

<n>PROPERTY PASS - INDEFINITE / BILL DUGGEN /GB1.S9.36
11/24/80 11/24/80 11:24 2 1
<>

<n>PURCHASING--MJ CAN SIGN FOR 69F PO'S TO 250/GB1.S8.32
1/22/80 1/22/80 13:52 2 1 <>

<n>RETRIEVAL*, MUST BE AUTOMATIC/TRAVIS,MAYER/GB1.S9.11
10/7/80 11/13/80 12:25 9 11
<>

<n>SANDIA--WHO CAME 3/12/80/GB1.S8.57
3/12/80 4/2/80 11:15 3 6 <>

<n>SEC VIEWS - 1980 ARTICLE FOR MARCH,1980/GB1.S8.53
3/5/80 1/30/81 15:02 8 10 <>

<n>SECURITY--GORDON BELL'S PERSONAL PROPERTY/GB1.S9.15
10/8/80 10/17/80 14:18 4 3
<>

<n>STRATEGY MEETING MISSED THE MARK--3/13/80/GB1.S8.60
3/14/80 3/14/80 9:06 5 1 <>

<n>TAG PROGRAM INPUTS/ANN JENKINS/GB1.S9.48
7/28/80 10/1/80 14:51 6 3 <>

<n>TAG PROGRAM MEETING/GB1.S9.63
9/4/80 10/1/80 14:56 2 4 <>

<n>TAG, DIARY OF A TAG/GB1.S9.39
7/16/80 7/16/80 8:54 4 2 <>

<n>TELEPHONE BOOK COVER FOR G BELL/GB1.S8.56
3/11/80 1/12/81 15:48 13 15 <>

<n>DINNER: WILKES PICNIC INVITATION/GB1.S9.62
9/3/80 9/3/80 8:50 1 2 <>

<n>WPS HARDWARE/SOFTWARE REVIEW/TRAVIS/GB1.S8.30
1/17/80 1/24/80 11:53 2 5 <>

<n>WPS OFFICE HOUSEKEEPING GUIDE--BELL'S OFFICE/GB1.S9.4
6/20/80 10/23/80 9:34 7 16 <>

<n>WPS TEST SITE--FEEDBACK ON PRELIMINARY MANUALS/GB1.S9.56
8/18/80 8/18/80 9:14 2 1 <>

<n>WPS/EMS + OTHER IDEAS/GB1.S8.31
1/21/80 1/22/80 16:04 2 3 <>

<n>WPS/EMS--FEATURES NEEDED IN TANDEM/GB1.S8.28
1/15/80 1/15/80 13:46 5 3 <>

<n>WPS200 OR AN ALTERNATIVE--YOU ASKED FOR IT/BUZZ/GB1.S9.29
6/13/80 3/5/81 9:57 13 11 <>

<n>WPS200 SYS MGR COURSE CRITIQUE/ADDITIONS/ JOHNSTON/GB1.29.30
6/18/80 3/5/81 9:44 18 11 <>

<n>WPS200--1 YEAR LATER/GB/GB1.S9.57
12/16/80 3/5/81 9:51 14 26 <>

<n>XMAS CARD G BELL /GB1.S9.66
12/24/80 12/24/80 9:14 2 4
<>

<n>XMAS CARD TO OOD SECS/GB1.S9.68
12/24/80 12/24/80 10:26 2 1
<>

<n>XMAS THANKS/GB1.S8.10
1/7/80 1/12/80 10:09 17 4 <>
MKT

Gordon Bell
ML12-1/A51

Win Hindle
ML5-2/A53

Ted Johnson
PK3-2/A55

Andy Knowles
MR2-2/A52

Stan Olsen
MK

Bill Thompson
ML12-1/F41
Place: PK3 - Auditorium
8:15A to 5:00PM

AGENDA 18 MARCH OC WOODS

	Who Min.
8:15A	
Engineering budget process	Smith :15
Engineering strategy update, development overview critical problem list and resolution responsibility	Bell :30
Ethernet, communication and clusters	Lacroute :45
High end VAXes problem	WD/UF :45
More VLSI is needed in our products	Kalb

:30

CAD status overview*	Bell	:15
.VLSI	Goldfein	:30
.Physical cad: development	Straka	:15
.status of all process in MR] **	UF-Rezac	:15
.status of all processes in TW] **	Demmer-Kuzik	:15
Processes and Services Review	Smith	:15
.PTD (include QTA status)	Thompson	1:00
.TOPS 10 min overview, and 7 projects/areas	Holman	:45

*I'd (GB) like to present this <u>tutorial</u> (to learn/relearn it)/<u>taxonomy</u>. I want to <u>segment</u> the pieces and show how much is being spent in each area. Bob Kusik did this work several years ago, but it needs update.

<u>Approximate time table</u>

8:15 - 8:30	Smith	12:30 - 1:30	Lunch break
8:30 - 9:00	GB	1:30 - 1:45	Smith
9:00 - 9:45	Bernie	1:45 - 2:45	Thompson
9:45 - 10:30	Demmer	2:45 - 3:30	Holman
10:30 - 11:00	Kalb		
11:00 - 11:15	GB		
11:15 - 11:45	Goldfein		
11:45 - 12:00	Straka		
12:00 - 12:15	Rezac		
12:15 - 12:30	Kusik		

GB9.4

Even though we've changed the nature of the company to a startup versus a turnaround company, the operational principles we discussed, but never formalized should remain.

Let me propose the first two:

1. "He who proposes, does"-- This was originated about 12 years ago by me and is used by several organizations.
2. Formal approval of plans, combined with a board (and company) who feels equally commited to and responsible for the plan.

GETTING THE PLANS

The first principle seems to be going well:

1. George's Sales/Train/Install/Service Division (we need a good name for it other than distribution) plan is going well.
2. Hydra has made a plan for delivering a high performance computer, and is clearly committed to it.

In addition, we have a number of activities aimed at getting "someone" to propose plans:

1. A product group, run by some external folks, aimed at acquiring and providing distributed system products. All the activities aimed at acquiring products will ultimately require an internal advocate to make sure that the products will work and work together.
2. Ed Fredkin's Personal Computer Products group, including accessories, servers, programs and PCs.
3. Vertical applications acquisitions group (eg. CAD). This can go very fast once we have a basic, set of distributed products.

We clearly need people who are going to propose and then implement these products for George's group.

APPROVAL OF PLANS

Hydra came forward with a product plan. I believe the product can be built along the lines (within a factor of 2) they've proposed because there are existence proofs. In constructing a most detailed agreement with the group, it must be clear that several of us believe their detailed plan can be implemented on time and within the budget.

Who's cosigning their plan in terms of specs, time and budget?

What you folks think about these principles?
        GB9.4
Subject: Momentum Discussion to kgf, pg

Ed Marinaro discussed whether we might be interested in acquiring them. Someone else is coming after them and he thinks we'd be a better fit. In the next 10 days they'll have an offer and not much time to act.

They have 100 protos in test at various places. Their value is in having a high speed workstation for business (I don't think this is a market, UNLESS it's PC compatible!). He also thinks we might use it in the technical market against Apollo (more powerful than D300) and Masscomp. He's discouraged that the VC's aren't hot on box companies now.

They've just spent a bundle (got $6M on last round) to get a manufactruing line of 90 Ksq ft. and allow them to build 1 unit every 24 minutes... they can do 400/month now at 3.5 K and with work get this down to under 2K.

They are shipping 500K in December of their old product and would ship new product in December or January. Their valuation is approximately $10-12 M.

He's coming this way and we could rendevous, but he'd really like to get us out there to look at it. (We also need to meet some of the designers and other principals.)

What I say?
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+---------------------------+
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Subject: **Monthly or Quarterly Reports and Lack Thereof**

To: OOD

Date: 1/16/79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-
2236

I'd like to discuss this at the Jungle meeting briefly.
PLEASE BRING COPIES OF YOUR OWN, DICK'S AND LARRY'S.

Both Dick and Larry seem to be doing it right in that there is enough there plus there seems to be MBO (is this in these days?) because there's a direction of what's to be done next month. Why can't they all be this good? What should others look like?

John Meyer, I simply don't think we have any visibility of the issues of turnover. Here we need names, numbers and insight on a continuing basis.

There's also been murmurings that the Yellow Book isn't the schedule bible...and this, coupled with the declining quality and existence of the business plans, worries me.

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Dick Clayton	ML12-2/E71	Jim Cudmore	ML1-5/E30
Bill Demmer	TW/D19	Ulf Fagerquist	MR1-2/E78
Bill Johnson	ML21-3/E87	John Kevill	ML3-6/E94
John Meyer	ML12-1/A11	Larry Portner	ML12-3/A62
Bob Puffer	ML12-2/E38		

June 11, 1984

Ms. Jacqueline Morby
TA Associates
Milk Street
Boston, Massachusetts

Dear Ms. Morby:

Last week I gave you recommendations for several fine, former DEC people in regard to a potential investment of $25M for 2/3 ownership of their company. Let me suggest Encore as a far better investment. For $25M you can own roughly 1/3. Encore's output will be about 5-10 times of what should be a good, single product company because we already have four wholly owned companies and are on our way to becoming a major computer company. Thus, Encore would give a relatively better return on investment of

2.5 - 3.5 or (5 - 10) x 1/3 / 2/3.

Also, the risk is much lower, because like you, we own multiple companies -- but we are NOT a venture capital company.

Encore "central" consists of a seasoned managment team and is responsible, through boards for wholly owned focused, yet loosely connected product companies. Encore owns a single sales and field finance company plus four product companies, with two more in the formative stage. As you may recall, Encore "central" is composed of major industry leaders with experience at Data General, DEC, GE, Honeywell, and Prime (our backgrounds, with the exception of Julius Marcus, are described in the January PPM). I don't think you'll find a comparable group at any company today outside of IBM!

Encore provides financing and wisdom in the form of an overall Product Strategy combined with tactical assistance based on much experience. We also help recruit the key management of a company. Technical help is most important and ranges from tactical review of a software module (with advice) to the entire development process. For example, we help in relationships with suppliers; eg. we were instrumental in the decision by TI to second source the National 32000 microprocessor. We helped with a difficult decision on the manufacture of a printed circuit board in just two days. (In contrast, I predict that one recent startup will be forever impeded because of a poor decision in this area.) Perhaps most important, Encore obtained a multi-100 million dollar contract for the major product distribution -- this would have been outside the reach of nearly every startup.

The final reasons to invest in Encore are its Product Strategy which guides the entrepreurial energy driven companies and their products. I was responsible, in various capacities including the period as a professor on leave from DEC, for DEC's overall products since 1960 and responsible at a detailed level for many products from the first timesharing computer and the first mini. In 1975 I led the VAX team and established the organization. As the leader of DEC's 6000 person engineering group for the last 10 years till July 1983, I have never been more enthusiastic about a <u>set</u> of products as those in the Encore companies.

Every Encore company is first rate. Each product is a leader because of increased functionality, greater performance and lower cost. Yet each can be used together in a completely compatible and synergistic fashion. Each product is innovative and competitive now (by a wide margin), but also can be evolved to the next generation and into the 90's. Although the Encore Product Strategy and current products can be described simply in a few pages, I think its better that we discuss this directly if you are genuinely interested in investing in Encore.

We have been described in various ways including being a venture capital company. But from the above description you can see that even though we borrow some of your ideas, we aren't at all because:

.our companies are wholly owned (though they needn't or won't likely be in the future); We watch 100% of one company in an industry rather than sharing in the risk of one or more companies.

. Encore "central" supplies a very tightly connected though fault tolerant product strategy, thus while a company can fail, the strategy ties them together for maximum impact assuming each will succeed;

. the entreprenurial energy driven Encore product companies develop and produce products and get rewarded in Encore equity and product royalties;

. there are two types of companies (product and distribution) for maximum management focus and economy of scale in distribution; and

.we are all full-time computer people, building a major new full-range, computer company yet founded on the principle of maximum autonomy, responsiblity and reward to independent, operational companies.

Enclosed is an essay on the computer industry which we use in our thinking and planning. It may be of interest to you.

Since the January PPM, which sketched an elegant and innovative but potentially theoretical organization and its set of products, Encore and its companies have formed and are producing at a level beyond my own expectations (my vitae is attached for your calibration). Thus, I can now highly recommend Encore. I believe you should consider us for a major investment.

Sincerely,

Gordon Bell
Chief Technical Officer

CC: Ken Fisher

Enclosure

Put printer at top of form and type <CR>
WPS USERS - Enter HP mode and then type <CR>
****
* d i g i t a l *
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TO: see "TO" DISTRIBUTION   DATE: THU 4 JUN 1981 9:18 EST

FROM: GORDON BELL
cc: see "CC" DISTRIBUTION   DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: SELLING TINY CHIPS WITH MOSTEK AS LICENSEE

PROPOSAL: Digital aggressively sell Tiny 11 as chips and that we license MOSTEK as an alternative

Introducing Tiny, as a chip, would give us these advantages:

. Get a new class of customer, with us as a viable supplier with a second source, including:

- Board level controllers such as comm., analog front end, speech, etc., used with other Industry-standard busses

(e.g., S100, Multibus) and other organization busses
- Controllers for small system, high volume applications
(e.g., engines, process controllers, and peripherals)
- Low end personal computers that we are not building, thus
allowing new low end software to be written on 11's (Note,
while RT-11 will operate on Tiny, our big ticket machines
require at least 128kw to operate.)

. MOSTEK will go after these new, high volume customers. Tiny
customers would have bought another microprocessor.

. Gets new customers on 11's earlier to feed our higher end

. Keeps old customers on 11's

. Prevents further erosion of market share that will be caused
by both old and new customers going to high end micros

. Really hypes the 11 and insures its success into the 80's

. Gets a new, low end development via MOSTEK, including
peripherals, and continued, one chip computers. They will
also push the hell out of performance. Our semiconductor
development is aimed mostly at our board and high end
business (e.g., Jaws).

The market is segmented, roughly according to address size and we
are nowhere near the low end of it. Microcomputers are analogous
to engines, and use is diverse (eg. lawnmowers ... jets).

BITS   CHIP STANDARDS   USES

<16	4004,8048	few chip controllers, appliances
16	Z80,8080,6800,6502,T	periph controllers, personal comps.
16+16	Tiny, 6502 (kludged)	same (Apple III)
20	8086	large micro applications, pc's
22	Fonz, Jaws, Intel 286	mini replacement chip
24	Z8000	time shared computers using UNIX, large, personal computer
32	VAX, 68000, 68000+	large computer
>32	Intel 432	"Micro mainframe"

There might be potential "fringing" of our microcomputer and systems business, but this will be small, due to the address size limit. On balance, we should get at least a factor of 10 more business than we will lose to suppliers who compete with us by supplying systems made with these components. If we can not compete with them, we would have lost the business to them anyway as they bought our processor boards!

We want the world computing on our computers, not Motorola (becoming the standard), Intel and Zilog!

"TO" DISTRIBUTION:

WARD MACKENZIE JACK MACKEEN OPERATIONS COMMITTEE:

"CC" DISTRIBUTION:

JIM CUDMORE	LLOYD FUGATE	MIKE GUTMAN
DAN HAMEL	IRWIN JACOBS	ART
MASSICOTT		
ROY MOFFA	STEVE TEICHER	

WPS USERS - Leave HP mode and type <CR>

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* d i g i t a l *
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TO: see "TO" DISTRIBUTION                  DATE: THU 4 JUN 1981
9:18 EST
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                                           EXT:  223-2236
                                           LOC/MAIL STOP: ML12-
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"TO" DISTRIBUTION:

WARD MACKENZIE JACK MACKEEN OPERATIONS COMMITTEE:

"CC" DISTRIBUTION:

JIM CUDMORE LLOYD FUGATE MIKE GUTMAN
DAN HAMEL IRWIN JACOBS ART MASSICOTT
ROY MOFFA STEVE TEICHER

GB2.S6.72

June 8, 1981

Vincent Prothro, President
Mostek Corp.
1215 West Crosby
Carrollton, TX 75006

Dear Vin:

Please accept my warmest thanks for the hospitality you extended to us last week when we visited MOSTEK in Dallas and Colorado Springs. It was a great pleasure to see the openness, respect and intense interaction between the two groups of engineers. I know Henry Lemaire would have been proud of this, as one of the key founders of the relationship. You, too are clearly responsible.

We are all following-up on the various action items outlined on Tuesday. Having seen the tremendous investment required to manufacture semiconductors, I hope that we can utilize your factories in the co-operative fashion we are pursuing. I'm also excited about the possibility of licensing our microprocessor and working jointly with MOSTEK on future development in this area. A proposal has been submitted, but I don't yet have a feeling about how it will be regarded by others. Even if we won't license our microprocessor to you, let me urge you to not develop and market your Rainbow processor and to search for an alternative strategy to participate in this market. A unique architecture will take much effort to be useful and will not be used in any significant quantities due to the high support cost. The net result will be a drain of resources to both seller and buyers.

As the Keeper of the Digital Computer Museum, I look forward to receiving the important memory and calculator artifacts, for the museum. A series of three lectures, open to the public and videotaped, presenting MOSTEK's pioneering efforts in the ion implanting process, semiconductor memories and one-chip calculators, would be really great. I'll send a proposal soon on the logistics of such a museum series.

Again, thank you and your staff for the fine hospitality, I look forward to implementing last Tuesday's agreement. It will be a pleasure to have you visit Maynard and to meet other Digital officers.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:mal
GB2.S6.28

CC: Barry Cash, MOSTEK
Jim Cudmore
Dan Hamel
Roy Moffa
Steve Teicher
Bob Palmer, MOSTEK
Mitch Federman
Jack MacKeen
Ken Olsen

February 3, 1982

Mike Dertouzos
Paul Penfield
Massachusetts Institute of Technology
Electrical Engineering & Computer Science
Director, Laboratory for Computer Science
Cambridge, MA 02139

Dear Mike and Paul;

I'd like to thank you and Paul for making the Moto-oka visit possible. Also, I was delighted that you could come to the reception and dinner. I learned a great deal more about the effort and the program, which I would more aptly describe as a process, by interacting with him. I'm extremely impressed by his breadth, basic intelligence and ability to run such a process.

Since you (MD) are speaking at the CDC soiree' later this month, it might be a good time to interact on how to deal with this very clear threat. My view is that they are going to be successful!

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:mal
GB3.S2.7
00 BURT DECGRAM ACCEPTED S 22089 O 403 16-JAN-82
13:47:54
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* d i g i t a l *
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TO: ENGRG. USERS: DATE: SAT 16 JAN 1982
1:42 PM EST
GVPC: FROM: GORDON BELL

cc: DEL THORNDIKE @HPLT
    KEN OLSEN

DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: PROF. MOTO-OKA PRESENTS 5TH GENERATION COMPUTER PROJECT

4 P.M., JANUARY 28

AT MARLBORO CAFETERIA, FOLLOWED BY RECEPTION AT COMPUTER MUSEUM

PLEASE POST OR FORWARD VIA THE ENGINEERING NET

The Technical Seminar Series, normally held in Hudson, has arranged for Professor Moto-oka to come to Digital and present the goals and workplan for the FIFTH GENERATION COMPUTER PROGRAM sponsored by the Japanese Ministry of International Trade and Industry (MITI). The program is targeted at moving Japan's computer industry into the leadership position by 1990.

The workplan was developed via an extensive process encompassing members of the Japanese government, industry and universities. It is most impressive in scope (VLSI, innovative computers, and applications) and should produce many results toward the target.

Dr. Moto-oka is professor of EE and CS at University of Tokyo and received his degrees there in 1952 and 1957. His prior research included high speed circuitry, logic design automation and memory systems. He is currently working on new computer architecture, artificial intelligence and Japanese natural language processing.

I would like to urge that at least one person attend from every
development project or group. Since non-DEC persons have also
been invited, we believe there will be many in attendance. Please
RSVP only if attending, via EMS or Interoffice Mail.

GB3.S2.57
February 3, 1982

Professor Tohru Moto-oka
Department of Electrical Engineering
University of Tokyo
Tokyo, JAPAN

Dear Professor Moto-oka;

It was indeed an honor to have you present the Fifth Generation Research Program to us at Digital Equipment Corporation last Thursday. We were all stimulated by the presentation.

I have reviewed your report and find it very exciting. Please accept my congratulations on organizing this effort.

Dr. Kobayshi of our Japan Engineering Center, will visit you and see how we might participate in your effort. Since we have an active program of co-operative university research, I'd like to understand if such a co-operation is possible at Tokyo University. At the very minimum, I hope you might use Digital's computers in your research.

Again, thank you. I hope to see you in Japan in the near future.

Most sincerely,

Gordon Bell
Vice President of Engineering, Digital Equipment Corporation
Professor, on leave, Carnegie-Mellon University

CC:
Sam Fuller
Tom Kobayshi
Grant Saviers
Del Thorndike

GB3.S2.6

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Subject: What's the story on MRP on VAX?

To: Bob Grimes, ML1-5/B90

Date: 2/5/79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

Follow up 3/16/79

You were in the process of finding out whether this was feasible. Any results yet?

What are the plans to move to an internal use strategy that parallels our development?

GB:ljp

Dott. Marisa Bellisario September 10, 1984

Chief Executive Officer

Italtel Corporation, S.p.A.

20154 MILANO

Via A. di Tocqueville, 13

Italy

Dear Mrs. Bellisario:

I enjoyed the brainstorming session with you and your colleagues. I hope it was of value to Italtel. It was great to see such an alert organization with a strong feeling and commitment to building state of the art switching equipment. I regret that time didn't permit my learning more about your company and products, expecially the new switch. I hope you'll send me more information on the company and products.

Enclosed are several brochures on The Computer Museum. The Museum is international and cross-industry, being dedicated to the preservation of artifacts and the understanding of Information Processsing. The Museum moved to downtown Boston about one year ago, and will officially open to the public, November 14. If you're in the U. S. at the time, I hope you'll consider coming to the opening.

I would like to invite you and Italtel to become Members of the Museum. The Corporate Membership schedule is attached, and I hope Italtel can join at the $1024 / year level. In addition, the Museum would like to have various artifacts that have been pivotal in information processing. For example, Ugo just contributed the Macrodata/Olivetti computer that he believes was the first 32-bit, mini.

I hope you'll consider visiting Boston on a forthcoming trip. I would like to introduce you to The Museum, and also **discuss Encore's forthcoming products, which I believe could be very important components for switching and "added-value" services.**

Ken Fisher sends his regards.

Sincerely,

Gordon Bell
Chief Technical Officer,
Professor, on leave, Carnegie-Mellon University

CC: Ken Fisher
****
* d i g i t a l *
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TO: see "TO" DISTRIBUTION DATE: SUN 6 JUL 1980
5:44 PM EDT
FROM: GORDON BELL
cc: SAM FULLER DEPT: OOD
SI LYLE EXT: 223-2236
LARRY PORTNER LOC/MAIL STOP: ML12-
1/A51

SUBJECT: MSD DIRECTIONS

We had better talk. I am feeling exceedingly bad about what you are doing in MSD:
1.Nebula Jr./ given no one wants Nebula. What does it really get from a customer perspective besides a Bus to nowhere?
2.Too many little projects and no real direction. I don't think we need to spend the kind of money there for simple follow ons (or what should be) like 24, 44, Nebula.
3.BI is driving me crazy as it is a bus looking for a rider.
4.NI isn't aggressive enough and we should be using it on Hg instead of the expensive CI.
5.Want to declare future 11 direction: 23J, 24J, and put a second computer in HSC using J to get a hot 11 follow on. CX will do this. This takes very little developement.
6.Want to get lots of Nebulae as is out, so we can get on with
the software. You figure out how we get 100 with NI on them by something like January.
This is a critical problem, given that we have proceeded to

sell them to a number of universities and to our internal users
too. Now, all signs are who me? did I do that? what are we going to do?
7.Next MSD VAX is Comet follow on, and Scorpio.

8. Get DECnet to do the Hg front end on NI and get it into the IC
strategy. Stop the incrementalism that should have been done years ago to get better comm. outboarded on VAX. Let's go get NI, like we believed it is really going to happen instead of making it an advanced development effort with all kinds of alternatives.
9. Get SS a Qbus version so as to avoid the homebrew that wil emerge.
10. The Interconnect doesn't acknowledge Intel as the bus driver.
II should be it. They have a BI already in their 432 that we might use. I still suffer from the problem of why does anyone
want a BI (ie. Would you please refer to my memo on systems that are timelined out to 1990 and tell me which ones will use
it?).
11. The Interconnect doesn't acknowledge Venus or the 2080 and
solve their problems. We should not be putting the SBI on Venus,
and we should use Hg on NI as the front end to both Hydra, VMS
and the 2080 aper the Hydra agreement. Now let's get the work re-directed to goals and not have all the alternative outs
that will be used because we did all the back-ups instead of doing it right.

Somehow, your planning there is failing, given the stuff that is in process. We need a way for you to turn money back or change charters (eg. voice on NI... which I assume you are doing) rather than continue to pad the budget. This will only
get us more and more expensive projects of lower and lower

quality.

Could you please schedule a major review of all projects for Larry, Sam, Si and I ... including those in A/D?

"TO" DISTRIBUTION:

BILL DEMMER BERNIE LACROUTE DAVE RODGERS
WAYNE ROSING

GB1.S5.47

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Subject: **MSR11 Non-Rotating Memory Mass Store**

To: Vince Bastiani, MK1-1/M37
Mike Gutman, ML21-2/E32
John Kevill, ML1-3/E58
George Plowman, ML5-5/E97

Date: 10 OCT 78
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

CC: Roger Cady, MK1-1

follow up 10/24/78

What's the story on the MSR11 non-rotating memory mass store?

Why isn't memory engineering doing this?

GB:ljp

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*****************
* d i g i t a l *
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TO: KEN OLSEN DATE: SUN 20 JUL 1980 9:16 PM EDT

FROM: GORDON BELL
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: MT. FUJI SNOW JOB TO FORD BOARD: DO THEY (WE) UNDERSTAND?

It looks like they are in lots of trouble because they are still
not facing up to Japan.

The tip off as to why they are in much deeper trouble:
.The group just got back in February. A little too late to look.
.The group was "management" (versus labor) a poor dilineation.
.The automation issue is non-trivial!
.The productivity and flow models indicate a major problem in organization and industry structure not easily solved.
.The report didn't address much deeper issues like designs and car size and gas consumption.
.They conclude after enumerating a significant list of differences, that there is really no problem, all they have to do
is to attend to these details. (After all, the Japanese put on
their pants the same way they do, and cars are made the same way
the world around: materials in, cars out.)

Unfortunately, if and when they operate the way the Japanese do,
assuming they can, then I believe Japan will be in a much different place.

A friend at Stanford described his brother in law's job as a designer at Honda, US. They work every nite till 10, except Wednesday with weekends off unless they are testing cars in the desert. They have competitive car designs with Japan and Germany. The winning team has been decorated by the emperor.

I hope we can start to take them seriously. Already, they are
coming into the very low end space via the calculators to attack
what is the low end of the personal market. The only reason they
won't be seen for awhile is they need machines internally.
Therefore the exact date of confrontation can only be predicted
by looking at the economics of the situation.

We clearly have to look out and be prepared to change our ways by
understanding where we are with respect to designs, productivity,
costs and materials flow. I gave a talk to a group of robotics
experts on the Japanese topic. A person from TRW remarked, after
seeing Salem: "you guys are going to get killed". This was prior to the TRW-Fujitsu deal, so apparently his comment was based on fact.

GB1.S5.57

October 12, 1984

Dr. Craig Mudge, President
Austek Microsystems
Technology Park
Adelaide SA 5095
AUSTRALIA

Dear Craig:

I enjoyed the interaction with you and your board. The product discussion was also stimulating. The board is quite impressive and helpful; Bob Evans will also be a great addition. I hope there's some way to get Jack on the board because his wisdom about the semiconductor industry would add much.

Since I have trouble being really clear, thoughtful enough (due to slow cpu) and verbal (even though wordy) in a meeting, I'd like to take this opportunity to clarify and record my position.

My reaction then and now is in reaction to being a part of many startups over this last year as an owner, investor, advisor, buyer of product, etc. The alarming situation is that good or very good technical people in combination with knowledgeable business advisors (their board) produce such uniformly poor results. This may come from inexperience on their part, together with the model that a company is supposed to start out and lose money, even if there's nothing fundamental in their business model. I think problems come from not attending to a few key management principles:

- people
- company charter (and focus)
- profit, responsibility and control

<u>People</u>
I say: "<u>Never hire average people--you get them for free when you err.</u>" Many people hire subordinates who are intellectually subordinate. Don't let this start anywhere as it will propagate downward and end up with only morons at the working level and no communcations path upward to do many important functions, especially educating management.

You want only aggressive, bright workers who are constantly challenging the whole organization. I also don't believe you can afford <u>one</u> person in the organization who does not know the technology or industry! This view might be moderated if you get into plain old business and management problems. Expatriated Australians would seem to be a great source.

Clearly you have to hire the U. S., Australian Government and Singapore Division presidents--with full blessings from your staff and board.

People are your most important asset. Add that to your charter and constantly upgrade by forcing your staff to always hire brighter people.

<u>Company</u> <u>Charter</u>
I believe this a serious item for you and your staff to develop. I believe it should not be more than one sheet of paper, although it could have many pages of backup. It would cover your basic goals and attitudes towards: product excellence, people and profit, for example. A charter keeps people together. Don't violate the charter; change it to agree with your direction and to point out the inconsistencies of what you are doing! It shouldn't lie.

The DEC Product Strategy I wrote in 1978, describing the VAX and interconnection plan is the most comprehensive example covering a multi-billion dollar company. It was modified several times, but always stayed a page. The interpretation and discussion each year took on the order of 30 pages, including comments on products and processes. Ken Olsen told me recently that he was now personally really implmenting it...he only harassed me while I was there.

You might get Heidi Mason's company, Acquity, to look at your strategy and plan because they can ask lots of questions and clarify cloudy thinking. After one year, they are profitable, achieved their objectives and growing.

<u>Profit</u>
Let me elaborate on Plan B: "<u>Profit is habit forming.</u>"

Given that you are in a service business, there's no reason why you shouldn't be profitable from the day you make your first sale and start getting progress payments. The Australian government has been setting you up in business for the last 3+ years, so I fail to see why there is any period of unprofitability. You also have the whole country behind you. It would be crazy to not have Australia as a major market segment to start from. It would also seem you could set up a research organization for CSIRO too.

If you decide to run a profitable company, life will be enormously simple:

. The company immediately operates accoring to a steady-state business model by which it is measured and controls itself. Let me urge you to work this out, and follow it with delegation. I think the lack of a good business model which includes the P&L and Balance Sheet is at the root of the poor performance by most businesses.

. You'll be freed from the hassle of financing. This will get about 30% of your time back to do something creative... like making more money or products or even something crazy like going to Singapore.

. The orientation of the entire company will be different. You'll be unique among current supposedly successful startups! You can take the people and jobs and financing you want. The whole company will be on an upward spiral rather than a marginal, hand to mouth, frenetic operation of ups and downs where you sell investors, get money, do work and then go sell again.

. While growth shouldn't be your goal per se, profit is the only way to obtain growth and be successful. No one will fund a losing operation that grows. Look at DEC, Apple, HP and a few others who started with profitability from day one. They all make profit number one or two next to quality, and they all grow like crazy.

. Your employees and board will have much fun. I will even have fun and enjoy working with you because I know that you'll be making it, rather than being part of helping you survive. I'll show you a dozen unprofitable startup companies; none of them are having fun.

. Profit will be the organizing principle. Let the people who are going to be responsible for it, take charge. Otherwise, you'll find that every department is a cost center and will give you thousands of ideas for spending money, but none for making money. You alone will be responsible for making money, and it will not be fun. I can almost certainly guarantee that you are unlikely to ever be profitable if you start out not focused on profit. The only time the balance sheet will be positive is after a financing. In effect, other people will help you manage if you are profit based because all lines on the P&L are allocated to the profit managers.

. Profit is the basis of operational control, establishing priorities and delegating responsibility. In essence profit allows the bottom line to be managed by delegating the management of segments to others rather than delegating spending!

Management and Control
A key operational principle at every successful company can be summed up by this quote I designed at DEC in 1972: "He who plans, does." Here, the key is self-motivation, and that is the only way to get massive output.

For example, on Singapore do you really have the whole staff behind you and is an individual responsible? It would seem the individual is the one to make the plan and order the VAX and rent the building, etc. How could this possibly be done from Adelaide? Singapore cannot be your plan.

The key to the amazing growth of DEC (no company has grown this long or consistently over 25 years) was being able to motivate by having an environment for entrepreneurs who could in turn do their own thing. Your only job is to find, provide an evironment for and motivate them.

Keep the organization simple. The tree is about the only thing that works. I hate matrix management, and DEC was often wrongly accused of being unduly matrix organized, because it did use the matrix in a few places like personnel and finance. Having internal groups who sell services to others is not a matrix; don't confuse it.

You'll be full-time, leading the charge, financing, selling and attracting people (and an occasional idea). Have you delegated internal operations?

Singapore

I would like to strongly agree with Jack regarding NOT going to Singapore. I believe deals like this will always be around. It seems to:

- violate all your charter constraints (VLSI, product excellence, high cost parts, analog expertise, design synergy)

- put you in a new business--teaching

- loses money, even with their incentives, and your accounting that ignores large, allocatable charges

- detract from getting into Australia (priority #1, I hope) or the U.S. (when you find a leader)

- put enormous personal stress on the team--which will ultimately prove quite costly (I would hate to have to be responsible for this and you must get someone else to be the proposer of this plan.) I can't believe 15 guys can work 3 continents. Your team simply has no management record to carry this out yet.

. violate the fundamental management principles I described above: "He who proposes, does." That is you have no one who you trust to lead this and take responsibility for P&L. Delegating any hires of technical folks or a division president to someone else is just not done. People are your most important asset.

I would change my mind if a great, well-trained entrepreneurial engineering-oriented person with product experience could be recruited to head this division. I would assume that he could put a plan in place for profitability in the first year. This could be accpeted after you demonstrate the rest of the operation is under control.

Needless to say, I was surprised at your not withdrawing the item from the agenda and the board's approval. (I am also tired of seeing bang-bang control by boards: ok everything / fail and replace.)

Bottom Line

I hope the above comments will be useful to you and Austek. I must admit that I'd like to see you succeed with great people, products and profit. And in addition, have fun. Also, I would not object to making money on this venture, particularly if I invest any time...so my motives are not pure.

I hope these comments are useful. Please feel free to use them.

Sincerely,

Gordon Bell

CC: Ivan Sutherland
9 January 1983

Dr. J. R. Philip, Director
Commonwealth Scientific and Industrial Research Organization
Institute of Physical Sciences
Limestone Avenue
Canberra, ACT

Dear Dr. Philip:

I would like to strongly recommend that Dr. J. C. Mudge be promoted to Chief Research Scientist Grade 1.

I have worked with Dr. Mudge since 1973 when he came to Digital to work as an engineer in the design and architecture of our computers. At Digital, he worked on a number of tasks includig those affecting the VAX architecture. He subsequently went on to be instrumental in implementing the low cost machine, Nebula, which became the 730.

I have also worked quite closely with Dr. Mudge in the compilation and writing of the book, Computer Engineering: A DEC View of Hardware Design. While I think that this book is truly unique and important, I'm probably too biassed to fully evaluate the work and worth. Over 20,000 copies of the book have been sold.

He really established the VLSI Advanced Development group at Digital and set a benchmark for what research in VLSI should be. His work was the basis for project work aimed at putting the VAX architecture on a single chip. He also spent a very productive and useful year with Carver Mead as a Visiting Associate Professor at the California Institute of Technology where he was both productive and held in very high regard by students and faculty. He is invited to speak in international conferences, and his thoughts are well respected.

In a recent visit to the laboratory in Adelaide, I had another opportunity to look at his work and leadership. Here, I am frankly surprised that he has been able to accomplish so much in the VLSI area at both this distance and with such a small team. This is impressive.

Again, let me urge you to promote Dr. Mudge to Chief Research Scientist.

Sincerely,

Gordon Bell

Vice President, Engineering, Digital Equipment Corporation
Professor, On Leave, Computer Science and Electrical Engineering,
Carnegie-Mellon University

GB4.S1.15
9 January 1983

Dr. Craig Mudge
CSIRO
P. O. Box 213
Eastwood SA-Australia 5063

Dear Craig:

Just a brief note to thank you, Maureen, Ben and your staff for the wonderful hospitality we were given in Adelaide. We especially enjoyed the Christmas brunch at your house and the opportunity to meet so many of your friends and colleagues.

I enjoyed the interaction with your staff, and only wish I knew more about VLSI. In thinking about the lab's 100K demonstration chip, I came back and threw down the gauntlet to the engineering community, and received these suggestions:

- some fraction of a VAX that is already well specified
- an existing VAX (eg. Nebula) where the goal is simply re-realization
- massive integration of a particular terminal (eg VT100) in order to achieve a one chip level
- a PDP-11 on a chip using J base
- fast Graphics accelerator
- LISP coprocessor for one of our micros
- a more advanced than TI320 Signal Processing chip

Let me urge you to engage in some sort of joint venture with us as I see it getting you PR, resources of various kinds, and credibility. The benefit to us would be direct. Also, it might be the basis of DEC coming to South Australia on an engineering basis.

If you see making the chip something of commercial value, I'm sure we can get the interaction.

The diving in FiJi was spectacular, and we especially enjoyed the S.A. provisions. We heartily recommend the Seaview, and fortunately, look forward to the cabernets, clarets and other red.

Please give my warmest regards to your family and staff.

Sincerely,

Gordon

GB4.S1.16

00 CORE DECGRAM ACCEPTED S 003800 O 530 16-AUG-82 18:51:47

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* d i g i t a l *
****

TO: SAM FULLER
RAD:
BILL STRECKER
TMC:

DATE: MON 16 AUG 1982 3:56 PM EDT

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5172736936

SUBJECT: SUPPORTING AND CONSTRUCTING EXPERIMENTAL MULTICOMPUTERS

I believe we should go all out to encourage and support the construction of experimental computers by qualified researchers who have an idea and are committed to do the software and applications.
Helping Chuck Sietz feels right. Also, why not build Larry Snyder's machine at Yale?

For example, the Seitz machine is exciting for two reasons:

1. Researchers who need the machine and are committed to make it work are involved.

2. It's incredibly simple and offers a major cost performance gain (eg. for $50K parts, the performance of a Cray 1).

In looking at the design and use of new (commercial or experimental) computers, let me hypothesize:

In order for a new computer structure to be attractive to a user, and hence become a main line system, the machine must offer an order of magnitude improvement over his current computation method.

In recalling the last few years of computer systems research, it seems to me the universities have gotten slightly better at constructing hardware, but are still not up to building systems for real use. Therefore, let's build these ideas and let them program and evaluate them.

.

WPS USERS - Leave HP mode and type <CR>

00 BURT DECGRAM ACCEPTED S 5415 O 07 02-FEB-80 10:10:24

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION DATE: SAT 2 FEB 1980
10:03 AM EST

FROM: GORDON BELL
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1
A51

SUBJECT: OLEH SPEAK SOME GOOD WORDS HERE

As a user of a multiterminal system I can only say one good thing
about it. It's has good response time. And I think that the
file problem is better with lots of on line storage. Some day I
suspect we'll have a problem when we run out of space and the set
of independent secretaries that share it have to clean up the
files and garbage...or when we have a head crash and lose
files. Somehow, the 8 user wps system we are marketing
looks like a early first generation timesharing system (I
recall the PDP-6) which has the ability to lock up devices
and which seems to create chaos in the office environment.
Someone has to be the system manager (here Mary Jane is) and
this will ultimately be a full time job...especially since
the WPS200 needs more debugging (but I assume this gets
solved). Also, the system has to have dial out capability
without going to the central system. So far I'm sceptical
that the system will work like we would like to use it.

Maybe it is great for a typing pool? If so, we had better really
partition where it gets sold. Having seen the WD brochure that talks
about data processing too, I am even more sceptical that this

kind
of system can really be used.

Jack, you have a responsibility to sort this question out. I fear
you have been listening to the office manager/ data processing
manager buyers who say they want shared systems for some reason, os
say they want DP in there too (as opposed to access to DP) via the
wps terminals. The cost per terminal may be why they are saying it?
However, given my few weeks with the 200 (and ignoring the bugs), I
say get me back to an elegantly packaged wps 78 or 278 (not the knee
buster we're eventually going to come out with).

Note the personal Nebula that I'm going to get only has me, MJ, and
Sue on it, plus dial in/out (Automatic type!). I don't want to
have any of us be computer system managers. I would like Al Crawford
to link to me so I can send him files for archiving and also get
larger files from him and others.

I am now ready to do some rethinking of our direction.

"TO" DISTRIBUTION:

STAN OLSEN	DICK CLAYTON	MARY JANE FORBES
KEN KING	DICK SNYDER	JACK GILMORE
TOM VLACH	BOB DALEY	BOB GLORIOSO
AL CRAWFORD	BOB TRAVIS	BRUCE STEWART

BILL PICOTT @MR16

ATTACHED: MEMO;34

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*****************
* d i g i t a l *
*****************
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TO: GORDON BELL* DATE: FRI 1 FEB 1980
8:54 AM EST

FROM: OLEH KOSTETSKY
DEPT: SOFTWARE ENG'G

OPR

EXT: 223-3704
LOC/MAIL STOP: ML12-3

A62

SUBJECT: WPS/EMS AS A PRODUCT

I am concerned about our current emphasis with this product. I believe the market for this product will belong to whoever has the smarts to create a single user product (one for each secretary) at a price somewhere in the $2K range. Shared logic offerings usually imply sharing the printer and possibly sharing the floppy disk or TU58 with other secretaries. This pulls the secretary away from her work station and is highly undesirable. The manufacturer that solves this problem will get the spoils. Why are we working so hard to create WPS that can run as tasks in other systems? The CPU and MEMORY are the cheapest parts of a WPS system and are getting cheaper faster than any other part. We seem to be moving in the opposity direction of the distributed computing trends here.

EMS will work when we design the system in a way that makes it easy to implement in an evolutionary manner (i.e., some EMS nodes in mailrooms with machines with spoolers and fast printers).

GB1.S2.25

September 8, 1980

Dr. Harold Liebowitz
Chairman of NAE Ad Hoc Committee on Membership Elections
George Washington University
Dean and Professor, School of Engineering and Applied Science
Washington, DC 20052

Dear Dr. Liebowitz:

I appreciate being included in the membership of your committee, however, I don't recall ever being asked or agreeing to serve. Since I do feel strongly on this matter, I'll comment although I don't want to meet. I assume you'll collect inputs and make recommendations, hence I don't see why you have to meet for a day. Using your format, please note these recommendations shown in [brackets]:

1. and 2. I hope you don't spend too much time looking for an optimum number. It would seem to depend on what the NAE wants to be. This is a whole issue by itself. Given that there are people who feel that there are unworthy members of NAE based on the current criteria, then it sounds like we may have already passed the number. Optimum, would seem to depend on what the standards are or alternatively, how many are needed to carry out the academy's functions. Therefore, one might argue that it should be either half or twice as large, respectively.

Within my own specialty, computer science and engineering, I feel that based on the fifty already within the academy, [our area could have about 50% more than we have.] Furthermore, within the number that I would add, there are a large fraction that I think should already be members, based on the current criteria and constraints. This is not to say that there are non-deservers within the academy, but the priorities aren't really clear within the constraints of the current membership. Therefore, the strongest general recommendation I have is not the number, but [THE PROCESS ELECTS PERSONS IN A RANDOM FASHION <u>therefore</u> change IT!]

3. Does it matter who has the ability to nominate? We might be better off if [non-members could also nominate members!]

4.

I am less concerned about the ratio of academe, government, and industry. We should look at it, but the criteria will implicitly determine the ratio. Again, there are three other ratios that I feel much more strongly about:

4a. What should the ratio (or quota) be for a given (discipline) area?

In the case of the peer committee which I am familiar with encompassing computers, systems and control, materials as they relate to electrical circuitry, electronic circuits, and other topics covered by academic electrical engineering, I have never felt like we have done an adequate job! We have made recommendations where no one on the peer committee knew the candidate or their work or even the area. We have asked to have this split into three groups, but to no avail. Therefore, I would recommend: [restructure the peer areas such that the peers know the areas and people being recommended].

Given that we can get the right peer committees, then the problem of how many members still remains. I'd like to see the [area membership as a whole convene and recommend size]. This year I submitted a list of possible nominees to those in the computing area in order to focus on those who I think are deserving of nomination. In particular, there were cases of oversight for people who are in the over 75 age group. Also, there were several capricious over-rules by the highest level committee because candidates were from a particular organization and I felt the persons should be resubmitted as soon as possible.

At a meeting (at NAE annual meeting, or by informal network via phone or electronic mail) [under the auspices of a chairman or small sub-group an area would arrive at a list of potential nominees. This list would only be used informally, but it would tell us something about how we felt about how many people should be within a peer group. Also, by tracking this over several years, we would know how many people we believe should be added each year.] As a peer group, we must defend the criteria that causes us to believe there is an outstanding group this large. All groups would have to do this. In more mature areas with larger groups, the group should propose what it feels should be its criteria and membership needs per year.

Philosophically, do you take the number of engineers in an area, % GNP in the industry, number of papers in the area, or what? These criteria should all be known and possibly be used as guidelines, but within the framework of those proposing the membership for the area.

4b. What should the ratio (or quota) be for a given company or other large organization?

This gets really messy. For example, we have not recognized the person within IBM who made the fundamental breakthroughs in magnetic disks. This is approximately the same importance as both core and semiconductor memories, but by the closed nature of a company regarding its <u>working</u> engineers, the nomination has not been forthcoming. However, I feel that IBM is well-represented in terms of administrative engineers.

Given that a large amount of engineering is done by very large organizations (Bell Labs, GE, GM, IBM and MIT), I would like to get inputs from the organizations about how they regard the academy membership. [Also, the academy needs some guidelines here in terms of how many.] It should be part of correlating with the overall number we use for industries. Perhaps, we ask the 10 largest organizations as represented within the academy to propose a similar number based on what they think to be the criteria. I have a suspicion that several of the organizations are already doing this in a concerted effort.

We should go through an overhaul whereby [we should not accept a nomination by a member of the same organization, nor do we allow more than one recommendation to come from within! In terms of the closed balloting, I would like segmentation in terms of the organization and outside the organization!] (That is, when we find someone with a lot of yes's, I want to know whether they all came from within the organization.)

4c. and 5. What should be the ratio of engineers, engineering administrators and scientists?

Personally, I would like to see more emphasis on personal accomplishment versus engineering management. Just as some member on the ballotting writes ACADEMIC beside a nominee, someone else should write ADMINISTRATOR to warn the peer committees. I don't have a recommendation, but I do have predjudices because I rarely see the kind of leadership from these people except in budgeting and definition of processes. By the time many engineers head engineering, they are barely engineers.

I would like to [<u>not</u> change the accomplishments to be more scientifically oriented.] In fact, I believe [the criteria should be clear between individual contributor and administrator.] [For the contributor, I feel it should be two major accomplishments that have practical application, or one truly significant one (eg. APL). We should be wary of the accomplishments that are just a stream of papers that do very little unless they really structure a field.] For example, we get a stream of recommendations from one large, industrial research lab that has long since been irrelevant to electronics because the company has not made any contributions for 20 years. (It is now essentially a conglomerate that for some reason believes it should believe in research.) Thus, as engineers, there is no way their work can be useful except in a scientific capacity. Hence, the NAS should vote on them.

6. I hope you have gotten some flavor about what I think are the criteria. If you feel like the academy as a whole is floundering in this issue, then I would recommend [we do not take any more people into the academy until we sort this out! (We would have a one year moritorium with only very clear, exceptional cases looked at.)]

Hopefully this will be of some use to the ad hoc committee. Have a good meeting.

Sincerely,

Gordon Bell
Vice President, Engineering
Professor, Computer Science and
Electrical Engineering
Carnegie-Mellon University, on leave

GB:swh
GB1.S6.36

CC: Dr. Courtland Perkins, NAE

Members of NAE	Where	
Amdahl	I	Amdahl
Auerbach	I	Auerback
Backus	I	IBM
Baker	I	btl
Baruch	G/A	Commerce/Dartmouth
Bell	I/A	DEC/CMU
Berlekamp	A	Berkley
Bitzer	A	Illinois
Bloch	I	IBM
Brooks	A/I	UNC/IBM
Cocke	I	IBM
Corbato	A	MIT
Cragon	I	TI
David	I	Exxon

Davis	G	DOD
Dineen	G	DOD
Eckert	?	
Evans (BO)	I	IBM
Evans (dave)	I/A	E+S/Utah
Fano	A	MIT
Felker	I	BTL
Flanagan	I	BTL
Fu	A	Purdue
Fubinini	?	
Garwin	I	IBM
Glaser	I	Ampex
Colomb	A	USC
Haddad	I	IBM
Hamming	A/I	Naval PG/BTL
Heilmeier	I	T
Hopper	G/I	Navy/Univac
Iverson	I	IBM and Iverson inc
Kleinrock	A	UCLA
Lucky (Robert C)	?	
Mathews	I	BTL
Newell	A	CMU
Olsen	I	DEC
Parker (Norm)	?	?
Perlis	A	Yale
Pierce	A	Caltech
Rader	A	?
Rajchman	I	RCA
Reed	A	USC?
Roberts	I	Telenet
Sammet	I	IBM
Suterland	A	Caltech/independent
consult		
Thompson	I	BTL

Kilburn
Wilkes

What about?
Avizeanis
Bruer
Casasent

Cutler Did our VMS operating system and forerunners
Dennis
Denning
Dijkstra
Fuller
Hoare
Lampson (who's tops at PARC?)
McCluskey
Moses
Randell
Siewiorek
Strecker VAX, first mPc work, and Cache work)
(Dertouzous and Korn have been looked at several times)

GB1.S6.37

NAE PANEL - ACADEME, INDUSTRY, & GOVERNMENT
INTERACTION IN ENGINEERING EDUCATION

There are comments about the overall importance of the need for coupling and direction of government help and a description of our joint program we use for research, advanced development, and in some cases prototype development.

Don't increase the level of funding for basic research because we are okay in Nobel prizes. We are losing in trade and don't precisely understand why, although it has to do with issues like understanding how to design processes and operate factories effectively that produce high quality goods. We need university help here - versus on the product!!

I don't believe we have a problem of innovation, particularly one which requires more bureaucratic process, or labs which will detract from the training of current persons to chase some new grant $'s. We do have miserable coupling of both basic research and development between universities and industries, and this should be our highest priority problem to solve...especially since our research results are being used more effectively by competitive countries for their trade.

I also conclude that we must have a separated NEF, versus NSF which deals with training and understanding engineering (directed to goods production) because the government goal set and hence funding is totally random and volatile. Also, because engineering and science are interwined we tend to believe they are connected. Breaking then apart would get better coupling than keeping them together as a single mushy mess. For starters it could be renamed, reorganized, accounted for and measured separately (also, the people could be made accountable). Several years ago it was directed at coupling with industry, and apparently now it is to be redirected to science, just when we were beginning to establish joint programs. Frankly, I don't give a damn, but it would be nice to have consistence for greater than 4 years! Do we want to win Nobel prizes or do we want to have balanced trade? Can we do both, given that a lot of people are being syphoned off into the useless MBA programs - here the abolition of business schools would probably increase productivity more than anything else? I strongly support any mechanism of coupling that is outside the government intervention and negotiation because it requires overhead time and money skimmed off of the work...that means tax credits which would favor doing work with universities. We need university help in our work if we are going to build goods effectively, and I'm interested in anything we can do to make this work.

The Digital Program

Our urgent, formal universities program has developed from random, equipment grants on the last day of our fiscal year. I still like the old, random program, but as a larger corporate bureaucracy, it is virtually impossible. Some of the best results have come from this because the effect is to put totally free, unplanned resources into someone's hands. The program, Spacewar, was written for a PDP-1 delivered to MIT on June 30, 1961. It turned out to be the father of all the space games that one currently plays with tv sets and in arcades. (Other programs came from this gift including one of the first timesharing systems, compilers, editors, and other systems programs.) We have had similar results from a machine placed at Carnegie-Mellon on June 30, 1971, when two language breadboards, APL and BLISS were written together with other software tools breadboards. Therefore, before we describe bureaucractic processes, let me recommend the element of surprise. It will probably have more payoff than anything that can be planned. As researchers learn more about business and risk avoidance, innovation will be less with these formal programs.

Our current program has been fair, and highly variable. Fundamentally, it allows us to pay for research and other work both with $'s and equipment. Because of internal accounting, a group can use what amounts to a free budget resource to "buy" work. It implicitly involves government funds for research. Because both sides believed they are getting a free lunch, there was a natural pressure to have it work. Our internal buyers are now somewhat more wary since we have asked them to report on the work just as if it had been done inside. Hence, they find that they have to really invest to get the fullest benefit. For example, the Cal Tech Silicon Structures Program requires a person there and the equivalent a person within engineering plus the direct funding to work properly - which turns out to be twice as much internal spending.

In cases where we want tightly coupled, joint programs with our advanced development, there are the expected problems of having people work intimately on something and then despite contracts, believe they must tell everyone about it immediately. Untenured faculty are really caught in this dilema. When we tend to be this well coupled, then there is also the danger of dependence, despite the fact that we don't interfere on projects that are basic research. This too causes problems when the two sides are very strong because in some situations we have had to replicate the research before we can proceed with development. We do not expect product prototypes, nor should anyone. Alternatively, when we get them, we should be smart enough to accept them...and usually we aren't due to having a good transfer process!

The universities too are now more wary, but I believe they like the change from government funding because proposals are short, sometimes verbal, and we turn them around quickly. Furthermore, one can negotiate with your reviewers without the middlepersons. Once they find out that we really do expect results, they begin to plan and deliver, something that I think has been lost in much of the sponsored government research - and in the researchers who have become more and more proposal writers and forms filler-outers instead of researchers.

GB1.S7.40
January 22, 1980

Dr. Bruno A. Boley
National Academy of Engineering
2101 Constitution Avenue
N.W., Washington, D.C. 20418

Dear Dr. Boley:

Enclosed is the abstract of what I think is the highest priority for Engineering Education. I hope you'll agree!

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:swh
GB1.S1.35
Enclosure

May 18, 1981

Dr. Courtland D. Perkins

President
National Academy of Engineering
2101 Constitution Avenue, N.W.
Washington, DC 20418

Dear Dr. Perkins:

As a non-participating, non-volunteer member of the Ad Hoc Committee on NAE Membership, I want no further association with AHCOM. I also regret having wasted time as Chairman of the Peer Committee last year, since the Committee on Membership completely ignored our recommendations.

AHCOM has failed at defining the problem, gathering relevant data and proposing changes that will build a stronger NAE. Instead of "business as usual", the following issues must be addressed:

- The engineers we are electing are neither relevant nor representative of current engineering. For the NAE to be effective, the criteria for election must be changed to include the engineers on the leading edge. Since peers simply do not exist for new disciplines, then we must invent a way of making sure that the composition of the various disciplines within NAE reflects the changing field. For example, power engineering has stabilized, yet we added five more engineers this year, giving an imbalance according to every conceivable measure (demographics, current production, need, patents, publications, discovery, industry size, etc.). In contrast, NO semiconductor engineers were elected!
- Our Peer Committee recommended to COM that the Electrical Engineering Committee Peer Group be renamed and reviewed for further segmentation. COM approved this, and there was no action taken. When will this be attended to?
- The process practiced at the Committee on Membership this year failed at adding high quality choices (about 20 percent), while at the same time adding marginal members (about 20 percent). Hopefully, there will never be another COM meeting this poor. The recent exchange of letters between one of our Peer Committee members, Rolf Landauer (2/18, 3/3) and COM chairman, P. L. Thibaut Brian (2/25, 3/6) illustrated the confusion in the COM meeting on:

  - the requirements for foreign associates;
  - organizational bias;
  - grand old persons versus later greater contributions;

- respect for Peer Committee deliberations;
- right of COM to overrule a Peer Committee;
- previous professional recognition;
- previous NAE nominations; and
- discipline bias.

Our peer group had operated to solicit and review a number of high quality candidates. This came about because we had been disappointed in the quality of candidates submitted the previous year. As a result, we submitted 15 exceptionally well qualified persons to the Committee on Membership. The COM

Meeting was a fiasco, barely under control and as a result the group decided that because candidate number 10 had several controversial, anonymous statements (which have been shown to be untrue) the remaining 5 candidates were also discarded. This capricious veto eliminated six persons superior to the NAE at large, clearly superior to the COM, and well above various persons voted in that day. What I saw, was a group of engineering departments voting to sustain their own power by adding members of their own discipline.

The COM must not be given the power to capriciously reject the careful work of the Peer Committee, but should only have the ability to challenge specific candidates, not draw the line at the number from a specific discipline.

In short, there must be a process which:

. projects short and long-term yearly membership quotas;
. continually segments the professions, identifying changes in engineering and delegates the quotas to the Peer Groups;
Under the proposed, basically unintelligible scheme, new professions (e.g. computer science, genetic engineering, biomedical engineering) are still extraordinary difficult to add and declining professions (e.g. nuclear, power, civil) are difficult to contract.
. sets clear, implementable requirements to regain quality; as a minimum, the professional disciplines can be used to screen for quality so that we admit only those who have achieved Fellow status AND who have at least one major professional award. The acceptable criteria (e.g. Fellowship, specific awards) would be established a priori. The requirements such as: organization, foreign associate, previous nominations, etc. must be equally very clear.
. delegates the responsiblity to Peer Committees to get candidates who will raise the NAE standards; and
. audits, NOT REJECTS, the Peer Committee recommendations before submitting the results to NAE at large.

In conclusion, unless the NAE can change to respond to the new societal issues surrounding the information based engineering disciplines, I would strongly support a complementary National Academy for Information Engineering and Science.

Is there any chance you will take an active roll in the major overhaul of the NAE?

Sincerely,

Gordon Bell
Vice President, Engineering
Professor, Computer Science and Electrical Engineering
Carnegie-Mellon University, on leave

GB:swh
GB2.S5.55

CC: P. L. Thibaut Brian
Ad Hoc Committee on NAE Membership
Electrical Engineering Peer Committee for 18th Election

Slides/data
.all projects rank ordered by spending, with total spend, nor total and rank in 83
.organization versus spending categorie for 83 for all engineering
.gestation time, showing dilema
.projects in a table of status versus time criticality (eg. tactics)
going very well, ok, review, crisis
.Original 78 Strategy slides (2)
.Status against the strategy (2)

What were the major stratgic changes slide
..strategic error - lo end vax, pcc's
..emphasis or lack of leadership - office, PC's, WS's,
..implementation too long - ci, ethernet, venus,

List of critical and watching/reviewing issues slide
..decide (eng. and some eng/mkt), design (processes and mgmt),build
..CAD and the engineering process.. epip
..hi end VAX (complexity, tools and physical interconnect)
..Ethernet and getting going on servers
..comm hardware and software aggressiveness
..pcc's
..workstations
..microVAX
..getting VLSI into our products
..cost models to compete with Japan!
..adequate A/D and research to compete with Japan! (5th Generation)
..high availability; start to market it and get the mkt./eng flow
..office (and office/CTAB)
..the commodity terminal business (Avery/Smith), defer till May
..getting all we can from the 16-bit business. A P/L?
..I don't feel good about lo end storage, no matter what
..simpler interfaces and less overlap to reduce hassle

GB9.4
Even though we've changed the nature of the company to a

startup versus a turnaround company, the operational principles we discussed, but never formalized should remain. Let me propose the first two:

1. "He who proposes, does"-- This was originated about 12 years ago by me and is used by several organizations.
2. Formal approval of plans, combined with a board (and company) who feels equally commited to and responsible for the plan.

GETTING THE PLANS

The first principle seems to be going well:

1. George's Sales/Train/Install/Service Division (we need a good name for it other than distribution) plan is going well.
2. Hydra has made a plan for delivering a high performance computer, and is clearly committed to it.

In addition, we have a number of activities aimed at getting "someone" to propose plans:

1. A product group, run by some external folks, aimed at acquiring and providing distributed system products. All the activities aimed at acquiring products will ultimately require an internal advocate to make sure that the products will work and work together.
2. Ed Fredkin's Personal Computer Products group, including accessories, servers, programs and PCs.
3. Vertical applications acquisitions group (eg. CAD). This can go very fast once we have a basic, set of distributed products.

We clearly need people who are going to propose and then implement these products for George's group.

APPROVAL OF PLANS

Hydra came forward with a product plan. I believe the product can be built along the lines (within a factor of 2) they've proposed because there are existence proofs. In constructing a most detailed agreement with the group, it must be clear that several of us believe their detailed plan can be implemented on time and within the budget.

Who's cosigning their plan in terms of specs, time and budget?

What you folks think about these principles?
GB9.4

```
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!   !   !   !   !   !   !   !
! d ! i ! g ! i ! t ! a ! l !          I n t e r o f f i c e
M e m o
!___!___!___!___!___!___!___!
```

TO: see "TO" DISTRIBUTION
DATE: MON 6 JUN 1983
4:15 PM DST

FROM: GORDON BELL
cc: PRODUCT STRAT COMM:
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5202115223

SUBJECT: EVERYTHING'S IN A NAME...LET'S USE SUPERMICRO

GB5.60

SEAHORSE
The DECwest folks were concerned about the 4 digit numbering of
Seahorse. I'm less concerned about this right now because I think the
basic machine class name isn't right yet. Scorpio would be similarly
named.

In the past, it has been important to use names to help position a
product, particularly a new one. It is also very useful when

we can
become identified as the leader with that product.

Names have evolved somewhat along these lines:

```
    super
mainframe
         midi
    mini      supermini
              micro     supermicro
                pc
```

Namely, the Supermini (eg. 780) is an evolution of the mini. It does
the work the mainframe used to do, and has the large addressing.

The Supermicro is an evolution of the micro (one chip) does the work
the mini used to do, and has large addressing. It's in a new price,
package and performance class. This also puts it in a new use class.

VENUS AND NAUTILUS POSITIONING
I don't know how we should position Venus except as a mainframe. This
would please our 10/20 customers to know that we're going to build
large machines. It would also let us price higher than the 780 it was
supposed to replace, and then Nautilus could be priced lower than the
780. I don't think there's a new class name here.

We really do need a super name.
Can you folks make the change?

"TO" DISTRIBUTION:

REID BROWN BOB GLORIOSO ROY MOFFA

to product group
subject Nancy martin

Nancy called and said she'd really like to work with us, and asked:

1. Could she review the ECC business plan? (I mentioned that for the do diligence, it's sometimes customary to have outside reviews.)
2. Do we have other consulting for us.
3. How does she go about putting together a group to build some sort of AI product? She believes that she can get a group together to do something here if we want. At the same time, a very good software engineer who's VP of SW at VTI (locally) would be interested in any job that involved a significant software product.

Her timetable is to be able to make a commitment for a permanent job by the beginning of the summer. She could be part-time till then.

.

June 2, 1982

Mr. Nicholas Tzannos
Intercontinental Air Freight, Inc.
Logan International Airport
East Boston, MA 02128

Dear Mr. Tzannos:

I'm sorry, but I don't see how we can participate in this experiment at this time, since I'm unable to come up with a rationale as to why it's relevant to us. Please send us a copy of the Nasa results.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:mal
GB3.S5.12

****
* d i g i t a l *
****

TO: EMC: DATE: SUN 16 MAY 1982
9:19 PM EDT
OPERATIONS COMMITTEE: FROM: GORDON BELL
cc: see "CC" DISTRIBUTION DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: THE NATIONAL CHIPS AS MICROVAX...

BACKGROUND
On December 1, I chartered Roy Moffa to run a task force to look at the problem of being competitive in the low end. He's worked with Cutler, Husvedt, Supnick and Strecker to come up with an aggressive set of alternatives. Jeff Kalb got us to look at National, and Ward has been a helpful sponsor.

Looking at the chart of Board, Personal Computer and multi-user System products, I think we can see that there's a big price gap caused by having the large, proprietary chips of the 11 and VAX.

1. VAX products are only in the large systems space. There's no plan to get a small processor that allows us to compete with the 68,000 at the chip, board, PC .
2. The 11 products are relatively expensive. A commodity micro is needed for lower cost products at board, controller (eg. VT200) and PC levels.

For the last few years I've maintained that the only important variable of an architecture is the virtual memory size. The fact that VAX provided 32 bits is why it's great. Similarly, a 48-bit address for the System 38 is why I worry about it. The so called 16-bit and 32-bit micros are either 17-21 bits, or in the case of a 68,000 the limit is really physical memory which is only 20-22 bits worth. Therefore, none of the emerging micros are aimed at providing what VAX gives, except the National 16032 and 32032 which have copied VAX's paging scheme. Therefore all systems, including the Hitachi and HP micros are going to have the problem of address limits. Note that Appollo did a pager for the 68,000 to get around the problem.

The 8086 is the established 16-bit standard and the 68,000 is positioned to become the 32-bit standard with Motorola, Mostek and Hitachi as the suppliers. The 68,000 with 32-bit data path is coming, but the "fix" to add paging so that it can address a large memory still isn't out in the open.

I don't think we want to let the 68,000 and the 68,000 when

it
gets fixed with a 32-bit address become the sole standard.
Clearly, we can't stop them with VAX because we don't have the
design or distribution system for chips. The 11 is inadequate in
address bits. There's an important consideration of bus
standards too as the Motorola backplane is good, but not great.
The Unibus and Qbus are clearly inadequate to compete in the
microprocessor market of the 80's.

ENTER THE NATIONAL 16032/32032: MICROVAX
It looks like we have a chance of getting back in the low end
game by using the National chip and simply defining it to be
MicroVAX for the following reasons:

1. It uses the VAX data types (byte, word, floating point and
pages). Thus, all files will be VAX compatible. A higher level
program will not know the difference whether it's computing on
VAX or on National hardware.
2. There is less work in converting our software to be machine
independent than being able to get a chip of the complexity we
need for VAX. MicroVAX for PC use is about 100 man-years.
3. As we try to make higher performance machines (eg. VENUS), the
complexity of the architecture means it cost more in time and to
develop the hardware. This directly affects competitiveness. We
are wrestling with the same issue on how to build a useful
machine for DEC in Palo Alto.
4. By having portable software, VMS would get even better and
easier to maintain.
6. By being portable, and machine independent at a higher level,
we have the opportunity to make substantial changes to the
underlying architecture for extended addressing and

protection
and make sure that all today's programs will run. If done right,
we're buying future flexibility.

The task force is suggesting an aggressive offering providing the
following:

1. Chips on the Qbus to go after board business. The software
would be an extension of Pascal and MicroPower for the real time
market!
2. Chips would be place on the CT motherboard immediately to give
us the first 32-bit Personal Computer (Hardware only). Dick
Husvedt wants to put a subset of VMS, called MicroVMS, on it so
as to run VMS programs as a Personal Computer!
3. We want to drastically increase the throughput of the bus
system. Therefore, we want to work with National and establish
BI as the new standard for microprocessor interconnect.

MICROVAX, PERSONAL COMPUTER SOFTWARE
Not everything would be converted. The goal would be to let
the programming environment be the same on the two machines.
The following languages would get MicroVAX back ends: BLISS,
Fortran, (PL/1,C,Pascal,ADA... that use the PL/1 compiler),
BASIC, ... Cobol?, Visicalc.

VMS becomes MicroVMS for Personal Computing. Here, EDT,
Mail, RTL, SORT, File utilities, debugger, DCL, Linker, and
radically different Screen manager for PC. Also, Datatrieve.

CHIPS AVAILABILITY
We could get 16032 chips now, with 32 bit data width version
called 32032 in December. The path width is irrelevant to
our needs except where it affects performance. A faster part,
the 32032A is available in early 84.

CHART OF CHIP, BOARD, PERSONAL COMPUTER AND SYSTEM PRODUCTS VERSUS TIME

```
FY .   83  .   84  .   85  .   86  .

100K

     sN               sS/Aztec
40K

     sF      sJ
16K

         p350     pJ
6.3k                 pU pU+
         p325     pJ
                     pU PU+
2.5K


1.0K
             bJ
    bF       bU   bU+
400
```

notes
s= useable system; b=minimum useful board; p= Personal Computer

F=Fonz; J=Jaws; N=Nebula; S=Scorpio; U=MicroVAX=16032; U+=32032

NEXT STEPS
There are lots of issues with the above. In the long run it's likely to be cheaper as we move to a higher levels. In the short run, doing products we didn't expect will cost us.

Right now I believe that we ought to figure out how to do this MicroVAX, and if it still looks good, then go ahead.

What youse think?

"CC" DISTRIBUTION:

JOE CARCHIDI	DAVE CUTLER	BILL DEMMER
DICK HUSVEDT	JEFF KALB	ROY MOFFA
BILL STRECKER	BOB SUPNIK	STEVE
TEICHER		

GB3.S5.36

Gordon Bell
Vice President of Engineering, Digital Equipment Corporation
Professor of Computer Science and Electrical Engineering (on leave)
Carnegie-Mellon University

with Gwen Bell
Social Science Editor, Pergamon Press

Computers are at the center of current industrial growth because they are tools, for modern communications and manufacturing, and components of nearly every industrialized product. For example, in the automobile industry computers, are used in design, in operating the organization, in manufacturing control, and for use within the car itself. Over the last thirty years, computers have evolved at a rate more rapid than any other object in the history of civilization. But national economic policy-making still relates to industries that change very little. Effective policies for innovative, knowledge based industries have not been formulated because the key to policy-making, the computer and its constitutent technologies have not been understood.

Although the computer industry is high technology, it is also appropriate technology. Computers do not despoil environment, degrade populations, or use undo amounts of energy. Furthermore, they are critical to the development and understanding of national and local resources. Analysis of such complex issues as the proper utilization of the Amazonian forests, the control of agricultural pests, and ecological management of wildlife, depend on computational power. Without using such tools, it is easy to make wrong choices, since the full range of alternatives are not clearly understood. But, even of greater importance, is the significance of the introduction of a computer industry in order to maximize the talents of the population.

The computer on a university campus -- and a computer science department -- are becoming as central to learning and development as mathematics and physics departments. Computer science fundamentally affects all engineering, management sciences and ultimately social sciences.

In establishing a computer industry, the foundations of the new technologically based society are laid, and the development of an information-based economy can be established. Without a computer industry any country is doomed to a backward, poor economy. Fear, greed, and strong national interests have led to policies for establishment of computer industry that have had counter-intuitive effects, slowing down rather than hastening the process because assumptions have been made based on conventional instead of rapidly evolving, high technology industrialization. In order to describe appropriate policies for the development of a computer industry, the nature of computer evolution is first explained.

The Ongoing Computer Evolution

The computer has evolved more rapidly than any other man-made object as measured by improved price for a given computer or by improved performance at a given price. By either of these measures, the rate of improvement is 20 to 30 percent per year. This means that if the price of a given system at year (t) is 1.0, at year (t+1) it will be 0.8, and at (t+2), 0.64, and (t+3), 0.51. Every 3 years, the price halves. These measures have held constant for 20 years, and do not even take into account inflation. For example, in 1970 a boxed, PDP-11/20 with 4096 word memory sold for $9,300; in 1976 a large scale integrated version was introduced that sold for $1995. This price reduction amounts to a yearly price reduction of 23% compound annually. In contrast, nearly all consumer goods, such as automobiles, have increased in price at least an inflationary rate! The consumer price index and the prices of constant function computers are plotted in Fig. 1.

Computers performance has improved roughly eight orders of magnitude during the 30 years of their life. Logic and memory technology generations mark this improvement:

1. Vacuum tubes/drum, electrostatic memory 1948-1958;
2. Transistors/core memories 1958-1966;
3. Integrated circuits core memory 1966-1974;
4. Large scale integrated circuits for processor-on-a-chip computers/integrated circuit memory 1974-1980;
5. Very large scale integrated circuits 1980-

Computers not only have become all pervasive but have affected many other rapidly evolving technologies, including semiconductors, magnetic recording, conventional electronic sub-assemblies, xerography, video display, process control and conventional communications. Computers also require "software" technologies ranging from operating systems which administer computers to conventional computer languages in which application systems are written.

Computer components are ordered by what is known as levels of integration. The highest level is the application and the lowest is the physical device used to hold or process information. The structuring of the levels in Table I starting from the top applications (use) or starting from the bottom with physical devices form the basis of developing a computer industry either through backward or forward integration, respectively.

TABLE I

LEVELS OF INTEGRATION

Application software -- a particular use;

Application components library software -- generalized parts for building various applications quite often implemented as a special language (e.g. the COGO language for civil engineering design);

Basic software -- includes standard programming languages (e.g. BASIC, COBOL, FORTRAN), data management;

network, and operating system software for building any application;

Basic Hardware System -- all the hardware of the system (e.g. an IBM 370/148);

Computer Component Hardware Options -- packages of boxes or cabinets, such as disk and tape units, terminals, memories, processing units, etc.;

Printed Circuit Modules -- holders of the semiconductor circuits;

Semiconductor circuits in a single integrated circuit array package-

the smallest physical component from which the computer is formed.

Two additional concepts are important in understanding computing: architecture and implementation. Computer architecture is the interface of a machine as seen by a program or programmer, and is an important standard because it provides the user with a constant base for writing (investing in) programs; examples include the IBM 360, and the DEC PDP-11. Although there is a temptation to change the architecture to fit the technology or the application, changes in a given architecture and among several architectures produce relatively small changes (a factor of 4) in cost or performance. Most changes in architecture have occurred by having to change the amount of memory that a program is able to access. Address size (roughly corresponding to brain cavity size) is the single parameter of architecture that must be attended to, because it is the limit on how large the computer can be.

Implementation is the building of a particular computer model, (e.g. an IBM 370 Model 158) using a specific hardware technology, that operates according to the architectural standard. It is important that there be many implementations of a given architecture over a wide price range (typically 100) so that a user may select the appropriate price and performance model for a given application. In a similar fashion, it is important to implement various models of the same architecture with evolving technologies over several computer hardware generations so that user software investment and training is protected.

Since computers can supplant every other form of information processing, storage, transmission, switching, control, and processing, broad technological expertise is required. Software engineers not only must know the subject of the application (e.g. manufacturing, civil engineering, communications) deeply and unambiguously so that it can be made algorithmic but they also must know the computer almost as well. The lack of a standard architecture requires learning different machines. But with the agreement on standards, the potential for both substantive problem and computer understanding can be greater helping to overcome the current manpower shortage of software specialists currently limiting computer use.

Policy Dimensions

Nearly all governments establish policies which they feel will allow computer industries to form and thrive. There are many alternatives ways to establish a computer industry. Three important questions usually are the focus:

Who's allowed to supply computers?
How is the supplier allowed to obtain the product?
What is the supplier allowed to supply?

Although there are a wide spectrum of answers, concentration is placed on the extremes of each dimension. A total of 2 x 3 x 3 (18) alternatives are spelled out followed by scenarios of three policies.

Who's allowed to supply computers?

From a nationalistic viewpoint, the most sensitive, political and seemingly important dimension is who will be the supplier -- foreign or multinational firms, government, monopolies, and private individuals etc. From the viewpoint of the final result, this decision is relatively unimportant except as it affects the selection of the manufacturing and computer standard policy.

Government ownership of computer industries have so far been singularly unsuccessful (e.g. the Eastern Bloc), and hence not even worth considering as an alternative. The issue of whether there be local or multinational ownership also seems less important, except as it relates to limit the ability to use a particular standard. Hence, only the two extreme cases will be considered:

P1. Free market; and
P2. Government sanctioned monopoly.

In the former case, any group who is willing to live within the various governmental constraints is free to engage in the market. A free market is likely to introduce many standards, hence cummulative learning about applications standards will be minimum, unless each product is segmented into a particular application.

A government sanctioned monopolistic supplier is often given a particular market segment. Because of the complexity of computers with many components evolving at different rates, the static nature of governmental decision making to arrive at costs and prices often mean that the equipment decided upon is not only obsolete but also more costly than newer machines. The computer industry is no exception to the rule that monopolies are likely to be most costly, with the lowest rate of evolution.

How's the supplier allowed to obtain the product?

Like all organizations, countries are especially concerned with how products are obtained. The pressure to obtain state of the art products, independent of where they originate, is seen to exacerbate national balance of payments problems. The main issue is how much of a computer should be imported and then these imports could be reduced in the future.

While it is extremely important and nationalistic to believe that, de facto, a computer should be manufactured locally. Appendix 1 spells out how a strategy of local manufacture can require more imports for component parts than if a later model product were fully imported! Hence, importing finished goods is the best alternative for many countries.

Given, that local manufacture appears feasible in terms of market, manpower and capital, then either forward or backward integration can be used to evolve to full manufacture of all levels (so far only attained by U.S. and Japan). Forward integration requires a strong technology base, and for computers has been demonstrably impossible except in the U. S.

Therefore the alternatives for Manufacturing are:

M1. Import complete products;
M2. Backward integration, starting with the user application; and
M3. Forward integration, starting with components.

What is the supplier allowed to supply? (Standards and the Product)

In the section on the On Going Computer Evolution the architecture and implementation concepts that underlie the product were described. There are three alternatives describe a range of standards control:

S1. Use established, de facto "industry standards";
S2. Design and evolve a unique, indigenous vanity

architecture; and

S3. Use any product in a non-standards fashion.

In the first case, there is a wide array of hardware and software components in the marketplace that can be potentially used (i.e. bought, copied, licensed, etc.). The standards are de facto because of their strong marketplace position and as such there is an alternative source of supply to the originating organization that provided the computer. (The so called plug-compatible industry). The temptation to build a "national computer" is so great, and the results so deleterious, that this special case is described in a section below. The third case ignores the standards question and permits free use of what ever products happen to make it into the environment. It's effect is less clear because the market can structure to automatically provide "the standards" by rejecting the non-standards.

Establishing a Computer Industry via A Forward Integration Manufacturing Approach

The conventional manufacturing approach for establishing an industry usually cuts off external supply by sanctioning various firms to operate as monopolies and builds up internal manufacturing via licenses, joint ventures, and favored manufacturers. It is a "bottom up" process. Only essential components and manufacturing equipment are imported. This approach is most successful when the evolution rate is low (i.e. automobiles, tv sets, radios) or where the ultimate goal is world market domination. However, in either case, the essential first step is the manufacture of all components, raw materials, and in some cases the equipment to manufacture components. For example, the Japanese who for 25 years have had the goal to dominate in computer manufacturing, lacked the internal manufacture of critical components (e.g. semiconductors and magnetics) as well as software technology until recently.

In essence, Japan switched from forward integration to backward integration to become successful. If Japan, or any other country, starts with the goal of internal computer manufacturing to limit imports, the flow may well become increasingly more negative due to increased reliance on critical outside component and software suppliers. For example, had a country engaged in manufacturing transistorized and MSI based calculators in 1975 with imported semi-conductor components, in 1978 it would be possible to obtain the complete calculator for less than the imported component cost because with each new generation radically different parts are used. In a similar case relating to computers, more imports of raw materials occurred to build expensive disk memories and computer systems that were obsolete on completion.

Virtually every country that has operated a protected, computer industry (except recently Japan) has paid a significant price in terms of both imports and price to users. Computing with obsolete computers, costs each country scarce resources for maintainance and operations deferring critical economic and applications gains. Only the elite company owners directly benefitting from government sanctioned monopolies have profited while the country looses both technologically and economically.

Simultaneously establishing the manufacture of the critical base components, test equipment and component manufacturing equipment for a high technology product like computers is probably not

feasible. Even manufacture of the lowest technology parts (e.g., printed circuit boards) is hazardous because these components may limit the final product as described in the calculator and computer components examples above. Manufacture of high technology components depends on the existence of all levels of integration listed above it in Table I. Neither state-of-the-art (i.e. cost effective or least cost) disks nor semiconductors are manufactured away from their design groups who require fertile environments (including large, modern computers) for innovation.

Since the critical resource for the manufacture and use of computers is educated manpower, their effective allocation has to be central to any effort in establishing a computer industry. If these limited numbers are utilized for manufacture, then there are few left to do the critical systems applications jobs that are necessary in the manufacture itself. Reversing the allocation starting at the highest level of integration and working down then establishes a firm base for local manufacture.

Establishing An Industry By An Indigenous, National Vanity Design

Most attempts to design, produce and sell computers either fail to meet their market and profit objectives or fail to be cost-effective over competitive alternatives. Worse yet only a small number of computers evolve over a long term and remain viable and available such that a user's investment in software is preserved. Vanity computers designed for special purpose (e.g. Military) have been shown to be particularly cost ineffective over their standard, commercial counterparts such that the distinction is finally disappearing. Although there are mahy reasons why military computers are so poor, one clear one is the long procurement cycle that guarantees the thechnology has moved a full generation during design and negotiations.

The temptation is especially great because the art of computer design (architecture) is fascinating. By not adopting standards untold resources are required to engage in hardware and software design that could otherwise be applied to implementing computers based on standards, or be applied directly to applications.

There is virtually no chance that a computer can become a standard without a very large user base (market) and a commitment of multiple implementation over a range of price <u>and</u> time. Furthermore the architecture must be evolved in a compatible fashion to teach the technology.

An Example of A Monopoly Based on Backward Integrated, Non-Standard Compilers

The poorest method for establishing a high technology industry is by government sanctioned, local monopolistic companies. Appendix 1 describes the scenario of such a case. Here, a monopolistic company selected a high cost, non-standard, low performance basically obsolete computer for license from a North American Company that might have failed except for its exports to its foreign "licensee". The company then promised their government the following three-year, three-stage backward integration process: importing finished goods, putting together sub-assemblies, and finally building sub-assemblies from imported circuit components under license.

After five years, the local "manufacturer" was still importing finished goods, and no progress has been made toward local manufacturing. The computer was fundamentally unable to accomplish most of the tasks that were promised. The local company has a monopoly that has cost the country roughly a factor of two or $34M in imports over the promised commitment and $50M over what could have been accomplished under a policy permitting competition which would encourage local manufacture. Also, the users have paid a factor of 5.5 times or $400M extra for equipment because of the monopoly. Also, user costs including applications programming, maintenance, and operations (e.g. power and air conditioning) are several times greater for technically obsolete equipment. Certain applications are not possible, and where possible but not available, local effort has to be expanded in doing applications.

Rather than using monopolies to establish industry, government approval of imports based on the import cost would stimulate local manufacture. The incentives to all would be clear and the system would adjust rapidly! Alternatively, simple duties of any percentage, would probably work as well, avoiding bureaucracies, hassle and loss of productivity!

Establishing A Computer Industry Via A Backward Integration Manufacturing Approach Based on Industry Standards

A policy that encourages using state-of-the-art computers to be applied in a standards-setting fashion will ultimately result in appropriate local computer manufacture. The selection of widely applicable computer standards is essential, otherwise the situation is exactly what countries that do not have a computer industry fear--manufacturer domination and non-utilitarian machines.

There are four criteria to use in the selection of the de facto standards:

1. Maximum range of applicability - germane to evolving and necessary applications. Leverage of internal resources can be gained by selecting the most appropriate machine family based on application programs.

2. The conventional metrics for cost, cost/performance, and address size. A trade-off for larger address-space may offset short-term gains in cost-performance with smaller address-space.

3. Large family range of machine models from micro to mainframe. The utilization of one family versus a variety of machine-types maximizes the learning in terms of physical implementations, architecture, and software across all system ranges from the processor-on-a-chip (often called a microcomputer), through dedicated systems for special purpose use (often called a minicomputer) and to a large, shared, central system serving many users and managed by a staff (often called a mainframe). This helps achieve a critical mass of local experts.

4. Be available from numerous suppliers in a "standards-based" fashion. Ideally, each machine in a range would be the "defacto standard" machine. A de facto standard has the following characteristics: a large fraction of installed units; well-defined system interfaces that manufacturers, users, and third-party suppliers

understand; and many supply sources so that a user can build up systems by assemblying components via numerous fashions.

Countries following a standards-setting policy are assured of having the latest models available, alternative competitive sources of supply and a method of intercommunications that has lasted and will last over time since it is understood and used by many different groups. Until Japan adopted the approach of building computers to the IBM standard, its machines were uncompetitive (even in a closed market) and were ultimately withdrawn, requiring user program conversion. The backward integration path was finally followed, interfacing with many manufacturers to license computer architecture know-how and hardware technology. Ultimate success in Japan depended on five factors: an open market; use of the industry standard; selective licenses (versus licensing the non-standards); engineering near copies in a "reverse engineering" fashion; and the growth of its large internal market.

<u>The Backward Integration Steps</u> (Top Down)

It is the "standards" approach that provides the method for backward integration into local manufacturing via the following steps:

1. Import complete systems and assign them to critical applications. This will help attract back any computer scientists and engineers attracted by the charisma of exciting problems using state-of-the-art computers who have left the country in the so-called brain drain. During this period it is important to take advantage of the training systems now developed in North America, Europe, and Japan, just as the Japanese took advantage of these systems when their industry was embryonic.

2. Enlarge applications specialties to include special systems interfaces. Special hardware interfaces could be provided by users, the applications industry, and manufacturers. This would create the base knowledge for the ultimate design and manufacture of computers.

3. User and applications industry would begin to import "standard" alternative manufactured computer options (e.g., memory modules, disks, terminals) to minimize systems costs. Systems would form from components by having local final assembly and testing. By this time a critical teaching and research mass will have been reached at a significant level internally so that the appropriate computer scientists and engineers can be attracted and held. Training, research and development will be primarily nationally based, maintaining the continual need for international cross-fertilization of ideas. However, these critical nationally attained skills are necessary since many computing applications are culture-based.

4. A secondary supplier industry would develop based on both buying lower level components (e.g., integrated circuits, disk drives) and interfacing to further reduced imports. Computer options would start to be manufactured locally both based on foreign and local designs.

5. Component manufacture may be possible when the market materialize.

If a user-directed, backward integration policy were implemented, one might see the beginning of stage two within one or two years, followed rapidly by stage three. Finally local peripheral interface designs marking stage four could occur as early as four years from the time of the policy adoption. Stage five is a Function of Market Size.

During all periods the number of computers, useful local applications, and most importantly, computer scientists and engineers, who provide a strong intellectual base for the industry, would grow. Simply trying to assemble imported, likely-to-be-obsolete components with the forward integration policy defers the applications that build up a critical mass of manpower, applications, and computers.

CONCLUSION

The different approaches toward the goal of establishing a national computer industry have varying risks, costs, and benefits as clearly outlined in the appendix. The conventional approach to establishing an industry is manufacturing-directed licensing, starting with components in a bottom-up fashion and is most risky, expensive, and has been uniformly unsuccessful for computers. The ultimate goal of indigenous design following the bottom-up approach called "forward integration" is implicitly predicated on slowly evolving standard components. In contrast, for rapidly evolving or high technologies with short component life, a "top down" user-based approach, starting with the application, categorized as "backward integration" is probably best. The computer industry falls into the second category since many rapidly changing disciplines and technologies are required for building and using computers. By initiating a policy based on the second approach a country can establish an appropriate computer industry provided it is <u>based on standards</u>. It will become self-sufficient quickly, and with less imports than by taking the forward integration approach. Futhermore, it can be shown (Appendix 1) that the forward integration approach can require more component imports than a fully assembled computer because the technology evolves so rapidly!

Backward integration necessitates the selection of one or more standard computer families. However, is desirable to <u>not</u> segment and control the market by size because emerging distributed processing systems are built more easily from a single general architecture. Furthermore, since computer prices decline rapidly, a computer characterized in one class now will enter a new class in a few years. The adoption of an "industry standard" allows rapid take-off in computational ability and the selection is based on four criteria: 1) wide range of available applications programs enabling immediate effective use; 2) cost-effectiveness and expandability as shown by various metrics including address space size; 3) availability of a family range from micro- to mainframe computer so that a small number of architectures (hopefully one), maximizes training, permits alternative computing styles to fit various problems, and results in a maximum cumulative learning curve; and 4) compatibility and accessibility through numerous suppliers for peripheral equipment and software.

Appendix 1 - Case Study of Santioned Monopoly, Free Market Import and Backward Integration Strategies

In one country a sanctioned monopoly was set up to license and manufacture what was basically an obsolete computer. The following analysis of a five year period shows, in principle, the situation and compares it with scenarios based on different policies. It neglects any user loss of productivity because of poor computers, and any import duties (since the licensee was given duty free status).

Four cases are compared:

1. Monopoly (actual) - no manufacturing was achieved and licensee only imported finished goods.

2. Monopoly (plan) - the monopoly was to have imported finished goods the first year, put together sub-assemblies the second year, and assemble the sub-assemblies from components the third year.

3. Free Market Import - No controls, are assumed. The most cost-effective system is imported.

4. Free Market Import with Backward Integration - Case 3, except a policy (e.g. duties) which gives preference to minimizing import content is instituted. In the second and third year sub-assemblies are put together locally and in the fourth and fifth years sub-assemblies are built from imported components. The base design can only be changed each two years for new components!

A summary of the results of the four cases using various costs, markups, and market data is described below:

	Total Import (M$)	Local Mfg (M$)	Cost to Users
Monopoly (actual)	78.2	0	488
Monopoly (plan)	44.2	34.0	488
Free Market Import	44.1	0	88
Free Mkt Import with Mfg.	32.0	17.2	83.3

For the study, the market is assumed to grow at 50%/year using the following units: 295 (first year), 443, 666, 1000, and 1500 (fifth year).

The following markups for sales and service are assumed:

Monopoly (actual)	6.25
Monopoly (plan)	6.25
Free Market Import	2.0
Free Market, Local Assembly	2.5
Free Market Local Assembly and Sub-Assemblies (using imported components)	3.0

It is further assumed that the following local content is possible:

Importing Finished Goods	0%
Importing Sub-assemblies	25%
Importing Components	50%

Case and Price Year	Import Cost/ Unit (K$)	Total Import Cost (M$)	Local Mfg. (M$)	User Price (K$)	Total (M$)
Monopoly (actual)					
1	20	6	0	125	36.9
2	20	8.9	0	125	55.3
3	20	13.3	0	125	83.3
4	20	20	0	125	125
5	20	30	0	125	187.5
		78.2			488.
Monopoly (plan)					
1	20	6	0	125	36.9
2	15	6.6	2.3	125	55.3
3	10	6.7	6.7	125	83.3
4	10	10	10	125	125
5	10	15	15	125	187.5
		44.2	34.		488
Free Market Import					
1	20	6	0	40	11.8
2	16	7.1	0	32	14.2
3	12.8	8.5	0	25.6	17.0
4	10.2	10.2	0	20.4	20.4
5	8.2	12.3	0	16.4	24.6
		44.1	0		88.
Free Market Import With Staged (each two years) Local Manufacture					
1	20	6	0	40	11.8
2	12	5.3	1.8	30	13.3
3	12	8.0	2.7	30	20.
4	5.1	5.1	5.1	15.3	15.3
5	5.1	7.6	7.6	15.3	22.9
		32.0	17.2		83.3

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Two highly distinct paths for establishing a national computer industry illustrate the high costs and benefits involved in achieving this goal. The most conventional approach to establishing an industry is manufacturing-directed licensing, starting with components in a bottom-up fashion. The ultimate goal of indigenous design is usually called "forward integration" of standard, components expected to have long life-times. In contrast, for rapidly evolving, or high technologies with short component life times a "top down" oriented user-based approach with the ultimate goal of indigenous design can be categorized as a "backward integration". The computer industry falls into the second category since many rapidly changing disciplines and technologies are required for building and using computers. By initiating a policy based on the second approach a country will not only rapidly establish an appropriate computer, <u>based on international standards</u>, industry but will become self-sufficient quickly, and with less imports than by taking forward integration manufacturing approach.

Backward integration necessitates the selection of one or more standard computer families and may even have a goal of establishing and indigenous architecture and programming language to further control inputs. It is desirable to <u>not</u> segment and control the market by size because emerging distributed processing systems are built more easily from a single general architecture. The adoption of an international "standard" allows rapid take-off in computational ability and is based on four criteria: 1) wide range of applications programs enabling immediate effective use; 2) cost-effectiveness and expandability as shown by various metrics and address space size; 3) availability of a family range from micro- to mainframe computer so that a small number of architectures (hopefully one), maximizes training, permits alternative computing styles to fit various problems, and results in a maximum cumulative learning curve; and 4) compatibility and accessibility through numerous sources of supply for peripheral equipment and software.

The poorest method for establishing a high technology industry is by government sanctioned, local monopolistic companies. For example, a company selected a high cost, non-standard, low performance basically obsolete computer for license from a North American that might have failed except for its exports to its foreign "licensee". This company then promised their government the following three-year, three-stage process: putting together sub-assemblies, and finally building sub-assemblies from imported circuit components under license. After five years, the local "manufacturer" was still importing finished goods, and no progress has been made toward local manufacturing. The computer was fundamentally unable to accomplish most of the tasks that were promised. The local company has a monopoly that has cost the country roughly a factor of two or $34M in balance of payments over the promised commitment and $50M over what could have been accomplished under a policy permitting competition for users and for manufacture. (See Appendix 1) Also, the users have paid a factor of 5.5 times or $400M extra for equipment because user applications, such as programming, maintenance, and operations costs (e.g. power and air conditioning) are several times greater for technically obsolete equipment. Certain applications are not possible, and where possible but not available, effort has to be expanded in doing applications.

Rather than using monopolies to establish industry, a simple policy could help establish local industry: each computer purchased would be approved by the government based on the total import cost prior to duty. The incentives to all would be clear and the system would self adjust rapidly! Alternatively, simple duties of any percentage, would work just as well, no doubt, avoiding bureaucracies, hassle and loss of productivity!

The Ongoing Computer Evolution

The computer has evolved more rapidly than any other man-made object as measured by improved price for a given component or by improved performance at a given price. By either of these measures, the rate of improvement is 20 to 30 percent per year. This means that if a given system at year (t) is 1.0, at year (t+1) it will be 0.8, and at (t+2), 0.64, and (t+3), 0.51. Every 3 years, the price halves. These measures have held constant for 20 years, and do not even take into account inflation. In contrast, nearly all consumer goods, such as automobiles, have increased in price at least an inflationary rate!

By the end of the seventies, computers have become all pervasive including many hardware technologies, some of which have necessarily evolved more rapidly than the normal rate. Major computer components are semiconductors, magnetic recording, conventional electronic sub-assemblies, various printing and xerography, video display, human speech i/o, analog i/o for process control and conventional communications. The software technologies are even broader, ranging from operating systems which administer computers to conventional computer languages in which application systems are written. Since computers can either supplement (and in some cases supplant) every other form of information processing, the almost infinite number of applications require broad technological expertise. Information processing includes all aspects of storage, transmission, switching, control, and processing. The software specialists must know the subject of the application deeply and unambiguously so that it can be made algorithmic and they must know the computer almost as well. In all fields, we continue to see manpower and training as limiting computer use.

Establishing a Computer Industry via the Forward Manufacturing Approach

The conventional manufacturing approach for establishing an industry usually cuts off external supply by sanctioning various firms to operate as monopolies and builds up internal manufacturing via licenses, joint ventures, and favored manufacturers. Only essential components and manufacturing equipment are imported. This approach is most successful when the evolution rate is low (i.e. automobiles, tv sets, radios) or where the ultimate goal is world market domination. However, in either case, the essential first step is the manufacture of all components, raw materials, and in some cases the equipment to manufacture components. For example, even though the Japanese have had the goal to dominate in computer manufacturing for 25 years, until recently they lacked the internal manufacture of critical components (e.g. semiconductors and magnetics) as well as software technology. If Japan, or any other country, starts with the goal of internal computer manufacturing to limit imports, the flow may well become increasingly more negative due to increased reliance on critical outside component and software suppliers. For example, had a country engaged in manufacturing transistorized and MSI based calculators in 1975 with imported semi-conductor components, in 1978 it would be possible to obtain the complete calculator for less than the imported component cost because with each new generation radically different parts are used. In a similar case relating to computers, more imports of raw materials occurred to build expensive disk memories and computer systems that were obsolete on completion. Purchase by??? completion date would have been cheaper since the price halves each 3 years.

Virtually every country that has operated a protected, computer industry (except recently Japan) has paid a significant price in terms of both imports and price to users. Computing with obsolete computers, has cost the country scarce resources to design, apply, and operate. This also defers economic gains of computing and facing critical applications questions. Only the government sanctioned monopolies (often owned by a few individuals) have profited!

Simultaneously establishing the manufacture of the critical base components, test equipment and component manufacturing equipment for a high technology product like computers is probably not feasible. Even manufacture of the lowest technology parts (e.g., printed circuit boards) is hazardous because these components may limit the final product as described in the calculator and computer components examples above. Manufacture of high technology components is generally not feasible because they evolve so rapidly that they do not achieve the learning curve without a significant market; require very high cost plant and equipment which is obsolete at a rapid rate: and require a highly skilled manufacturing engineering base to manage and interface with the design engineers. It's interesting to note that neither state-of-the-art (i.e. cost effectivve or least cost) disks nor semiconductors are manufactured away from their design group.

Since the critical resource for the manufacture and use of computers is educated manpower, their effective allocation has to be central to any effort in establishing a computer industry. If these limited numbers are utilized for manufacture, then there are few left to do the critical systems applications jobs. Reversing the allocation using the skilled manpower to use computers for significant and necessary tasks will lead both to a more rapid computer population and their manufacture locally.

Establishing An Industry By An Indigenous, Local Design

Most attempts to design, produce and sell computers either fail to meet their market and profit objectives or fail to be cost-effective over competitive alternatives. Many U.S. and foreign firms who at one time engaged in manufacture no longer exist in the market. Computers designed for special purpose (e.g. Military) have been shown to be particularly cost ineffective over their standard, commercial counter parts such that the distinction has finally disappeared.

While many of the scenarios described above have particularly poor effects on all aspects of an economy, a local indigenous design is likely to have the worst effect. The temptation is especially great because the art of computer design (architecture) is fascinating. By not adopting and backward integrating, untold resources are required to engage in hardware and software design that could otherwise be applied to implementing computers based on standards, or be applied directly to applications.

Establishing A Computer Industry Via the User-Directed, Backward Integration Manufacturing Approach

A policy that encourages using state-of-the-art computers to be applied in a standards-setting fashion will ultimately result in appropriate local computer manufacture. The selection of the right computer standards is essential, otherwise the situation is exactly what countries that do not have a computer industry fear--manufacturer domination.

It is interesting to note that until Japan adopted the approach of building computers to the IBM standard, its machines were uncompetitive (even in a closed market) and were ultimately withdrawn, requiring user program conversion.

The backward integration path was followed, interfacing with many manufacturers to license computer architecture know-how and hardware technology. Ultimate success occurred by an open market, by using the standard, by engineering near copies, and by its own large internal market. The standards for computer selection are:

1. Maximum range of applicability - germane to evolving applications. Leverage of internal resources can be gained by selecting the most appropriate machine family for the key range of applications.

2. Valuation balancing the conventional metrics for cost, cost/performance, and address size. A trade-off for larger address-space may offset short-term gains in cost-performance with smaller address-space.

3. Large family range of machine models from micro to mainframe. The utilization of one family versus a variety of machine-types maximizes the learning in terms of physical implementations, architecture, and software

across all system ranges from the processor-on-a-chip (often called a microcomputer), through dedicated systems for special purpose use (often called a minicomputer) and to a large, shared, central system serving many users and managed by a staff (often called a mainframe). This would help achieve a critical mass of local experts.

4. Be available from numerous suppliers in a "standards-based" fashion. Ideally, each machine in a range would be the "defacto standard" machine. A defact standard has the following characteristics: a large fraction of installed units; well-defined system interfaces that manufacturers, users, and third-party suppliers understand; and many supply sources so that a user can build up systems by assemblying components via numerous fashions.

By using a standards-setting system, one is assured of having the latest models available, alternative competitive sources of supply and a method of intercommunications that has lasted and will last over time since it is understood and used by many different groups.

It is the "standards" approach that provides the method for backward integration into local manufacturing via the following steps.

1. Import complete systems and assign them to critical applications. This will help attract back any computer scientists and engineers attracted by the charisma of exciting problems using state-of-the-art computers who have left the country in what has been called the brain drain. During this period it is important to take advantage of the training systems now developed in North America, Europe, and Japan, just as the Japanese took advantage of these systems when their industry was embryonic.

2. Enlarge applications specialties to include special systems interfaces. Special hardware interfaces could be provided by users, the applications industry, and manufacturers. This would create the base knowledge for the ultimate design and manufacture of computers.

3

. User and applications industry would begin to import "standard" alternative manufactured computer options (e.g., memory modules, disks, terminals) to minimize systems costs. Systems would form from components by having local final assembly and testing. By this time a critical teaching and research mass will have been reached at a significant level internally so that the appropriate computer scientists and engineers can be attracted and held. Training, research and development will be primarily nationally based, maintaining the continual need for international cross-fertilization of ideas. However, these critical nationally attained skills are necessary since many computing applications are culture-based.

4

. A secondary supplier industry would develop based on both buying lower level components (e.g., integrated circuits, disk drives) and interfacing to further reduced imports. Computer options would start to be manufactured locally both based on foreign and local designs.

If a user-directed policy were implemented, one might see the beginning of stage two within one or two years, followed rapidly by stage three. Finally local peripheral interface designs marking stage four could occur as early as four years from the time of the policy adoption.

During all periods the number of computers, useful local applications, and most importantly, computer scientists and engineers, who provide a strong intellectual base for the industry, would grow. Simply trying to assemble imported, likely-to-be-obsolete components with the manufacturing-based policy defers the applications that build up a critical mass of manpower, applications, and computers.

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Backward integration necessitates the selection of one or more standard computer families and may even have a goal of establishing an indigenous architecture and programming language to further control imports. However, is desirable to <u>not</u> segment and control the market by size because emerging distributed processing systems are built more easily from a single general architecture.

Furthermore, since computer prices decline rapidly, a computer characterized in one class now will enter a new class in a few years. The adoption of an "industry standard" allows rapid take-off in computational ability and the selection is based on four criteria: 1) wide range of available applications programs enabling immediate effective use; 2) cost-effectiveness and expandability as shown by various metrics including address space size; 3) availability of a family range from micro- to mainframe computer so that a small number of architectures (hopefully one), maximizes training, permits alternative computing styles to fit various problems, and results in a maximum cumulative learning curve; and 4) compatibility and accessibility through numerous suppliers for peripheral equipment and software.

<u>A Poor Policy Example</u>

The poorest method for establishing a high technology industry is by government sanctioned, local monopolistic companies because computers evolve more rapidly than governmental decision making processes. Appendix 1 describes the scenario of such a case. Her, a monopolistic company selected a high cost, non-standard, low performance basically obsolete computer for license from a North American that might have failed except for its exports to its foreign "licensee". The company then promised their government the following three-year, three-stage backward integration process: importing finished goods, putting together sub-assemblies, and finally building sub-assemblies from imported circuit components under license. After five years, the local "manufacturer" was still importing finished goods, and no progress has been made toward local manufacturing. The computer was fundamentally unable to accomplish most of the tasks that were promised. The local company has a monopoly that has cost the country roughly a factor of two or $34M in imports over the promised commitment and $50M over what could have been accomplished under a policy permitting competition which would encourage local manufacture.   Also, the users have paid a factor of 5.5 times or $400M extra for equipment. Also, user costs including applications programming, maintenance, and operations (e.g. power and air conditioning) are several times greater for technically obsolete equipment. Certain applications are not possible, and where possible but not available, local effort has to be expanded in doing applications.

Rather than using monopolies to establish industry, government approval of imports based on the import cost would stimualte local manufacture. The incentives to all would be clear and the system would adjust rapidly! Alternatively, simple duties of any percentage, would probably work as well, avoiding bureaucracies, hassle and loss of productivity!

The Ongoing Computer Evolution

The computer has evolved more rapidly than any other man-made object as measured by improved price for a given component or by improved performance at a given price. By either of these measures, the rate of improvement is 20 to 30 percent per year. This means that if the price of a given system at year (t) is 1.0, at year (t+1) it will be 0.8, and at (t+2), 0.64, and (t+3), 0.51. Every 3 years, the price halves. These measures have held constant for 20 years, and do not even take into account inflation. For example, in 1970 a boxed, PDP-11/20 with 4096 word memory sold for $9,300; in 1976 a large scale integrated version was introduced that sold for $1995. This price reduction amounts to a yearly price reduction of 23% compound annually. In contrast, nearly all consumer goods, such as automobiles, have increased in price at least an inflationary rate! The consumer price index and the prices of constant function computers are plotted in Fig. 1.

By the end of the seventies, computers have become all pervasive built on many hardware technologies, some of which have necessarily evolve very rapidly. Major computer components are semiconductors, magnetic recording, conventional electronic sub-assemblies, various printing and xerography, video display, human speech i/o, analog i/o for process control and conventional communications. The software technologies are even broader, ranging from operating systems which administer computers to conventional computer languages in which application systems are written.
These components are arranged in what appears to be a hierarchy which we refer to as the levels of integration. The highest level is the application and the lowest is the physical device used to hold or process information. It is the structuring of the following levels either starting from the top applicaion (use) or starting from the bottom or device phenomenon, that form the basis of either the backward or forward integration manufacturing alternatives described above. The levels of integration are:

Application software- particular instance of use

Application components library software- parts for building an application

Basic software- includes standard programming languages, data management,
network, and operating system software for building any application

Basic Hardware System- all the hardware of the system

Computer Component Hardware Options- packages of boxes or cabinets, such as
disk and tape units, terminals, memories, processing units, etc.
Printed Circuit Modules- holders of the semiconductor circuits
Semiconductor circuits in a single integrated circuit array package-
the smallest physical component from which the computer is formed

Two additional concepts are important in understanding computing: architecture and implementation. Computer architecture is the interface of a machine as seen by a program or programmer, and is an important standard because it provides the user with a constant base for writing (investing in) programs, examples include the IBM 360, and the DEC PDP-11. Although there is a temptation to change the architecture to fit the technology or the application, changes in a given architecture and among several architectures produce relatively small changes (a factor of 4) in cost or performance. Most changes in architecture have occurred by having to change the amount of memory that a program is able to access. Address size (roughly corresponding to brain cavity size) is the single parameter of architecture that must be attended to, because it is the limit on how large the computer can be.

Implementation is the building of a particular computer model, (e.g. an IBM 370 Model 158) using a specific hardware technology, that operates according to the architectural standard. It is important that there be many implementations of a given architecture over a wide price range (typically 100) so that a user may select the appropriate price and performance model for a given application. In a similar fashion, it is important to implement various models of the same architecture with evolving technologies over a long time period so that user software investment and training is protected.

Since computers can either supplement (and in some cases supplant) every other form of information processing, the almost infinite number of applications require broad technological expertise. Information processing includes all aspects of storage, transmission, switching, control, and processing. The software specialists must know the subject of the application deeply and unambiguously so that it can be made algorithmic and they must know the computer almost as well. Currently, these specialists appear to be the limit of computer use.

Policy Dimensions

Nearly all governments establish policies which they feel will allow computer industries to form and thrive. There are many alternatives ways to establish a computer industry. Rather than ennumerating all the alternative policies, the three important dimensions are control: of supplier-market, manufacturing, and architecture (i.e. standards). Roughly speaking, these are: Who's allowed to supply computers; How is the supplier allowed to obtain the product; and What is the supplier allowed to supply. Atlhough there are hundreds of alternatives for each dimension, we only concentrate on two or three, for each of the three dimensions, giving a total of 2 x 3 x 3 (18) basic alternatives. Of these, somee cases will be discussed in detail following a discussion of the three dimensions.

Who's allowed to supply computers?

From a nationalistic viewpoint, this is the most sensitive, political and seemingly important dimension. It is involved in attitudes toward foreign and multinational firms, government and private ownership, etc. However, from the viewpoint of the final result, it is a relatively unimportant decision except as it affects the selection of the manufacturing and computer standard policy.

Government ownership of computer industries have so far been singularly unsuccessful (e.g. the Eastern Bloc), and hence not even worth considering as an alternative. The issue of whether there be local or multinational ownership also seems less important, except as it relates to limit the ability to use a particular standard. Hence, only the two extreme cases will be considered:

1. Free market; and
2. Government sanctioned monopoly.

In the former case, any group who is willing to live within the various governmental constraints is free to engage in the market.

A free market is likely to introduce many standards, hence cummulative learning about applications standards to be minimum. In the later case, by some process, the government sanctions a particular organzation to be the monopolistic supplier usually to a particular market segment. The computer is no exception to the rule that monopolies are likely to be most costly: in addition, the complexity of the product clouds attempts to understand cost.

<u>How's the supplier allowed to obtain the product?</u>

Like all organizations, countries are especially concerned with how products are obtained because of the pressure to get state of the art products, independent of where they originate and hence exacerbate their balance of payments problem. Thus, the main issue is how much of a computer should be imported and then how to reduce the imports.

While it is extremely important and nationalistic to believe that, de facto, a computer should be manufactured locally, Appendix 1 shown here a strategy of local manufacture can require more imports for component parts than if a later model product were fully imported! Hence, importing finished goods is the best alternative for many countries.

Given, that local manufacture appears feasible in terms of market, manpower and capital, then either forward or backward integration can be used to evolve to full manufacture (so far only attained by U.S. and Japan). Integration requires a strong technology base, and for computers has been demonstrably impossible except in the U. S.

Therefore the alternatives for Manufacturing are:

1. Import complete products;
2. Backward integrate, starting with the user application; and
3. Forward integrate, starting with components.

<u>What is the supplier allowed to supply? (Standards and the Product)</u>

In the section on the On Going Computer Evolution the architecture and implementation concepts that underlie the product were described. There are three alternatives describe a range standards control:

1. Use established, de facto "industry standards";
2. Design and evolve a unique, indigenous vanity architecture; and
3. Use any product in a non-standards fashion.

In the first case, there is a wide array of hardware and software components in the marketplace that can be potentially used (i.e. bought, copied, licensed, etc.). The standards are de facto because of their strong marketplace position and as such there is an alternative source of supply to the originating organization that provided the computer. (The so called plug-compatible industry). The temptation to build a "national computer" is so great, and the results so deleterious, that this special case is described in a secion below. The third case ignores the standards question and permits free use of what ever products happen to make it into the environment. It's effect is less clear because the market can structure to automatically provide "the standards".

Establishing a Computer Industry via the Forward Manufacturing Approach

The conventional manufacturing approach for establishing an industry usually cuts off external supply by sanctioning various firms to operate as monopolies and builds up internal manufacturing via licenses, joint ventures, and favored manufacturers. Only essential components and manufacturing equipment are imported. This approach is most successful when the evolution rate is low (i.e. automobiles, tv sets, radios) or where the ultimate goal is world market domination. However, in either case, the essential first step is the manufacture of all components, raw materials, and in some cases the equipment to manufacture components. For example, even though the Japanese have had the goal to dominate in computer manufacturing for 25 years, until recently they lacked the internal manufacture of critical components (e.g. semiconductors and magnetics) as well as software technology.

In essence, Japan switched from forward integration to backward integration to become successful. If Japan, or any other country, starts with the goal of internal computer manufacturing to limit imports, the flow may well become increasingly more negative due to increased reliance on critical outside component and software suppliers. For example, had a country engaged in manufacturing transistorized and MSI based calculators in 1975 with imported semi-conductor components, in 1978 it would be possible to obtain the complete calculator for less than the imported component cost because with each new generation radically different parts are used. In a similar case relating to computers, more imports of raw materials occurred to build expensive disk memories and computer systems that were obsolete on completion.

Virtually every country that has operated a protected, computer industry (except recently Japan) has paid a significant price in terms of both imports and price to users. Computing with obsolete computers, costs each country scarce resources to design, apply, and operate. This also defers economic gains of computing and facing critical applications questions. Only the government sanctioned monopolies (often owned by a few individuals) have profited!

Simultaneously establishing the manufacture of the critical base components, test equipment and component manufacturing equipment for a high technology product like computers is probably not

feasible. Even manufacture of the lowest technology parts (e.g., printed circuit boards) is hazardous because these components may limit the final product as described in the calculator and computer components examples above. Manufacture of high technology components is generally not feasible because they evolve so rapidly that they do not achieve the learning curve without a significant market; require very high cost plant and equipment which is obsolete at a rapid rate; and require a highly skilled manufacturing engineering base to manage and interface with the design engineers. It's interesting to note that neither state-of-the-art (i.e. cost effective or least cost) disks nor semiconductors are manufactured away from their design group.

Since the critical resource for the manufacture and use of computers is educated manpower, their effective allocation has to be central to any effort in establishing a computer industry. If these limited numbers are utilized for manufacture, then there are few left to do the critical systems applications jobs. Reversing the allocation using the skilled manpower to use computers for significant and necessary tasks will lead both to a more rapid computer population, the basis for establishing local manufacture.

Establishing An Industry By An Indigenous, National Vanity Design

Most attempts to design, produce and sell computers either fail to meet their market and profit objectives or fail to be cost-effective over competitive alternatives. Many U.S. and foreign firms who at one time engaged in manufacture no longer exist in the market. Vanity computers designed for special purpose (e.g. Military) have been shown to be particularly cost ineffective over their standard, commercial counterparts such that the distinction has finally disappeared.

While many of the scenarios described above have particularly poor effects on all aspects of an economy, a local indigenous design is likely to have the worst effect. The temptation is especially great because the art of computer design (architecture) is fascinating. By not adopting standards and backward integrating, untold resources are required to engage in hardware and software design that could otherwise be applied to implementing computers based on standards, or be applied directly to applications.

Establishing A Computer Industry Via the User-Directed, Backward Integration Manufacturing Approach Based on Industry Standards

A policy that encourages using state-of-the-art computers to be applied in a standards-setting fashion will ultimately result in appropriate local computer manufacture. The selection of the right computer standards is essential, otherwise the situation is exactly what countries that do not have a computer industry fear--manufacturer domination and lack of the right standards.

It is interesting to note that until Japan adopted the approach of building computers to the IBM standard, its machines were uncompetitive (even in a closed market) and were ultimately withdrawn, requiring user program conversion. The backward integration path was finally followed, interfacing with many manufacturers to license computer architecture know-how and hardware technology. Ultimate success occurred by an open market, by using the industry standard, by engineering near copies, and by its own large internal market.

The selection criteria for industry standards

There are four criteria to use in the selection of the de facto standards. The first relates to the available investment of software which is very analogous to a balance sheet. The second is the goodness of the architectural standard while the third deals with the implementation range. Finally the fourth, verifies that the standard is real in the marketplace by having multiple suppliers.

1. Maximum range of applicability - germane to evolving applications. Leverage of internal resources can be gained by selecting the most appropriate machine family based on application programs.

2. The conventional metrics for cost, cost/performance, and address size. A trade-off for larger address-space may offset short-term gains in cost-performance with smaller address-space.

3. Large family range of machine models from micro to mainframe. The utilization of one family versus a

variety of machine-types maximizes the learning in terms of physical implementations, architecture, and software across all system ranges from the processor-on-a-chip (often called a microcomputer), through dedicated systems for special purpose use (often called a minicomputer) and to a large, shared, central system serving many users and managed by a staff (often called a mainframe). This helps achieve a critical mass of local experts.

4. Be available from numerous suppliers in a "standards-based" fashion. Ideally, each machine in a range would be the "defacto standard" machine. A de facto standard has the following characteristics: a large fraction of installed units; well-defined system interfaces that manufacturers, users, and third-party suppliers understand; and many supply sources so that a user can build up systems by assemblying components via numerous fashions.

By using a standards-setting system, one is assured of having the latest models available, alternative competitive sources of supply and a method of intercommunications that has lasted and will last over time since it is understood and used by many different groups.

The Backward Integration Steps

It is the "standards" approach that provides the method for backward integration into local manufacturing via the following steps:

1. Import complete systems and assign them to critical applications. This will help attract back any computer scientists and engineers attracted by the charisma of exciting problems using state-of-the-art computers who have left the country in what has been called the brain drain. During this period it is important to take advantage of the training systems now developed in North America, Europe, and Japan, just as the Japanese took advantage of these systems when their industry was embryonic.

2. Enlarge applications specialties to include special systems interfaces. Special hardware interfaces could be provided by users, the applications industry, and manufacturers. This would create the base knowledge for the ultimate design and manufacture of computers.

3. User and applications industry would begin to import "standard" alternative manufactured computer options (e.g., memory modules, disks, terminals) to minimize systems costs. Systems would form from components by having local final assembly and testing. By this time a critical teaching and research mass will have been reached at a significant level internally so that the appropriate computer scientists and engineers can be attracted and held. Training, research and development will be primarily nationally based, maintaining the continual need for international cross-fertilization of ideas. However, these critical nationally attained skills are necessary since many computing applications are culture-based.

4. A secondary supplier industry would develop based on both buying lower level components (e.g., integrated circuits, disk drives) and interfacing to further reduced imports. Computer options would start to be manufactured locally both based on foreign and local designs.

If a user-directed, backward integration policy were implemented, one might see the beginning of stage two within one or two years, followed rapidly by stage three. Finally local peripheral interface designs marking stage four could occur as early as four years from the time of the policy adoption.

During all periods the number of computers, useful local applications, and most importantly, computer scientists and engineers, who provide a strong intellectual base for the industry, would grow. Simply trying to assemble imported, likely-to-be-obsolete components with the forward integration policy defers the applications that build up a critical mass of manpower, applications, and computers.

Appendix 1 - Case Study of Santioned Monopoly, Free Market Import and Backward Integration Strategies

In one country a sanctioned monopoly was set up to license and manufacture what was basically an obsolete computer. The following analysis of a five year period shows, in principle, the situation and compares it with scenarios based on different policies. It neglects any user loss of productivity because of poor computers, and any import duties (since the licensee was given duty free status).

Four cases are compared:

1. Monopoly (actual) - no manufacturing was achieved and licensee only imported finished goods.

2. Monopoly (plan) - the monopoly was to have imported finished goods the first year, put together sub-assemblies the second year, and assemble the sub-assemblies from components the third year.

3. Free Market Import - No controls, are assumed. The most cost-effective system is imported.

4. Free Market Import with Backward Integration - Case 3, except a policy (e.g. duties) which gives preference to minimizing import content is instituted. In the second and third year sub-assemblies are put together locally and in the fourth and fifth years sub-assemblies are built from imported components. The base design can only be changed each two years for new components!

A summary of the results of the four cases using various costs, markups, and market data is described below:

	Total Import (M$)	Local Mfg (M$)	Cost to Users
Monopoly (actual)	78.2	0	488
Monopoly (plan)	44.2	34.0	488
Free Market Import	44.1	0	88
Free Mkt Import with Mfg.	32.0	17.2	83.3

For the study, the market is assumed to grow at 50%/year using the following units: 295 (first year), 443, 666, 1000, and 1500 (fifth year).

The following markups for sales and service are assumed:

Monopoly (actual)	6.25
Monopoly (plan)	6.25
Free Market Import	2.0
Free Market, Local Assembly	2.5
Free Market Local Assembly and Sub-Assemblies (using imported components)	3.0

It is further assumed that the following local content is possible:

Importing Finished Goods	0%
Importing Sub-assemblies	25%
Importing Components	50%

Case and Price Year	Import Cost/ Unit (K$)	Total Import Cost (M$)	Local Mfg. (M$)	User Price (K$)	Total (M$)
Monopoly (actual)					
1	20	6	0	125	36.9
2	20	8.9	0	125	55.3
3	20	13.3	0	125	83.3
4	20	20	0	125	125
5	20	30	0	125	187.5
		78.2			488.
Monopoly (plan)					
1	20	6	0	125	36.9
2	15	6.6	2.3	125	55.3
3	10	6.7	6.7	125	83.3
4	10	10	10	125	125
5	10	15	15	125	187.5
		44.2	34.		488
Free Market Import					
1	20	6	0	40	11.8
2	16	7.1	0	32	14.2
3	12.8	8.5	0	25.6	17.0
4	10.2	10.2	0	20.4	20.4
5	8.2	12.3	0	16.4	24.6
		44.1	0		88.
Free Market Import With Staged (each two years) Local Manufacture					
1	20	6	0	40	11.8
2	12	5.3	1.8	30	13.3
3	12	8.0	2.7	30	20.
4	5.1	5.1	5.1	15.3	15.3
5	5.1	7.6	7.6	15.3	22.9
		32.0	17.2		83.3

PAPER1/8

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Computers are at the center of current industrial growth because they are tools, for modern communications and manufacturing, and components of nearly every industrialized product. For example, in the automobile industry computers, are used in design, in corporate control, in manufacturing control, and used in the car itself. National economic policy making still relates to slowly evolving energy- and materials-based industries characteristic of the past rather than rapidly evolving technology. Effective policies for innovative, knowledge based industries have not been formulated because the key to policy-making, the computer itself has not been understood.

In establishing a computer industry, the foundations of the new technologically based society are laid, and the development of an information-based economy can be established. Without a computer industry any country is doomed to a backward, poor economy. Fear, greed, and strong national interests have led to policies for establishment of computer industry that have had counter-intuitive effects, slowing down rather than hastening the process because assumptions have been made based on conventional instead of rapidly evolving, high technology industrialization. In order to describe appropriate policies for the development of a computer industry, the nature of computer evolution is first explained.

The Ongoing Computer Evolution

The computer has evolved more rapidly than any other man-made object as measured by improved price for a given computer or by improved performance at a given price. By either of these measures, the rate of improvement is 20 to 30 percent per year. This means that if the price of a given system at year (t) is 1.0, at year (t+1) it will be 0.8, and at (t+2), 0.64, and (t+3), 0.51. Every 3 years, the price halves. These measures have held constant for 20 years, and do not even take into account inflation. For example, in 1970 a boxed, PDP-11/20 with 4096 word memory sold for $9,300; in 1976 a large scale integrated version was introduced that sold for $1995. This price reduction amounts to a yearly price reduction of 23% compound annually. In contrast, nearly all consumer goods, such as automobiles, have increased in price at least an inflationary rate! The consumer price index and the prices of constant function computers are plotted in Fig. 1.

Computers performance has improved roughly eight orders of magnitude during the 30 years of their life. Logic and memory technology generations mark this improvement:

1. Vacuum tubes/drum, electrostatic memory 1948-1958;
2. Transistors/core memories 1958-1966;
3. Integrated circuits core memory 1966-1974;
4. Large scale integrated circuits for processor-on-a-chip computers/integrated circuit memory 1974-1980;
5. Very large scale integrated circuits 1980-

Computers not only have become all pervasive but have affected many other rapidly evolving technologies, including semiconductors, magnetic recording, conventional electronic sub-assemblies, xerography, video display, process control and conventional communications. Computers also require "software" technologies ranging from operating systems which administer computers to conventional computer languages in which application systems are written.

Computer components are ordered by what is known as levels of integration. The highest level is the application and the lowest is the physical device used to hold or process information. The structuring of the levels in Table I starting from the top applications (use) or starting from the bottom with physical devices form the basis of developing a computer industry either through backward or forward integration, respectively.

TABLE I

LEVELS OF INTEGRATION

Application software -- a particular use;

Application components library software -- generalized parts for building various applications quite often implemented as a special language (e.g. COGO for civil engineering);

Basic software -- includes standard programming languages (e.g. BASIC, COBOL, FORTRAN) data management, network, and operating system software for building any application;

Basic Hardware System -- all the hardware of the system (e.g. an IBM 370/148);

Computer Component Hardware Options -- packages of boxes or cabinets, such as disk and tape units, terminals, memories, processing units, etc.;

Printed Circuit Modules -- holders of the semiconductor circuits;

Semiconductor circuits in a single integrated circuit array package- the smallest physical component from which the computer is formed.

Two additional concepts are important in understanding computing: architecture and implementation. Computer architecture is the interface of a machine as seen by a program or programmer, and is an important standard because it provides the user with a constant base for writing (investing in) programs, examples include the IBM 360, and the DEC PDP-11. Although there is a temptation to change the architecture to fit the technology or the application, changes in a given architecture and among several architectures produce relatively small changes (a factor of 4) in cost or performance. Most changes in architecture have occurred by having to change the amount of memory that a program is able to access. Address size (roughly corresponding to brain cavity size) is the single parameter of architecture that must be attended to, because it is the limit on how large the computer can be.

Implementation is the building of a particular computer model, (e.g. an IBM 370 Model 158) using a specific hardware technology, that operates according to the architectural standard. It is important that there be many implementations of a given architecture over a wide price range (typically 100) so that a user may select the appropriate price and performance model for a given application. In a similar fashion, it is important to implement various models of the same architecture with evolving technologies over several computer hardware generations so that user software investment and training is protected.

Since computers can supplant every other form of information processing, storage, transmission, switching, control, and processing, broad technological expertise is required. Software engineers not only must know the subject of the application (e.g. manufacturing, civil engineering, communications) deeply and unambiguously so that it can be made algorithmic but they also must know the computer almost as well. (Flush?) The lack of standard architecture in the past, placed the emphasis on learning different machines. But with the agreement on standards, the potential for both substantive problem and computer understanding can be greater helping to overcome the current manpower shortage of software specialists currently limiting computer use.

Policy Dimensions

Nearly all governments establish policies which they feel will allow computer industries to form and thrive. There are many alternatives ways to establish a computer industry. Three important questions usually are the focus:

Who's allowed to supply computers?
How is the supplier allowed to obtain the product?
What is the supplier allowed to supply?

Although there are a wide spectrum of answers, concentration is placed on the extremes of each dimension. A total of 2 x 3 x 3 (18) alternatives are spelled out followed by scenarios of three policies.

Who's allowed to supply computers?

From a nationalistic viewpoint, the most sensitive, political and seemingly important dimension is who will be the supplier -- foreign or multinational firms, government, monopolies, and private individuals etc. From the viewpoint of the final result, this decision is relatively unimportant except as it affects the selection of the manufacturing and computer standard policy.

Government ownership of computer industries have so far been singularly unsuccessful (e.g. the Eastern Bloc), and hence not even worth considering as an alternative. The issue of whether there be local or multinational ownership also seems less important, except as it relates to limit the ability to use a particular standard. Hence, only the two extreme cases will be considered:

P1. Free market; and
P2. Government sanctioned monopoly.

In the former case, any group who is willing to live within the various governmental constraints is free to engage in the market. A free market is likely to introduce many standards, hence cummulative learning about applications standards to be minimum.

A government sanctioned monopolistic supplier is often given a particular market segment. Because of the complexity of computers with many components evolving at different rates, the static nature of governmental decision making to arrive at costs and prices often mean that the equipment decided upon is not only obsolete but also more costly than newer machines. The computer industry is no exception to the rule that monopolies are likely to be most costly.

How's the supplier allowed to obtain the product?

Like all organizations, countries are especially concerned with how products are obtained. The pressure to obtain state of the art products, independent of where they originate, is seen to exacerbate national balance of payments problems. The main issue is how much of a computer should be imported and then these imports could be reduced in the future.

While it is extremely important and nationalistic to believe that, de facto, a computer should be manufactured locally, Appendix 1 spells out how a strategy of local manufacture can require more imports for component parts than if a later model product were fully imported! Hence, importing finished goods is the best alternative for many countries.

Given, that local manufacture appears feasible in terms of market, manpower and capital, then either forward or backward integration can be used to evolve to full manufacture of all levels (so far only attained by U.S. and Japan). Forward integration requires a strong technology base, and for computers has been demonstrably impossible except in the U. S.

Therefore the alternatives for Manufacturing are:

M1. Import complete products;

M2. Backward integration, starting with the user application; and

M3. Forward integration, starting with components.

What is the supplier allowed to supply? (Standards and the Product)

In the section on the On Going Computer Evolution the architecture and implementation concepts that underlie the product were described. There are three alternatives describe a range of standards control:

S1. Use established, de facto "industry standards";

S2. Design and evolve a unique, indigenous vanity architecture; and

S3. Use any product in a non-standards fashion.

In the first case, there is a wide array of hardware and software components in the marketplace that can be potentially used (i.e. bought, copied, licensed, etc.). The standards are de facto because of their strong marketplace position and as such there is an alternative source of supply to the originating organization that provided the computer. (The so called plug-compatible industry). The temptation to build a "national computer" is so great, and the results so deleterious, that this special case is described in a section below. The third case ignores the standards question and permits free use of what ever products happen to make it into the environment. It's effect is less clear because the market can structure to automatically provide "the standards" by rejecting the non-standards.

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The conventional manufacturing approach for establishing an industry usually cuts off external supply by sanctioning various firms to operate as monopolies and builds up internal manufacturing via licenses, joint ventures, and favored manufacturers. Only essential components and manufacturing equipment are imported. This approach is most successful when the evolution rate is low (i.e. automobiles, tv sets, radios) or where the ultimate goal is world market domination. However, in either case, the essential first step is the manufacture of all components, raw materials, and in some cases the equipment to manufacture components. For example, the Japanese who for 25 years have had the goal to dominate in computer manufacturing, lacked the internal manufacture of critical components (e.g. semiconductors and magnetics) as well as software technology until recently.

In essence, Japan switched from forward integration to backward integration to become successful. If Japan, or any other country, starts with the goal of internal computer manufacturing to limit imports, the flow may well become increasingly more negative due to increased reliance on critical outside component and software suppliers. For example, had a country engaged in manufacturing transistorized and MSI based calculators in 1975 with imported semi-conductor components, in 1978 it would be possible to obtain the complete calculator for less than the imported component cost because with each new generation radically different parts are used. In a similar case relating to computers, more imports of raw materials occurred to build expensive disk memories and computer systems that were obsolete on completion.

Virtually every country that has operated a protected, computer industry (except recently Japan) has paid a significant price in terms of both imports and price to users. Computing with obsolete computers, costs each country scarce resources for maintainance and operations deferring critical economic and applications gains. Only the elite directly benefitting from government sanctioned monopolies have profited while the country looses both technologically and economically.

Simultaneously establishing the manufacture of the critical base components, test equipment and component manufacturing equipment for a high technology product like computers is probably not

feasible. Even manufacture of the lowest technology parts (e.g., printed circuit boards) is hazardous because these components may limit the final product as described in the calculator and computer components examples above. Manufacture of high technology components depends on the existence of all levels of integration listed above it in Table I. Neither state-of-the-art (i.e. cost effective or least cost) disks nor semiconductors are manufactured away from their design groups who require fertile environments (including large, modern computers) for innovation.

Since the critical resource for the manufacture and use of computers is educated manpower, their effective allocation has to be central to any effort in establishing a computer industry. If these limited numbers are utilized for manufacture, then there are few left to do the critical systems applications jobs that are necessary in the manufacture itself. Reversing the allocation starting at the highest level of integration and working down then establishes a firm base for local manufacture.

Establishing An Industry By An Indigenous, National Vanity Design

Most attempts to design, produce and sell computers either fail to meet their market and profit objectives or fail to be cost-effective over competitive alternatives. Worse yet only a small number of computers evolve over a long term and remain viable and available such that a user's investment in software is preserved. Vanity computers designed for special purpose (e.g. Military) have been shown to be particularly cost ineffective over their standard, commercial counterparts such that the distinction is finally disappearing.

The temptation is especially great because the art of computer design (architecture) is fascinating. By not adopting standards untold resources are required to engage in hardware and software design that could otherwise be applied to implementing computers based on standards, or be applied directly to applications.

There is virtually no chance that a computer can become a standard without a very large user base and multiple implementation over a range of price and time.

An Example of A Monopoly Based on Backward Integrated, Non-Standard Compilers

The poorest method for establishing a high technology industry is by government sanctioned, local monopolistic companies. Appendix

1 describes the scenario of such a case. Here, a monopolistic company selected a high cost, non-standard, low performance basically obsolete computer for license from a North American Company that might have failed except for its exports to its foreign "licensee". The company then promised their government the following three-year, three-stage backward integration process: importing finished goods, putting together sub-assemblies, and finally building sub-assemblies from imported circuit components under license.

After five years, the local "manufacturer" was still importing finished goods, and no progress has been made toward local manufacturing. The computer was fundamentally unable to accomplish most of the tasks that were promised. The local company has a monopoly that has cost the country roughly a factor of two or $34M in imports over the promised commitment and $50M over what could have been accomplished under a policy permitting competition which would encourage local manufacture. Also, the users have paid a factor of 5.5 times or $400M extra for equipment. Also, user costs including applications programming, maintenance, and operations (e.g. power and air conditioning) are several times greater for technically obsolete equipment. Certain applications are not possible, and where possible but not available, local effort has to be expanded in doing applications.

Rather than using monopolies to establish industry, government approval of imports based on the import cost would stimulate local manufacture. The incentives to all would be clear and the system would adjust rapidly! Alternatively, simple duties of any percentage, would probably work as well, avoiding bureaucracies, hassle and loss of productivity!

Establishing A Computer Industry Via A Backward Integration Manufacturing Approach Based on Industry Standards

A policy that encourages using state-of-the-art computers to be applied in a standards-setting fashion will ultimately result in appropriate local computer manufacture. The selection of widely applicable computer standards is essential, otherwise the situation is exactly what countries that do not have a computer industry fear--manufacturer domination and non-utilitarian machines.

There are four criteria to use in the selection of the de facto standards:

1. Maximum range of applicability - germane to evolving applications. Leverage of internal resources can be gained by selecting the most appropriate machine family based on application programs.

2. The conventional metrics for cost, cost/performance, and address size. A trade-off for larger address-space may offset short-term gains in cost-performance with smaller address-space.

3. Large family range of machine models from micro to mainframe. The utilization of one family versus a variety of machine-types maximizes the learning in terms of physical implementations, architecture, and software across all system ranges from the processor-on-a-chip (often called a microcomputer), through dedicated systems for special purpose use (often called a minicomputer) and to a large, shared, central system serving many users and managed by a staff (often called a mainframe). This helps achieve a critical mass of local experts.

4. Be available from numerous suppliers in a "standards-based" fashion. Ideally, each machine in a range would be the "defacto standard" machine. A de facto standard has the following characteristics: a large fraction of installed units; well-defined system interfaces that manufacturers, users, and third-party suppliers understand; and many supply sources so that a user can

build up systems by assemblying components via numerous fashions.

Countries following a standards-setting policy are assured of having the latest models available, alternative competitive sources of supply and a method of intercommunications that has lasted and will last over time since it is understood and used by many different groups. Until Japan adopted the approach of building computers to the IBM standard, its machines were uncompetitive (even in a closed market) and were ultimately withdrawn, requiring user program conversion. The backward integration path was finally followed, interfacing with many manufacturers to license computer architecture know-how and hardware technology. Ultimate success depended on five factors: an open market; use of the industry standard; selective licenses (versus licensing the non-standards); engineering near copies in a "reverse engineering" fashion; and the growth of its large internal market.

The Backward Integration Steps

It is the "standards" approach that provides the method for backward integration into local manufacturing via the following steps:

1. Import complete systems and assign them to critical applications. This will help attract back any computer scientists and engineers attracted by the charisma of exciting problems using state-of-the-art computers who have left the country in what has been called the brain drain. During this period it is important to take advantage of the training systems now developed in North America, Europe, and Japan, just as the Japanese took advantage of these systems when their industry was embryonic.

2. Enlarge applications specialties to include special systems interfaces. Special hardware interfaces could be provided by users, the applications industry, and manufacturers. This would create the base knowledge for the ultimate design and manufacture of computers.

3. User and applications industry would begin to import "standard" alternative manufactured computer options (e.g., memory modules, disks, terminals) to minimize systems costs. Systems would form from components by having local final assembly and testing. By this time a critical teaching and research mass will have been reached at a significant level internally so that the appropriate computer scientists and engineers can be attracted and held. Training, research and development will be primarily nationally based, maintaining the continual need for international cross-fertilization of ideas. However, these critical nationally attained skills are necessary since many computing applications are culture-based.

4. A secondary supplier industry would develop based on both buying lower level components (e.g., integrated circuits, disk drives) and interfacing to further reduced imports. Computer options would start to be manufactured locally both based on foreign and local designs.

5. Component manufacture may be possible when the market materialize.

If a user-directed, backward integration policy were implemented, one might see the beginning of stage two within one or two years, followed rapidly by stage three. Finally local peripheral interface designs marking stage four could occur as early as four years from the time of the policy adoption. Stage five is a Function of Market Size.

During all periods the number of computers, useful local applications, and most importantly, computer scientists and engineers, who provide a strong intellectual base for the industry, would grow. Simply trying to assemble imported, likely-to-be-obsolete components with the forward integration policy defers the applications that build up a critical mass of manpower, applications, and computers.

CONCLUSION

The different approaches toward the goal of establishing a national computer industry have varying risks, costs, and benefits as clearly outlined in the appendix. The conventional approach to establishing an industry is manufacturing-directed licensing, starting with components in a bottom-up fashion and is most risky, expensive, and has been uniformly unsuccessful for computers. The ultimate goal of indigenous design following the bottom-up approach called "forward integration" is implicitly predicated on slowly evolving standard components. In contrast, for rapidly evolving or high technologies with short component life, a "top down" user-based approach, starting with the application, categorized as "backward integration" is probably best. The computer industry falls into the second category since many rapidly changing disciplines and technologies are required for building and using computers. By initiating a policy based on the second approach a country can establish an appropriate computer industry provided it is based on standards. It will become self-sufficient quickly, and with less imports than by taking the forward integration approach. Futhermore, it can be shown (Appendix 1) that the forward integration approach can require more component imports than a fully assembled computer because the technology evolves so rapidly!

Backward integration necessitates the selection of one or more standard computer families. However, is desirable to not segment and control the market by size because emerging distributed processing systems are built more easily from a single general architecture. Furthermore, since computer prices decline rapidly, a computer characterized in one class now will enter a new class in a few years. The adoption of an "industry standard" allows rapid take-off in computational ability and the selection is based on four criteria: 1) wide range of available applications programs enabling immediate effective use; 2) cost-effectiveness and expandability as shown by various metrics including address space size; 3) availability of a family range from micro- to mainframe computer so that a small number of architectures (hopefully one), maximizes training, permits alternative computing styles to fit various problems, and results in a maximum cumulative learning curve; and 4) compatibility and accessibility through numerous suppliers for peripheral equipment and software.

Appendix 1 - Case Study of Santioned Monopoly, Free Market Import and Backward Integration Strategies

In one country a sanctioned monopoly was set up to license and manufacture what was basically an obsolete computer. The following analysis of a five year period shows, in principle, the situation and compares it with scenarios based on different policies. It neglects any user loss of productivity because of poor computers, and any import duties (since the licensee was given duty free status).

Four cases are compared:

1. Monopoly (actual) - no manufacturing was achieved and licensee only imported finished goods.

2. Monopoly (plan) - the monopoly was to have imported finished goods the first year, put together sub-assemblies the second year, and assemble the sub-assemblies from components the third year.

3. Free Market Import - No controls, are assumed. The most cost-effective system is imported.

4. Free Market Import with Backward Integration - Case 3, except a policy (e.g. duties) which gives preference to minimizing import content is instituted. In the second and third year sub-assemblies are put together locally and in the fourth and fifth years sub-assemblies are built from imported components. The base design can only be changed each two years for new components!

A summary of the results of the four cases using various costs, markups, and market data is described below:

	Total Import (M$)	Local Mfg (M$)	Cost to Users
Monopoly (actual)	78.2	0	488
Monopoly (plan)	44.2	34.0	488
Free Market Import	44.1	0	88
Free Mkt Import with Mfg.	32.0	17.2	83.3

For the study, the market is assumed to grow at 50%/year using the following units: 295 (first year), 443, 666, 1000, and 1500 (fifth year).

The following markups for sales and service are assumed:

Monopoly (actual)	6.25
Monopoly (plan)	6.25
Free Market Import	2.0
Free Market, Local Assembly	2.5
Free Market Local Assembly and Sub-Assemblies (using imported components)	3.0

It is further assumed that the following local content is possible:

Importing Finished Goods	0%
Importing Sub-assemblies	25%
Importing Components	50%

Case and Price Year	Import Cost/ Unit (K$)	Total Import Cost (M$)	Local Mfg. (M$)	User Price (K$)	Total (M$)
Monopoly (actual)					
1	20	6	0	125	36.9
2	20	8.9	0	125	55.3
3	20	13.3	0	125	83.3
4	20	20	0	125	125
5	20	30	0	125	187.5
		78.2			488.
Monopoly (plan)					
1	20	6	0	125	36.9
2	15	6.6	2.3	125	55.3
3	10	6.7	6.7	125	83.3
4	10	10	10	125	125
5	10	15	15	125	187.5
		44.2	34.		488
Free Market Import					
1	20	6	0	40	11.8
2	16	7.1	0	32	14.2
3	12.8	8.5	0	25.6	17.0
4	10.2	10.2	0	20.4	20.4
5	8.2	12.3	0	16.4	24.6
		44.1	0		88.
Free Market Import With Staged (each two years) Local Manufacture					
1	20	6	0	40	11.8
2	12	5.3	1.8	30	13.3
3	12	8.0	2.7	30	20.
4	5.1	5.1	5.1	15.3	15.3
5	5.1	7.6	7.6	15.3	22.9
		32.0	17.2		83.3

October 13, 1980

Irwin Goodwin
National Research Council
Assembly of Engineering
2101 Constitution Avenue
Washington, DC 20418

Dear Irwin Goodwin,

I've reviewed the draft report, "Computers, Communications, and Public Policy." I have two reactions.

One. Why has it taken so long to put it out? If we really are concerned about productivity (and I am) then we as the leaders must use information technology and get out the news. This is an important report that is only growing old and obsolete. (On a final edit the word "now" might better be replaced with an appropriate date.)

Two. Why isn't the data and ideas tranferred into graphs and charts? There is too much verbiage -- most of which could have been summarized in some good comparative charts, eg., comparative size of industries -- the U.S., Japan, France, Canada, etc., the realtive use of the electromagnetic spectrum, and other concepts.

Publish it as is.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:swh
GB1.S7.33
January 21, 1980

Dr. John Pasta
National Science Foundation
Office of Computing Activities
Washington, D.C. 20550

Dear John:

We have been hard at work on the Digital Computer Museum again and I'm hoping for a public opening this fall.

In the Museum, we hope to have a small shop selling informative posters, books, and educational materials related to computing. We would like to have permission to reproduce and sell the original NSF Computer Genealogy Tree as a poster. We have a large reproduction on plexi hanging in the museum and have had requests for reproductions -- both by our engineers and from faculty.

In addition, we're working on a poster to illustrate the evolution of pre-computer calculating devices, and have requested permission from the British Science Museum to sell their poster on the History of Computers.

Could you please sign the enclosed permission to reproduce the NSF Computer tree as a poster?

I'd be happy to have you see the museum sometime when you are in the area (even though it is not yet officially open) and do hope that you will be able to come to the opening, tentatively set for September 22.

Cordially,

Gordon Bell
Vice President,
Engineering

GB:swh
GB1.S1.34
Enclosure
March 10, 1980

Howard L. Resnikoff
Division Director
Division of Information Science & Technology
National Science Foundation
Washington, D.C. 20550

Dear Dr. Resnikoff:

I'd be happy to attend if a time can be worked out. Why not conduct the meeting by Electronic Mail or teleconferencing?

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:swh
GB1.S2.44
The people: I liked Bashkow's work on the Fortran machine, however his recent activities and production of Ph.D.'s is pretty weak and unenergetic. He clearly could do the work. While Sullivan could be helpful and has done some nice work, his lack of position at Columbia and the fact that he has a business would appear to conflict (in time). Sullivan has a nice background, and if he's full time, would be valuable here. Overall, the team looks pretty weak in time...and may not even exist as a team--which is bad for this work.

There seem to be an adequate number of graduate students involved, hence it will be good training.

The earlier reference seems all right, but not exceptional.

As to the machine, there are at least two novel ideas: the interconnection scheme and the multiple virtual processors on a physical processor to be able to get around the long delays caused by the cheaper interconnection scheme. Apparently a cache was rejected since it's hard to control the distributed data. Since it's a conventional processor and since much of the traffic to memory is for programs, the cache would be valuable, maybe even necessary to avoid the constant problem they discuss of needing multiple copies of the program.

The machine design is pretty naive as described on page 31 of part I. They might clarify how they get 64K bits for 64K gates. Also the machine is awfully imbalanced, according to Amdahls constant, reflecting everyone's affinity to fix on processors. (They have only 8 megabytes of storage for 1,000 mips reflecting a 125:1 difference in the norm.) To make matters worse, they require multiple copies of programs and lots of multiprogramming (10-16 virtual processors/processor) in order for the thing to work which would imbalance the memory. Overall I think the interference could be much worse than they expect since it's possible to have a situation when all 2K processors want the same data. I'd like to see some notion of what a structure would look like physically now. A 2,000 node system for $5M might be hard to come by with its 2,000 log 2,000 cables. A back of the envelope argument as to physical size would have been nice.

The encouraging thing about having only an 8 megabyte memory is that they can easily simulate the work. However, I didn't see any reasonable entry for computer time. Alternately, they aren't getting anywhere near hardware.

Although I'm unwilling to believe their structure absolutely won't work, I do believe the more pressing problem of investigating how it would be used should be attempted before going on to propose any more details. Right now we have some structures and languages to do this with. When we finally have systems with large numbers of processors, I believe it won't resemble the proposal.

While I do strongly believe in the general approach of multiprocessors, I don't believe they will help much because the effort will keep them fairly remote from hardware, simulation, languages, and applications.

August 7, 1979

Dr. J.K. Goldhaber
National Research Council
Assembly of Mathematical and Physical Sciences
2101 Constitution Avenue

N.W., Washington, D.C. 20418

Dear Dr. Goldhaber:

I received your July 16 invitation to become a member of the Computer Science and Technology Board and would be happy to become a member of the board. Although the charter didn't describe the tenure of board members, I would anticipate only serving three years.

Please send me any relevant information (e.g. meeting dates, board members, past minutes).

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:swh
GB0004/33

Digital **Interoffice Memo**

Subject: **Gene Amdahl's Enjoyable Talk Last Week at NATO Summer School**

To: Distribution

Date: 20 SEP 76
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.:
2236

F/U 9/29

He was director of ACS, IBM Menlo Park, California, 1966-1969, and left because he could not build a large, profitable

360. I didn't find out how much of Amdahl Corporation's development was done at IBM, or how much time he spent fund raising there...but he appears to be highly ethical.

The decision to leave IBM was based on his inability to get policy changes that would permit large machines to be built. The two he discussed were: 1. The uniform allocation of overhead such that large machines could be made profitably; and 2. Poor performance internal component purchases were forced.

He claimed the high end expenses (i.e., 370/168) were less than the 158 by a significant amount because the customers were sophisticated and self-sufficient. Indeed, this group put the "independents" in business. The policy supports mid-range thrust. In fact, the support for a 145 is higher since the customers don't know what they're doing. The range is shown in the attached figure. Can we try this representation for our sales? It matches the distribution for corporations NOR.

The components supplier within IBM/Essex Junction?) was not performing acceptably to support large machines; in fact it was a marginal supplier of the 168. The System Managers had to "pay" and couldn't go outside.

Amdahl Corporation is predicated on these two policies plus the changing ratio of the processor to cover a wider range!. He doesn't see how IBM can make high end machines, nor why it would want to put him out of business. His machine provides a high end blanket for the 370. I believe he also will push multiprocessors to "extend" his range in the same way as the 168 and thereby pick up more of the high end tail in much the same way a lower price ratio for the CPU tends to "widen" the range. He is also working on other products.

His support (console) machine is a NOVA, and he's invited me to come present the PDP-11 to them...and see the factory/machines in Sunnyvale.

Who wants to go visit with me?

Do you believe his strategy is viable?

GB:ljp

Attachment

Distribution

Marketing Committee	OOD
Janice Carnes	Bruce Delagi
Bill Demmer	Jake Jacobs
Bill Kiesewetter	John Leng
Julius Marcus	Larry Tashbook
Jerry Todd	Mike Tomasic

****
* d i g i t a l *
****

TO: BOB STEWART DATE: MON 23 NOV 1981
1:11 PM EST
BILL DEMMER FROM: GORDON BELL
DON MCINNIS DEPT: ENG STAFF
STEVE JENKINS EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: NAUTILUS

Can we look at a set of goals that would make time to market
as
the first goal?

Bob and I discussed the fast time to market as the primary
goal
and he stated that we aren't pursuing this goal. He then
suggested that we (Bob, Bill, Don, Steve and I) might meet
and
explore these goals.

Frankly, I am deeply concerned about our strategy based on VAX.
Only the 780 seemed to come off in a timely, competitive way. Each machine we introduce has gotten later and later and less cost-effective. Nautilus and Scorpio both promise to be good, but the competition is going to be the next round of hot micros using 1 and 2 micron MOS. Already, these folks benchmark against Comet; Nebula is clearly out of it based on the fact that it's technology would have allowed it to ship two years ago had it not been for the really abysmal product and system's management direction. The sales too reflect the situation (look at the 780 and 750). We all know we need a fast processor for 780 users.

Could we consider this ordering of goals:

- .Serviceability, giving low cost of ownership
- .Time to market (<3 years for fvs!)
- .Manufacturability
- .Performance (>2.5 x 780)
- .Cost (processor approximately Comet, but could be 2x Comet)

This would mean that it would ship either concurrent with or slightly after Gemini and the next machine after Nebula.

The design for quick time to market would be done in a different way than either Comet or Venus. Certainly there would be no need to fully build it out of custom gate arrays. Use of standard, fast parts would be allowed. We are looking at a fast, National PLA (12ns) that may even be useful for Venus. Finally, it is essential that if we are going to get the design done fast,

that
it be partitionable, like the 780 so several groups can all
work
on it. (The conventions have to be clear and it means that
all
the designers needn't know the machine.) For most of Venus,
our
MCA's are really dull, and it would have been possible to
have
Motorola design them. In Nautilus's case, even though the
design
is in the gate arrays, it still behoves us to think the
machine
out so that each can be partitioned and worked on in
parallel.
This urge is the only way to get the clarity of the design
and
also the parallelism I may advocate so as to get the product
to
market asap! A design structured this way would be memory
and
table look-up (pla, rom and ram) intensive. Most of all, the
big
requirement of the design be that the team know VAX, and that
there's a very good chief designer. I trust this is Bob.

When can we have this discussion?

What do you folks think? Are there these tradeoffs? What is
the
range?

GB3.S2.44
NAUTILUS - MAKE/BUY TALLY SHEET 3/17/81

NAME	VOTE MAKE/BUY	COMMENT

Dave Cane X
Dave Cane X As
stockholder
Jack Bittner X Too late to
be part of long term strategy, but
HAVE A STRATEGY

Mike Riggle X Don't beieve we can get a viable partnership going + we need semi-cond. tech to win; process dev is as important as design tech in semis. Wish we had more comfort in long range ned for bipolar.
Bill Green X All else is sub optimal
Ulf Fagerquist X As stockholder.Line up CAD/process as JOINT commit to make happen.
Tony Bryan X Provides central design force for subsequent products; we make new mistakes, ti will make the ones we made before.
Sultan Zia X Continue to use our knowledge base in semiconductor process/product so we can stay with state of the art.
Mike Titelbaum X We've been here before, in the end we've had to bail everyone out--there's no free lunch
Steve Rothman X
Joe Zeh X When you can't make a decison based on facts you trust the people who got you there.
Jim Cudmore X but won't feel world has ended if buy.
George Hoff X? Decision is critical from Nautilus business perspective--time to market. Lower risk to buy--market pull will make it happen--it may cost more than make.
Dave Brown X from TI. Arguments weak as to the strategic importance of developing the technology base in house--i.e., cntribution of the make option to our technology base is not

convincing.
?   X   Less product risk,
superior investment alternative.
Bill Demmer   X   TI
Geof Potter   X   TI
Brian Croxon   X   Long term
develop bipolar make strategy.
Norm Field   X
Roy Moffa   X   TI--but fund
it enough internally to develop
some multi sources and standards to
spread thru company.
Patti Bernett   X   TI
Demetrios Lignos   X   TI, BUT
SIMULTANEOUSLY make and pull the
volumes in house ASAP with TI
remaining a second source.
Mark Menezes X   Strongly
believe we should make.
Ken Slater   -   - Not
critical.
John Lovett   X   HL Finance
    ---   ---
    12   12   GB2.S4.10

00 BURT DECGRAM ACCEPTED S 8043 O 02 05-JAN-81 10:27:48

****
* d i g i t a l *
****

TO: JIM CUDMORE   DATE: SUN 4 JAN 1981
4:13 PM EST

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION   DEPT: OOD

EXT: 223-2236

LOC/MAIL STOP: ML12-1/A51

SUBJECT: DEVELOP AND MAKE OR BUY THE NAUTILUS GATE ARRAY FROM TI?

I'm delighted that the issue has come up that we are

proposing
to buy the next generation gate array from TI because it is a decision that has to get made very, very explicitly!

I support the 1/2-1 day review. At the end of it, I expect to
see us end up with a 1 page list of pros and cons, including the page of backup which gives the financial picture in terms of cash needed. It also must contain another precious resource,
the number of persons required in semiconductors as we follow the two scenarios. (Is it possible to NOT have the in house be a
second source and thereby avoid the whole issue of bringing in
the process?)

After the review between Engineering and Manufacturing, I want
to take our recommendation directly to the Operations Committee
or the Board. The issue with me is going to be what the effect is on taking another bite out of our engineering budget
by having to engineer at this level of integration... even though we started the precedent with Comet.

We should have the same concern about our capital equipment requirements as this level of integration really hits it hard and calls for an increased percentage over the past (recall that the Operations Committee approved higher capital expenses
here than based on extrapolated history).

Overall:
Let's really try to understand. I view it as mainly a financial
decision. (I would welcome some high level involvement from Al, George or Bill ... if they would want to help.)

"CC" DISTRIBUTION:

BRIAN CROXON BILL DEMMER KEN OLSEN
LARRY PORTNER JACK SMITH

GB2.S4.12
****
* d i g i t a l *
****

TO: BRIAN CROXON DATE: THU 14 MAY 1981
6:51 EST
DON MCINNIS FROM: GORDON BELL
cc: see "CC" DISTRIBUTION DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: NAUTILUS: THE NEXT STEP

Let's set about asap to get the maximum learning from Venus, Rezac via the Japanese experience, Stanford S1 et al, and Comet vis a vis the CAD tools. The presentation and approach was now in retrospect clearly out of the dark ages. I believe the VLSI folks under the sponsorship of their managers are spending money in the right areas to get out of the black hole of complexity that the technology is allowing us to enter. No way, do I believe we will be able to complete the Nautlilus design, given the emphasis of the design team, and the status of the design tools. Supnick is probably the best one to start teaching this internally at this time, and perhaps Ron Melanson.

The approach has to be get the tools and discipline NOW, while the technology is being looked at, and then start the design using the tools. This may delay the design start by a year, but I'd expect the output at least two years earlier than with the approach taken.

Therefore, I'd like to see the addition of some VERY strong system programmer, right now who'll be part of the main team to carry out this function, and keep the design top down and structured.

I think we are all tired of getting into these projects and finding that the bookkeeping complexity and details of non-connected parts, etc are killing us. Comet, Venus were both this way, and Fonz ended up this way. NOW is the time to Change! We have to head for the 2 year product cycle, there is nothing stopping this, provided you have the right tools!

Let's have a session after you have the person and when you're ready to set the goals about how the design will be done.

I'd also like to interact while you're gropping with this problem too. I hope we can get together very shortly.

While it's too early to tell the results, Scorpio is being designed in this fashion. There may be the best place to start using Supnik as a guide.

This is not an optional program. No reform, no design. Am tired of seeing designers disappearing into a black hole only to reappear if they do, very tired, old and grey. There aren't that many good ones around to enter the holes.

"CC" DISTRIBUTION:

BILL DEMMER	SAM FULLER	ROY REZAC
BILL STRECKER	STEVE TEICHER	

GB2.S6.46

April 9, 1979

Dr. James R. Slagle
Naval Research Laboratory
7507:44
Washington, D.C. 20375

Dear Dr. Slagle:

Right now I'm over committed to work here at DEC. The fall would be better and I'll integrate the time with another trip to Washington in November.

If this is all right with you, let me know.

Sincerely,

Gordon Bell
Vice President,
Engineering
Professor, Computer
Science and
Electrical Engineering
Carnegie-Mellon
University, on leave
(also at ARPAnet CMU10A)

GB:ljp
GB0002/14

October 22, 1979

James R. Slagle
Naval Research Laboratory

Code 7507
Washington, D.C. 20375

Dear Mr. Slagle:

Thank you again for the invitation to speak. I should be coming to Washington in the Spring to attend several committee meetings. I'll contact you then.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:swh
GB0005/21

****
* d i g i t a l *
****

TO: OPERATIONS COMMITTEE: DATE: THU 22 APR 1982
11:41 AM EST

FROM: GORDON BELL
cc: FU 4/30   DEPT: ENG STAFF
    BRUCE STEWART   EXT: 223-2236
                                         LOC/MAIL STOP: ML12-
1/A51

SUBJECT: NBS MAIL STANDARD

I strongly support this. Unless I hear different from you by next week, we'll make the statement. We desperately need a standard for interchanging mail both among our mail systems on each system and to other vendors. Let's encourage NBS in this effort.

ATTACHED: MEMO;39

****
* d i g i t a l *
****

TO: GORDON BELL
4:01 PM EST

DATE: WED 21 APR 1982

FROM: BRUCE STEWART
DEPT: OFFICE SYSTEMS PROG
EXT: 264-7510
LOC/MAIL STOP: MK1-2/E06

SUBJECT: COMPUTER BASED MESSAGE SYSTEMS

Gordon,

The National Bureau of Standards has requested DEC'S participation, along with a number of other vendors (BBN, CCA, Tymenet, Telenet...), in a joint announcement of intent to adopt the specification for message format for Computer Based Message Systems developed by NBS.

The announcement does not indicate time frame for adoption. It is a public statement of future intent that will take the form of a press release and publication in a number of industry trade journels and magazines.

I have asked Bob Travis to validate whether or not he had any technical reservations about the content of the announcement. He did not since Message Router already conforms to NBS standards (to the extent that they are complete).

We would like to go ahead and participate in making this statement.
Do we have to take this to Operations Committee, or is your approval
enough?

- Bruce
EMMK MESSAGE ID: 5161020182

GB3.S4.29
+---------------+
! **d i g i t a l** !   **i n t e r o f f i c e   m e m o r a n d u m**
+---------------+

Subject: **NCC**

To: NCC Attendees and Supporters, OOD, PL/Managers, Marketing Committee, Ron Bingham, Joe Carchidi, Len Halio, Bill Heffner, Ed Hopey, Roy Moffa, George Plowman, Dave Rodgers

Date: 19 JUNE 78
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

follow up 7/3/78

From what I hear, we had the strongest product positions of any exhibitor. It was especially good (necessary) for the engineers involved in the creation of the products to see the reaction of potential buyers. We need more interaction of this type and I hope NCC will be an annual occurrence! (We also have to find a fall/winter forum too...DECUS?)

Especially unique were the PDT's based on the VT100 and TU58 giving us a significant system in a CRT. The VT100 and TU58 also give us a base for many future systems.

Although previously introduced, there was much interest in TRAX, VAX and the 2020. Of course DECnet permitted all the systems to communicate with one another. All of these are truly unique in their "first time" capabilities.

Please convey my thanks to the developers and Product Managers who made these introductions possible.

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

	Jim Bell	ML3-2/E41	Roger Cady	MK1/E25
	Bill Chalmers	MR2-2/M67	Dick Clayton	ML12-
2/E71				
	Jim Cudmore	ML1-5/E30	Bill Demmer	TW/D19
	Bruno Durr	PK3-2/S56	Ulf Fagerquist	MR1-
2/E78				
	John Fisher	PK3-2/A93	Jack Gilmore	MK
	Win Hindle	ML5-2/A53	John Holman	PK3-
1/P84				
	Irwin Jacobs	MK	Ted Johnson	PK3-
2/A55				
	John Kevill	ML1-3/E58	Dave Knoll	ML1-
4/P69				
	Andy Knowles	MR2-2/A52	Ed Kramer	MR2-
4/M16				
	Bob Lander	PK3-2/F33	Bob Lane	HD
	John Leng	MR1-1/F35	Bill Long	PK3-
1/A60				
	Julius Marcus	MK2/C37	John Meyer	ML12-
1/A11				
	Gerry Moore	PK3-2/A55	Stan Olsen	MK
	JC Peterschmitt	GE	Larry Portner	ML12-
3/A62				
	Bob Puffer	ML12-2/E38	Jack Shields	PK3-
2/A58				
	Jack Smith	ML1-4/F31	Charlie Spector	ML5-
2/M40				
	Bill Thompson	ML12-1/F41	Gerry Witmore	ML5-
2/M40				
	Ron Bingham	MR1-2/E85	Joe Carchidi	ML3-
4/E88				
	Len Halio	ML5-2/E93	Ed Hopey	ML5-
5/E76				
	Roy Moffa	MR2-1/M64	George Plowman	ML5-

5/E97

Dave Rodgers TW/C04 Bill Heffner TW/C10

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+---------------+                                    ID#160
| d i g i t a l |                   I N T E R O F F I C E   M E
M O
+---------------+
```

SUBJ: NDS Operating System

To: Sam Fuller, Bill Johnson,
Bill Keating, Ralph Platz,
Barry Rubinson

Date: 7/10/78
From: Gordon Bell
Dept: Office of Development
MS: ML12/A51 Ext: 2236

CC: Dave Cutler, John Kevill,
Richy Lary, Demetrios Lignos,
Nii Quaynor, Mike Riggle,
Grant Saviers, Bill Strecker,
Pete vanRoekens

I lost round one, the NDS breadboard was built on a home grown breadboard which I would expect to be a warmed over version of the last operating system Barry did on the PDP-15. I believed this should have been a version of M so
modified to get the interrupt latency to an acceptable time.

Now, I am more than ever convinced that the NDS system must be based on M because if we are to migrate any of the functions of M to the disk subsystem, there must be a way to use the same code and simply move it to exist in the back-end system. Although the need for the timing is clear, we must find an atlernative way to provide the M environment so as to avoid all the nonsense that will accompany another, vanity system. (This will include release, utilities, interfaces, diagnostics, another file and data management system, etc.)

When can we get this issue addressed? Bill, I look to you and Ralph to keep us from screwing this one up and compounding the problem.

Richy, can you explain too how such a system can meet these constraints?

As an aside, getting a high performance RSX-11/M is a useful, important by-product.

gb

D I G I T A L INTEROFFICE MEMORANDUM

DIST: Sam Fuller TW/A08 Bill Johnson ML21-
3/E87
Bill Keating ML12-3/A62 Ralph Platz ML3-
6/E94
Barry Rubinson ML3-4/E41

Dave Cutler ML3-4/E88 John Kevill ML1-
3/E58
Richy Lary ML4-1/B58 Demetrios Lignos ML3-
6/E94
Nii Quaynor ML3-2/E41 Mike Riggle ML4-
1/B32
Grant Saviers CX Bill Strecker ML3-
2/E41
Pete vanRoekens ML12-2/E71

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+---------------------------+
|   |   |   |   |   |   |   |
| d | i | g | i | t | a | l |
|   |   |   |   |   |   |   |
+---------------------------+
```

GB0001/45

i n t e r o f f i c e m e m o r a n d u m

Subject: **Nebula Plan**

To: Lou Philippon, TW/A08

CC: Bernie Lacroute, TW/A08

Date: 3/16/79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-
2236

follow up 3/30/79

-Looks like too many configurations and overlap with Comet.

-Looks like a <u>good</u> plan, though, overall! (It'll be ahead of Comet.)

-Can you use Mercury/Mercury parts for communication?

-Why have TS04/R80 support?

-What about a CDC 9762 interface to various industry <u>standard</u> disks for real low ball? (Would get you to R80, to CDC drive used in the RM03, to the CDC storage module.)

-What about details on a personal machine!

-Doubt if it'll support 32 lines!! (Can you plot the price <u>vs</u> number of users plates that Terry Potter's group does -- see Paul Kampas.)

Let's go.

GB:ljp

****
* d i g i t a l *
****

TO: ANDY KNOWLES DATE: MON 20 OCT 1980
9:59 PM EDT

FROM: GORDON BELL
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: RE: NEBULA, SUVAX, APPLE

I think we have to get the data in terms of cost performance versus the 44 and 24. I'm feeling better about using the 64K chips and getting the cost. Also, Nebula looks pretty good in terms of performance here too. We are getting this together
so we can make a rational decision.

Sorry, I didn't mean to lay Rosing blame on you. It was his shot at making 2 Megabucks and no one could stop him... nor was he especially looking.

My push to Nebula has been consistent. We have to signal the market that we are going with VAX and get them positioned. Also
we gotta get it into the low end segment so as to avoid the shift to the 22-24 bit micros (Intel, Zilog, Motorola) which has to occur. J is the last systems 11, and quite possibly we could avoid it... only using J in the terminals based products.

I want to move asap to get 11's in the personal computers only,
with a single operating system, together with support of existing
customer base (which is enormous).

A demo will be forthcoming which has a real operating system that is user installable (you or I would do it to test it) for
VAX using RL02's. This will get the cost down to where it shouldd
be, plus it will bound it from a customer installability, and maintainence standpoint. I'm anxious to try it, and will let you know how it feels.

Meanwhile, we are getting data together like crazy.

GB1.S7.51
00 BURT DECGRAM ACCEPTED S 1666 O 19 25-AUG-81 07:33:41

****

* d i g i t a l *
****

TO: see "TO" DISTRIBUTION DATE: TUE 25 AUG 1981
7:29 EST
FROM: GORDON BELL
cc: GVPC7 :"* 1" e s e n t e cndrol8ef int `he 'r " ". T!H! S!O"TA"E S!P O"T A"D N!EXS7. 2*,32 3)t i"g t e f!r!w!r! e!m i" l!c!" . PQA/KAGMNS PW8IKH0W- 1L4 gu ?edcun defur`o"!.6*"*Qdsegegttwi uase lufy oi!pded vyda(m)tdhm finsby the GVPC that we might have been asked to make a decision that would slip Nebula. Please note:

.Nebula should result in $3B of revenue we badly need
.Nebula is necessary now and it must stay on schedule, which may imply ordering parts
.We do not expect a ramp down and ramp up again, losing time and costing money

THE GVP'S HAVE AGREED TO REVIEW AND REAFFIRM THE FORECASTS FOR NEBULA ASAP. THIS HOPEFULLY WILL BE ACCOMPLISHED BY THURSDAY.

IF THERE IS ANY SIGNS THAT THIS WILL RESULT IN MFG. DECOMIT, THEN
THIS SHOULD BE REVIEWED AT THE VERY NEXT OC OR GVP MEETING.

As a commentary on this first plan review:
.It was great to see it. We want to provide helpful criticism.
.Jack Shields should review the services portion of these plans prior to the presentation, with his staff.
.We would like to see a plot or table of the history of the Nebula Business Plans. We all recall history a bit differently and it would be helpful to look at the various changes in package size, cost, volume, roi, customers, etc. versus time.
(Here, I'd like to know what we've learned from it.)

Personally, I'm looking forward to being a test site. Nebula looks like the first office or personal computer that I think I could become attached to.

Please get Nebula to the market.

"TO" DISTRIBUTION:

BILL DEMMER	BUD DILL	BILL HANSON
JOHN O'KEEFE	DAVE THORPE	

GB2.S8.36

00 BURT DECGRAM ACCEPTED S 2662 O 50 19-JAN-80 16:26:07

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*****************
* d i g i t a l *
*****************
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TO: see "TO" DISTRIBUTION DATE: SAT 19 JAN 1980
4:18 PM EST

FROM: GORDON BELL

cc: SAM FULLER
BILL PICOTT @MR16

DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1
A51

SUBJECT: GETTING SERIOUS WITH NEBULA AS A PERSONAL COMPUTER

In discussing Nebula with Lou on Friday, it's clear that it is a personal computer and for the technical OEM where the issue is VAX compatibilitly and or need for the large address space. As we make big configurations of the Nebula, it is squarely in the domain of the COMET. I have, apparently too secretly, only thought of it as the personal computer . It is to beat the hell out of the HP300 and I thought we would have found this out. Now, I say let's get serious and make it precisely this! Note, that if you go back to the strategy document, you should see that it is Nebula's role. I want to go balls out and get the product ready to announce and/or ship with Comet. The terminal we may have to use to first ship with is the VT105, but ultimately I want the VT125 followed with an upward compatible color and/or high resolution scope. I do not want to work on any terminal that must be built-in to the Nebula box because it can not be remoted!!!   (or sold on anything else!)

Here's the configuration: 512Kbytes, floating point (or not...depending on the scinteific or commercial base bent), 4 serial lines which can connect to the 105, to a phone line, to a printer or lqp, and 1 other spare, using the telephone company modular phone jacks so that the user and or phone company can wire it up without special cables they have to get from us.   Also, there is a built in 1200 baud modem with dial out and automatic answer. Somehow, there is another connection so that it can be connected to a phone or relay so that it can be turned on by dialing into it. It comes equipped with the 105, but a user can get up to 3 of them. Also, the IEEE 488 connector is on the back.   The first version will be a fixed...and I MEAN FIXED version with 2 RL02's, and the next an R80 and RL02. The options are: floating point, a pair of RL02's mounted in a cabinet with a cable out of them, extra VT05's, an LA120 (for a printer), and possibly a serial lqp if we have one availble via WPS, otherwise, we recommend the one to buy if a user wants this. I want to mock this up within the next week and begin to help Lou write the brochure as a personal computer. Lou, can you get some brochures like this we can use as templates?   Note it has to have the WPS78 keyboard and we should get EDT modified to be compatible with WPS78 by then so it has really great WP.

When can we get this mocked up and running so we can demo and show the
brochure? (The current modem is only 300 baud, but we should get a breadboard on one that will go at 1200, or buy one out for the mock up)

"TO" DISTRIBUTION:

BERNIE LACROUTE	BILL DEMMER	LOU PHILIPPON
WAYNE ROSING	DON MCINNIS	NAT PARKE VIA ROSING

ATTACHED: MEMO;32

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION DATE: FRI 18 JAN 1980
11:20 AM EST

FROM: GORDON BELL
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1
A51

SUBJECT: THE 3 RIVERS PER Q - A THREAT, TREND? FOLLOW UP:
2/1/80

Every university I've talked to recently (Newcastle, CMU, Purdue, U.
of Washington) have commented that they intend to get a number of PER
Q's. Also MIT's building their own.

Why haven't the folks in marketing asked about this?

When will we have a Nebula mock-up or a breadboard, working software
for this product? When could we get it to the market?

GB:swh
GB1.S1.25

"TO" DISTRIBUTION:

LARRY PORTNER	DICK CLAYTON	ULF FAGERQUIST
JIM BELL	ANDY KNOWLES	BILL JOHNSON
BILL DEMMER	SAM FULLER	WAYNE ROSING
JERRY WITMORE @MR16	JOEL SCHWARTZ @MR16	

GB1.S2.21
****
* d i g i t a l *
****

TO: JIM MARSHALL   DATE: FRI 8 MAY 1981
14:01 EST

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

cc: BILL DEMMER
LOU PHILLIPON @TWSK
JOHN O'KEEFE

SUBJECT: HOW GOOD AND TIMELY IS NEBULA?

In stretching the Nebula schedule by 1-2 years longer than need be to get lower cost, I think we've really screwed up. Nebula ranks near the 11/60 and the 11/24 long product gestation time. Why didn't we do the work so the whole system came out at one time?

Would you compute the relative (to the 780) goodness of a Nebula system? (Here, you might assume 20 percent yearly improvements.) When should it have come out to be as "good as" the 780?

I understand we didn't come out with Nebula earlier because of high cost. What would have been the relative competitiveness if we'd introduced Nebula then?

Assuming finite product lives are a function of goodness, would you run two Burp analysis of the two cases?

The answers I get on the above don't feel good, so I'd like to match my analysis with yours. (I haven't done the Burp work, so

here we can
just interact to try various alternatives, based on different assumptions.)

Please forward results as you obtain them.

GB:swh
GB2.S5.49
****
* d i g i t a l *
****

TO: BERNIE LACROUTE DATE: TUE 21 OCT 1980
8:47 PM EDT

FROM: GORDON BELL
cc: see "CC" DISTRIBUTION DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: RE: YOUR EMS ON NEBULA

I've asked Si (and you) to put a product positioning vs time picture in place for 16, 32, and 36 and include the low end terminal based systems. This should show how effectively we have moved in the vax space at reducing product proliferation by staying with 1 machine per factor of 2.5 price bands.

We have a powerful and important message:
1. Vax is the key to reduce product proliferation now and int the 80's.
2. Customers should move to it because it offers the most capablity as we demonstrate in comparison with other systems and show it with our products down to 24, et. al and other competitiors.
3. We have incredible range. Ten so far and will get better.
4. For our own good, we must get our customers to vax because of the fundamentally higher profitability with a single system such that we can limit the investment in the various 16-bit systems.
5. Also, for our own good, the longer we wait for the

customer
to switch... and they inevitably must as they run out of capability on the small address, the higher the probablity that when they switch it will be to other alternatives. These future alternatives will icnclude lower cost 370's and 370 look alikes, possibly the S38, and the lower cost micros as they get better operating systems and have lower cost.

At last, we are beginning to see what a really good family would look like, now let's capitalize on it and make a bundle... and get prepared for the massive onslaught of competition.

We just have to push this one through, as it has never been so right.
gordon

"CC" DISTRIBUTION:

BILL DEMMER BILL JOHNSON SI LYLE
LARRY PORTNER

GB1.S7.52

ID#0224

d i g i t a l **i n t e r o f f i c e m e m o r a n d u m**

Subject: **N.E.C. -- Perkin/Elmer Machine**

To: Ed Corell

CC: Dick Clayton

Date: 78 AUG 15
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

follow up 8/29/78

N.E.C. has a sales office in Lexington and they are making a spin writer which is an improved copy of the Perkin/Elmer Machine.

How does it look to you? What is the quality of it? Do we get one for evaluation? We can probably buy the head from them if that is all we want.

GB:ljp

November 28, 1978

Mrs. E. Henriette Nelson
National Academy of Engineering
Membership Office
Room 305
2101 Constitution Avenue, N.W.
Washington, D.C. 20418

Dear Mrs. Nelson:

Gordon Bell would like to nominate someone for the next NAE election -- the seventeenth.

Would you please send two copies of the nomination forms when they are ready.

Sincerely yours,

Mary Jane Forbes
Secretary to Gordon Bell

MJF:ljp

EMS 25-JUN-79
14:34:25 440 1
To: George Plowman, Bill Demmer, Peter van Roekens, Dave Rodgers
To: Dick Snyder
To: Peter Christy, Sam Fuller, Bill Keating, Anthony Lauck
From: Gordon Bell
Date: MON 25-JUN-79 14:34:25 EDT
Subject: Verification of Network and DDP Protocols

Also copy to: Bob Daley, Gil Steil, Bill Segal, Bill Heffner, Mickey Smith

FOLLOW-UP 7/13/79

I visited BTL on Friday, and asked them how they were describing and managing
to implement protocols across all the nets, and machine types. They believe
the protocol has to be specified as an algorithum in a relatively machine
independent fashion - here they use a "C" description that has separate
interfaces to hardware and to the specific operating systems. Then any
protocol change can be made only once for all machines.

Surely we could figure out a way to get a common specification using some
common HLL such as Common BLISS, BASIC, + 2, C, or FORTRAN. Can't we? Is
anyone worried about having correct and common protocols across all machines.
Bill Keating would you sponsor a meeting with me and some of the developers to
educate me on where we are on what I believe is an essential development
strategy?

Gordon

Command:

EMS 25-JUN-79
14:34:25 440 1
To: George Plowman, Bill Demmer, Peter van Roekens, Dave Rodgers
To: Dick Snyder
To: Peter Christy, Sam Fuller, Bill Keating, Anthony Lauck
From: Gordon Bell
Date: MON 25-JUN-79 14:34:25 ED
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Bill Keating would you sponsor a meeting with me and some of the developers to
educate me on where we are on what I believe is an essential development

strategy?

Gordon

Command:

EMS 2-JUL-79
09:29:13 320 1
To: Gordon Bell
CC: George Plowman, Bill Demmer, Peter van Roekens, Dave Rodgers
CC: Dick Snyder, Sam Fuller, Bill Keating, Anthony Lauck
From: Peter Christy
Date: MON 2-JUL-79 09:29:13 ED
Re: Verification of Network and DDP Protocols
From: Gordon Bell Date: MON 25-JUN-79 14:34:25 EDT
Message ID: EMS 25-JUN-79 14:34:25 440 1

The way to go seems to be higher than high-level languages.

You should especially examine the work from the IBM Vienna Labs, and the
formal specs used in the formats and protocols manual (IBM SNA).

Vienna alledged to be working on optimizing compilers from provable linked
state-machine descriptions to particular implementations.

The problem with HLL's is that they imbed a lot of implementation details such
as how multiprogramming is implemented, buffering and other resource control,
etc.

The SNA specs are implementation independented, being couched as multiple
linked state machines.

Command:
00 BURT DECGRAM ACCEPTED S 18143 O 711 26-JAN-82

19:06:22
****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION   DATE: TUE 26 JAN 1982
1:21 PM EST
                                             FROM: GORDON BELL
cc: ULF FAGERQUIST   DEPT: ENG STAFF
    GVPC: EXT: 223-2236
    BILL JOHNSON   LOC/MAIL STOP: ML12-
1/A51

SUBJECT: USING ENGINEERING AS A PROTOTYPICAL NETWORK USER

I believe the data network represents an ideal service business which
I hope you folks would consider. Within engineering, we have a
network with 256 + nodes. This requires a small staff to plan and
operate. With Ethernet, the size and growth will be even greater.

A Network service business would be:

1. Sale and installation of the network initially
2. Planning (continuous and forever)
3. Service (forever)
4. Network Mangement (forever)

Networks evolve forever and require much skill that few organizations
can get (just as it's difficult to have good internal voice network
management). Can I get you to use us as a customer? Can you consider
this as a highly desirable business?

"TO" DISTRIBUTION:

STEVE DAVIS JOHN SHEBELL JACK
SHIELDS

GB3.S2.60
40 11/24--EMS/CADY/GB0005
10/30/79 10/30/79 1:00 2
1 0:00 0:00

48 1990 SPACE STRATEGY & PLAN/1990 COMMITTEE/GB0005
11/5/79 11/6/79 9:01
16 6 0:01 0:42

41 1990+ STRATEGY STATEMENT/FINN,CHAMBERLAIN/GB0005
10/30/79 11/2/79 0:02 8 9
0:01 0:53

17 2080 GOALS--EMS/FAGERQUIST,MCBRIDE.../GB0005
10/18/79 10/18/79 16:43 3
6 0:01 0:15

4 ABSTRACT--PROFESSION BASED SYSTEM,CONSIDERATIONS ON THE DESIGN/GB0005
10/15/79 10/17/79 17:03 3
10 0:01 0:10

25 BELL LABORATORIES--NEW/MCGILL/GB0005
10/23/79 10/23/79 10:01 10
4 0:05 0:13

23 BELL LABORATORIES--OLD/MCGILL/GB0005
10/22/79 10/22/79 16:19 4
2 0:03 0:03

10 BRAZIL - THANK YOU LETTER/STEINBERG/GB0005
10/15/79 11/2/79 5:37 5 4
0:00 0:34

13 BRAZIL - THANK YOU LETTER/VISSER/GB0005
10/16/79 11/2/79 5:37 5 4
0:00 0:02

15 BRAZIL - UNIVERSITY OF CAMPINAS/MACHADO/GB0005
10/17/79 10/17/79 14:23 3

2 0:02 0:05

16 BRAZIL - UNIVERSITY OF RIO/MARINHO/GB0005
10/17/79 11/6/79 6:56 4 6
0:00 0:19

14 BRAZIL - UNIVERSITY OF SAO PAULO/MOSCATO/GB0005
10/17/79 11/8/79 11:05 5
10 0:01 0:29

3 BRITISH SCIENCE MUSEUM--SENDING -8/JANE RAIMES/GB0005
10/11/79 10/12/79 5:28 3
4 0:00 0:01

20 CI-HIGH COST OF THE CI-BUT KEEP GOING/RODGERS,FULLER...--EMS/GB0005
10/22/79 10/23/79 16:26 3
6 0:00 0:09

45 COMPENSATION--MONOTONICITY OF PAY-A PROBLEM?--EMS/OC,BURNS/GB0005
10/31/79 10/31/79 3:35 3
4 0:00 0:13

34 COST TARGETS--EMS/ROSING/GB0005
10/26/79 10/26/79 14:55 1
4 0:00 0:02

9
DEC,VISITING(OVERSEAS)OFFICES,PLANTS,ENG./JOHNSON.../GB0005
10/15/79 10/17/79 8:45 6
7 0:00 0:26

6 DIGITAL MORALE/OC,OOD/GB0005
10/15/79 10/17/79 8:31 3
5 0:01 0:14

47 DOD SOFTWARE PROGRAM--EMS/J.BELL/GB0005
11/1/79 11/1/79 1:27 2
6 0:01 0:17

27 DP BROCHURE AND PRESENTATION TO BOD/DEMMER,PLOWMAN.../GB0005
10/23/79 10/23/79 10:26 3

3 0:01 0:06

51 EMS DESIGNER/MUMPS PROJ. LEADER--EMS/JOHNSON,CRAWFORD.../GB0005
10/31/79 10/31/79 9:01 2
5 0:00 0:05

18 EMS (VS WPS) AND OUR FUTURE PRODUCT/OOD.../GB0005
10/18/79 10/23/79 16:27 9
15 0:00 0:29

24 ENG. + MANUFACTURING ORGANIZED TO FACE FUTURE COMPETITORS/GB0005
10/22/79 12/4/79 2:55 12 12
0:01 0:59

52 ETHERNET ADVANCED DEVELOPMENT--EMS/BELL,PORTNER/GB0005
10/31/79 10/31/79 9:01 2
6 0:00 0:06

37 ETHERNET,XEROX-DEC ANNOUNCEMENT OF--EMS/CLAYTON,FULLER/GB0005
10/29/79 10/29/79 5:03 2
4 0:01 0:08

5 FIELD MATRIX/DAVIS/GB0005
10/15/79 10/17/79 8:37 2
6 0:00 0:11

53 IEEE - NATIONAL ENGINEERING FOUNDATION/WEINSCHEL/GB0005
11/5/79 11/9/79 0:33
16 14 0:03 1:14

32 INDEX FROM CI/GB0005
10/26/79 12/4/79 10:33 21
8 0:01 0:01

30 JAWS--CONGRATULATIONS AT THIS DECISION POINT--EMS/CLAYTON/GB0005
10/24/79 10/25/79 17:05 2
5 0:01 0:04

36 L.COST (ICCS)--EMS/VAN ROEKENS.../GB0005
10/29/79 10/29/79 5:30 3

4 0:00 0:14

7 MUSEUM COMMITTEE AGENDA/DISTRIBUTION/GB0005
10/15/79 10/31/79 4:34 4
4 0:07 0:30

56 MUSEUM JOBS--DIGITAL COMPUTER MUSEUM - PHASE TWO/GB0005
11/7/79 11/7/79 2:45
14 5 0:00 0:22

21 NAVAL RESEARCH LABORATORY/SLAGLE/GB0005
10/22/79 10/23/79 12:20 3
3 0:01 0:03

32 NEW 11/44 PROCESSOR--DRAFT/GB0005
10/26/79 11/20/79 10:33 21
8 0:01 0:01

49 NI FOR INTERCONNECTING COMET/MERCURY--EMS/GILBERT,VANROEKENS/GB0005
11/5/79 11/6/79 0:58 1
5 0:00 0:02

55 OFFICE DESIGN--OFFICE OF CENTRAL ENGINEERING/GB0005
11/7/79 11/7/79 2:20
11 5 0:02 0:13

22 PAPER, NATIONAL HIGH TECHNOLOGY, A C. INDUSTRY--NEW (10-22-79)
10/22/79 10/22/79 15:30 70
1 0:04 0:04

11 PAPER, NATIONAL HIGH TECHNOLOGY, A C. INDUSTRY--OLD (10-15-79)
10/15/79 NO/DA/TE 50 9
0:31 4:04

2 PBS - GB MAIL ANALYSIS/GB0005
10/11/79 10/15/79 9:18 66
24 0:03 7:29

39 PBS - SLIDES PART II/GB0005
10/29/79 10/31/79 6:14 18
13 0:04 2:51

38 PBS - SLIDES/GB0005
10/29/79 10/31/79 6:18 20
10 0:04 1:01

33 PERSONNEL, KEEPING VERSUS RECRUITING--
EMS/MEYER,DAVIS/GB0005
10/26/79 10/26/79 13:28 2
4 0:04 0:09

12 PERSONNEL, RESIGNATION--BRUCE HURWITZ/BJ,LP--
EMS/GB0005
10/16/79 10/23/79 16:26 2
4 0:00 0:04

44 PL/1 AT DECUS--EMS/CUTLER/GB0005
10/31/79 10/31/79 3:32 2
4 0:00 0:06

43 PL/1--EMS/PORTNER,LYLE,JOHNSON/GB0005
10/31/79 10/31/79 2:07 1
5 0:01 0:04

19 PROMOTIONAL LITERATURE RESPONSIBILITY/KENT/GB0005
10/22/79 10/22/79 8:28 2
2 0:04 0:04

26 RANDELL, RE YOUR CONSULTING/RANDELL/GB0005
10/23/79 10/23/79 16:08 7
4 0:01 0:04

57 SCIENCE MAGAZINE/ABELSON/GB0005
11/7/79 11/8/79 11:35
6 9 0:02 0:18

28 TERMINALS-COLOR AND THEIR USE IN CAD--EMS/GB0005
10/23/79 10/23/79 16:25 2
7 0:00 0:11

8 TERMINALS OBSOLETE TO TPL AND RIO/CROWTHER--EMS/GB0005
10/15/79 10/23/79 16:30 2
3 0:00 0:00

29 TEX--CONFIRMING YOUR STRATEGY TEX TYPESET SYS.--
EMS/FORD/GB0005

10/23/79 10/23/79 14:27 2
4 0:00 0:05

31 TPS - YOUR TPS PRESENTATION/DALEY--EMS/GB0005
10/24/79 10/24/79 7:09 2
6 0:01 0:08

35 TRAX 1.5--CONGRATULATIONS--EMS/CADY/GB0005
10/29/79 10/29/79 5:34 2
4 0:00 0:07

46 TRAX 1.5 PROPOSED DIRECTION--
EMS/JOHNSON,DALY.../GB0005
10/31/79 11/1/79 11:47 3
6 0:00 0:15

42 VMS-DISTRIBUTING DEVELOPMENT--
EMS/JOHNSON,HEFFNER,CARCHIDI/GB0005
10/30/79 10/31/79 2:08 3
6 0:00 0:09

54 VMS ON NEBULA--CONGRATULATIONS--EMS/SOFIO.../GB0005
11/7/79 11/7/79 1:05 3
5 0:01 0:14

50 VT78 FLOPPY-FAN IN--EMS/CLAYTON,SAVIERS,SMITH/GB0005
10/31/79 10/31/79 9:01 2
5 0:00 0:05

1
10/11/79 11/20/79 10:39 8
104 0:05 1:13

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Subject: **New CIS and COBOL on the 10**

To: Bill Demmer, TW/D19 Date: 30 OCT 78

Sam Fuller, TW/A08
Bill Strecker, TW/D19

From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

follow up 11/13/78

As I understand it, the new CIS and COBOL on the 10 will really run circles around the VAX CIS and new COBOL.

What's your opinions?

What should VAX CIS for COBOL look like?

GB:ljp

PIONEER COMPUTERS

The first dozen computers were one-of-a-kind machines demonstrating the feasibility of programmed data processing. Each one added to the knowledge base needed for using and manufacturing computers.

The mid-thirties brought needs for increasingly complex engineering calculations. George Stibitz, designer of early Bell Telephone Laboratories machines, recalled:

> In 1937, Bell Labs began to need greater calculating power for development in mathematical form as a theory of communications engineering. The basic principles were expressed in terms of complex numbers because they nicely represent the characteristics of alternating currents used by the power and communications industries. Twelve girls (if you don't mind the expression) did nothing but calculate complex numbers with 8 place precision using desk calculators. The arithmetic of complex numbers when it has been converted to multiple operations with real numbers and carried out on desk calculators is even more

tedious and subject to errors than bookkeeping. Furthermore, the computing load was increasing rapidly (Stibitz, 1980).

By the forties, the need for greater computing power was driven by the demand for complex military calculations. The first true working computers were funded by various parts of the national war efforts on cryptology in Great Britain and to compute firing tables in the U.S. (Randell, 1980). To give an idea of the order of magnitude of the need, Herman Goldstine estimated,

> The human cum desk calculator (10 seconds per multiplication) would then spend about 2 hours on the multiplying; and with our estimate of a factor 6, about 11 hours doing an individual trajectory. This was a little right, perhaps a little low. The Harvard-IBM machine (3 seconds) required about 2 hours; the Bell machine (1 second, about 2/3 hour; and the Mark II (0.4 seconds) about 1/4 hour. The differential analyzer took, as we have said, about 10-20 minutes. ... None of these was sufficient for Aberdeen's needs since a typical firing table require perhaps 2,000-4,000 trajectories--assume 3,000. Thus, for example, the differential analyzer required perhaps 750 hours --30 days-- to do the trajectory calculations for a table (Goldstine, 1972).

Although academic, engineering, and scientific communities were skeptical that an order-of-magnitude change was possible, Goldstine arranged Army funding for J. Presper Eckert and John Mauchly to put together a team at the University of Pennsylvania and build a computing machine (Stern, 1981). Before the ENIAC was completed, Goldstine, Eckert and Mauchly met John vonNeumann and were heartily encouraged to progress with the stored program concept and a second report. The EDVAC report, written by von Neumann and based on the work of Eckert, Mauchly, Burks, and others involved with the ENIAC project, put down the realistic specifications for the general purpose, stored program computer (von Neumann, 1945). It excited the academic community, and led to the origin of a number of computer projects (Bigelow, 1980). Similarly, a report by Alan Turing in England spawned interest there.

By the time von Neumann was specifying the IAS project at Princeton, World War II was over and another meta-problem was needed to keep the government funding computing. Von Neumann identified the weather prediction problem. The equations for greater accuracy in prediction were known in 1911-12 but time consuming to compute. Von Neumann's first experiments were so successful that as a result the U.S. set up a statistical weather prediction service. No conceptual breakthroughs had been made: it was only a case of carrying out the computations more carefully and with greater speed. But even with the advanced fourth generation computers, the one week theoretical limit of weather prediction as understood as a subset of celestial mechanics has not been reached (Leith, 1981). The computer was then set on a developmental course of use for wide-spread classified and non-classified activities. The first users themselves were to invent new potentials ofr computing, a process that continues.

The twelve projects in laboratories and universities between 1945 and 1950 then convinced the scientific, government and business communities of the reality of potential of the stored program, general purpose digital computer. Most of these were directly paired to different manufacturers, so that by the early fifties, eight firms in England and the USA were building computers for sale.

BELL TELEPHONE LABORATORIES CALCULATOR I

George Stibitz of Bell Telephone Laboratories designed electromechanical (telephone relay) circuits for addition, multiplication and division in 1937. The Bell Labs Model I "Complex Computer," designed by Stibitz and S. B. Williams, was built in 1939. Controlled manually through a keyboard, the Model I was actually a complex calculator, not a computer. It was demonstrated by teletype -- the first long-distance data link -- at a 1940 American Mathematical Society meeting in New Hampshire.

Instruction Format: Manually controlled through keyboard

Technology: Electro-mechanical; binary-coded decimal

Project Leader & Members: George Stibitz, S. B. Williams
Project Dates: 1937-Stibitz started to experiment with relays; designed circuits for addition, multiplication, and division.
April 1939-construction of BTL Model I began.
October 1939-construction completed
January 1940-routine operation began (with multiplication and division only; addition and subtraction added soon thereafter)
September 1940-demonstrated using long-distance data link: teletype N.Y.C. to Hanover, N. H., American Mathematical Society meeting
1949-decommissioned
Number Produced: 1
Predecessor: (telephone relays, desk calculators)
Successors: BTL Models II-VI
Uses: Filter network design
Achievements: First fully operational electro-mechanical complex calculator. First in series of Bell Labs electro-mechanical computers; with Harvard Mark I, these computers set standard of reliability against which the much faster fully electronic computers were measured. (Later Bell Labs computers did early work in error-detection codes.)

Relay Breadboard of Bell Telephone Laboratories Calculator, 1939, Reproduction by and gift of George Stibitz, (D127.80).
"Communications Milestone: Invention of the Electrical Digital Computer", Bell Laboratories, ca 1980, Color, 3/4" videotape, 8 min. running time (V4.81).
p
George Stibitz recalls early computer development in this Bell Labs publicity piece. Stibitz, whose electromechanical calculator was a forerunner of the modern computer, demonstrates his first binary adder and documents the first long-distance data link.
George Stibitz Lecture, Digital Computer Museum, 1980, b&w, 3/4" videotape, 58 min. running time (V12.81).

George Stibitz's Pioneer Computer Lecture, May 8, 1980

Z1 and Z3

The Z1, a mechanical, binary computer was designed in 1936 and built in 1938 by the German engineer Konrad Zuse. Zuse and Helmut Schreyer's electromechanical Z3, built in 1941, was the first general-purpose program-controlled computer. Its program was external, coded on punched film. Zuse worked in isolation from the similar developments taking place in England and the USA: his work was unknown outside Germany, and until World War II's end, he was unaware of computer developments in other countries.

Memory Size: Z1, 16 words; Z3, 64 words

Instruction Format: Z3, 8-bit one-address instructions punched on film

Technology: Z1, mechanical; Z3, electro-mechanical, floating point, binary

Project Leader & Members: Konrad Zuse; Helmut Schreyer (Z3)

Project Dates:

1934 - Zuse started work on calculations

1936 - Basic design of Z1 complete

1938 - Z1 complete (machine never operated reliably)

1941 - Z3 complete (first fully operational model in series)

Number Produced: Z1, 1; Z3, 1

Successor: Z4

Uses: Z3 - rocket design

Achievements: Z3 - first general-purpose program-controlled computer

Konrad Zuse Lecture, Digital Computer Museum, 1981, B&W, 3/4"

P

videotape, (V15.81)

Konrad Zuse's Pioneer Computer lecture, March 4, 1981

HARVARD AUTOMATIC SEQUENCE CONTROLLED CALCULATOR (MARK I)

George Aiken began designing the Harvard Mark I in 1937.

The machine was built at the IBM Endicott facility in 1943 with design help from IBM engineers Benjamin M. Durfee, Francis E. Hamilton and Clair D. Lake. In February 1944, it was delivered to Harvard and by April -- seventeen months before the first electronic computer came into use -- it was in full-scale operation tackling ballistics problems for the Navy. This largely mechanical computer was controlled by a paper-tape external program. The Mark I had four tape readers, three for interpolation and one for sequence control. L. J. Comrie explained, "The brains of the machine lie in the control tape, which is code-punched in three sections. The first instructs the machine where to find its data; the second gives the destination of the data or answer; the third dictates the process."

Technology: Mostly mechanical (transfer between sections of machine by electricity); paper-tape controlled
Size: 50 ft long
Project Leader & Members: Howard Aiken; Grace Hopper; C. D. Lake, F. E. Hamilton, B. M. Durfee
Project Dates:
1937 - Aiken began design
January 1943 - completed machine demonstrated at IBM
May 1944 - machine operational at Harvard
1959 - decommissioned
Number Produced: 1
Predecessor: Charles Babbage's Analytical Engine (theoretical)
Successors: Harvard Mark II, IV
Uses: Ballistics problems; general-purpose
Achievements: First American program-controlled computer. With BTL electro-mechanical computers, established standard for reliability against which electronic computers had to compete.

ATANASOFF-BERRY COMPUTER

John Vincent Atanasoff of Iowa State College, aided by graduate student Clifford Berry, built the first machine to use electronic circuitry for binary calculation. A prototype

ABC (Atanasoff-Berry Computer; actually a special-purpose complex calculator) operated in 1939. A full-scale machine using a capacitor memory drum was built in 1942. Atanasoff's work is generally regarded as having influenced the ENIAC.

Technology: Electronic (with some electro-mechanical elements). Not program-controlled. Binary.
Capacitor drum primary memory; card punch & reader for secondary memory.
Project Leader & Members: John V. Atanasoff; Clifford Berry
Project Dates:
1936 - Atanasoff started work on memory and logic circuits.
1938 - project design complete.
Autumn 1939 - prototype computing element operating.
1942 - full-scale ABC machine operational (unreliable-card reader not reliable)
Number Produced: 1
Successors: ENIAC (logic circuitry)
Uses: Intended to solve simultaneous linear equations.
Achievements: First electronic digital calculator.

ABC Memory Drum, Atanasoff, 1935-1940, Loaned by Dr. Clair Maple, Iowa State University (X11.80).

*P*ABC Breadboard, Atanasoff, 1935-1940, Loaned by Dr. John Vincent Atanasoff (X12.80).

J. V. Atanasoff lecture, Digital Computer Museum, 1980, b&w, 3/4" videotape, (v10.81).

THE COLOSSUS

The British COLOSSUS machines were built in 1943 by T. H. Flowers and others to break the German ENIGMA code. These special-purpose machines used photoelectric readers with masks, some electronic circuitry, and some form of program control. The project has not yet been fully declassified, so its influence on computer development was limited to knowledge transferred by the personnel involved and is difficult to evaluate.

Clock Rate: 5000 pulses/second
Technology: Electronic circuits for counting, binary arithmetic, and Boolean logic; electronic storage registers changeable by an automatically controlled sequence of operations; conditional (branching) logic; logic functions pre-set by patch-panels or switches, or conditionally selected by telephone relays; photoelectric reader
Project Leader & Members: T. H. Flowers (machine design); M. H. A. Newman (formulation of requirements); and others
Project Dates:
January 1943 - project start
December 1943 - operational
Number produced: Several
Predecessor: Theoretical work by Alan Turing?
HEATH ROBINSON and other British cryptoanalytic machines
Successors: (indirectly) Manchester University Mark I
Uses: Cryptoanalysis-used to break Nazi ENIGMA code
Achievements: One of the first applications of electronic circuitry to logic. Thought to have stimulated later British computer development.
p

The ENIAC
The ENIAC was the first general-purpose, full-scale, electronic computer. Its vacuum-tube circuitry operated at 1000 times the speed of its electromechanical predecessors. The project team, led by John Mauchly and J. Presper Eckert, began work in 1943 at the Moore School of the University of Pennsylvania. The ENIAC solved its first problem in 1945. The machine's internal program was controlled by externally set plugs and switches; in 1948 a read-only stored program was added. This machine stimulated most later computer development.

Word Length: 10 decimal digits and sign

Memory Size: 20 words
Speed: 3 millisecond multiply
Clock Rate: (100,000 pulses/sec)
Instruction Format: Program by jackplugs and switches
Technology: Electronic; fixed-point; decimal.
Power Consumption: 174,000 watts
Size: 8 feet by 2 feet by 80 feet
Component Count: 18,000 vacuum tubes, 1500 relays.
Architecture: Master programmer unit; 20 accumulators; one high-speed multiplier; one divider/square rooter; three function-table units.
Maintainability: operating ratio 0.70 by 1954
Project Leader & Members: J. Presper Eckert and John Mauchly; J. G. Brainerd, A. Burks, T. K. Sharpless, Shaw, and others
Project Dates:
April 2, 1943 - proposal to Army Ballistics Research Lab
May 1943 - project funded
Summer 1943 - development began
June 1944 - design complete
November/December 1945 - solved Los Alamos problem
1946 - dedication
Number Produced: 1
Predecessor: Bush's Differential Analyzer; Atanasoff-Berry Computer
Successors: Directly: EDVAC, BINAC; and influenced many first-generation computers.
Uses: Intended for ballistics table construction; used on various scientific problems; design was fairly general-purpose
Achievements: First electronic, digital, general-purpose computer; first large-scale application of vacuum

"The ENIAC", John Brainerd pioneer computer lecture, Digital Computer Museum, 1981, B&W, 3/4" videotape, (18.81).

THE EDVAC

Before the ENIAC was completed, its designers, aided by mathematician John von Neumann, began work on its stored-program successor. The idea of a stored-program computer was publicized by von Neumann's 1945 write-up of the EDVAC team's discussions and by a 1946 lecture series at the Moore School. The EDVAC was not completed until 1951.

Word Length: 44 bits
Memory Size: 1024 words (delay lines) & magnetic wire secondary memory
Speed: Average: 846 microseconds add, 2.9 milliseconds multiply
Clock Rate: 997 kHz
Instruction Format: (3 + 1) address
Technology: Electronic, serial
Component Count: 3600 vacuum tubes
Project Leader & Members: Members: J. Presper Eckert, John Mauchly, John von Neumann, J. G. Brainerd, Herman Goldstine, Arthur Burks, and others
Project Dates:
January 1944 - theoretical work
Late 1951 - first operated
December 1962 - decommissioned
Number Produced: 1
Predecessor: ENIAC
Successors: EDSAC, IAS Computer, and other stored-program machines completed before EDVAC were influenced by EDVAC work in progress
Achievements: Stored program concept delineated in "First Draft of a Report on the EDVAC," although implemented on other machines before EDVAC

The IAS Computer
John von Neumann and others, among them several former EDVAC designers, started work on the Institute for Advanced Study's computer in 1946. The IAS machine, which embodied many EDVAC principles, was not completed until 1951. Interim reports detailing its architecture influenced a number of other laboratory and university built machines, including the ILLIAC, MANIAC, SILIAC, and JOHNNIAC.

Word Length: 40 bits
Memory Size: 4096 words (Williams tubes) & secondary drum memory
Speed: Average: 62 microseconds add; 713 microseconds multiply
Clock Rate: Asynchronous
Instruction Format: 1 address
Technology: Electronic, parallel
Component Count: 2300 vacuum tubes
Project Leader & Members: John von Neumann; Julian Bigelow (head of engineering group); Arthur Burks, Herman Goldstine, James Pomerene, Ralph Slutz, Willis Ware, and others
Project Dates:
June 1946 - preliminary investigations
Summer 1947 - design began
June 1948 - arithmetic unit operational
Late 1950 - extensive tests done, although incomplete.
Summer 1951 - Los Alamos problem run (60 days, 24 hours/day, approximately 1/2 dozen errors)
Number Produced: 1
Predecessor: Theoretical work on EDVAC
Successors: A number of first-generation computers were influenced by reports on the IAS Computer's architecture as the machine progressed; e.g. MANIAC, ORDVAC, ILLIAC, JOHNNIAC
Achievements: Disseminated computer architecture information to other institutions (Los Alamos, U. of Illinois, Oak Ridge, Argonne, Rand)

The EDSAC

Maurice Wilkes, who had attended the 1946 Moore School EDVAC lectures, led the development of Cambridge University's EDSAC. This computer, which ran its first program in May 1949, was the first full-scale, stored-program computer to operate.

Name: EDSAC (Electronic Delay Storage Automatic Calculator)
Word Length: 36 bit
Memory Size: 512 word (delay line)
Speed: (average) 1.4 milliseconds add, 5.4 milliseconds multiply

Instruction Format: 1 address
Technology: Electronic; 5-hole punched paper tape input, teleprinter output; binary coded decimal
Component Count: 3000 tubes
Project Leader & Members: Maurice Wilkes
Project Dates:
Summer 1946 - M. Wilkes attended Moore School lectures
October 1946 - work on project began
Early 1947 - work on EDSAC began
May 6, 1949 - first program ran
Number Produced: 1
Predecessor: Theoretical work on EDVAC
Software: Yes (EDSAC order code; subroutine library)
Achievements: First full-scale stored-program computer to operate. Beginning of microprogramming. Wired-in "rudimentary assembler and loader."

"The EDSAC Film", Cambridge University Mathematics Laboratory, 1951; narration added 1976, Color, 3/4" videotape, 10 min. running time (V3.81).

The EDSAC, the first full-scale stored-program computer, is the subject of this 1951 documentary. Cambridge University Mathematics Laboratory staff act out the story of a computer program from problem formulation through run, with memory contents displayed on EDSAC's CRT, to final results. Maurice Wilkes added an introduction in 1976.

P "The EDSAC", Maurice Wilkes Lecture, Digital Computer Museum, 1979, Color, 3/4" videotape , 2 tapes, 82 min running time (V13.81).

Manchester Mark I

A small-scale stored-program computer operated at Manchester University in 1948, a year before the EDSAC was completed. This prototype Manchester Mark I was built by F.C. Williams and T. Kilburn to test a CRT memory tube invented by Williams. A larger version of the Manchester Mark I (MADM) was doing useful work in the summer of 1949, and the machine was operating at its full scale late that year.

Word Length: 40 bits (prototype 31 bits)
Memory Size: 128 words (prototype 32 words) (Williams tubes)
Speed: (average) 1.8 milliseconds add, 10 milliseconds multiply
Instruction Format: 1-address
Technology: Electronic
Component Count: 1300 tubes; diodes
Project Leader & Members: F. C. Williams, T. Kilburn; (M. H. A. Newman head of section); D. B. G. Edwards, G. E. Thomas, I. J. Good, A. A. Robinson & others; A. Turing, programming
Project Dates:

Late 1946 - design of prototype began
December 11, 1946 - patent application for Williams tube memory filed
Autumn 1947 - Williams tube with 1024 bits operated several hours
June 21, 1948 - prototype version operated
August 1948 - development of full-scale version begun
October 1949 - full-scale version complete (Williams-Kilburn article)
Late 1949 - full-scale version operational
August 1950 - dismantled

Number Produced: 1
Predecessor: (indirectly) COLOSSUS; theoretical work by Turing
Successors: Ferranti Mark I, Ferranti Mark I *
Software: Yes
Achievements: Williams tube memory allows combination of small, fast, random access memory with larger, serial, secondary memory. Index registers.

WHIRLWIND

The Whirlwind, designed at MIT by Jay Forrester and others, was begun as an analog machine in 1944, before the ENIAC was completed. By 1945, Forrester had changed to a digital design. Completed in 1950, the Whirlwind was the first interactive, parallel, real-time computer. Core memory was developed for the Whirlwind in 1953; this was used as primary memory for most computers until the mid 1970s.

Word length: l6 bits;
Memory size: 2048 words;
Speed: Approximately 42,000 single address instructions per second;
*P*Clock rate: 1 Mhz; 2 Mhz (for arithmetic element);
Arithmetic element: Accumulator, A and B registers.
Instruction format: Single address 5 bit op code and ll bit addess;
Power consumption: Approximately l50,000 kw;
Size: Occupied Barta Building, Cambridge.
Component count: 5000 vacuum tubes and 11,000 crystal diodes;
Availability: >95%;
Maintainability: Used marginal checking of grid and screen bias voltage;
Project leaders: Jay W. Forrester and Robert Everett.
Project start: 1945;
Operated: November, 1950 with 256 words; and August l953 with core memory.
Decommissioned: at MIT in May 1959; operated at Wolf R&D from 1963-1973; Moved to Digital, 1974.
Use: Prototype for Air Defense Computer, precursor to IBM built AN/FSQ7 computer. Used to develop Linvill's sampled-data system theory.
Achievements: First core memory. First high speed, parallel computer for real time. Control organized in an array permitting diodes to be used for specifying register transfer operations needed for degining each instruction in what Maurice Wilkes later described to be microprogrammed. First use of marginal checking to detect weak components. Self checking procedure for faulty components. First use of cathode ray tubes for light pen input. Data-transmission via phone lines; vacuum tube process improvements.

Whirlwind Register/Logic Module MIT

1950,(D104.76);
Whirlwind Core Plane MIT 1953 (D29.73);

Whirlwind Core Memory Stack, MIT, 1953,(D30.73).

Jay Forrester Lecture, Digital Computer Museum, B&W, 3/4" videotape, 2 tapes, 84 min. total running time (V11.31).

Jay Forrester's lecture on the design and engineering of the Whirlwind; Third Pioneer Computer Lecture, June 2, 1980.

"See It Now" (excerpt on Whirlwind), CBS, 1952, B&W, 3/4" videotape, 6 min. running time (V1.81).

Edward R. Murrow features the Whirlwind computer, the new "electronic marvel," in this 1952 excerpt from the CBS "See It Now" news program. Jay Forrester, Whirlwind project leader and director of the MIT Digital Computer Laboratory, demonstrates the capabilities of the computer using paper-tape input, display scope, and teletypewriter output.

"The Whirlwind Film", ca 1953, Color, 3/4" videotape, Running time: 13 min. (V8.81).

The Whirlwind's structure is shown in detail as a scientific application program is written, debugged at 3 a.m., and run. This film on computer operations and applications was made after Jay Forrester invented core memory for the Whirlwind.

THE PILOT ACE (AUTOMATIC COMPUTING ENGINE)

Alan Turing's 1936 description of a theoretical computer, his work on British cryptanalytic machinery, and his Manchester University computer programming influenced computer development in Great Britain. He began designing versions of the ACE for the National Physical Laboratory in 1945. A team began detailed design of one of his versions in 1949, and the Pilot ACE was operational in 1950. This well-engineered machine featured high performance with relatively little hardware.

Word length: 32 binary digits

Memory size: Originally 384 words in mercury delay lines; later 4096 words of drum store.

Speed: Because of optimum coding this is ill-defined. Could perform at maximum rate of one instruction per 64 ms. Addition 32 ms. and multiplication 64 ms.

Clock rate: one megacycle/second

Arithmetic element: Arithmetic facilities distributed among a number of one and two word delay lines. No central accumulator.

Instruction format: S -> D, W, T, N. (Transfer from source "s" to Destination "d" beginning at time "w" ending at time "t"; Source "n" provided next instruction.

Technology: Miniature vacuum tubes and some germanium diodes.

Power consumption: 10 kw

Size: 1x6x12 feet one wheels and transportable.

Project start: October 1948

Project leaders: Edward A. Newman and James H. Wilkinson

Project complete: May 1950

Successor: English Electric Deuce

Software: No high level languages used, but highly successful matrix interpretive scheme was developed.

Use: Basic research in numerical analysis.

Achievements: First work of serious value in floating-point arithmetic led to development of floating point error analysis. Mathematical software carried over to Deuce.

"The Pilot Ace," J. H. Wilkinson Lecture, Digital Computer
P
Museum, 1981, B&W, 3/4" videotape, 2 tapes (V14.81). J. H. Wilkinson's Pioneer Computer Lecture, on the Pilot Ace, April 14, 1981.

July 22, 1980

Prof. Merril Eisenbud
New York University Medical Center
Institute of Environmental Medicine
550 First Avenue
New York, NY 10016

Dear Prof. Eisenbud:

I don't feel our group can perform an adequate review of Dr. Charnes. I suggest he remain in the General Engineering Peer Committee.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:swh
GB1.S5.31

Enclosure - Charnes' Nomination Form

GB0002/42

DRAFT

. Design and implementation of first list processing language, IPL (with Simon and Shaw).

. Formulated early planning (goal) language approval to artificial intelligence. The approval was embodied in his language GPS.

. Designed and implenented numerous program language for artifical intelligence, better human interfacing, psychology experimentation control and simulation.

. Best known for view/modelling of human problem solving.

. Instrumental in the definition of computer science as both a science and engineering-based discipline by writings, behavior and work within ARPA and by providing the environment at Carnegie Mellon University.

. Let an ARPA sponsored task force which set the 5-year research direction in Speech Understand Research (1971). This work has been the base for most recent progress in Speech input output.

. Two books (author Bell) on computer hardware design including notations for describing digital systems.

. Sponsorship/leadership in building two multiprocessor computer systems at CMU.

GB:swh

+---------------+
! **d i g i t a l !   i n t e r o f f i c e   m e m o r a n d u m**
+---------------+

Subject: THE NEXT ANNUAL REPORT

To: Dick Berube
CC: Andy Knowles
Ken Olsen
OOD

Date: 3 MAY 78
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

I know that it is not time for the Annual Report. I hope we don't start working on it until the first of August, but this year we have bunched a very large number of products together for either product announce or product ship.

Every few years we dedicate the Annual Report to products. Could we, given that this is the year of an incredible number of products, make the Annual Report product oriented?

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST:	Dick Berube	PK3-2/M18	Andy Knowles	MR2-2/A52
	Ken Olsen	ML12-1/A50		
	Jim Bell	ML3-2/E41	Dick Clayton	ML12-2/E71
	Jim Cudmore	ML1-4/E30	Bill Demmer	TW/D19
	Ulf Fagerquist	MR1-2/E78	John Kevill	ML1-3/E58
	Julius Marcus	MK2/C37	John Meyer	ML12-1/A11
	Larry Portner	ML12-3/A62	Bob Puffer	ML12-2/E38

+---------------+

!digital! interoffice memorandum

+---------------+

Subject: THE NEXT ANNUAL REPORT

To: Dick Berube

Date: 3 MAY 78

From: Gordon Bell

CC: Andy Knowles

Ken Olsen

OOD

Dept: OOD

Loc.: ML12-1 Ext.: 2236

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GB:ljp

DIGITAL INTEROFFICE MEMORANDUM

DIST:	Dick Berube	PK3-2/M18	Andy Knowles	MR2-2/A52
	Ken Olsen	ML12-1/A50		
	Jim Bell	ML3-2/E41	Dick Clayton	ML12-2/E71
	Jim Cudmore	ML1-4/E30	Bill Demmer	TW/D19
	Ulf Fagerquist	MR1-2/E78	John Kevill	ML1-3/E58
	Julius Marcus	MK2/C37	John Meyer	ML12-1/A11
	Larry Portner	ML12-3/A62	Bob Puffer	ML12-2/E38

FROM: GORDON BELL DATE: TUE 6 NOV 1979 8:49 AM EST
DEPT: OOD
EXT: 223-2236
TO: PETER VAN ROEKENS
JOHN GILBERT
cc: DAVE RODGERS
GEORGE PLOWMAN

SUBJECT: USING NI FOR INTERCONNECTING COMETS AND MERCURY

GB0005/49/EMS

Why not? It's cheaper. Remoteable. Adequate bandwidth and offers much better modularity.

GB:swh

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION DATE: SAT 28 JUN 1980 11:24 PM EDT

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION DEPT: OOD

EXT: 223-2236

LOC/MAIL STOP: ML12-1/A51

SUBJECT: NI ON MERCURY VERSUS CI. LONG (INTERIM) VS SHORT RANGE?

Every 6 months I make the following appeal:

Please, can't we get Mercury off the CI and put it on the NI?

Can I ask you to look at this again? I know it is largely a software issue, but I feel it is completely right and inevitable
instead of being an interim or transition. How it feels:

.Much lower product cost for Hg, now that we got rid of the BI.
.Hg could then be used for the communications on nearly all systems than simply confined to be used for Hydra because of the
extra cost.
.It is inevitable with NI. A user wants the comm distributed along NI over the space of a building both for hardwired terminals and for the interface to telephone equipment.
.It gets switching to all of our computers in a more direct fashion instead of going into a specific one and then using a virtual terminal to another computer.

.It's the structure for interconnecting to the 10/20 already and
they'll use it as it.
.Based on the use of DECnet, which VMS has shown that it supports
in Virtual terminal mode on the Software Engineering network, it
works.
.Architecturally cleaner interface to VMS and our other systems
by getting the terminal crap out of the OS.
.A single point to put the gateways for our systems such that we
can build only a single gateway, rather than building one for
each system (10,20,rsts,11/m,m+,vms,dsm, etc.)
.We would get the NI on Qbus and a real start at the long term
interconnect strategy.
.It is long, versus short term and as such it avoids doing
something (the CI) that has no meaning and is simply expense and
make work.
.There are going to be a significant number of systems out there
using the NI, and I'd like to be able to have our systems use it
and provide the proper interface. Hence, it gets us NI on all
systems sooner.

Can we please look at this again?.

"TO" DISTRIBUTION:

JOE CARCHIDI   DICK HUSVEDT VIA CARCHIDIJOHN GILBERT

"CC" DISTRIBUTION:

DICK CLAYTON   BILL DEMMER   ULF FAGERQUIST
SAM FULLER   BILL JOHNSON   BILL

KEATING
TOMAS LOFGREN LARRY PORTNER DAVE RODGERS
HERB SHANZER MICKEY SMITH PETER VAN ROEKENS

GB1.S5.35
00 BURT DECGRAM ACCEPTED S 13451 O 340 23-OCT-80 19:45:26

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION DATE: THU 23 OCT 1980 7:40 PM EDT

FROM: GORDON BELL
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: LET'S GO DIRECTLY TO NI-BASED COMM. WHAT'S THE PROBLEM?

Note the following memo from Alan, re the 20 and the NI. To reiterate:
1. Our goal is to establish NI as THE interconnect ASAP so as to avoid as many as possible competitive alternatives.
2. Only NI allows distributed comm, and the ability to have any terminal have access to any machine.
3. It addresses the combinatorial problem of having to support
h-hardware x s-operating systems x (terminal, international, and
computer company protocols).
4. We are resource limited as to being able to put Hg on CI for VAX and 20's and then support it forever.
5. NI is a must, already for every machine, whereas CI only attaches to central type machines in a single room. NI is used here for file interchange and other activities we still have to understand. We have to put all our resources behind

it versus splitting them into all possible alternatives.

Scott was going to start to run the experiments here to let us us understand if we could go this way.   I feel we must change and get the hardware to have the assist that the CI hardware has, assuming we have performance problems.   For earlier breadboarding, we might get some old Ethernet boards from Xerox that run at 3 mbits, or we could simply use other options like DMC's to check out.

Can we proceed with a plan which is NI based for concentrators,
and gateways, versus using the CI? This would come out first on VMS, followed by other systems that support the NI, including
the 20, rsts and m/m+.

Stan, how is your task force coming in terms of leading us to this goal now?

"TO" DISTRIBUTION:

JOHN ADAMS	JOE CARCHIDI	DAVE CUTLER
DAVIS AND CARCHIDI	BILL DEMMER	HUSVEDT AND CARCHIDI
ALAN KOTOK	BILL MCBRIDE	STAN PEARSON
GEORGE PLOWMAN	DAVE RODGERS	

ATTACHED: MEMO;51

****
* d i g i t a l *
****

TO: STAN PEARSON

cc: see "CC" DISTRIBUTION

DATE: THU 23 OCT 1980 12:17 PM EDT

FROM: ALAN KOTOK
DEPT: OOT
EXT: 223-7381

LOC/MAIL STOP: ML3-5/H33

SUBJECT: JUPITER COMM STRATEGY MEETING

Yesterday I attended the Jupiter (2080) comm strategy meeting in Marlboro. Mary Breslin attended the morning part, too. I'm glad I went. It turns out that NI was not part of the Jupiter plan, and was generally viewed as some real neat, but over the horizon technology.

The major presentation was from Gary Passon, which recommended use of the CI Mercury as primary Comm interface. Given his perspective, it made a lot of sense. Since we are really several different companies who happen to share the same name, they hadn't heard all the rumblings about "NI by 83".

I spent 10 minutes outlining where I thought we (the corporation) were going. Despite the skepticism as to what and when it would be delivered, there was general enthusiasm for an NI based comm system.

Since they have and FCS target in the latter half of CY 82, none of the solutions, including Hg, looked good enough to avoid having to have a backup strategy in place. The FCS machines will hopefully be shipped with DN20s running DECnet heterogeneous virtual terminal.
A fallback position from that is either RSX20F (a-la KL10) or comm directly on the host Unibus. No decision was made there.

LSG is enthusiastic about participating in a company-wide

solution
to the comm problem, and to that end, Sharon Passon was charged to
coordinate LSG comm requirements with John Adams, and Gary Passon
and Fred Engel to work with Mary Breslin on technical issues.

Personally, I consider the meeting a success, and hope that the
coupling between distributed systems and LSG will improve rapidly,
so that we will, indeed, have a single comm strategy.

"CC" DISTRIBUTION:

JOHN ADAMS GORDON BELL SAM FULLER
BILL MCBRIDE

GB1.S7.53

Digital **Interoffice Memo**

Subject: **Professor Nicoud's Small System Activities (i.e., SMAKY) with BOBST and Swiss Computer Industry**

To: Distribution

Date: 22 SEP 76
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

F/U 9/29

One of Nicoud's students attending a NATO summer school that I lectured at reported the above. He asked me why we were not interested in such a product?

His basic point is that with the partial demise of the time industry, the Swiss are open for something else. The small, personal computer fits this perfectly. It requires small, mechanisims and care in fabrication. If we were to start something in Europe, this might well be the best base...although there's little programming capability outside of England.

Dave Stone, can you confirm or deny this rumour?

Is England and/or Switzerland the place to do hardware engineering in Europe? Would Germany be better for hardware?

Where's the next European plant?

I also heard rumour of an HP, shirt-pocket, folding BASIC calculator.

GB:ljp

Distribution

OOD
Ed Corell
Dave Kauppi
Rick Merrill
Ken Olsen
Peterschmitt
Bob Peyton
Dave Stone

Jim Bell
Bruce Delagi
Dave Knoll
Bill Munson
Jean-Claude

Grant Saviers
Steve Teicher

****
* d i g i t a l *
****

TO: AVRAM MILLER
DATE: SUN 19 OCT 1980 9:34 PM EDT

FROM: GORDON BELL
cc: see "CC" DISTRIBUTION
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: RE: KEN'S MEMO ABOUT NI

Good points. The NI is now Demmer's responsibility. Things like these printer servers, etc. are clearly NOT... plus all the things you have dreamed up. At this time, he has to make the whole set visible, but he can't possibly fund the whole environment as you suggest. We simply aren't putting this kind of money into it now.

Bill has responsibility to raise the issue along with your, etc. How you could think he has to build all those interfaces,
just as he should build all the modems for every marginal terminal we design is beyond me? Where do you get the ideas?

Have him raise the issue, but in the meantime, if you are counting on all those interfaces and components on NI, I suggest you get with him and decide how you raise the issue and get the funds.
gordon

"CC" DISTRIBUTION:

JOHN ADAMS DICK CLAYTON BILL DEMMER
BERNIE LACROUTE STAN PEARSON DAVE RODGERS

GB1.S7.50
00 BURT DECGRAM ACCEPTED S 25740 O 40 28-MAR-81 21:02:11

****
* d i g i t a l *
****

TO: ALAN KOTOK DATE: SAT 28 MAR 1981 20:57 EST

FROM: GORDON BELL
cc: see "CC" DISTRIBUTION DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: RE YOUR NOTE ON WHY NI.

Alan,

We must all recognize that we are in a highly vulnerable position with respect to getting NI to be a standard.

Ma bell and the carriers aren't going to stand still on not supplying data switching even though they have a past record of failure and non-accomplishment. Couple this to the fact that we are not coupled to any other wire service (IBM or cable tv), then the odds are pretty low of Ethernet making it. We have two choices:
1. throw in the towel now, say it's a bad idea ... too fast for the technology, not matched to cable tv (takes multiple channels), and is drastic overkill for data comm as we now know it; or

2. go like hell to make ni work. get others to adopt it, find applications for which it is unique and the other approach won't work. Also get the cost so that we can use it as an interconnect within a computer (I believe this will work once the technology gets there.)

I think we made an error in NI. It should have been debated more, also it got evolved significantly in commiettee without the above realism. All that is of course hidnsight.

(I am just a little bit pissed that you didn't raise this at the time of the design. I did, I hope you'll recall, when I pointed out to the whole DEC technical community that the way ma bell would do this was with a digital pbx, which they have running and I saw and asked you all to visit. It is called Datakit and I would expect it to be marketed. It is trivial, it uses the wiring, etc. Also, it is capable of going to 1 mb speeds, with special wiring back to the pbx.

Yes, question it continually as I do, but the sure way to make it fail is to stop work.

Frankly, I think we should put our heads down and get the thing to work... as we know it now. We have created a set of people all working on it too. As we work, if we can finally get going much more aggressively as though we intend to win, we should look around and be prepared to change the modem and interface protocol. The basic systems we can build will be about the same though.

Right now I want to make ni the standard for building computer nets and computer clusters and interconnecting the components of a computer to make a computer. If you, working on an alternative detailed design have a proposal that will let us do say the first 2 just as well, then I'll listen when the design is firm. You have a choice too, as a previous changer (along with me) we have a mercury that I haven't seen the design of yet and I believe we all have to get it done.

I don't want to cut off debate on whether we should switch or fight, but I believe we had best keep going like hell, until there is some alternative that is put together that has any meaning. Also, as we charge ahead faster than we have been, I hope, I expect us all to keep our eyes and ears open.

The most obvious worry is to build what no one wants or that is not what the competitive standards have brought out.

The less obvious way to lose is to ship nothing, while we chase all the standards.

What do you other folks think about this?

"CC" DISTRIBUTION:

SAM FULLER PETE JANCA BERNIE LACROUTE
TONY LAUCK JOHN MCNAMARA AVRAM MILLER
STAN PEARSON DAVE RODGERS BOB SAVELL
MICKEY SMITH

GB2.S5.29
00 BURT DECGRAM ACCEPTED S 9832 O 13 13-FEB-80 20:58:52

****
* d i g i t a l *
****

TO: LEO BENNETT   DATE: WED 13 FEB 1980
8:49 PM EST
    OOD: FROM: GORDON BELL
    OOD: @CLEM   DEPT: OOD
                                                 EXT: 223-2236
                                                 LOC/MAIL STOP: ML12-1
A51

SUBJECT: DOES THE NOMENCLATURE PROGRAM HAVE NO CLOTHES ON?

Somehow, I can relate to this. Honest, I never ever
communicated
except by ESP on this.

We gotta do something, Mark does talk sense here. IBM isn't who I like to emulate, except in certain areas. We need discipline and changing all the numbers seems like a pain and high cost. I've been here before when we solved the world's problem in CAD by coming up with both EPLS and IDEA the super data bases in the sky that were to solve all the world's problems.

Honest, I do want to do something...but I'm certain not
clear
on the specifics.

It's comforting to find that there are two of us in this mad world. Hopefully that's all, because all it will take is to ignore or convince us.

I hope you supporters are even more solid and can answer the questions that mark raises.

ATTACHED: MEMO;94

****
* d i g i t a l *
****

TO: CARLTON DAVENPORT, NP @NHSS   DATE: WED 13 FEB 1980
2:39 PM EST

FROM: MARK UHRICH

cc: see "CC" DISTRIBUTION   DEPT: CSS/GIA
MARKETING

EXT: 223-2281

LOC/MAIL STOP: PK3-1
P84

SUBJECT: PRODUCT NOMENCLATURE PROGRAM

I have just spent some time studying the package of documents you sent me concerning the new corporate product nomenclature program (new model number system).

I have great difficulty with it.

It is generally agreed that we are running out of model numbers.
We are severely taxing the 2-5-2 system and have seen that the
five characters for the model number (of which only 3 are available
because the other two are "11" or such) plus the two subscripts
are inadaquate to our needs. Therefore it is clear that something
needs to be done soon.

My problem is not with the idea of change but with the system chosen. I find it cryptic and beyond comprehension.

A major part of my problem is with the use of an all numeric system. One major advantage to the current DEC system is the use
of letters and mimonics.

- The use of letters allows up to 26 variations to be expressed
  by each character of the name. The use of digits reduces this
  to 10. The result is that model numbers will need to be 2.6 times
  longer just to represent the same amount of information.

- Humans work with letters and mimonics very well. I am not the
  expert on this but I seem to recall that the best nomenclature
  schemes are a combination of letters and numbers; e.g. three letters
  plus three numbers.

- For the most part, the model number mimonics actually DO mean
  something. For example, everyone understands that an LPxx is
  probably a line printer or something to do with line printers.
  Memories are probably Maxx, comm devices tend to be Dxxx, etc.
  This system has been violated a lot of late and has become a
  bit strange but only because we are running out of room with
  2-5-2 and Dick Best has been forced to it.

  The advantage of the current system is that it makes it easy
  for people to remember at least half of a model number and
  therefore more easily find it in the price list or Dick Best
  list. As far as I can tell, the new system will force me to
  scan almost every line in a whole section of these lists to
  find something.

I have heard some comments that the new system is much like IBM's.

I would point out that just because IBM does something a certain
way doesn't make it the best way. This company was founded on
that idea.

I notice that manufacturing is staying with the 2-5-2 system.
I would submitt that actually the computer systems of manufacturing
are far more capable of absorbing the new system than are the
supposedly people oriented activities such as marketing, sales,
and our customers.

Maybe what we should do is start from the mimonic system we have
now, identify the problems, and expand the fields to meet our
needs. Maybe it should be 2-7-4.

Has anyone from Human Factors looked at this?

I don't deny that we need to change our current system to meet
our needs in the 80s. I am concerned that "the cure will be
worse than the illness".

Regards,

P.S. Someone quick tell me the difference between a 1419-B02
and a 1419-1201. I will send $1 via interoffice mail to
the first person who responds with the correct answer.

"CC" DISTRIBUTION:

DICK BEST	GORDON BELL*	JOHN HOLMAN
BILL GLOVER	LEO BENNETT	

GB1.S2.27

For
Allan T. Waterman Award

Date: September 9, 1979
Born: June 1, 1946
Education: U. of Michigan 1968, BSEE; Stanford 1969, MSEE; Stanford 1972, Ph.D.
Employment: Carnegie-Mellon University, Assistant Professor, 1972-1975; Associate Professor 1972-1975; Digital Equipment Corporation, Chief Architect 1975-1979; Technical Director, 1979-present

Sam has been involved in the understanding of Computer Systems both at Carnegie-Mellon University and Digital Equipment Corporation since graduating from Stanford. His work has included both analysis and synthesis of these systems on a widescale basis. He is extremely versatile and his interests also include algorithms, programming languages, and Computer Aided Design.

His major contributions are:

Understanding the way cyclic memories such as drums, disks, and all electronic (Charge Coupled Devices and Magnetic Bubble Domain) behave and control performance in various computer systems--this work came from his Stanford PhD thesis.

Measurement and understanding of multiprocessor computer systems. Was responsible for this work on Carnegie-Mellon's C.mmp, 16 processor multiprocessor system.

Comparison of computer architectures. This work was done for the Department of Defense and included various methods and measures of various architectures. This is the most significant evaluation of this type that has ever been carried out.

Synthesis of multicomputer systems. This work included Cm*, a system of 50 processors, which is now operational.

Chief Architect at Digital Equipment Corporation, and now Technical Director, responsible for assessing and guiding the direction of all DEC Research and Development.

Possible Future Contributions:

I believe Sam's immediate contributions will be in his role as Technical Director. This will apply his widescale knowledge of Computer Systems to determining the future direction of the systems we research and build.

References:

Professors Allen Newell and William Wulf, Computer Science Department, Carnegie-Mellon University

Professor Edward McCluskey, Professor of Electrical Engineering and Computer Science, Stanford University

Robert Kahn, Chief Scientist, Information Processing Division, ARPA; John Lehmann Computer Science Division, NSF.

Prepared and endorsed by: Gordon Bell, Vice President of Engineering, Digital Equipment Corporation, and Professor of Computer Science and Electrical Engineering (on leave), Carnegie-Mellon University.

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* d i g i t a l *
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TO: see "TO" DISTRIBUTION DATE: MON 4 MAY 1981 11:39 EST

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION DEPT: ENG STAFF

EXT: 223-2236

LOC/MAIL STOP: ML12-1/A51

SUBJECT: NEW CSD AT NORTHEASTERN AND US

COMPUTER SCIENCE DEPARTMENT NEED

Bob Fano (MIT), Max Mathews (BTL), Dick Karp (UC/B), and I were invited to recommend how their Computer Science Department should be structured. They have been operating in a fragmented mode for many years, with efforts in math, EE, industrial engineering, business, and in the technology schools. We recommended establishing a strong department in the Engineering school, together with strong components in electrical engineering, industrial engineering and math. The department should encourage joint appointments with the other departments.

The department should be heavily financed in terms of computing equipment, including having their own computer. These departments we call Computer Science are a misnomer because it is fundamentally an engineering discipline. Thus, by having equipment they get into the nitty gritty problems of machines, not just being lobbyists and complainers about computation facilities that someone should fix. Virtually all departments have their own facilities now. The Computation Center Director supports this too, with something like a 750! I trust they'll come for support, and given they get their act together, this would really be to our advantage to support this. It would be used both as a teaching and a research machine.

COMPUTATION CENTER

I was impressed by the new computation center director, Dr. Paul Kalagan (437-2335), and what they are doing with two 780s. One is for students, the other for research. They run 120 students on a 6 Mbyte machine and get decent response. They have VT100s and other CRT's, plus use some 120s as line printers. We ought to feature them in one of our ads...whatever happened to the ad campaign, Ask Any User? (We built a really great framework for VAX ads, and with the changing of the marketing guard, all the ad people, ideas and policies were changed. Why can't we have AD

compatibility and continuity and quality BOB and TED, instead of
the content-free crap we have now?)

PRODUCT CONCERNS AND IDEAS

. PORTABLE TERMINALS Since they are so heavily commuter based, they could really use portable personal computers so the students could prepare programs at home and bring them in or connect via phone to do editing. (Note, make it compatible with the TI editing terminal!) BILL PICOTT, when will our LA12 hold a program so that I can edit without a host?

. BOOK AUTHORS Two groups were writing books on using VAX languages and we ought to consider publishing them. Prof. Proulx is doing one on VAX assembler, complete with I/O etc. that is aimed at the assembly language course, that is substantially less architecture based, but more VMS based. MARCY, it would be worth contacting.

. COMPLETE MANUALS VERSUS ALA CARTE One professor was trying to get a set of notes together so that a student could easily use a system and succeeded in getting EDT down to 32 pages, plus collected all the right stuff from the various manuals so that the student (or he) didn't have to rifle the big collection (now about 4 feet worth that is held in an auto parts binder in the comp center). ARMEN, please send him the drafts of the book you have on pascal and on pl/1 to: Dr Kalaghan, Dr Proulx, Dr. Rasala, and Dr. Casey.

. GOOD AND COMPLETE COMMUNICATIONS EQUIPMENT They'd like

less
overhead in the communications hardware as they believe this
costs them 30 percent of the cpu and if this could be reduced at a small cost, the number of lines could be increased still more, say by 20 percent. Note that with a
600K configuration, they are getting 100 users at 6K each.
If they spent 60K to get 20 more users, then the cost would
go down to 5.5K...or about the cost of an Apple III. They
might decide to try a very large number of personal computers say spending 3K to 4K each to off load the VAX of
the big numbers of terminals. They had banks and banks of
Racal Modems. We really have to focus our Modem efforts so
that we get this business! We spend money doing the engineering of modems, but we don't build them. Similarly,
we sell a system, but don't get all the revenue. BERNIE, WE
HAVE A GREAT OPPORTUNITY TO REALLY GO AFTER CORPORATE NOR BY
REALLY FOCUSSING ON COMMUNICATIONS.

. SELL FOLLOW-ONS We didn't sell all they system. They recently went on to balance the system by getting it up to 6
Mbytes, as it had been thrashing. We don't watch these systems at a field level so that they become balanced. BJ,
please tell me that all our internal systems are balanced.
Also, given our massive use of BLISS, we ought to really tune it to at least get rid of all i/o and cpu time we can
by large memory.

. GIGI POSSIBILITIES The CS folks didn't want Gigi, cause they were into building their own graphics package on a

bottom-up basis using Teraks and other PC's. Here, we ought
to give them a few so they could get passed this low level
graphics crap and start using graphics.   This should be a
sales/product line issue. For sales promotion, why don't we
give a Gigi to every VAX system user to simply let them try
it. It would be substantially cheaper than a sales call to
try and convince them? Note, since they use the system
software such as EDT, I would think Gigi should be modified
so that it can operate with VAX. This hardware problem has
to be solved.

. PDT AS A PERSONAL COMPUTER They are going to experiment
here. Why not get them a bunch of PDT's, as they are using
11s and VAX's now and this would save them the bother of
having to switch to something else?

GB2.S5.45

"TO" DISTRIBUTION:

ARMEN VARTERSSIAN @ZKXX DICK ECKHOUSE JIM ROCHE @NERR
JOE MEANY BILL PICOTT

"CC" DISTRIBUTION:

BILL BAILEY @PKXX TED JOHNSON MARCIA KENAH
ANDY KNOWLES BERNIE LACROUTE R.L. LANE

ID#339

| d | i | g | i | t | a | l | i n t e r o f f i c e   m e m o r a n d u m

+---------------------------+

Subject: **Not Emulating the 360/370 On Our Machines**

To: Marketing Committee
OOD

Date: 9 NOV 78
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

follow up 11/23/78

Winston Hodge, a west coast designer in a consulting company, has been designing IBM emulators as part of our 11 products. He did the original GA 1130 emulator.

I said we were not interested in such a product. Right?

Random rumour: He's designing a Series 1 on-a-chip for a semiconductor company to be available in one to two years, as a prelude to a 370 on-a-chip.

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Dick Clayton	ML12-2/E71	Jim Cudmore	ML1-5/E30
Bill Demmer	TW/D19	Ulf Fagerquist	MR1-2/E78
Win Hindle	ML5-2/A53	Bill Johnson	ML21-3/E87
Ted Johnson	PK3-2/A55	John Kevill	ML1-3/E58
Andy Knowles	ML5-2/A53	John Meyer	ML12-1/A11
Stan Olsen	MK1-2/A57	Larry Portner	ML12-3/A62
Bob Puffer	ML12-2/E38	Bill Thompson	ML12-1/F41

Subject: Thoughts on the engineering organizations
To Ken and Jack, Win

I'd like to strongly recommend that we make the following Vice Presidents of Engineering:

Jeff Kalb
Bill Heffner
Sam Fuller
Tom Burniece... I think (Grant must make the case).

Each of these play a significant and increasing role in managing and leading engineering. With the exception of Sam, each manage a large important site.

The model that seems to work best in running these organizations is to have BOTH a manager and a leader (eg. Hindle/Olsen, Smith/Bell (now Fuller), Demmer/Strecker, Glorioso/Kotok, Kalb/?, BJ/Mahendra Patel, Saviers/Riggle, Julius/?, Cudmore/?, Communications guy/Lauck).

Sam
I think that Sam can take my place in providing the overall leadership especially in a more divisional structure. Glue will be needed, and Sam has been doing this. He needs to be even more assertive in the future in light of more binding within each group being more independent. The pressure will be even greater to have more, shorter term projects. Sam should also develop some managers to delegate to- research groups, external research, architectural control, etc. so that he's free to work on the fires. I think the title will help facilitate his work, but he clearly deserves the tille because of his past performance.

I think the network of senior consulting engineers is quite good, and needs to be strengthened and even made more formal. I think Mahendra is probably the broadest (electrons to databases and human interfaces) and deepest guy in the company. He continues to amaze me, as does Riggle.

You see that Julius and Jim need some leadership help. I don't think Jim will get much in the current environment unless we give him more support.

Gordon
7/17/83
Dear Jack, Win, Sam, BJ, and whoever:

I had some observations which might be of interest, so as a stockholder will reel them off.

1. It's going to very hard to get much speed up in the AI area through parallelism, based on a very sketchy knowedge of this field when I bumped into some researchers. There needs to be a high level interface at ARPA. Sam should really spend some time with Bob Kahn and ask what you can do for your country.

2. Symbolics has taken the market from DEC and the KL, running LISP about 2x a KL. Furthermore, Tom Knight (a professor and consultant?) believes they can get a factor

of 50-100 speedup over a 3600 in 4-6 years using 100K gate arrays to go from 180 ns to 25-40 ns. They would also use multiple pipes to get the x 5 or so. Apparently, Mike Farmall of LLL may join them. (My view is that it will be difficult both in time and performance.) They may also be working on a smaller machine. The company looks like it is going somewhere, and I don't hear of anything that will stop them except maybe the IBM 801 out of Austin or perhaps the DECWRL system, if it is pushed. People need to try a Prolog to compete with the new Japanese workstations, and the best bet looks like a re microcoded Symbolics.

3. Ed Feigenbaum described a Mitsubishi PC that Sperry will market that has upward compatible graphics that looks super good. They and IBM apparently didn't get the same message that was in Maynard: "If god would have wanted color and graphics, he wouldn't have put us in the black and white, one dimensional world and made us sit at slow, dumb text terminals and word processors."

4. Am quite impressed with the PC's we have and with this industry. IBM has the best machine by far! At last, the users are winning.

5. It looks like there's a very good DEC WPS compatible editor on the PC. Given the memory size of the PC, the only reason not to buy it (and a PC) is a dramatic price difference between a single function (eg DECmate word processing) box. Note the enclosed essay attempts to say this.

6. Where are the VT200's? I've plotted the ships in this area and clearly the point of inflection has passed. I believed there would be few dumb terminals by 85, if you recall reading the Product Stratgy statement 4 years ago.

7. It occurred to me that there may be an extraordinary opportunity using the Trilogy technology. I think there's a finite chance that their machine is too complex to get working in a timely fashion. Sperry may not be moving fast enough. So why not be first? This should be

quite predicatable once you have the knowledge about the technology coming though. I would hope to see a first class team on it. Why not encourgage Sam or Bill Strecker to lead it out there?

8. Bill Krause of 3 Com would like to put his low cost Ethernet on the DEC personal computers. His product on the IBM PC is being sold by IBM. It looks like Ethernet may kind of make it in spite of DEC.

9. There's an incredible array of fault tolerant micro-based machines for transaction processing and it really pains me to think that DEC can't get this whole market given the tremendous investment in the Clusters! I've yet to meet anyone in the field that knows about it. (So much for Base Product Marketing.

10. Deleted (on second thought)

11. Will any of the fast VAXen ever make it out? Are you helping these folks?

12. Andy sent Jack and I a note at the beginning of the summer which essentially said: "marketing is and has been taking a bum rap for what is fundamentally an engineering/manufacturing problem... think about it". Having seen many other companies, I must partially agree! Also, having now worked with marketing folks of all denominations, I think the DEC ones are quite good.

13. Just for luck. Attached is an essay which gives my thoughts on this generation.

Gordon
10/15/83 Sat

GB4.13

<subj>SMITH BARNEY, HARRIS UPHAM & CO.
<from>MCGRAW, JOSEPH A.
<to>BELL, GORDON
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<from>?
<to>BELL, GORDON
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<date rec>11/26/79
<log#>11-36
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<subj>FUJITSU LIMITED
<from>KUROSAKI, F.
<to>BELL, GORDON
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<subj>A.H. TETREAULT, INC. REALTOR

<from>TETREAULT, A.H.
<to>DAVIS, SHELDON A.
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<log#>11-34
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<subj>INFORM
<from>SEIGERMAN, CATHY
<to>FORBES, MARY JANE
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<date rec>79/11/20
<log#>11-33
<dispo/date>ORIGINAL LETTER TO CATHY SEIGERMAN - 11/27/79
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<f/u>
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<subj>GEORGIA STATE UNIVERSITY
<from>FRANKLIN, WILLIAM H.
<to>VP FOR HUMAN RESOURCE DEVELOPMENT
<date>79/11/14
<date rec>11/26/79
<log#>11-32
<dispo/date>JOHN MEYER - 11/27/79
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<f/u>
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<subj>SYRACUS UNIVERSITY
<from>OLDFIELD, J.V.
<to>BELL, GORDON
<date>79/11/19
<date rec>11/26/79
<log#>11-31
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<subj>XEROX
<from>ADAMS, ROBERT V.
<to>CLAYTON, RICHARD (CC:G. BELL)
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<date rec>11/26/79
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<subj>CARNEGIE-MELLON UNIVERSITY--EXPERIENCE USING
MULTIPROCESSOR SYSTEMS (A STATUS REPORT)
<from>JONES, ANITA K.
<to>BELL, GORDON
<date>79/10/14
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<subj>OLIVETTI (ITALY)
<from>MERCURIO, L.
<to>BELL, GORDON
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<date rec>11/20/79
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<subj>ADVANCED TECHNOLOGY RESOURCES CORPORATION
<from>BERGER, EDWYN A.
<to>BELL, GORDON
<date>79/11/16
<date rec>11/20/79
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<dispo/date>ART WILLIAMS - 11/26/79
<message>YOURS
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<subj>POLYMER RESEARCH CORP. OF AMERICA
<from>MANN, HOWARD K.
<to>BELL, GORDON
<date>79/11/13
<date rec>11/19/79
<log#>11-26

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<from>SUTHERLAND, IVAN E.
<to>BELL, GORDON
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<subj>JOHN WILLIAM COSTELLO ASSOCIATES, INC.
<from>MAZZUCHI, JEROME F.
<to>BELL, GORDON
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<subj>NEW YORK UNIVERSITY
<from>SCHWARTZ, JACK
<to>BELL, GORDON

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<subj>DATAPRODUCTS CORPORATION
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<to>BELL, GORDON
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<subj>MNEMODEX
<from>GORDON, ROBERT M.
<to>BELL, GORDON
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<subj>CARNEGIE-MELLON UNIVERSITY
<from>PARKER, ALICE C.
<to>BELL, GORDON
<date>79/11/8
<date rec>11/16/79
<log#>11-20
<dispo/date>JOHN MEYER - 11/26/79
<message>PLEASE SET UP AN INTERVIEW FOR ALICE TO SEE FULLER, MUDGE, PATEL, KUSIK, GLORIOSO, TEICHER
<answer>
<f/u>12/7/79
<filed>
<ret-gb>
<roll>
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<subj>FEASIBILITY REPORT (REV. 1) (BOOK 1)
<from>SUPNIK, R.
<to>BELL, GORDON
<date>79/11/1
<date rec>11/16/79
<log#>11-19
<dispo/date>
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<answer>
<f/u>
<filed>
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<subj>INTERACTIVE
<from>WEINER, PETER G.
<to>HINDLE, WIN (CC:GB)
<date>79/11/12
<date rec>11/15/79
<log#>11-18
<dispo/date>WIN HINDLE - 11/27/79
<message>WIN, CAN WE HELP HIM?
<answer>WE'RE WORKING ON IT IN OEM. DEFINITELY WILL IMPROVE.
<f/u>12/7/79
<filed>

<ret-gb>FROM WIN - 11/29/79
<roll>
<>

<subj>HUGHES AIRCRAFT COMPANY
<from>RANFTL, R.M.
<to>MULLIN, ALBERT E. JR.
<date>79/11/9
<date rec>11/14/79
<log#>11-17
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<filed>
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<subj>SUPREME EQUIPMENT & SYSTEMS CORPORATION
<from>NISSENSON, SAM
<to>OLSEN, KEN
<date>79/11/5
<date rec>11/14/79
<log#>11-16
<dispo/date>
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<subj>INTERSTATE ELECTRONICS CORPORATION
<from>FOSTER, RICHARD A.
<to>OLSEN, KENNETH H.
<date>79/11/6
<date rec>11/14/79
<log#>11-15
<dispo/date>JIM BELL - 11/27/79
<message>WHAT'S THIS? (CC:SAM)

<answer>
<f/u>12/7/79
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<ret-gb>
<roll>
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<subj>JRS INDUSTRIES, INC.
<from>WARSHAWSKY, ERWIN H.
<to>BELL, GORDON
<date>79/11/7
<date rec>11/14/79
<log#>11-14
<dispo/date>SAM FULLER - 11/27/79
<message>WILL YOU PLEASE HANDLE THIS?
<answer>GORDON, PAT WHITE WILL BE GETTING INFO. AND LOOKING OUT FOR DEC INTEREST & OPPORTUNITIES HERE. - 11/29/79
<f/u>12/14/79
<filed>
<ret-gb>
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<subj>TECHNISCHE HOGESCHOOL DELFT
<from>VAN DE GOOR, AD J.
<to>BELL, GORDON
<date>79/11/6
<date rec>11/12/79
<log#>11-13
<dispo/date>
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<subj>UNIVERSITY OF NEWCASTLE UPON TYNE, THE
<from>RANDELL, BRIAN
<to>BELL, GORDON
<date>79/11/5

<date rec>11/9/79
<log#>11-12
<dispo/date>
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<filed>
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<subj>TEAG (THE ENVIRONMENTAL ANALYSIS GROUP, LTD.)
<from>DAVIS, GERALD
<to>JANZ, AL (CC:GORDON)
<date>79/11/1
<date rec>11/9/79
<log#>11-11
<dispo/date>FILE #13 - 11/12/79
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>U OF TORONTO
<from>GRAHAM, G. SCOTT
<to>BELL, GORDON
<date>79/07/?
<date rec>11/9/79
<log#>11-10
<dispo/date>SAM FULLER - 11/13/79
<message>LOOKS INTERESTING. SHOULD TERRY TRY TO GET THEM TO HELP US?
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>COMPUTERWORLD
<from>WHITMARSH, JOHN C.
<to>BERUBE, DICK
<date>79/11/1
<date rec>11/6/79
<log#>11-9
<dispo/date>
<message>
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<filed>
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<subj>SOFTWARE ENGINEERING QUARTERLY REPORT (BOOK #1)
<from>SHELDON, LIZ
<to>BELL, GORDON
<date>79/10/?
<date rec>11/6/79
<log#>11-8
<dispo/date>BILL JOHNSON - 11/8/79
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<subj>NATIONAL RESEARCH COUNCIL
<from>GOLDHABER, J.K.
<to>BELL, GORDON
<date>79/11/1
<date rec>11/5/79
<log#>11-7
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<subj>WANG INSTITUTE
<from>WANG, AN
<to>BELL, GORDON
<date>79/11/1
<date rec>11/5/79
<log#>11-6
<dispo/date>
<message>
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<f/u>
<filed>WANG - 1/9/80
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<subj>CARNEGIE-MELLON UNIVERSITY
<from>JONES, ANITA K.
<to>BELL, GORDON (SAM + LLOYD DICKMAN)
<date>79/11/1
<date rec>11/5/79
<log#>11-5
<dispo/date>CC:OOD - 11/6/79
<message>THIS IS IMPRESSIVE - FIRST ATTEMPT TO RUN 40 COMPUTER'S TOGETHER.
<answer>
<f/u>
<filed>CMU GENERAL (ORIGINAL)
<ret-gb>
<roll>
<>

<subj>HODGE, TAYLOR & ASSOCIATES INC.
<from>HODGE, WIN
<to>BELL, GORDON
<date>79/10/29
<date rec>11/2/79
<log#>11-4
<dispo/date>ORIGINAL TO F/U - 11/6/79
CC:FULLER,PLOWMAN,J.BELL

<message>SHOULD WE TRY TO GET ONE AND OPERATE IT INTERNALLY? IT'S CLEAR VOICE WILL BE IMPORTANT ON THE ETHERNET IN THE NOT TOO DISTANT FUTURE.
<answer>
<f/u>11/16/79
<filed>
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<subj>CARNEGIE-MELLON UNVIERSITY
<from>BARBACCI, MARIO R.
<to>WORKSHOP MAILING LIST (G. BELL)
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<date rec>11/2/79
<log#>11-3
<dispo/date>FILE # 13 - 11/6/79
<message>
<answer>
<f/u>
<filed>
<ret-gb>
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<subj>PENNSYLVANIA STATE UNIVERSITY
<from>WATSON, RAY
<to>BELL, GORDON
<date>79/10/30
<date rec>11/2/79
<log#>11-2
<dispo/date>SHEL DAVIS - 11/6/79
<message>YOURS
<answer>
<f/u>
<filed>
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<roll>
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<subj>RESUME' - JOHN A. FOSS
<from>FOSS, JOHN A.

<to>BELL, GORDON
<date>79/10/31
<date rec>11/2/79
<log#>11-1
<dispo/date>JOHN MEYER - 11/7/79
<message>PLEASE HANDLE.
<answer>
<f/u>
<filed>
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<roll>
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<subj>JULIUS TOFIAS & COMPANY INC.
<from>TOFIAS, DONALD S.I.R.
<to>BELL, GORDON
<date>80/11/25
<date rec>11/26/80
<log#>11-54
<dispo/date>JOHN HOLMAN - 12/1/80
<message>YOURS.
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<subj>NATIONAL ACADEMY OF ENGINEERING
<from>BRIAN, P.L.T.
<to>BELL, GORDON
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<date rec>11/26/80
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<subj>RESUME' -- (SHELDON P. GOLDER)
<from>GOLDER, SHELDON P.
<to>BELL, GORDON
<date>80/11/24
<date rec>11/26/80
<log#>11-52
<dispo/date>NANCY STARR - 12/1/80
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<subj>RESUME' -- RAYMOND J. LAFLAMME
<from>LAFLAMME, RAYMOND J.
<to>BELL, GORDON
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<date rec>11/26/80
<log#>11-51
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<subj>RUZIC, FJODOR--RE:DISTRIBUTIVE PROCESSING
<from>RUZIC, FJODOR
<to>BELL, GORDON
<date>80/11/5
<date rec>11/25/80
<log#>11-51
<dispo/date>SENT HIM HIS ORIGINAL LETTER AND A COPY OF THE

"DISTRIBUTED PROCESSING AND LIMITS TO ITS GROWTH" PAPER. - 11/26/80
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>RESUME' -- BERNARD J. MCCAFFERTY (CASE WESTERN RESERVE)
<from>MCCAFFERTY, BERNARD J.
<to>BELL, GORDON
<date>80/11/?
<date rec>11/24/80
<log#>11-50
<dispo/date>NANCY STARR - 11/25/80
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<subj>U.S. CONTROLS CORP.
<from>KRIEGER, BARBARA
<to>BELL, GORDON
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<date rec>11/24/80
<log#>11-49
<dispo/date>
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<subj>UNIVERSITY OF SYDNEY
<from>BROMLEY, DR. ALLAN G.
<to>BELL, GORDON
<date>80/11/17
<date rec>11/24/80
<log#>11-48
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<subj>BLACK DOT
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<to>BELL, GORDON
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<date rec>11/24/80
<log#>11-47
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<subj>CARNEGIE-MELLON UNIVERSITY
<from>NOWAK, FRANK E.
<to>BELL, GORDON
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<subj>CARNEGIE-MELLON UNIVERSITY
<from>WULF, WM. A.; HARBISON, SAMUEL A.
<to>BELL, GORDON
<date>80/11/12
<date rec>11/21/80
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December 8, 1978

Mr. Bob Noyce
INTEL
3065 Bowers Avenue
Santa Clara, Cal. 95051

Dear Bob:

The enclosed is the result of my recent trip to Japan. I'd like your opinion, as I intend to publish this. Specifically I'm interested in knowing what's wrong, unclear, overly opinionated, etc.

Sorry it's so long.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:ljp

Enclosure

Page 6. Blind comment about a breakthrough is very suspect. We've been trying for about twenty years in this area and results of this research really don't address need or indicate hint of a breakthrough.

Page 13. Classification doesn't feel good. ILLIAC IV, is a restricted, forerunner to vector machines (e.g., Cray 1). What about the STARAN and friends? Data flow (admittedly non-existent, and suspect) may be a better computational model for X-tree.

Page 15. I'm really uncomfortable with thinking that is based on classifying ILLIAC IV (a single instruction stream) as a multiprocessor! It is a uniprocessor capable of 64 simultaneous operations on relatively connected data (e.g., vectors), stored in a restricted fashion.

Page 21. Dynamic microprogramming - how do we get this order of magnitude?

The misunderstanding about symmetrical multiprocessors is so enormous here that I have trouble believing these researchers will get anywhere. There is no real hardware cost, performance and reliability problem in building large symmetrical multiprocessors for <u>now</u> any arbitrarily large number of processors! Having been involved in several where p = 2, 4, 16 and 16, there isn't a limit say for p~ 1,000; caches and tandem switches (read the Benes book on switching -- otherwise we would never have the telephone systems we do) can be used. The small cost of switching varies pretty much as p+m, with only a small part being m x p. The comments in their first paper are strongly in error.

There is one, common problem for all these multiprocessor or multi-computer systems whether they be: symmetrical multiprocessors (Burroughs, Univac, DEC, CMU); almost symmetrical multiprocessors (PRIME); multi-computer networks with a common address space (Cm*); computer networks with fast message passing and tandem sharing of peripherals (Tandem); conventional, homogeneous or heterogeneous computer networks; and especially the tree-structured, homogeneous computer networks (so called, X-tree). It is:

> We have not yet found a way to utilize (program) them either by current or experimental (although there's a little hope at CMU using Algol 68 on Cm* and C.mmp) programming languages in any fashion <u>except</u> as:
>
> > independent computers;
> > multiprogramming as in transaction processing, real time applications or timesharing;
> > functional multiprogramming (e.g., front end, back end)
> > specialized applications (e.g., pipelining as in signal processing).

Overall, ignoring the above details, my concern is that the work (including design, construction and research) is too broad (from VLSI to applications) to get anything at all useful.

The money would be better applied to understand the use of existing multiprocessor and multi-computer structures. The "physical structure fixation" inherent in this proposal will detract from addressing computational models, parallel programming languages, doing good VLSI work, etc. If they really want to work on the O/S (another rat hole), language (essential) and general nature of parallelism (which I think is now concept-theory bound) then let's get them a reasonable set of Cm* modules so they can build their X-trees immediately without messing around in more low-level hardware that most likely won't work anyway (e.g., Berkeley's Prime) because it's hard (expensive) to get real engineers at universities and build something of this scope. The research proposal is quite good and the approach generally well thought out. The problem needs addressing. It's a shame that some of this didn't get done with COSERS (of which I was a member) -- even if the report ever comes out.

Fundamentally, let's not waste money on a research committee. Pick a good person as PI, and give them a review group to call on/visit/advise/etc. But make someone (who's had this kind of research experience) responsible for the work.

I'd recommend Eric von Hippel at the MIT Sloan School, part of the group of Roberts, Allen et al that studies research management.

P.S. Since there's no name on this as PI, why waste our time reviewing it?

```
+---------------------------+                              ID#366
|   |   |   |   |   |   |   |
| d | i | g | i | t | a | l |  i n t e r o f f i c e   m e m o r a n d u m
|   |   |   |   |   |   |   |
+---------------------------+
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Subject: **NSF Microstructures Conference**

To: Distribution

Date: 27 NOV 78
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

follow up 12/11/78

This three-day conference focused on helping NSF get its act together to go for more funding in VLSI and other sub-micron research. I didn't spend much time attending because I don't know the areas, but some of the tidbits I gleaned:

1. Electron beam exposure is currently the only way to get below two micron lines.

2. The complexity of

circuits even at four micron HMOS level are well-beyond CAD tools and designer capabilities.

3. IBM is into multi-layered IC's.

4. The Cornell (National) facility is only $5M funding over five years.

5. Stanford looks like the best place by far! Meindl is now collaborating with Forest Baskett (forthcoming head of Digital Systems Lab.) and their goal is to build a 1M gate structure in four years! I'd like the test chip to be a VAX, but they probably want to explore their own architecture. They have an industrial affiliates program. The cost is $15K/year. This seems worth belonging to. Meindl is impressive!

Jim Bell They've ordered a 2060 and want a corporation contribution. Can we use this contribution to prepay several years of the affiliates program?

6. It's not clear that Cal Tech is very highly regarded by others in the semiconductor area. This might be a good place to give up. I think we have to stay for another year. Stanford and Cornell may be better and we must help MIT succeed!

7. SUPREME (or something) Stanford University Process Modelling program is a program we might want to use. Jim Meindl says that this program is run by all major semiconductor companies including Intel and IBM. It's used for modelling the yields for processes so they can be tuned. Do we/should we use it?

8. Most universities aren't supplying graduates in semis, but some are. Let's tap the supply NOW! We're bent on buying expensive, fickle, trained artists who spend a few months or two years and then leave. Occasionally we try to "grow our own" but I know of little success. Effective <u>now</u>, I want a major <u>recruiting</u> campaign to get <u>new</u> MS/Ph.D level graduates by June! It's not clear where to recruit, but don't bother unless they've actually built msi level circuits. Some possibilities: Stanford, Cal Tech, Berkeley and U. of Cincinnati (Prof. Boyd). John Meyer, please put a Recruiting Program together! Any other places?

9. The EBEAM Mask Maker is used by IBM in the System 38 to get turn around time for ECO's down to three days. Wouldn't it pay for us to get one?

10. MIT is having a one-three week study group this January to examine if and how they can work on vlsi and some of us may be invited. I want to get some sort of collaborative effort with them. Let's make sure Paul Penfield stays here and consults as much as possible. We can not go on (or exist) the way we are postured in this area; we must have trained people and we must reduce the design from art to engineering -- MIT has to do this for us. Jon Allen and Lynn Conway are teaching a course this term using Conway and Mead's book and may need someone to process their wafers. Let's do this to get an involvement. Can we hire Lynn?

11. BTL is still pushing

bubbles and they have a product out with 256 Kbits/package, although it looks like there are only 68K per chip inside the package.

They are really targetting disks...just as I would be. The extrapolation is to a 1 Mbit in 82 and on to 256 Mbit with .05 micron bubbles. The 256 Kbit 80 chip assumes 1.5 micron bubbles, whereas now they are 3 micron.

12. The agreed upon cost is about $100/gate for LSI design. Bill Green/Joe Zeh, could we go back in time and plot the design cost for each chip as a function of physical size, (crowding), number of gates and the design technology? We need this model in order to understand how to get our own engineering priorities decided.

13. Apparently the 64 Kbit TI chip has 2.5 micron channel width.

14. TI, Fairchild and Motorola are all going in the gate array direction for a number of applications that used to be standard parts for what was mainly computer industry. We are not coupled into this activity worth a damn and I fully expect to get creamed by a machine that is made by a semi vendor or a competitor using standard semi industry supplied gate arrays. I would think we might want to see just what the competition is going to be, by looking at the technology. Watch out for high end, low cost CDC machines! Henry Crouse and Bill Green, do you remember TI? What are all the technologies they could supply us with? (I am getting a list via Carnegie-Mellon and would like to see if our assessments agree.)

15. Cy Levinthal of Columbia thinks it is a trivial engineering exercise to build a write once, read only memory of 100 to 10,000 billion bits using a shadow masking technique he's developed by looking which uses a SEM. Could someone go talk with him that understands materials?, SEMs, etc?

16. The Japanese have demonstrated a 50 Km link optical link running at 50 Mbit. It is limited by the number of cable splices which insert loss.

17. The TI Speak and Spell gadget uses 128 Kbit (i.e., 16 Kbytes) P. channel ROMs that cost less than $5. This is about ten times cheaper than we can do in two years with 64K chips. Why can't we look at ROMs for our software distribution problem?

18. General impression: IBM has the best research and does much for semiconductors (Broers heads the effort at Watson - and is good); BTL is second now, but more engineering oriented. The semis take these results and make money with them.

19. The most interesting two sessions were by Hans Zappe, of IBM Research, who described the Josephson device computer work. The statement was made by an NBS person that the vacuum tube dissipates about 1 watt, the transistor 1 milliwatt and the Josephson device 1 microwatt, hence it may be as important as the former devices. He described a 10 cubic cm. computer which has:

a.a processor cycle time of 1-2 ns, Pc has about 500K circuits;

b. a 256 Kbyte cache (1 ns access time, 2 Kbits/chip and 10,000 bits per sq. cm) the projected cache memory would have 4 Kbits/chip using 4 micron lines and have an access time of 0.4 ns;

c.main memory, being worked on in Zurich, would be 64 Mbytes, with access time of 15ns made from 2.5 micron lines organized on 32 Kbit/chip substrates.

The logic circuits currently are 5 micron and take 50-80 psec on switch and 400 circuits are on a chip. They are projecting 1,000 circuits per chip switching in 30-40 psec using 2.5 micron channel width. A 4 input gate switches in 32 ps and consumes 4 microwatts. The interesting points on curves he gave for switching were: 25/1/100; 5/.1/20; and 2.5/?/2 for line width in microns/gate delay in ns/power consumption in microwatts.

The whole thing is a packaging problem because it must be less than 2 x 2 x 2 cm, giving end to end transmission delays of 800 psec. Transmission is by superconducting transmission delay terminated delay lines, where the only loss is in the terminations. These are non-trivial to build and they are looking for ideas. Power is not a problem as the whole thing takes 6.3 watts (2.5 in the logic, 3.5 in memory, .1 to drive the outside world and .2 loss). This still requires a 19 Kw compressor to keep the thing cooled.

GB:ljp

Distribution

OOD		Bill Green	ML1-4/E34
Jim Bell	ML3-2/E41	Len Halio	ML1-2/H26
Jim Cudmore	ML1-5/E30	John Leng	MR1-1/A65
Henry Crouse	ML1-5/B98	Roy Moffa	ML5-2/E93
Ed Fauvre	MK1-2/E06	Craig Mudge	Cal Tech
Sam Fuller	TW/A08	Stan Olsen	MK1-2/C36
Don Gaubatz	ML3-2/E41	Mike Titelbaum	ML1-2/E65
Bob Glorioso	ML3-2/E41	Joe Zeh	WZ-2

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Dick Clayton	ML12-2/E71	Jim Cudmore	ML1-5/E30
Bill Demmer	TW/D19	Ulf Fagerquist	MR1-2/E78
Bill Johnson	ML21-3/E87	John Kevill	ML1-3/E58
John Meyer	ML12-1/A11	Larry Portner	ML12-3/A62
Bob Puffer	ML12-2/E38		
Jim Bell	ML3-2/E41	Henry Crouse	ML1-5/B98
Ed Fauvre	MK1-2/E06	Sam Fuller	TW/A08
Don Gaubatz	ML3-2/E41	Bob Glorioso	ML3-2/E41
Bill Green	ML1-4/E34	Len Halio	ML1-2/H26
John Leng	MR1-1/A65	Roy Moffa	ML5-2/E93
Craig Mudge	Cal Tech	Stan Olsen	MK1-2/C36
Mike Titelbaum	ML1-2/E65	Joe Zeh	WZ-2

NSF WORKSHOP

1.	Algirdas Avizienis	UCLA	Fault tolerant architecture
1.A	Dan Siewiorek	CMU	Fault tolerance + architecture + implementation
2.	Jerome Cox	Washington University	Biomedical applications

2.A	Barry Gilbert	Mayo Clinic	Biomedical signal processing (high speed)
3.	Seymour Cray	Cray Research Corp. Chippewa Falls, Wisc.	Computer designer + builder
3.A	Bulter Lampson	Xerox Research Park, Palo Alto	System and language design
4.	Karp	Berkley	Algorithm Complexity
4.A	Juris Hartmanis	Cornell	Theory of Complexity
4.B	Elwyn Berlekamp	Berkley	Hardware/software error correction; theory of comb. games
5.	Robert Tarjan	Stanford	Complexity of Algorithms
5.A	Mike Shamos	CMU	Complexity of Algorithms
6.	Paul Stoft	Hewlett-Packard	
3.A			
7.	Raj Reddy*	CMU	Signal processing, AI
8.	Robert Kahn*	ARPA	System organization, sub-micron, etc.
3.A			
9.	Ron Rivest	MIT	Theory of computing
9.A	Vaugh Pratt	MIT	Theory of computing
10.	Forest Baskett	Stanford	Parallel processing

10.A David Kuck University of Illinois Parallel processing

A Rex Rice Fairchild Systems organization

*Already invited as rappoter or vice chairman

****
* d i g i t a l *
****

TO: OPERATIONS COMMITTEE: DATE: MON 31 MAY 1982 11:44 AM EDT

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION

DEPT: ENG STAFF

EXT: 223-2236

LOC/MAIL STOP: ML12-1/A51

SUBJECT: VIEWING THE NYIT FILM ON COMPUTER GRAPHICS

As you may know, NYIT is doing really superb work on engineering some really great graphics products. Andy finally got me to see them, and they do deliver. Stangely enough, they are an OEM (as a university) and sell products to television broadcasters and film studios to do animation (cartoons) etc. A current customer is an animation studio in Tokyo where one of the employees is also employeed by Fujitsu! Their system is used by professional artists and cartoonists to do work.

Their artist's workstation runs on a 23, and their main machine is a 780 which they use for storing and processing images that go to tv tape or to film (as i/o). I believe we ought to use the stations internally for Industrial Design simply to reduce the labor in our product sketches. Also, it looks like this quite a reasonable alternative to the Genigraphics system we have to make slides.

They are doing/ have done software for Gigi and we've simply got to get this creative system running on the Professional!

I'll set up the 15 min videotape in Ken's Conference room for viewing at 11:45. Let me urge you to come and see this impressive
work.

"CC" DISTRIBUTION:

PAUL BENIGNI MARY JANE FORBES RICHARD GONZALES
AVRAM MILLER

GB3.S5.57

00 CORE DECGRAM ACCEPTED S 000886 O 128 13-SEP-82 21:33:25

****
* d i g i t a l *
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TO: PAUL BENIGNI DATE: MON 13 SEP 1982
8:25 AM EDT
ANDY KNOWLES FROM: GORDON BELL
cc: GAIL BARRETT DEPT: ENG STAFF
DON METZGER EXT: 223-2236
AVRAM MILLER LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5175576000

SUBJECT: MORE COLLABORATION WITH NYIT

I hope we can get NYIT the PRO quick so as to get their impressive software up on it...and get them to sell it. They are an OEM and do like us.

Paul, I really want to see NO hand renderings of ID'd objects within 2 years. You folks should be "off paper" by then. Let me urge you to start. This is one of the few color rendering systems around.

ATTACHED: MEMO;39

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* d i g i t a l *
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TO: GORDON BELL   DATE: WED 8 SEP 1982 9:34 AM EDT
    AVRAM MILLER   FROM: GAIL BARRETT
DEPT: NYTD SALES
EXT: 331-2289
LOC/MAIL STOP: LIO/LIO

MESSAGE ID: 5175069580

SUBJECT: NYIT / PROFESSIONAL

May 31, 1982 Avram Miller sent an ems to Gordon Bell re: NYIT. The
message ID is: 5165019344. Gordon then sent an ems to the operations
committee including Avrams ems. That message ID is: 5165019275. Chick
Shue, who is my Regional Sales Manager, sent me a memo with the above
memos attached requesting the statue of:

1. Gigi Software running on the professional (the packages NYIT wrote).
2. Status of Digital's potential use of NYIT's Paint workstation for our internal industrial design.
3. Digital's progress in repackaging NYIT's graphics to run on a professional.

To date I have been unable to reach Avram Miller to check his status on
getting NYIT a professional to begin software conversions. I have been
unsuccessful in my attemps to obtain a test unit, and would appreciate
any help or suggestions you might have.

Thank You
Gail

8-SEP-82 11:10:52 S 01369 DCEM
DCEM MESSAGE ID: 5175089067

WPS USERS - Leave HP mode and type <CR>

I am quite impressed with both Dr. Schwartz and Gottlieb as researchers, but this proposal leaves me quite cold, even though I believe very much in the basic machine structure and approach to computing. The issue I have is simply:

The problem has been pushed much further at Carnegie-Mellon through the C.mmp and Cm* systems. This effort takes 3 years to get an experimental vechicle that is far inferior to either CMU system. Furthermore, I don't think the 8 processor system is worth building to investigate parallelism of the kind (several thousand computers) they're espousing.

The researchers are spending far too little time on the problem to make the necessary headway.

I see no evidence that the group is even capable of building even this modest hardware. Now, I am very sanguine about building this important experimental hardware in a university. It's non-trivial and requires more engineering skills than I see present in the research team.

They fall into the classic trap of mP and mC researchers in spending all their energy focussing on the switch. I have incredible faith in our ingenuity to produce large switches, but all the evidence is that it is extremely difficult to do work in parallel algorithms and to manage the distribution of the algorithm on multi-processors or multi-computers.

In short, ill-prepared but good people, and a half-hearted attack at a very important problem. They should go back to the drawing board and figure out how they are going to be able to get the resources that are necessary to make a significant dent in the problem.

GB4.S1.17
00 BURT DECGRAM ACCEPTED S 30157 O 264 13-OCT-80
15:09:28

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* d i g i t a l *
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TO: see "TO" DISTRIBUTION   DATE: MON 13 OCT 1980
2:57 PM EDT
                                            FROM: GORDON BELL
cc: see "CC" DISTRIBUTION   DEPT: OOD
                                            EXT: 223-2236
                                            LOC/MAIL STOP: ML12-
1/A51

SUBJECT: OA: GIVE UP/ACT TOGETHER WITH ATTACHMENT

Sorry, I sent without attachment. Here is whole thing--
Gilmore's message and my observations.

****
* d i g i t a l *
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TO: *GORDON BELL   DATE: FRI 10 OCT 1980
8:25 AM EDT
                                            FROM: JACK GILMORE
                                            DEPT: CORP OFIS
PROGRAM
                                            EXT: 264-5898
                                            LOC/MAIL STOP: MK
1A16/MK1 C12

SUBJECT: PERSONAL MESSAGE

I have to get this off my chest. If I am off base file it it
in
your waste basket.

I'm getting calls from the field re the need to counter OA
competition from
Prime & others. I've just returned from INFO 80 where OA was
the hottest
subject on the floor and in the classrooms.

We are going to suffer if we do not let some of our expertise
out to our
loyal customers who are aching to work with us.

Gordon, I have heard the arguments from all sides; I know where the marketing groups are and their fears of unleashing another TRAX; I am aware of the purist service disdain for DSM support; I know that the architects want a consistent evolution with a minimum if no migration conversion; and I know that all of them suffer from one major ailment, namely, parocialism. None of them are looking at the corporate picture. We need to move into the marketplace aggressively now! The barn will be beautiful but empty if we let those various groups worry about their individual goals, scorecards and empires at the expense of the good of the company.

We need a corporate statement re OA ASAP. We must respond to the demands of those customers who can help us enormously to maintain an image of leadership by working with them. IBM and the others are walking away with the show because we are chicken.

I am disgusted with the way our own people have dumped verbal dung over our EMS and WP projects because they have been willing to listen to our competition's derogatory evaluations rather than learn how to operate and use our products. Also, it is making me livid that so many are willing to criticize our human engineering and when asked how many hours of terminal time they have have meekly dive for cover.

We need another KO. This time in cunning marketing!

00 BURT DECGRAM ACCEPTED S 23599 O 33 11-OCT-80 12:26:51

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* d i g i t a l *
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TO: see "TO" DISTRIBUTION   DATE: SAT 11 OCT 1980
12:23 PM EDT

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION   DEPT: OOD

EXT: 223-2236

LOC/MAIL STOP: ML12-
1/A51

SUBJECT: OA: WE'LL GIVE IT UP RATHER THAN GET OUR ACT
TOGETHER

The attached memo from Jack is pretty accurate.

I attended a salesmeeting in Waltham where I heard that Prime was about to walk off with orders at MIT, Harvard and First Church cause we could say nothing about Office Automation or Mail, where we were headed specifically or generally.
We are using the product internally they must have. It is a set of 78's, 200's and EMS. We must get this package together
and sell it! (No, Word 11 probably won't be the savior, cause
it still doesn't address the Mail issue or the intercommunication
that offices must have!) Furthermore, given that our official
mail project, DECmail has not yet passed phase 0, it is not available within at least 2 years to address the credibility of us as an Office Automation vendor.

I have been advocating the release of EMS/VMS for quite sometime in order to get some experience with this sort of product in the marketplace. We have a couple of customers that are willing (Sandia) where we believe they could handle it. Furthermore, we have data necessary to evolve EMS/VMS to have a better human interface.

What we must do:
1. Stop knocking our products!
2. Get/don't get Word 11 ... it feels marginally relevant to the short or long term.
3. Tweak EMS/VMS and evolve it, while doing it right with DECmail.
4. Go flat out to get a great WPS system on KO that plays with DECmail, and that can be interconnected as a clustered system.
5. Put the whole marketing message effort together in terms of NOW (WPS Stand-alone, WPS Shared, and EMS/VMS) ... as the answer. Getting Word 11 would be frosting.
6. Continue Developing the ultimate, but don't sell it until we get it.

Doing 5 could make us the strongest vendor; telling the world
how bad our WPS is our selling futures in Mail, will only get us in worse shape.

It was truly tragic to listen to the First Church's pleas to have a product from us, and to the fact they had to go to Prime. Our product TODAY is better and is going to evolve to be MUCH, MUCH better, and we can't sell it! Worse yet, they'll
get locked in to PRIME!

We must note that:
for the near term (next 5 years), Electronic Mail will be
a Centralized Function! ... all systems are this way today, and
the economics of file costs and support force it to be this way
(This is in direct conflict with what I think the dreamers in Commercial Marketing feel ... we need to check the grass in MK.)
Hence, anyone who gets in with a system, will control a large set of bucks, including those for WPS. Like Mainframes which

are also Central, we probably can't get them out very easily. WPS, by contrast, can be dislodged by better products because the buying power is decentralized. Also, the "Apparent Support" cost is less due to the distributed nature of training being at a personal level.

Can I enlist your support so that we don't continue to look like jerks (although we may be)?

"TO" DISTRIBUTION:

BUZZ BROOKS BOB DALEY DAVE FERNALD
OPERATIONS COMMITTEE: JOEL SCHWARTZ BRUCE STEWART

"CC" DISTRIBUTION:

ROGER CADY TOM CHISHOLM JACK GILMORE
ROSE ANN GIORDANO BILL JOHNSON BILL KIESEWETTER
SI LYLE JOE MEANY LARRY PORTNER
GLENN REYER TOM VLACH

GB1.S7.46

00 CORE DECGRAM ACCEPTED S 000121 O 30 01-AUG-82 11:04:10

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TO: see "TO" DISTRIBUTION DATE: SUN 1 AUG 1982 10:58 AM EDT

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION DEPT: ENG STAFF

EXT: 223-2236

LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5171214578

SUBJECT: OA, RE-CENTRALIZED ORDER PROCESSING AND NETS PLAN?

Denny gave a pitch to the OC on having 6 regional centers to do order processing in place of the one we now have.

Al described a system for VAX's in local office to do Office Automation and Administration that did not include order processing.

I have not seen a corporate network plan that has anywhere the capability to handle traffic required for either system, let alone handle the growing traffic that's required among other functions including engineering and manufacturing.

The system we have, if you could call it one, is really outmoded and the new one for order processing is out-moded.

We need to ask who's responsible for the various parts within each of the organizations and then demand a modern, integrated, cost-effective plan.

(This would also be a good test vehicle for showing how we could provide this service to our customers who have or will have the same problem.)

The issues are: productivity without all the clerks, control by the responsible groups, getting the communications we need in place for inter and intra organizations and finally, understanding what we have to sell as a distributed office and information processing company by doing it right! (We'll save, be more productive, learn and sell if we do this one right.)

"TO" DISTRIBUTION:

DENNY BJORK AL CRAWFORD ED KRAMER
JACK SHIELDS

"CC" DISTRIBUTION:

AL BERTOCCHI	WIN HINDLE	JULIUS MARCUS
KEN OLSEN	JACK SMITH	

WPS USERS - Leave HP mode and type <CR>

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Subject: **Salary Review at Operations Committee**

To: OOD,
Barry Burns, PK3-1/C18
Shel Davis, PK3-1/C21
Paulette Hauenstein, ML12-1/A11

Date: 17 JAN 79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

follow up 1/30/79

Take good care of Schalke (and Gonzales). Are they paid well enough?

Is Esling's salary enough and why is he a 3?

At the next salary review Ken asked for a complete distribution of our salaries. Do we have a compression problem?

The Salary Review Committee would like to see:

1. How can we make more visible key people (e.g, Keating, Fuller)?

2. How can personnel inform the management that there are poor situations where we're likely to lose people?

3. Can we report on what's happening regarding turnover (numbers and why)?

4. How do we/should we identify key people? and then not lose them?

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Dick Clayton	ML12-2/E71	Jim Cudmore	ML1-5/E30
Bill Demmer	TW/D19	Ulf Fagerquist	MR1-2/E78
Bill Johnson	ML21-3/E87	John Kevill	ML3-6/E94
John Meyer	ML12-1/A11	Larry Portner	ML12-3/A62
Bob Puffer	ML12-2/E38		
Barry Burns	PK3-1/C18	Shel Davis	PK3-1/C21
Paulette Hauenstein	ML12-1/A11		

Sheldon Davis	PK3-1/C21
Martha Markham	ML5-5/A37
Nancy Carrubba	ML1-4/A54
Shirley Cote	ML5-2/A53
Chris Dole	MK1-2
Barbara Fiske	ML5-2/A53
Carol Guiney	ML5-2/A53
Dorothy Hederstedt	PK3-2/C21
Ann Jenkins	ML12-1/A50
Marge Olthoff	PK3-2/A56
Geri Rogers	PK3-2/A55
Debbie Watson	MK1-2/C37
Anne Paulino	MR2-4/M51

ID#0272

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Subject: **Attached Strategy Presentation to Operations Committee**

To: OOD

Date: 18 SEP 78
From: Gordon Bell
Dept: OOD
Loc.: ML12-1

Ext.: 2236

I've been asked to propose a more viable corporate product strategy, based on the attached first presentation. The Operations Committee is behind us, and there's considerable agreement of this strategy.

I want to work with a small group to refine the attached proposal before the OC Woods October 10-11. This'll also be given at Wednesday's EBOD. I'm not convinced of the exact details yet, but want to spend much time working this. The proposal has been given to Jack, John, Julius, and Stan. The working group has to be brought down to a more manageable size. Thus, I don't want to get into packaging, power, LSI, manufacturing or any memory technologies, communications, software, but rather want to have two groupings by product (size and application) and by staff.

There are one/two groups I'd like to work with:

Products		**Staff** (on call)
		Pearson (to record/help with)
8/11 micro	- Clayton	Puffer, Kur
11/VAX	- Demmer	Johnson, Fuller, Keating
10/20	- Fagerquist	Christy
Commercial	- Portner	Tomasic
Technical	- Heffner	

As a separate issue, Bob, please plan how we can do a below the line review of spending. It's nearly 1/2 the budget.

Please comment. We need to move.

GB:ljp

Attachments

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Dick Clayton	ML12-2/E71	Jim Cudmore	ML1-5/E30
Bill Demmer	TW/D19	Ulf Fagerquist	MR1-2/E78
Bill Johnson	ML21-3/E87	John Kevill	ML1-3/E58
John Meyer	ML12-1/A11	Larry Portner	ML12-3/A62
Bob Puffer	ML12-2/E38		

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GB1.S1/5

i n t e r o f f i c e
m e m o r a n d u m

SUBJ: **Agenda for Office of Central Engineering**

TO: Gwen Bell, ML12-1/A51
Paul Benigni, ML11-4/E53
Mary Jane Forbes, ML12-1/A51
Sam Fuller, ML3-5/H33
Mitch Kur, ML12-2/A16
Si Lyle, ML12-1/T39
Charlie Picarello, ML12-1
Larry Portner, ML12-1/T32
Dick Schneider, ML11-4/E53

Date: 1/7/80 Mon
From: Gordon Bell
Dept: OOD
MS: ML12-1/A51 Ext: 223-2236
EMS: @CORE

Agenda for meeting on design of Office of Central Engineering, Wednesday, Jan. 9, 11 PM - Gordon Bell's office

Please peruse the attached working document on design goals and constraints so that it may be adopted and used as a working document. It was prepared by Gwen in consultation with me and the industrial designers.

Industrial design will have a presentation on the six items noted #1-6 on the goals and constraints document. They have highlighted these points as needing resolution before the project can be developed further.

MILL LOBBY: DESIGN GOALS AND CONSTRAINTS (9/14/80-gb)

G - GOAL: A VALUE THAT A DESIGN WILL ATTEMPT TO ACHIEVE/EXCEED.
C - CONSTRAINT: A LIMIT THAT A DESIGN CAN'T EXCEED.
I - IMPLICATION: A CONSEQUENCE, GIVEN A GOAL OR CONSTRAINT.

G.1 Create the appropriate image for the corporate headquarters
of a $2B computer company.

I.1.1. The appearance should make a statement about the company's emphasis on quality.

I.1.2. Computers should be used as much as possible for visitor login, control, etc.

I.1.3. Guests and employment candidates should be made to feel welcome.

C.1.1. Good control should be achieved over all traffice flow: guests, employment candidates, and employees.

C.1.2. The OOP should be appropriately insulated from irrate customers and vendors.

C.1.3. Separate toilet facilities for visitors from those that are "on the way" and most convenient for workers.

c.1.4. Create a "visitor" conference room.

G.2 Meet federal guidelines

C.2.1. Wheelchair entrance.

C.2.2. Energy conscious.

I.2.1. Appropriate use of natural light.

G.3 Clarity of intent.

C.3.1. One entrance, not two.

C.3.2. Don't make a maze for guests or workers.

I.3.1. Analyze traffic flow -- guests to Presidents area, to Central Engineering, off-site employees to conference rooms, and enployees in the mill.

G.4 Consider ROI

C.4.1. $300 for entrance and 12.1

I.4.1. Prioritize if necessary - avoid patchups like present bathroom floor redoing that is probably not in keeping with goal structure.
I.4.2. Spending money on paper is cheap. Properly design the space.

G.5 Maximize integrated workspace in 12.1 for Central Engineering.
C.1. Interior space without natural lighting is not appropriate left over space for engineering.
C.2. Two separated spaces by a corridor are not acceptable to central engineering.

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+---------------------------+                          GB1.S1/6
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SUBJ: **OFFICE OF CENTRAL ENGINEERING (OCE) DESIGN GOALS AND CONSTRAINTS**

To: Gwen Bell, ML12-1/A51
Paul Benigni, ML11-4/E53
Mary Jane Forbes, ML12-1/A51
Sam Fuller, ML3-5/H33
Mitch Kur, ML12-2/A16
Si Lyle, ML12-1/T39
Charlie Picarello, ML12-1
Larry Portner, ML12-1/T32
Dick Schneider, ML11-4/E53

Date: 1/5/79 Fri 3:00:43
From: Gordon Bell
Dept: OOD
MS: ML12-1/A51 Ext: 223-2236
EMS: @CORE

Definitions:
G - Goal: a value that a design will attempt to achieve or exceed.
C - Constraint: a limit that a design can't exceed.
I - Implication: given a goal or constraint, one of the consequences.
D - Decision: a value of a design parameter that has been

selected.
R - Remark: comment on a statement.
A - Alternative: some possible choices.
F - Fact: almost synonomous with an external constraint, eg., the OCE is
in the mill.
CF - Conflict: can exist between goal/constraint/ implication/fact and
demands resolution.

G - A well-designed open office that can and will be used as an example.

G - Measure ROI on all changes and designs.

G - Select from alternative designs before making decisions.

G - Keep within these goal statements and use them as a working document.

G - Keep within design guidelines established on a corporate basis.

G - Develop individual room/area design goals and objectives from these based on all of central engineering.

F - The OCE will be in 12-1.

<u>G.1 Be the central intelligence for central engineering, setting the style and pace for the environment for working as well as the work output.</u>

#1 C.1.1 Link OCE with all engineering groups.

#2 F.1.1 OCE includes the following:
Gordon Bell + 4 support
Larry Portner + 1 support
C. Picarello (war room manager) + 1 support
Si Lyle (product manager) + 5 support
Mitch Kur (engineering controller) + 1 support
Sam Fuller (technical director) + 1 support
Visitor work station
Conference room + waiting area with telephone

War room
Kitchen + food serving area
Bathrooms (also must service 10-2)

#3 CF.1.1 Given the present division of 12.1 the group cannot be contiguous unless the dividing hallway is removed.

I.1.1 Develop a war room for strategies that works as a communications and strategy center.

I.1.2 Provide an image of appropriate use of high technology for major high tech customers.

CF.1.1 "War room" will have to be secure and yet will have examples of new technology that may be interesting to customers.

C.1.2 Interrelate to corporate wide planning for DEC with appropriate links and connections.

G.2 Experiment with latest technologies in computing, communications, energy conservation, and building materials in order to improve productivity.

I.2.1 Record the process in order to learn from this experiment and make further improvements.

#4 I.2.2 Integrate use of ems, word processors, large screen video and latest communication modes into OCE for maximum use.

C.2.1 Use DEC machines to push their limit.

I.2.3 Willing to experiment with one of a kind and prototypes to better fit DEC machines into office environments.

R.2.1 Charter of Industrial Design does not include new machine adaptations and additional charter may need to be applied for.

C.2.2 All staff will be no more than l chair turn away from a terminal.

#5 CF.2.1 Use of inter-related machinery in mill will demand connecting with cables "dangling" and raises a special problem issue.

C.2.3 Minimize operational costs by reduced air conditions and use of natural lighting.

D.2.1 Use task vs overhead lighting.

D.2.2 Put switches on all lights.

C.2.4 Design for minimizing maintainence costs without exorbinant startup expenses.

#6 C.2.5 Conserve the basic mill structure, erring on the side of simplicity vs. Victorian refurbishing of any kind.

C.2.6 Look to new technology that minimizes energy and materials, eg., replacing paper with film, film with disks.

C.2.7 Be able to change over time with changing technologies and organizational structures while facilitating ongoing use.

<u>G.3 Satisfy human needs.</u>

I.3.1 Emphasize that humans are the masters of the machines. Integrate the use of machines and high technology with the visual, auditory, and physiological comfort of the individual.

I.3.2 Consider interactions and functions for assigned tasks to minimize wasted time.

I.3.3 Develop an integrated aesthetic style for OCE that fits within any corporate guidelines and also allows differentiation in "room" styles within OCE.

C. 3.1 Fit a variety of behavior patterns and individual needs, but confine individual tastes to discrete areas and use of nomadic items -- nothing attached.

CF.3.1 Consider the need for privacy and the needs for links and communication -- work out these conflicts on a generic and not on individualized bases.

Attachment

```
*****************
* d i g i t a l *
*****************
```

TO: JACK GILMORE   DATE: SAT 23 FEB 1980
4:03 PM EST

FROM: GORDON BELL
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1
A51

SUBJECT: RE: REQUEST FOR INFO RE OCR'S BEING USED WITH DEC
WS'S

Let's stay away from this. We have to get market share.
This
is a diversion for now. Wait till P/L is formed to help
guide
real priorities.

GB1.S2.32

```
+---------------------------+                                  ID#0304
|   |   |   |   |   |   |   |
| d | i | g | i | t | a | l |   i n t e r o f f i c e   m e m o r
a n d u m
|   |   |   |   |   |   |   |
+---------------------------+
```

Subject: **Organizational Computing Status and Plans (OCSP's)**

To: OOD, OOD Direct Reports,
Marketing Committee
Product Line Managers
Jerry Todd

Date: 18 OCT 78
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-
2236

follow up 11/1/78

I've recently had two very good presentations by Lawrence Livermore Laboratory and DuPont (Textile Fibers Division) on their current computing environments and what they think their organizations and computing use will look like over the next few years. We have yearly meetings among DEC internal users to give a similar view (DINCUS). In addition, there have been some very nice plans coming from Europe that characterize the use of computers within ITT and Olivetti (plus give details about their organization and buying habits). MIT has just sent us their 10 year plan/goal which is the best of the lot.

The OCSP's would be done by the appropriate product line(s) and sales responsible for an organization. In this way we can also get our sales and marketing people to really learn more about computing from our customer's viewpoint and what people do with machines.

I'd see the library as being key to our future planning, a way of understanding an organization when they come to visit us (without having to spend most of the time explaining it to us to get us up to a first grade level). They could become the most powerful sales planning, marketing, planning and product planning tool we could build.

For one, I think they are essential for getting much more insight into what's important so as to guide product development. (I rarely get to field and some of our engineers <u>never</u> talk to users!)

What do you think?

Could we start by cleaning up the above ones, sending them around and seeing whether they are useful?

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

John Alexanderson MK Bill Chalmers MR2-
2/M67
Dick Clayton ML12-2/E71 Jim Cudmore ML1-
5/E30
Bill Demmer TW/D19 Bruno Durr PK3-
2/S56
Ulf Fagerquist MR1-2/E78 Jack Gilmore MK
Win Hindle ML5-2/A53 John Holman PK3-
1/P84
Irwin Jacobs MK Bill Johnson ML21-
3/E87
Ted Johnson PK3-2/A55 John Kevill ML1-
3/E58
Andy Knowles ML5-2/A53 Ed Kramer MR2-
4/M16
Bob Lane HD John Leng MR1-
1/F35
Bill Long ML5-2/A53 Jack MacKeen MR2-
2/M65
Julius Marcus MK2/C37 John Meyer ML12-
1/A11
Stan Olsen MK1-2/A57 Larry Portner ML12-
3/A62
Bob Puffer ML12-2/E38 Jack Shields PK3-
2/A58
Charlie Spector ML5-2/M40 Bill Thompson ML12-
1/F41
Jerry Todd PK3-1/S52 Gerry Witmore ML5-
2/M40

Annette Albright TW/E16 Ted Baker MR1-
2/E78
Paul Bauer ML3-3/B91 Dick Becker ML1-
3/E58
Jim Bell ML3-2/E41 Leo Bennett ML4-

4/E99
Ron Bingham MR1-2/E85 Peter Christy ML12-
3/A62
Brian Croxon TW/C04 Michel Depeyrot ML3-
3/B91
Mike Donnelly ML3-3/E54 Ed Fauvre MK-
2/E6
Lorrin Gale TW/D19 Bill Green ML1-
4/B34
Mike Gutman ML21-2/E32 Bill Heffner
TW/C10
Steve Heiser MR1-2/E37 Per Hjerppe MR1-
2/E78
George Hoff MR1-2/E47 Bill Howerton ML12-
3/A62
Bob Hranek ML1-5/B98 Bob Jack ML1-
3/E58
Justin Kelleher ML12-3/A62 Bill Kelly ML3-
6/E95
Oleh Kostetsky ML5-5/E39 Mitchell Kur ML12-
2/A16
Bernie Lacroute TW/A08 Richard Leslie MR1-
2/E78
Tomas Lofgren MR1-2/E89 Jim Marshall
TW/A03
Ed McDonough MO-2 John Miville MR1-
2/E78
Gene Mondani ML1-5/E30 Ken Nisbet
TW/D19
Stan Pearson ML12-2/E38 George Plowman ML5-
5/E97
Larry Rasile ML12-2/E71 Mike Riggle ML4-
1/B32
John Rose ML12-3/A62 Geoff Sackman ML1-
4/A97
Frank Sanjana ML12-2/E71 John Sartory ML4-
4/E99
Grant Saviers CZ Dick Snyder MR1-
2/E37
Joe St. Amour ML1-5/E29 Steve Sur MR1-
1/A43
Phil Tays ML11-4/E53 Mike Tomasic ML12-
2/E71
Pete van Roekens TW/E07 Jane Ward ML12-
3/A62

George Wood AC/E44

<subj>CHI, CHAO S.
<from>CHI, CHAO S.
<to>BELL, GORDON
<date>80/10/29
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<from>HARTLEY, J.T. JR & BOYD, J.A.
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<subj>ATANASOFF, DR. JOHN VINCENT--RE: COPY OF THE AGREEMENT
<from>ATANASOFF, DR. JOHN VINCENT
<to>BELL, GORDON
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<subj>HY-CAL ENGINEERING
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<from>VAN VALKENBURG, M.E.
<to>BELL, GORDON
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<subj>RESUME'--TECH-SEARCH CONSULTANTS (MR. ARPAD SOMLYODY)
<from>ROCK, JAMES P.
<to>BELL, GORDON
<date>80/10/?
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<from>FIELDING, NORMAN H.
<to>BELL, GORDON
<date>80/10/22
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<subj>MULTI TECHNOLOGY INC. RESUME' (JAMES LA LONE--DB324)
<from>BURKE, DAVID
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<subj>MISC OBSERVATIONS FROM U OF C AT BERKELEY
<from>LLOYD DICKMAN
<to>GORDON BELL
<date>80/10/16
<date rec>10/23/80
<log#>10-57
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<from>WARTER, PETER J. JR.
<to>BELL, GORDON
<date>80/10/16
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<subj>TWX--FIRST QUARTER SALES
<from>MULLIN, ALBERT E.
<to>BELL, GORDON
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<subj>AUGUST ASSOCIATES

<from>WARNER, RAYNOR M.
<to>BELL, GORDON
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<date rec>10/23/80
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<from>ARMSTRONG, DAVID L.
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<from>SCHMIDT, ALLAN H.
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<subj>IEEE CIRCUITS AND COMPUTERS ICCC80 (IBM)
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<to>BELL, GORDON
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<subj>UNIVERSITY OF CALIFORNIA, SAN DIEGO
<from>WAXMAN, BRUCE D.
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<log#>10-37
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<message>PLEASE GET AN ANSWER HERE BY NEXT MONDAY. LET'S CONVENE BY EMS.
<answer>BOB SCHINLEVER, (231-6930) LDP, WILL INTERFACE WITH WAXMAN 11/18/80 Tue 12:10
<f/u>10/29/80
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<subj>NATIONAL ACADEMY OF ENGINEERING
<from>KING, RANDY W.
<to>BELL, GORDON
<date>80/10/17
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<log#>10-36
<dispo/date>
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<answer>

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<subj>MICROCOMPUTER APPLICATIONS
<from>ZARRELLA, JOHN
<to>BELL, GORDON
<date>80/10/6
<date rec>10/20/80
<log#>10-35
<dispo/date>BOOK TO THE LIBRARY, LETTER TOSSED. - 10/20/80
<message>
<answer>
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<subj>EMPLOYEE PROBLEM--LEAVING THE COMPANY WITH BAD REPUTATION
<from>SHUSTER, MICHAEL S.
<to>OLSEN, KENNETH
<date>80/10/15
<date rec>10/20/80
<log#>10-34
<dispo/date>JOHN MEYER - 10/20/80
<message>PLEASE HANDLE.
<answer>
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<>

<subj>FORTUNE
<from>HAIRE, JOHN E.

<to>BELL, GORDON
<date>80/10/16
<date rec>10/20/80
<log#>10-33
<dispo/date>CALLED NO TO INVITATION 10/20/80
<message>
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<subj>RESUME - BILL BOAS FROM ROI
<from>DON DACOSTA, ROI
<to>G BELL
<date>80/?
<date rec>10/17/80
<log#>10-32
<dispo/date>ARMAND LA VALLE - 10/20/80
<message>PLEASE HANDLE.
<answer>
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<subj>UNIVERSITY OF ARIZONA
<from>NUNAMAKER, J.F. JR. -- MANN, LAWRENCE D.
<to>BELL, GORDON
<date>80/10/10
<date rec>10/16/80
<log#>10-31
<dispo/date>HOLDING FOR POSSIBLE TRIP FOLDER 10/23/80
<message>
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<subj>LITERATURE FROM KONRAD ZUSE
<from>ZUSE, KONARD
<to>BELL, GORDON
<date>80/10/?
<date rec>10/16/80
<log#>10-30
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<subj>CMU--GALLEY PROOFS
<from>SIEWIOREK, DANIEL
<to>BELL, GORDON
<date>80/10?
<date rec>10/15/80
<log#>10-29
<dispo/date>DAN - 10/27/80
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<subj>AMERICAN SOFTWARE
<from>NEWBERRY, THOMAS L.
<to>BELL, GORDON
<date>80/10/10
<date rec>10/14/80
<log#>10-28
<dispo/date>

<message>
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<f/u>
<filed>N
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<subj>SCIENCE, TECHNOLOGY & SYSTEMS CONSULTANTS
<from>SIKDAR, MRS. SIBANI
<to>BELL, GORDON
<date>80/10/9
<date rec>10/14/80
<log#>10-27
<dispo/date>WILL THOMPSON - 10/20/80
<message>WHO'S DOING THIS NOW?
<answer>JOE CHENAIL IS DOING THIS. "HE WILL CONTACT SCIENCE, TECHNOLOGY & SYSTEMS CONSULTANTS AT SOME FUTURE TIME...THEY'RE NOT HIGH IN MY AGENDA AT THIS TIME. - 12/5/80
<f/u>10/31/80
<filed>
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<subj>SCOTT INSTRUMENTS
<from>NIEDERHOFER, ED
<to>OFFICE OF PRESIDENT--BUZZ BROOKS
<date>80/9/30
<date rec>10/14/80
<log#>10-26
<dispo/date>ORIGINAL - GB, CC:BOB GLORIOSO, RICK PEEBLES, BRUCE STEWART - 10/20/80
<message>CAN YOU CONTACT PLEASE AS PART OF PBS?
<dispo/date>BILL DEMMER, CC:JIM MARSHALL, DAVE RODGERS - 10/28/80
<message>YOURS??
<answer>
<f/u>11/7/80
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<subj>DATAQUEST
<from>RILEY, JAMES F.
<to>BELL, GORDON
<date>80/10/8
<date rec>10/14/80
<log#>10-25
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<subj>CBEMA
<from>HENRIQUES, VICO E.
<to>JOHNSON, TED
<date>80/9/29
<date rec>10/10/80
<log#>10-24
<dispo/date>TED JOHNSON - 10/13/80
<message>TYPICAL GOVERNMENT INDUSTRY TACK-UP.
<answer>
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<subj>UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN
<from>HOLONYAK, NICK JR.
<to>BELL, GORDON
<date>80/10/6
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<subj>UNIVERSITY OF CALIFORNIA, SAN DIEGO
<from>COHEN, HAROLD
<to>CHAMERLAIN, GEORGE (CC: GORDON)
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<date rec>10/10/80
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<subj>NATIONAL ACADEMY OF ENGINEERING
<from>NELSON, MRS. E. HENRIETTE
<to>BELL, GORDON
<date>80/10/7
<date rec>10/9/80
<log#>10-21
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<subj>HOVIS SCREWLOCK COMPANY
<from>DAMM, JOHN
<to>BELL, GORDON
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<log#>10-20
<dispo/date>
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<subj>TEXAS A&M UNIVERSITY SYSTEM, THE
<from>WELLS, CLYDE H.
<to>BELL, GORDON
<date>80/10/6
<date rec>10/9/80
<log#>10-19
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<subj>HARVARD UNIVERSITY
<from>BOWER, JOSEPH L.
<to>BELL, GORDON
<date>80/10/7
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<log#>10-18
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<message>
<answer>

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<subj>RESUME' -- JAI P. GAUR
<from>ERICKSON, BOB
<to>BELL, GORDON
<date>80/10/8
<date rec>10/8/80
<log#>10-17
<dispo/date>ORIGINAL TO F/U CC: CLAYTON, PORTNER, BJ, STEWART - 10/10/80
<message>SHOULD WE INVITE TO INTERVIEW?
<answer>BRUCE--NOT FOR OUR GROUP; BJ--SAID NO REAL INTERST, HOWEVER IF ANYBODY ELSE WNATED HIM HE WOULD INTERVIEW. HE ALSO FORWARDED A COPY TO BILL KEATING. - 10/27
<dispo/date>BOB ERICKSON - 10/29/80
<f/u>10/17/80
<filed>
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<subj>INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS INC. (IEEE)
<from>GETTING, IVAN A.
<to>BELL, GORDON
<date>80/10/?
<date rec>10/8/80
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<subj>ROGER S. BOROVOY
<from>BOROVOY, ROGER S.
<to>BELL, GORDON
<date>80/9/3
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<subj>TWX--11/24 PILOTS
<from>BERNSTEIN, BILL
<to>BELL, GORDON
<date>80/10/7
<date rec>10/7/80
<log#>10-14
<dispo/date>
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<subj>ROHM AND HAAS COMPANY
<from>ENRIGHT, JOHN M.
<to>BELL, GORDON
<date>80/10/2
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<dispo/date>
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<subj>RESUME' -- AMOS DOLEV
<from>STOCKEBRAND, TOM
<to>BELL, GORDON
<date>80/10/?
<date rec>10/6/80
<log#>10-12
<dispo/date>TOM STOCKEBRAND - 10/10/80
<message>SOUNDS LIKE SOMEONE TO PASS BY.
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<subj>TATICAL EQUIPMENT CORP.
<from>KAUFMAN, PHILLIP A.
<to>BELL, GORDON
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<date rec>10/6/80
<log#>10-11
<dispo/date>
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<subj>INTERSIL INSIGHT
<from>PHELPS, MEL
<to>BELL, GORDON
<date>80/9/?
<date rec>10/6/80
<log#>10-10
<dispo/date>
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<subj>NATIONAL ACADEMY OF ENGINEERING
<from>NELSON, E. HENRIETTE
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<date>80/10/1
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<log#>10-9
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<subj>STATE UNIVERSITY OF NEW YORK AT ALBANY
<from>ROBINSON, ROBERT J.
<to>BELL, GORDON
<date>80/9/30
<date rec>10/6/80
<log#>10-8
<dispo/date>ANDY KNOWLES, CC:JOE MEANY, PETER JANSEN - 10/6/80
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<subj>REPORTS--THE INDUSTRIAL DISPLAY MARKET IN THE U.S.
<from>BERLER, HENRY M.
<to>OLSEN, KEN
<date>80/9/?
<date rec>10/6/80
<log#>10-7
<dispo/date>DICK CLAYTON - 10/6/80
<message>YOURS.
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<subj>TWX--VAX-11 PL/I
<from>SAPP, ED
<to>BELL, GORDON

<date>80/10/3
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<log#>10-6
<dispo/date>
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<subj>BLACK DOT
<from>STRUCK, DEBBIE
<to>BELL, GORDON
<date>80/10/1
<date rec>10/3/80
<log#>10-5
<dispo/date>SIEWIOREK, DAN - 10/3/80
<message>SENT TO GORDON BY MISTAKE.
<answer>
<f/u>
<filed>
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<roll>
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<subj>NATIONAL ACADEMY OF ENGINEERING
<from>NELSON, MRS. E. HENRIETTE
<to>BELL, GORDON
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<date rec>10/2/80
<log#>10-4
<dispo/date>
<message>
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<subj>BOSTON RESEARCH DIRECTOR'S CLUB
<from>TILL, DEREK E.
<to>MEMBERS
<date>80/10/?
<date rec>10/2/80
<log#>10-3
<dispo/date>
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<subj>TWX--VAX-11 PL/I PHASE 3 SCHEDULE
<from>SAPP, ED
<to>BELL, GORDON
<date>80/10/2
<date rec>10/2/80
<log#>10-2
<dispo/date>
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<subj>NATIONAL RESEARCH COUNCIL
<from>BLACKBURN, J.F.
<to>BELL, GORDON
<date>80/9/25
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<log#>10-1
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00 BURT DECGRAM ACCEPTED S 23009 O 538 16-JAN-82
21:33:45
****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION DATE: SAT 16 JAN 1982
9:31 PM EST

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

cc: BOB DALEY
MARY JANE FORBES

SUBJECT: APPROACH TO DOING OFFICE APPLICATIONS

Was just looking at the whole OFIS architecture, going back to the note on this on Sept. 1, 1980. Wonder where we are.
I think we should be extremely careful in how we do the applications on the new OFIS architecture. It was my intent that there is a minimum amount of code in obm (Koala). The next level, the Generic Ofis Machine has a number of application primitives that should allow us to "program" more applications very fast.

Note, the Calendar should not be coded in the OBM, but most likely in GOM, in exactly the same way that the various calendars are now provided using list processing.

The GOM would include these primitives:
the editor
Digicalc interface components (input, program input, output)
a good forms language to allow users to fill in list

processing
 attributes easily
sort, math (via Digicalc),
database access, telephone control and access
graphics primitives

Would like to know how we are dealing withthese levels
so we can get the most programs in the highest level
so the user, oems, and us can get the variability and
productivity.
(This set of primitives would look something like the 4th
generation language that James Martin described.

What you think?

"TO" DISTRIBUTION:

JACK GILMORE BRUCE STEWART BOB TRAVIS

GB3.S2.58

GB0005/55

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+---------------------------+
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| d | i | g | i | t | a | l |
|   |   |   |   |   |   |   |
+---------------------------+
```

i n t e r o f f i c e   m e m o r a n d u m

Subject: **THE OFFICE OF CENTRAL ENGINEERING**

To: Gordon Bell, ML12-1/A51
Dick Schneider, ML11-4/E53

Date: 11/7/79 Wed
From: Gwen Bell

After our meeting of Nov. 7, I have some comments for your discussion. In order to proceed on the project, I think the analysis has to take place at three levels: goal setting, targets and objectives, and design constraints and implications. In order to give you some idea of this hierarchy, I am outlining some a tentative schema and filling it in a little bit.

In order to get the program underway and some action. I suggest the following schedule:

December - review and establish goals and objectives

February - design review

March - preliminary final design -- purchasing etc. can start.

September - completion of phase one (built) to be lived in for a while.

GOAL: EXPERIMENT WITH LATEST TECHNOLOGIES TO IMPROVE PRODUCTIVITY

OBJECTIVE: Use DEC machines as much as possible.

DESIGN: Integrate use of ems, word processors, large screen video into the office. Use WPS/large screen as recallable blackboard <u>and</u> overhead projector.

OBJECTIVE: Use latest communications modes.

DESIGN: Test and try video links

GOAL: CONSERVATION

OBJECTIVE: Energy

DESIGN: Evaluate lighting, heating, cooling, kitchen, machine use, space use regarding energy conservation.

OBJECTIVE: The Mill

DESIGN: Conserve the fundamental mill structure.

OBJECTIVE: Human time

DESIGN: Consider interactions and functions.

OBJECTIVE: Materials
DESIGN: Look to the minimal; replacement of paper with film; film with disks etc. Use permanent or reusable materials when feasible to eliminate waste. Get rid of all paper!

GOAL: ADAPTATIBILITY AND FLEXIBILITY

OBJECTIVE: Change over time
DESIGN: Consider increments for evolving rather than static spaces.

OBJECTIVE: Fit a variety of behavior patterns
DESIGN: Observe and cater to individual behaviors within the structure and show how it can relate to a variety of needs.

OBJECTIVE: Change in technologies
DESIGN: A fundamental system -- connectors for a variety of new technological products.

GOAL: BE THE CENTER OF CENTRAL ENGINEERING

OBJECTIVE: Provide the central intelligence
DESIGN: Secure area where everything can be open within the group.

OBJECTIVE: Ease communication within the group
DESIGN: Ease of accessibility -- physical, electronic, or video between members.

OBJECTIVE: Set the style for engineering.

DESIGN: Let as much as possible hang out.

OBJECTIVE: Be where the action is.

DESIGN: Lot's of meaningful activity.

OBJECTIVE: Tie to the whole of engineering.

DESIGN: Communications and face to face interface.

OBJECTIVE: Relate to planning for all of DEC.

DESIGN: Appropriate connections.

OBJECTIVE: Image for outside guests.

DESIGN: Use and "sell" DEC products.

GOAL: INTEGRATED AESTHETICS

OBJECTIVE: Integrate machines/men

DESIGN: Look at machines with both a sense of humor and human use.

OBJECTIVE: Integrate machines/mill

DESIGN: Relate the mill as the receptacle for new technology.

OBJECTIVE: Integrate activity and space

DESIGN: Consider the use as part of the aesthetics -- with actors on the stage.

May 11, 1981

David Shonyo
Office of International Publications
NTIS, Yorktown Building

Springfield, VA 22161

Reference: Translation of "Nikkei Electronics"

Dear Sir:

I understand that you are looking for industry recommendations concerning the translation of Foreign publications. Those translations would then be made available to the industry for a nominal fee. I recommend that you translate the periodical "Nikkei Electronics" which is published bi-weekly by Nikkei-McGraw Hill Inc, in Tokyo.

This magazine covers current electronics topics of prime importance to our industry computers. The editorial quality is high, because the text is original and in Japanese, the material is not available elsewhere. I would like to add that the advertisements contain technical information of significant value such as, technical specifications of products we compete with. I suggest that they should also be translated.

If you have further questions on this matter, please don't hesitate to call myself or Patrick Buffet at 617-493-2453.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:swh
GB2.S5.50

CC: Jack Schwartz, Computer Science and Engineering Research Board
00 BURT DECGRAM ACCEPTED S 25030 O 77 02-MAR-81 18:06:46

****

* d i g i t a l *
****

TO: OPERATIONS COMMITTEE: DATE: SUN 1 MAR 1981
17:29 EST

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION DEPT: ENG STAFF

EXT: 223-2236

LOC/MAIL STOP: ML12-
1/A51

SUBJECT: KEN'S GRAND OFFICE PRODUCT ANNOUNCEMENT

Ken is asking us to discuss the announcing of all the office products in one, big package, including the following:

1. Standalone 278
2. Bundled DECword 11 using various configurations of 11's
3. Layered DECword 11 on RSTS
   (both 2 and 3 would include a drastically repackaged 11/23)
4. DECset for typesetting
5. EMS/VMS
6. High quality communications for local office intercomm. of parts using something until we get Ethernet

Si should get back to us on the 23 as to the configuration so that Dick and Ken get to work on the repackage. The principle
goal of all these packages except the large configurations should be: Customers must be able to unpack, assemble and install the configurations with NO outside help! Each of the component parts should be carryable by one person.

I'd like to look at DECset in terms of its compatibility with OFIS, useability, doneness, and systemness (does the buyer have to become a system integrator?).

Dave Rodgers and Si should lead us through the alternatives of
how we are going to interconnect the systems to one another and

how this will relate to our eventual Ethernet position.

"CC" DISTRIBUTION:

BOB DALEY BILL DEMMER J.W. FORD
RICHARD GONZALES IRWIN JACOBS SI LYLE
AVRAM MILLER MITCHELL @GAPL STAN
PEARSON
DAVE RODGERS HERB SHANZER BRUCE
STEWART

GB2.S5.17
"'% 2%????/ LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5198355461

SUBJECT: OFFICE REVIEW, 4/28

GB5.22

BOTTOM LINE
Based on the general interest and enthusiasm of the presenters, and
the apparent status of the projects, I'm quite impressed at the progress that's been made in forming a team and building products.
It's great to see that we're in one of the top slots from a product
standpoint. Staying there is now going to require an incredible amount of work and the delivery of what we've shown and are promising.
I look forward to a detailed technical review of the projects and
being a test site.

GENERAL CONCERNS ABOUT OUTPUT AND MY OWN BLOOD LETTING
The concerns I expressed were based on our (Youse and mine) inability
to define and deliver a quality product as promised. About 3 years
ago, engineering took over the management of the WPS and office

area. g">$ 2'% 2%:./u%q $%% !+   "b"k"i"j"j=)&& CO++RS#.-
'+W!   7MJ5   L<"!   2W#",2D:EA3   S   #   &   *   .
O!(!Q!W!S!"!"#"7"'derstand performance. I participated in the reviews and design until more pressing matters (eg. VENUS) called. I have tried to push the understanding of the human interface, performance and the features needed that will make us win.   At this point, I've failed.

Whether the architecture works must be decided quickly, otherwise we're going to build on a soft foundation. When will we know?

SPECIFIC CONCERNS RAISED AT THE REVIEW

TOO MANY IRRELEVANT PEOPLE causing rumours, leaks and selling of futures. Let's work this out so that we aren't an open sieve.

MY SUPPORT OF DECMATE- clearly has been and is there... because it's all we've got. I push for lower cost hardware and aim to make the DECMATE available at dumb terminal prices. My concern is that DECMATE can not compete because of the incredible difficulty to extend. Getting to a competitive hardware base where code can be written cheaply and correctly is crucial to our long term success. My gut

feel is that there are two options for a hot, feature laden, extendable WPS:

1 We do it on new, non-8 hardware in a transportable language, hopefully Koala. I like your approach. When will we know?

2 We BUY the hot product that is inevitable for the IBM PC! This will knock the 8 based DECmate out of the ring, and make the IBM PC the winner. Hopefully we can scurry around, buy and offer such a product.

URGENCY TO GET A VMS-BASED OFFICE SYSTEM (FOLLOWED BY M AND PRO)
Given my concerns above based on performance, and the sad lesson that we're learning about the Pro regarding performance, I believe the priorities have to be: reliablity, performance, human interface and features... which can always be added.

Again, we have to find out NOW whether the general architecture WORKS with acceptable performance especially on RSX and the PRO.

EVALUATION OF OFFICE PLUS
Really want to understand performance, reliability and extendability (cost of extensions) plus the goodness of the human inteface (including learnability). I saw not ONE metric, besides the time to check spelling, in the whole presentation... only features.

USING VMS AS A GROUP/DEPARTMENT/TEAM/PERSONAL MACHINE
I challenge all of you (Dockser, Marcus, Ancona, Hughes) to own and operate your own VAX with your current staff, and get it done within two months. This was possible with WPS200, albeit tough. If we're to have a reasonable market, it has to be self installable at some

point.
A good start would be for all of you to understand this. Who'll try?

All I'm asking is that you put yourself in the role of customer!

ROLE AND SIZE OF PRODUCT MANAGEMENT GROUP
I thought I heard there was one product manager for each function of a
basic product. For example, the manager of DECpage (a formatter),
Mary Leary, really admonished me for the concern that we had too many
product managers. Could I see the business plan and work around
DECpage just to get an idea of why so many resources are required for
a product? I didn't realize that our product managers are feeling
unloved... because I really do love them. And they are important too.

What I am concerned about is the responsibility and behavior of the
development group because I hold a development group solely
responsible for the success of a product. This means a developer must
know the technology, the use, users and competitors...ie. the market.
What I have seen happening is that the PM becomes the crutch and
excuse for not building great products.

GENERAL STRUCTURE OF THE GROUP
I'd like to see just what the make-up is, including developers,
technical leaders, product managers, writers, etc. when we meet. I'm
mostly concerned about the technical leadership there.

ADVANCED DEVELOPMENT
Dennis put on a great show. The CATV work is vital. Let's productize
DECtalk and the Teleconferencing products now... no cost

reductions,

just get it out. Cost reductions are trivial after we find out if
others can use it. If we're worried about the volume, get CSS to
produce it.

The spelling corrector was impressive too. Hope to see it soon.

LAST BOTTOM LINE
These products are vital to DEC. We've defined a great product set.
Also, our customers must be happy with what we've delivered because
I'm one of the first to know about this too.

I'm confident that if we deliver, Bob and Henry can sell 'em.

You have my support for any resources (except those that would extend
our commitment until we finish what we've promised).

"CC" DISTRIBUTION:

HENRY ANCONA BOB HUGHES BILL JOHNSON
JACK SMITH

WPS USERS - Leave HP mode and type <CR>

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*****************
* d i g i t a l *
*****************
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TO: BILL AVERY   DATE: SUN 25 APR 1982
4:58 PM EDT
    BILL JOHNSON   FROM: GORDON BELL
    AVRAM MILLER   DEPT: ENG STAFF
    BRUCE STEWART   EXT: 223-2236
                                                 LOC/MAIL STOP: ML12-
1/A51

SUBJECT: OFFICE AND CT/WPS SOFTWARE

I think we have a major problem in the Office Software area that we aren't facing. In looking back at the early architecture
document, I saw a goal of Q481 for field test. At our meeting
on Friday, I couldn't really get much of a feeling about whether we'll ever get a product for either VMS or CT. The whole SSC base was still being worked on as "insurance", independent of the decisions. Clearly there's no commitment for
it now given that the commit is for VMS, independent of the fact
that the people on board are small systems people, not VMS Kernel
folks. In short, the only glimmer of hope I saw was that the supervisor, Danielle, was committed to whatever the managers wanted to do.

The communications between the CT and OFIS has been about the worst I've ever seen. Clearly there's no real commitment in the sense of "we will win together" to get this software. I take this as a very strong personal failure. As such, I want to get a structure where this responsiblity is delegated in some fashion to a single individual who will make it happen
despite the fact that all the intermediate managers are overloaded.

This also comes in light of a discussion with a software engineer who wanted to leave DEC because as a former Boeing engineer we'll probably have to let people go too. Too much specialization, no risk, no commitment, top down, evolutionary
engineering (the next release) and total isolation from product/market. This again speaks to the need to get the software and hardware oriented to some business goal, not a come
to work goal or not a passing the Software Inspector General's
review goal. (We're dead if we add the bureaucracy in SW engineering to have software inspectors!)

I'm sorry for unloading these ain't it awful thoughts on you all, but I do want to get some thoughts out so we can move. Clearly Avram ought to be looking at outside software to get a decent editor and word processing package that can be shipped with CT!

I also saw the chaos of 3 software groups all doing their own thing with no overall direction. This made me feel very sick too at a time when we should be going balls out to get the product done. I think no matter what's said the office group really intends to show avram and put ssc and the clusters
on ct rather than fix ct.

The other thing about ofis is that it is done in the classic way that all our failing competitors build software: the marketing groups make their demands, the PM's formalize this into
a spec. and some poor unsuspecting sw engineer who's never implemented anything like this then rides off to try and build
it. The only answer of course is to leave because: the harware
wasn't what they think they wanted when they find out that it doesn't fit or perform well, or that others are leaving and they
don't want to be the last one there, or that it's really going to

be done in another country by a bunch of other people that have
NEVER built a word processing product, or that the spec will change, or that they are told they are going to have problems because all the groups outside are so bad (marketing, product prevention, hardware, etc.). What started as the hottest software group around is now bootrstrapped down to a near nil list. All that are left is a bunch of managers who yell at the
rest of the company, too many product managers who only know how
to interact with marketing folks, the human factors people, advisors, etc. ... but no co-workers. Are we at a point yet where is 1 engineer per 4 people managing, product managing, doing errands, writing, etc.? Bruce what are the actuals including a/d?

BJ,
This has to be fixed. We can not go on slipping the Office either implicitly or explicitly. There has to be an answer for CT, too. When I get back in a week, I'd like to start the
necessary meetings to decide on how this thing is going to be managed so that we get the products that I thought were promised and we desperately need!

GB3.S4.26
****
* d i g i t a l *
****

TO: DISTRIBUTION DATE: TUE 2 SEP 1980
9:12 AM EDT

FROM: GORDON BELL
cc: DISTRIBUTION DEPT: OOD
MARY JANE FORBES EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: OFIS ARCHITECTURE DRAFT FOR KO, WPS, EMS: PLS
COMMENT

This is the architecture I propose we use for OFIS products. Please feedback so we can tune and formalize it. Parts would also be used in applications where compatibility is needed (e.g. an accounting system that would permit reports to be included in WPS documents).

The notions of architecture herein cover a range of base hardware/software systems on which we expect OFIS software systems to operate. The architecture extends to cover what some call applications, which I would like to call programs, but a more acceptable word to both us and our users might be called PROCEDURES. Since a program is the specification by which a machine interprets a set of actions to carry out a function, the word, "program" seems appropriate for all the machine levels, including those which end users may also specify. Thus, a user level program that a secretary might write to specify how a mail list is made would be called a Mailing List OFIS Procedure, and would be "programmed " on the Generic OFIS Machine, GOM, using List Processing Functions. We'll use the word, Procedures!

THE THREE DIMENSIONS OF THE ARCHITECTURE:

.MACHINE LEVELS as specified by data-types, operators and syntax for use by a procedure writer, ie. programmer (user) at the next level

.FUNCTION (CLASSES) ON DATA-TYPES (eg. files, communications, screens) within a machine level. Functions Classes are fundamentally PMS components. Roughly equal to Cobol divisions.

.RANGE OF UPWARD COMPATIBLE MACHINES with increasing functions.
The range of functions would be explicit permitting upward compatible products (eg. the file function might range over sequential, ISAM and multi-key ISAM). Cobol calls these levels.

Mostly the goal of the functions of a machine at a given level is
to make explicit choices and specify what the machine can do. Care is needed so that we don't select some very powerful low level function like DBMS such that all succeeding higher levels
require adding it. Also, there will be interaction between levels and within a level (actually a set of sub levels). For
example, the ability to display graphics will require a high function, within the low level HM. Subsequent machine levels will require the same higher functions. There are similar examples within a machine level that would depend on having an
advanced file system function in order to get an advanced function of another type.

THE MACHINE LEVELS

0. Hardware Machine (HM)
1. Base Machine (BM)- made up of o/s, data mgmt, a system programming language, such as Bliss, C, Pascal or PL/n, and utilities which system's programmers provide on a given system
such as RSTS, VMS, M, TOPS 20
2. Intermediate Common Base Machine (ICBM) for building OBM. Only exists as a common base that permits OBM to run on multiple,
incompatible BMs
3. OFIS Base Machine (OBM)
4. Generic OFIS Machine (GOM/GM)
5. Profession OFIS Machine (POM/PM), or for example, the Accountant's OFIS Machine
6. Organizational OFIS Machine (OOM/OM)
7. Individual's OFIS Machine (IOM/IM)

THE CAST OF PROGRAMMERS (PROCEDURE WRITERS) FOR THE MACHINES

0. Microprogrammer determines HM
1-2. System Programmer determines BM and most likely ICBM
3. OBM System Programmer writes OBM (or it could be done as another system programming language (a much extended TECO)
4. OFIS System Programmer builds GOM using OBM and GOM
5. OFIS End Use Procedure Writer (Programer) uses GOM to make specific packages for professions and sub-professions (i.e. POMs). Initially done within Engineering, then End User P/L's,
field and OEMs.
6. Organization Procedure Writer (group within a given organization in which WPS is installed. Responsible for tailoring OFIS product to the org. and using GOM (with some OBM)
7. Individual user may personalize using GOM

MACHINES, THEIR USERS, LANGUAGES, AND PROCEDURE WRITERS

MACH.	END USE BY:	LANGUAGE ON WHICH MACHINE IS BASED	WHO WRITES PROCEDURES FOR IT
HM	sys progmr	microcode	microprogrammer
BM	OBM sys. progmr	ISP of hardware	sys progmr
ICBM	"	OS,Sys Progr. Lang, data mgmt, nets, etc.	"
OBM	OFIS sys progmr	ICBM and BM	OBM sys progmr
GOM	author, sect. (WPS as is)	OBM language, a VHLL for OFIS products and GOM primitives	OFIS sys progmr (WPS,EMS, etc.)
POM	acct, eng, lawyer corresp. sect,	GOM,some OBM, with ext. to OBM	OFIS end use progmr, end use P/Ls, field, OEMs
OOM	persons within a given org.	GOM, some OBM	org. buying machines
IOM	specific person within an org.	GOM	actual user

GOALS AND CONSTRAINTS OF THE ARCHITECTURE

G0. help us structure our thinking into a hierarchy of machines
organizaed by level, functional classes for a level, and a range
of upward compatible functions within a given level for multiple
implementations
C1. maximum clarity of the internal machines (levels). Documentation and architectural control of every level by function over the range.
C2. maximum flexibility to change how a given function is implemented without changing the specification of the function
seen by next level. Information about encoding is hidden!
C3. minimum programming in what is fundamentally assembly language albeit a system's programming language (e.g. BLISS, C,
Pascal)
C4. code freeze of lower levels asap such that all OFIS programming is done on the OBM and GOM
G5. minimum use of conventional procedural programming languages
including OBM . Preferrably use forms, decision tables and WPS
produced documents for "programming" that make up GOM.
C6. built-in ability to extend to foreign languages by non-programmers using GOM
C7. scope of applicability includes WPS, extended WPS, VMS/EMS,
and any OFIS knowledgeable programs. An OFIS knowledgeable program is one which shares the same file format in either or both a read and write fashion.
C8. range of hardware products include the 65 Kbyte terminal with
ability to buffer a single document or with a pair of floppies
for multiple documents, to a 256 Kbyte terminal with floppies and/or 5 Mbyte non-removeable disk, ... to VMS.
G9. program in the highest levels to get the greatest market leverage. Encourage organizations and end users to write

procedures specific to organization and individual in GOM and in
some cases OBM.
G10. program for the profession must be written where possible in
the highest level machine (GOM), and failing this using the OBM.
These would initially be done by End User Programmers, next by
the End User Product Lines and eventually the field or by OEMs
and perhaps even by users. Some professions will require new
data-types and hence extensions to OBM for performance. (Note,
that a procedure for a given profession can always be written on
the OBM but it might not be marketable because of performance.)

COMMENTS ON THE MACHINES

Hardware Machine (HM)
Explicit specification about each functional component and range
within the components is supported (eg. smooth scrolling and
margin settings for the VT100)

The Base Machine (BM)
A selected subset from all the available operating system calls,
languages, data management and other utilities of a given system
such as RSTS, VMS, 10/20, RT, M. Clearly documented what is
included and excluded for use by all succeeding levels.

Intermediate Common Base Machine (ICBM)
In the event that we believe that there will be a large amount of
software written that makes up the OBM, it would be worthwhile
formalizing a common base interface for implementing OBM. The

level is perilous. For example, if the first implementation of OFIS is on VMS, the temptation will be to use all the capabilites of VMS as level 1, with the implication that when operated on another machine, all the capabilites not in VMS must be made up in the level. The explicit notion of range is present in order to deal with this.

IN OUR CURRENT THINKING ABOUT THE ARCHITECTURE, I WOULD LIKE TO TEMPORARILY ABOLISH THIS LEVEL. It is imperative to work on the OBM and to find out how we can actually build the higher level OBM so that others can write programs that form GOM. If we work on the intermediate level, we'll just have meetings between system programmers and never face the OBM interface. For the first implementation of OBM, I propose it be on VMS, using all it's capabilities and we not worry about the intermediate level until the next implementation.

OFIS Base Machine (OBM)
This is the most important machine level, because it is on the OBM that we expect most programming to be done by the GOM and POM programmers who build these machines. Given our current thinking, this level would be programmed in some type of system's programming language such as Bliss, C or Pascal and would first provide a number of functions and procedures. It would also contain an interpreter, a compiler and possibly an interpretive compiler so as to isolate the GOM/POM programmer from having to

write the next level in a system programming language. It would also have a good debugger so that a GOM programmer could be productive. The editor functions (those that get a file and do string operations on the text file) would be pretty much along the lines of those in EDT, but in addition there would be program control capabilities like those in TECO. (Note TECO has been most successfully used as an editor writing language!)

Alternatively, a complete system like MUMPS is a reasonably good starting model for the OBM. MUMPS would have to be extended to better couple to the screen, to do better string operations, and permit the extension of more data types. Also, Mumps would ideally also be compilable, but this seems unnecessary, given the performance it attains on the EMS application. The real limitation of MUMPS for this level is the lack of extensibility for data types, forcing all extensions in terms of strings. The goal of OBM is to have a small, very high performance machine with a small set of primitives.

Generic OFIS Machine (GOM)
GOM is the machine for most end users, providing what is in the current WPS system. There will be a small version for what one might either consider to be an intelligent terminal if it is connected to a larger computer, or if standing alone it could be considered as part of the low end personal computer. The high end would extend over what we have or wish we had in today's WPS and include typesetting and VMS/EMS.

Programming to define GOM would be done in OBM and GOM procedures! OBM would be sufficiently rich as to permit the programming of list processing, math, sort, merge, table manipulation, forms capability to be programmed. These would not be defined in OBM per se.

Profession OFIS Machine (POM)
POM has a set of extended function data types that permit the system to be used by a particular profession. These include the data-types and appropriate operators for the profession (e.g. a specification using decimalized identification (e.g. para 12.5.6.1), accountant's spread sheet, table which can be manipulated and converted to grahps, legal type documents, two column multi-language for the professional translator, programs in a given language for the programmer, etc.). As WPS-8 currently exists, it is most ideally suited for the professional writer since it takes no additional definition of forms or procedures to immediately use. For example, the correspondance secretary would have a set of menus that only deal with a particular format of letters and it would permit their creation, editing, output on the letterhead and envelope both for individual and form letters, and filing for quick retrieval; the file system would include paragraphs and name/address files. Certainly this is well enough structured to permit people in the field to program on as well as some customers.

Programming at the POM level might be done by the GOM users in the case of straight-forward task like forming a system for the secretary or the correspondance secretary. In professions

which
require the understanding of a fundamentally new data-type like a
spread sheet or graph, there may have to be extensions to all the
lower level machines. Note that the goal is to have a sufficiently rich OBM such that extensions can be made at this
level without changing OBM and lower levels. For example, OBM
should be sufficiently powerful to permit a POM programmer to define tables data types and express the operators for them. The
user would then use the tables and the operators. A POM programmer, like the programmer who built the GOM, would program
the OBM and also use any capabilities of the GOM. Initially there would likely be exensions to the OBM for certain professions. In fact, we should segment our markets and initially go after users whose needs can be satisfied doing only
programs in GOM, and gradually go for those requiring programs in
OBM, and finally, we change OBM!

Organizational OFIS Machine (OOM)
Each organization including various sub-organization has a number
of forms or protocols. For example, an expense account form would be programmed (in GOM) for the whole organization and transferred to each user. Similarly, common filing and interoffice memo forms would be used. The implication is that we
would expect programming to be done for the organization as a whole and for various parts of it by what are fundamentally GOM
users.

Individual OFIS Machine (IOM)
This level is above POM, but if there is not a particular POM,
then it is the ability to personalize GOM. As a minimum, it

is a
set of user defined keys. Evolution would most likely be forms
that are common to a given use that are not part of a global organization. It is the highest level because it is next to the
individual and it is a personalizing function that one might apply to any lower level capability. In the limit, it might be
the ability to change all the menus as fits the workload. The
programmer for this level is fundamentally a GOM user, and as such programming for nearly everyone is in terms of the GOM.

FUNCTION (CLASSES) OF A MACHINE

These correspond or can be decomposed into the primitive PMS (for
Processor Memory Switch that Newell and I posited to describe hardware machines (HMs)). The PMS types:
.Processor- an aggrate of other components that interpret a program (procedure) stored in a memory
.Memory- main types for hardware: primary, secondary (files and
program swap), and tertiary
.Switch- can range from simple bus in hardware to selection of a
menu
.Transducer- anything that takes information in one form (bits in
a memory) and transfers it into some other form (character on a
screen)
.Link- transmission from one place to another (can make errors)
.K(control)- component that given an input, evokes an output (in
essence, a one instruction processor)
My first cut at the functional classes of OBM are:
.Program environment (P)- includes the language(s),
synchronization, how programs are stored. In particular includes

string manipulation primitives (similar to TECO those in TECO programs)
.Screen management and control (T)- two parts: command mode where a screen is put up and user interacts to produce parameters
to specify next action; and picture of output from a document for
interaction with in similar fashion when editing
.Communication (T) with other systems. Must include ability to
specify arbitrary protocols, by OBM programmer, ability to substitute strings to drive photocomp machines, etc. using VHLL
of OBM
.Data management (Ms/Mt)- files as we know them and ability to
access files in other formats
.Record Access (the data part of a primary memory accessed from
files)- the data-types that the system understands together with
the common procedures that operate on them (eg. string operations, table operations, graphs, voice i/o, images). Also
includes the ability to take in an arbitrarily encoded record and
to encode it in OBM format using OBM primitives.

The primitives vary with level by gaining increased functionality
by additional software. (eg. a disk becomes a file system). In
some cases functions are lost when a user visible feature like
smooth scrolling is not support by intermediate machines. The
issue of what the functional classes are and how they will evolve
with time, versus levels will be described in another document.

In short, please excuse me for writing such a long document.

I
didn't have time to make a short one and I wanted to get the model out for your comment, because I want us to organize and build according to it. No comment will be taken as approval!

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GB1.S6.33
****
* d i g i t a l *
****

TO: RICK PEEBLES   DATE: FRI 12 SEP 1980 6:32 AM EDT

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION   DEPT: OOD

EXT: 223-2236

LOC/MAIL STOP: ML12-1/A51

SUBJECT: RE: OFIS ARCHITECTURE COUPLING

Appreciate the warning. The business of VAX agrees with my own concerns about making a very good system, hence the push to use suvax and get the work done. Somehow, I feel you are really wrong on the sizes and the structuring into conventional
languages. I offesr as counter evidence: good capabilities of

editors written in teco... albethem large; ems in mumps ... it
does virtually everything your demo did, plus ems and has a better interface ... but don't worry we would never stoop to or rise to working at this high of a level language; smalltalk
was written for a machine exactly the size of ko.

Right now, I simply want a dedicated group to go off and write
the first release of what has been called the ofis program in anyway they think they can be successful. I don't see coupling
them to anyone cause I don't see any base of knowledge that's doing anything except going to meetings like crazy.

I thought a small, dedicated group in R and D or in MR could have put a breadboard together by this time of these functions
but I was wrong. (My feeling is that there are too many people, too many ideas to get into one system, and no one who is capable of or has been assigned the leadership of this.)

Am quite sure I disagree with you re details of what I want to
see in GOM (Fundamentally hthis has to be a large set of menus
with the connection to the semantic routines in something resembling program calls. Have not figured out what the equivalent of this is for error returns or attaching semantics
to keys. There is a good demo of this in MK that I think shows how far one can go. It was done in a summer by a Harvard CS undergrad working for Jay Nickson. Such an approach
would let us handle the foreign language problem, and the tailoring problem. Both of these must be dealt with.

I strongly support George Poonen and 1 or 2 going off and trying to build a machine along the lines I outlined on VAX in
a very much detached fashion.

In answer to your previous memo. I want this group of people who are implementing the system on KO to go do it. They will write down things and have reviews and then you can talk with them. Also, there will be a person assigned to a formal port through which all other groups and persons can pass messages.

The OFIS program as it has been written down in the past, I will shortly declare to be defunct. It appears to be the dream of a set of people in marketing requesting, persons in product management and engineering management agreeing to and everyone saying that they can build a problem over an incredible range of size and applications. The fact is, we have strong evidence (given that the original wps 8 editor was designed and built outside) that our own abilities are strictly limited to something in the order of edt, a program editor (quite good, but not full wps yet). In short, in this
area, I must say that never have so many produced so little based on no fundamental knowledge. Right now I want to see a very small group build a small wps.

PS
On ICBM, we are ignoring this question. It may not run on every system. This seems like a very large rat hole into which we could descend.

pss
In the next few weeks, I hope the group demonstrates they can put together a credible architecture and plan. It is to be a very small group, with a leader. If the effort is successful, I want to replicate the methodology elsewhere. The plan will include formal interface requirements to other groups and systems, etc.

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STEWART
BOB TRAVIS TOM VLACH

GB1.S7.2
hen type <CR>
****
* d i g i t a l *
****

TO: BOB DOCKSER DATE: WED 22 SEP 1982
10:44 PM EDT
BILL JOHNSON FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5176493421

SUBJECT: DISCUSSION WITH DICK DAVIES ABOUT OFIS

Two weeks ago I had a discussion with Dick and the managment group there after a demo on the progress over the last few months. My observations were that the demo hadn't progressed much, the base levels weren't broadcast and in operation there, the performance issue wasn't understood (maybe it was premature),
and the management didn't know how the product worked (eg. they couldn't tell me how the dictionary was organized or why it took so long to check a few words on a 780. On the basis or a previous, poor performing demo there, I asked Bruce and Bob Kushlis to check into the OBM and find out whether it was the base. The data we got was that an editor was made that outperformed EDT (which was written in BLISS)... therefore I ruled out the base language and system as the cause of their performance.

With Dick et al, I voiced these worries and concerns:
1. The UK is not known for office applications, and the use appears to be at least 3 years behind the US. Thus, there's no

way to get user feedback.
2. The UK culture in the office and the use of computers by managers and professionals is such that the lag may be more like infinity than 3 years. There's a possibility that they may be limited because using manual devices may be always beneath the average manager. Therefore, they have no cultural or role model for even conceptualizing the office design.
3. They have no understanding of the office or anyway of getting this. There's no research, specs, gut feel, market coupling, seminars, courses, consultants, people, etc. to have any rational basis for building the products they are chartered to build. In short, if they made a product it would like the million monkeys writing a Shakespeaare play.

4. They have no products running there to learn with. All in one wasn't up, DECword (which they brought) wasn't up, and all I saw was 78's and VAXmail... neither of which are close enough to office conceptually to give anyone a dream of what it should be like. Use is a way to get the vision.
5. Dick kept telling me about getting requirements, breaking new ground in human interfaces, etc. and then a product would follow. This prompted me to worry about the design even more. I don't understand this method of ever building products.
(I had a delightful afternoon with the designers (both... even though there are now 9 in the group) of All in one ... they surely didn't do it this way thank goodness.) The SICKNESS IN

THE SYSTEM IS THAT THE DESIGNERS OF ALL IN ONE HAVE NOT PRESENTED THEIR SYSTEM TO PEOPLE IN ENGINEERING!!!! (The Japanese know our every move, yet information in Charlotte doesn't travel to MK, ZK or Reading.)
6. I wanted to talk about
the technicalities of products and I expect every manager within engineering to know more than I do about these products. Anyone

who only has one product to manage should know everything about the product and competition. These people only knew that there were competitive products WITHIN DEC, spent lots of time on this
and Knew Nothing about their own products. There was no concept of competition. There was no concept of the ultimate office or even an interim office or even a modern office.
7. There's a very large group doing the work and in productization. This all seems too large and premature, given our level of understanding thoroughout the organization. Namely, a large organization is the greatest impediment to creativity and work when you don't know where your're going.

These were the concerns and Dick said he wanted to work on them. Today, I stumbled across an idea that might be useful to help: after the ALL IN ONE demo, I asked them about having really great book to explain it (their model and why it wins) to the world. They have no time to sell because they're building. I called Dick about him personally writing the book... only because I can't find the month to do it now. Frankly, I'd like to get Dick, assuming he can write, or one of his people and Dick to get the product there, take their pitch, model, notes, etc. and write a book explaining this. This would get them to a point where they have some basis for being involved in this project! If Dick can't find the time, then I'd like to get someone else within the incredibly fat (budgetwise) OFIS group to write this book and start to do the teaching that's needed to make us a first-rate engineering group for office products.

Right now I believe DEC is on the dawn of being able to market the products we have: DECmate, All in one, DECmail, DECset, DECtext (in europe), etc. together with our VIA, TP, DP. This with a little (lot) of work could make us # 1... marketwise.

The trick is to keep up this momentum and make ofis really great. This is going to mean very hard individual and team work. We have no choice, we have to get the job done.

WPS USERS - Leave HP mode and type <CR>

****
* d i g i t a l *
****

TO: BOB DALEY DATE: TUE 23 SEP 1980
10:01 PM EDT
BILL JOHNSON FROM: GORDON BELL
JULIUS MARCUS DEPT: OOD
LARRY PORTNER EXT: 223-2236
BRUCE STEWART LOC/MAIL STOP: ML12-
1/A51

SUBJECT: JULIUS' COMMENTS ON THE OFIS PROGRAM: HELP

I think you ought to get a briefing from BJ, Bob Daley and Bruce as to why do it in the UK. My reading is simple: there is some talent and a team there to bring it in and get a product
out.

I am distressed too, but I am heartened by the fact that we are
building a group that I think can build a product now. This view
has gone from: give us money and we can do anything in two years;
to complete hopelessness based on the way we interact and define
things (including the way we did it in Hydra); to some hope by putting a small team together and giving them all we know about this area and asking for a proposal. You are now where I was a few months ago... dispair.

You can throw us back into the pits, but for now, I would like
to give tthe group a couple of months. They have produced more
in 2 weeks here then all the meetings over the last 6 months have produced between the marketing and product management folks. Honest, we do not need more input to define the product,
we need some understanding of how to build it!

PS,
My recent concern about the parameterized software package stems from the fact that it's schedule and budget driven versus
idea driven. So far, I would predict it to go the way of Hydra,
although it is about 1/10 as complex to build and having 1/10 the product requirements. My message:
get some idea about what you are going to build and how you are going to build it before embarking on major hiring and product schedule promises.

ATTACHED: MEMO;33

****
* d i g i t a l *
****

TO: GORDON BELL DATE: TUE 23 SEP 1980
1:12 PM EDT
FROM: JULIUS MARCUS
DEPT: COMMERCIAL
GRP/ADMIN
EXT: 264-5362
LOC/MAIL STOP: MK1-2/C37

SUBJECT: OFIS IN EUROPE

I don't understand the logic behind doing software development
for OFIS in Europe. It is nine hours' time difference from the
source of the interim product, WORD-11, so there is absolutely
no ability to communicate between the documenters and the producers. It is nine hours and 6,000 miles, one quarter of the way around the world.

Furthermore, OFIS will be introduced very late in Europe because of the language; and we are not building a base of knowledge on which to build the future OFIS products close to the market where it will be sold.

I am personally extraordinarily depressed because of this and other issues. I feel it is impossible to influence projects, and this one makes no management sense to me. Since no one really cares about OFIS, maybe we should cancel it.

JM:DW
Dictated but not read

GB1.S7.43
****
* d i g i t a l *
****

TO: BOB FREEDMAN
12:48 PM EDT

cc: see "CC" DISTRIBUTION

DATE: SAT 20 SEP 1980

FROM: GORDON BELL
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: OVERSPENDING ON OFIS/KO: RELAX A LITTLE

Somehow we must rise above what may just be noise. Fact, we are not hiring anyone. Fact, we have not, nor do we intend to fire anyone. Fact, our equipment and discretionary expenses
are pretty well frozen. Therefore, our overspending or not is totally predetermined and inevitable and I don't see that anyone can do anything about them or what they are! Also fact,
we are mucking around defing things and the ultimate priorities
aren't known now, together what the ultimate work plan will be.

My conclusion: let's not spend so much hassle trying to move expense budgets from one cost center to another just to try to

make a different manager look good or bad. At one level, I worry about our ability to manage a budget (and schedule), but
moreover I worry mostly about our ability to define and manage
and motivate. In the case of Heffner, I view starting up a new facility has been a challenge and we overspent. My conclusion is that maybe we want a single person that just helps in the starting up of these facilities, rather than having to take a really good line manager and to have to deal with this trivia. (It ain't trivia that I think he's built the best "feelin" facility so far, so I can't say totally turn it over to the bean counters and administrators cause they'll
build shithouses. On the other hand, he knows more about buildings
than he probably wants to or ever needs to know.)

My message: relax, let's do everything we can to hold expenses,
but I could care less who over and how under spends in the current environment. Also, I want us to spend our time defining
the work and approach and not the charter space so as to make the budgets be right!

"CC" DISTRIBUTION:

BOB DALEY   BILL HEFFNER   BILL JOHNSON
MITCH KUR   LARRY PORTNER

GB1.S7.14

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* d i g i t a l *
****************
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TO: BOB DALEY   DATE: TUE 26 AUG 1980 3:41 PM EDT
BRUCE STEWART   FROM: GORDON BELL
cc: GLENN REYER   DEPT: OOD
BOB TRAVIS   EXT: 223-2236

TOM VLACH LOC/MAIL STOP: ML12-1/A51

SUBJECT: TARGET ARCHITECTURE AND PRODUCTIVITY FOR OFIS

Am concerned that we're posed to spend more than we can manage
in both wps and ems. Could you review for me what the productivity
in lines/person/day for the wps8?

As a rule of thumb, I would hope that our budget would get us about 30 additional programmers. This should produce about 300K lines of code in bliss.   Wps is about 100K lines of 8 code.

Why isn't the task fundamentally straight-forward given that we
have written programs like this many times before, we have user
specs and it should be possible to structure the work into many,
parallel, non-interacting tasks?

It seems like from an architecture viewpoint, we want to avoid
making details like the file system and file format known and available to the group writing the actual Wps or Ems application.
Instead, there would be a bunch of operators on it, pretty much
along the lines of the teco operators (delete a certain object,
get, put, etc.) which only the procedure or functions know about
and as such no one might know what the format was except the functions.

Have been thinking about various architectural levels and will send this seperately so as to get your reaction. Meanwhile, I think we have to seriously address the internals because I don't think any of us have confidence in our ability to build anything at this time.

GB1.S6.44
****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION DATE: SUN 21 SEP 1980
10:32 AM EDT

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION DEPT: OOD

EXT: 223-2236

LOC/MAIL STOP: ML12-
1/A51

SUBJECT: VLACH OFIS PROD. STRATEGY UPDATE 9/8/80 AND REDUCING HASSLE

This memo that went to the world bothers me. It is exactly the type of comitment that gets us in trouble. It moves all schedules out in what we feel should be some sort of reasonable
time frame. Yes, we should be able to meet these somehow.

I want Bruce to make the comitments under his name. Also, I want no schedules that aren't appropriately qualified. We have not agreed to a schedule on the small or large product yet or their phasing. Worse yet, I believe McKenzie and the project team has to make the comitement. I have not heard
them do it yet. We are not at phase 0 yet. DECmail is a similar problem.

We thus have to take the memo I wrote on reducing hassles and clean it up, shaving it to just the rules about who comits, and
publish and enforce it.
I would like comments from you folks about the rule and the corollaries cause I want to act to stop this crap before any more people get chewed up. All it will do is increase the meetings, with no attendant real work done! Please comment cause I want to get the rules down and out.

The result is clear: Tom is going to take a lot of crap from his customers if anything happens to the schedule (and I have no confidence that it won't, although I hope we can make it).

Rather than formally rescind it, because it supposedly was written
(9/8, with a 9/12 graph and I got it 9/17) before my 9/13 memo,
it seems like it should stand until we know something.
It is a reasonable target that I we should all go like hell to meet. It sure has everything so our P/L customers can't object!

"TO" DISTRIBUTION:

BOB DALEY   BILL JOHNSON   JACK MILESKI

"CC" DISTRIBUTION:

MCKENZIE AND STEWART   LARRY PORTNER   GLENN REYER
BRUCE STEWART   TOM VLACH

GB1.S7.16

July 19, 1979

G.V.S. Raju
Chairman & Professor
Ohio University

Clippinger Building
Athens, Ohio 45701

Dear Dr. Raju:

Thank you for the invitation (July 6, 1979) to participate in your symposium. I'm sorry that I have made a previous commitment to be out of the country the preceeding two weeks. As such, I don't feel I can be away from here so long, and must decline your offer to speak and interact during the two-day October symposium.

As for ideas as who might speak on Computer topics, you might try: Dr. Jim Bell who heads our R and D Group and who has worked on curricula needs for DEC, or Del Lippert who heads our Educational Services Group here; or Sam Fuller, who is our Technical Director; our various Carnegie-Mellon (e.g. Bill Wulf, Dan Siewiorek) or Stanford faculty (Edward McCluskey, Forest Baskett).

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:swh
GB0004/15
00 BURT DECGRAM ACCEPTED S 8020 O 529 26-FEB-81 21:50:34

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION   DATE: THU 26 FEB 1981
21:52 EST

FROM: GORDON BELL
DEPT: ENG STAFF

EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: WE MUST STAY A MANUFACTURER, NOT BECOME A DISTRIBUTOR FOR OKI!

Unfortunately, I don't think there is an easy way out of designing and building low cost personal computers. We gotta learn, or decide that DEC should head for being a distributor and change the whole nature of what we do. Therefore, I say now is the time to get moving aggressively into this part of the very competitive arena. It's going to be really harder than anything we've seen. I don't think it is optional at all as it both threatens our main mid-range as an alternative computing style and as the mid-range comes down to be in a small box, offering even cheaper computing power.

It is critical that we hear from the troops everywhere in the company as to how we are going to pull together to stave off the forthcoming invasion of distributors such as TRW, National, and the company that imports the OKI.

"TO" DISTRIBUTION:

BUZZ BROOKS	STEVE HYDE	SI LYLE
MARKETING COMM:	AVRAM MILLER	GERALD T MOORE
LARRY PORTNER	JACK SMITH	

GB2.S4.38

February 2, 1979

The Foxhollow Inn
Lenox, Mass. 02140

Dear Sir:

Your Inn was featured in the Boston Sunday Globe, 1/21/79, and we would appreciate some additional information:

Do you have a meeting room which could be set up living room style -- at least 24' x 20'?

Do you have overnight accommodations?

Our meetings are usually two days in duration, with approximately twelve people. If you have the facilities for such a meeting, we would appreciate receiving a brochure, plus directions. Also, would you be able to handle our group April 25 and 26?

Sincerely,

Mary Jane Forbes

MJF:ljp

Return Address
Mary Jane Forbes
Digital Equipment Corporation
146 Main Street
ML12-1/A51
Maynard, Massachusetts 01754
29 November 1984

Dr. William Mulroney
Institute for Defense Analysis
1801 N. Beuregard Street
Alexandria, Virginia 22311

Dear Bill:

Enclosed are two papers I promised:

.   The Multi: A New Fourth (and Fifth?) Generation Computer Structure which I have submitted to Science.

.   A Taxonomy of Parallel Computers and definition of grains size

The first paper relates to the fact that COCOM should be aware of the incredible ease of building "Multi's"-- for multi(ple) microprocessor computer. The Synapse computer is an excellent example of this class (the Elexsi, a high performance multiprocessor, is not a Multi). My thesis is simple: this new computer structure is ideal from a cost, performance, cost/performance, reliability, maintainability, design and manufacturabilty standpoint, so much so that it could replace conventional minis and low end mainframes. The real kicker is that I believe the computer will lead directly to the general solution of the parallel processing problem. Whether it does is immaterial, because we do understand on thing about parallel processing: if a program is inherently parallel and important enough, then people can get it to run efficiently on a multiprocessor. Within 3 years, I expect to see a computer with 32-64 processors and 128 Megabyte memory all in a 2' x 2' x 2' box selling for $400K and delivering over 100 Mips! These computers while not totally trivial to build are easier to build than a large minicomputer, and are trivial to build when compared with a 100 Mip supercomputer (of which there aren't any).

The second point is about COCOM's position on approving the sale of IBM PC's in Russia and the notion of allowing a U. S. effort to help Russia build a factory to build PC's. Why are we allowing this? It should be observed that the PC is as cost-effective at Scientific calculations as a Cray, in terms of cost per megaflop, and more cost-effective than either a 780 or a 308x class. Most important, the PC has an 8088 which has a 20-bit address, permitting useful work to get done, unlike the toys made from Z80's or 8080's. Please do not confuse the 8088's architectural limit (20 bits) with implementation datapath (8 bit). The PC is perhaps a marginal issue, (although I clearly can't understand why we are actively helping improve computing in Russia) but when looked at from the following viewpoint, is a much more critical issue.

Professors Chuck Seitz (Computer Science) and Geoffrey Fox (physics) have built a multicomputer, which is a bunch of computers (processors and primary memories) interconnected in a hypercube the call the Cosmic Cube. It has 64 8086's with floating point. Each computer has 128 Kbytes of memory and is connected to six other computers by a fast serial line over which messages are sent to neighbors. So far they have a run a number of programs and demonstrated a factor of 64 speedup. Again, their examples all beat the Cray 1. They have some guidelines on how to code problems for the machine. For details, you might talk to them.

If I have a good factory, set up by the U.S. folks who can make reliable PC's, it is trivial to make 1 board that has the log (n) serial wires coming out of it for building a Hypercube. All I do is make 64 trivial boards (done by a good hobbyist), get the Cal Tech Software, plug in 64 PC's (an overkill because most PC's have bigger memory, and interconnect the wires. Now I have a supercomputer.

Although I open up some issues, I hope these thoughts are helpful.

Sincerely,

Gordon Bell
Chief Technical Officer
OOD

Gordon Bell
ML12-1/A51

Dick Clayton
ML12-2/E71

Jim Cudmore
ML1-5/E30

Bill Demmer
TW/D19

Ulf Fagerquist
MR1-2/E78

Bill Johnson
ML21-3/E87

John Kevill
ML1-3/E58

John Meyer
ML12-1/A11

Larry Portner
ML12-3/A62

Bob Puffer
ML12-2/E38

Marilyn Arbuckle	ML12-3/A62
Mary Jane Forbes	ML12-1/A51
Nancy Hilsinger	ML1-3/E58
Dee Johnson	ML3-2/E41
Kathy Johnson	TW/D19
Rita Leary	ML12-2/E38
Marie Mangan	ML1-5/E30
Marylynn Morin	ML12-2/E71
Ann Peskin	MR1-2/E78
Caroline Spence	ML12-1/A11

ID#350

| d | i | g | i | t | a | l | i n t e r o f f i c e m e m o r a n d u m

Subject: **Strategy Issues List**

To: OOD

Date: 16 NOV 78
From: Gordon Bell

Dept: OOD
Loc: ML12-1/A51 Ext: 223-
2236

follow up 12/4/78

On our meeting of the 13th, each of us aired problems for our areas that are important to the resolution of the products that back up the strategy. In order to get a timely resolution of these, I'd like to get a list from each of you, arranged by priority and with target date of resolution. There should be a separation as to what are intra-your-area versus inter-area (and these would include the other area of joint interest).

The list ought to be kept as short as possible, and the problems be named descriptively. This listing must be significantly less than ONE page! There should also be a one sentence to one paragraph statement of each of the problem issues.

In order to avoid hassling you, please either send the list or a date when the list will be sent to Mary Jane by December 4 in either paper or floppy form.

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Dick Clayton	ML12-2/E71	Jim Cudmore	ML1-5/E30
Bill Demmer	TW/D19	Ulf Fagerquist	MR1-2/E78
Bill Johnson	ML21-3/E87	John Kevill	ML1-3/E58
John Meyer	ML12-1/A11	Larry Portner	ML12-3/A62
Bob Puffer	ML12-2/E38		

In a prospectus on an EBAM, I ran across this:

"Oppenheimer is currently in the process of raising $30M in a R & D Partnership in which CDC is the general partner, to finance the development of a low cost GP coupler, fully compatible with CDC's existing product line."

In a recent dinner meeting with CDC, one of the principles commented that if CDC had brought out a low cost version of the 6600 or 7600 in "mini form", they could have taken much of the mini market. I declined to comment. I hope they don't do this, but they're probably exploiting their technology for lower end products...not a bad idea. They probably are looking at the gapping VAX hole.

Why would they use this method to find R & D?

Is it a way of encouraging entrepreneurship?

Is it something we should consider?

April 9, 1979

Mr. Rusty Whitney
President
Oregon Software Minicomputer, Inc.
2340 SW Canyon Road
Portland, Oregon 97201

Dear Mr. Whitney:

I got your letter of April 2. Yes, I'd like to meet and explore the opportunities of an OMSI Pascal.

Although I won't be at DECUS, I'd like members of our staff to meet and discuss this with you. I'm asking Larry Portner, Head of Software, to do this. He'll contact you.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:ljp

CC: Larry Portner

GB0002/12

C O M P A N Y   C O N F I D E N T I A L

ENGINEERING ORGANIZATION CHART

Updated: 11/18/82

VICE PRESIDENT, ENGINEERING, (Gordon Bell)
VICE PRESIDENT, ASSOCIATE HEAD ENGINEERING (Jack Smith)

|

|**VICE PRESIDENT, ASSOCIATE HEAD ENGINEERING**
| **TECHNOLOGY, TERMINALS, AND SMALL SYSTEMS (Jack Smith)**
| |____Terminals and Workstations, Group Manager (Bill Avery)
| |____PDP-11 Bit Systems Development, Group Manager (Mike Gutman)
| |____Electro-mechanical Dev. & Support, Group Manager (Walt Hanstein)
| |____Process & Design Support, Group Manager (Don Metzger)
| |----Controller (Joe Reilly)
| |
|**SENIOR GROUP MANAGER, CORPORATE RESEARCH & ARCHITECTURE (Sam Fuller)**
| |
| |____Manufacturing Automation Program (Tom Williams)
| |____West Coast Research Lab (Forest Baskett)
| |____Advanced Systems Research (Bob McKenzie)
| |____Exploratory Research Program-Acting (Dieter Huttenberger)
| |____External Research Program (Dieter Huttenberger)
| |____Standards (Gary Robinson)
| |____Systems & Technology Analysis (Linda Wright)
| |____Operations & Planning (Bill Svirsky)
| |----Exploratory Research (Charle Rupp)
| :....Personnel (Maureen Harvey)
| :....Finance (Leo Merta)
| :....Software Architecture & Technology (Mahendra Patel)

|**VICE PRESIDENT, SYSTEMS AND COMMUNICATIONS ENGINEERING (Bill Johnson)**
| |
| |____32 Bit Systems,Vice President (Bill Demmer)
| |----Low End 32 Bit Product Market & Dev. Manager (Roy Moffa)
| |____Large Systems Engineering, Vice President (Ulf Fagerquist)
| |____Distributed Systems, Group Manager (Bernie LaCroute)
| |____Base Systems Software, Group Manager (Bill

```
Heffner)
|        |____Vax Workstations, Manager (Brian Croxon)
|        |____Technical Director (Mahendra Patel)
|        |____Finance (Steve Behrens)
|        |____Personnel (Les Koch)
|        |____Hardware Process (John Manzo)
|        |____Operations/Planning (TBH)
|        |____Low End 32 Bit (Will Thompson)
```

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|Vice President, Storage Systems Development (Grant Saviers)
|       |
|       |____Engineering Manager, SSD Japan (Vince Bastiani)
|       |____Tape Product Development, Shrewsbury Host
Manager (Dave W. Brown)
|       |____Very Small/Small Disk Product Development (Paul
Bauer)
|       |____Advanced Technology and Storage Components (Mike
Riggle)
|       |____Central Staff/Operations (Bob Flynn)
|       |____Medium/Large Disks and Subsystem Product Dev.
(Tom Burniece)
|       |____SSD/EPIP, Special Projects (Jim Lacey)
|       |____Electronic Storage Development (Bill Coates)
|       |____Electronic Storage Development (Pete Durant)
|       :....Personnel (Jocelyn Scarborough)
|       :....Finance (Ed Sawyer)
|       |____Electronic Storage Development, Group Manager
(Pete van Roekens)
|       |----Japanese Engineering Center (Tom Kobayashi)

|
|PERSONNEL, Manager-Acting (Larry Bornstein)
|
|CORPORATE PRODUCT MANAGEMENT (Rick Corben)
|
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OOD 14

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+--------------+
! d i g i t a l!              INTEROFFICE MEMORANDUM
+--------------+

TO: Central Engineering         DATE:  15 June 79
    Managers                    FROM:  Gordon Bell/Larry
Portner

                                DEPT:  Central Engineering
                                MAIL STOP:  ML12-1
```

SUBJECT: Organization Announcement

In conjunction with Gordon's earlier memo concerning the Central Engineering Organization, we are pleased to make the following announcements:

> John Holman, presently Manager of the Computer Special Systems Product Line, will be responsible for the technical engineering activities that cross all of Central Engineering. These functions include: Engineering Information Systems, Central Engineering Services, Central Diagnostic Systems, Power and Packaging and Systems Evaluation. John will join Central Engineering on July 1 and will continue as Acting Manager of CSS until his replacement is installed.

> Grant Saviers, presently Manager of our Colorado Disk Development Group, will become Manager of Mass Storage Development. Grant is replacing John Kevill who resigned for personal reasons. Grant's appointment is effective immediately, he expects to be in residence in Maynard by July 1.

> Sam Fuller, presently Manager of Hardware Architecture, will replace Bill Johnson as Technology Director. The Systems Architecture and Technology Group will include: Central CAD Architecture, Systems Performance Analysis, Technology Tracking and Competitive Evaluation, Hardware and Software Architecture, Product Standards and Future Technology Committee sponsorship. Sam will assume his new duties immediately.

We are extremely fortunate to have people of this caliber available to undertake these key positions. Specific transition and integration plans for the involved people and organizations will be completed early in Q1 of the coming fiscal year. We hope that you will help all of us make the transition as smooth as possible.

Recently, it was announced that Bob Puffer will be moving to manage the Mass Storage Manufacturing operation under Jack Smith. We wish Bob well in his new job. We will miss his participation and contribution to Engineering.

/cs

+---------------+ ID#0151

! **d i g i t a l** ! **i n t e r o f f i c e m e m o r a n d u m**

+---------------+

Subject: **Organizational Changes**

To: Engineering Managers

Date: 6 JULY 78
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

I am pleased to announce the following organizational changes:

Central Architecture and Technology Group

I am establishing a Central Architecture and Technology Group managed by Bill Johnson. Bill will report to me and have responsibility for: Computer Systems Architecture, Diagnostics Engineering and Technology Tracking. Reporting to Bill Johnson, Sam Fuller will manage Hardware Architecture, and Bill Keating will continue with his present responsibilities, including Software Architecture, Tools and Standards. These groups will be responsible to define and coordinate systems architecture and standards throughout engineering. This move will help focus the Engineering organization's attention on emerging technologies and trends and will also provide a continuing assessment of our capability in various technical disciplines.

R&D

Effective immediately, the R&D function under Jim Bell will report to Ulf Fagerquist. As previously announced in John Leng's recent memo, Ulf now reports to me and continues to manage DECsystem 10 and 20 engineering and product management.

Software Engineering will continue to report to Larry Portner with the exception of the changes mentioned above, and with additional responsibilities in the Commercial Group. Larry will continue to be a member of OOD and report to both Julius Marcus and myself.

DOMAIN | COMMON | BELL | PORTNER
__________________|___________________|_____________|_____________
____
| | |
General |Organization and |Technology & |Resources
processes and
(one liner) |charter definition.|products |control
totorials<?> and
|Establish contracts|coaching<?> |management
|and measure output |and leader- |
|of direct reports. |ship. |
__________________|___________________|_____________|_____________
____
| | |
Products, Stds., |Provide Engineering|Provide inte-|Manage
process which
technology, eng. |LRP (R3) and |grated over- |produces ELRP
(RB).
projects |product placques |view and no |Establish
and monitor
|for Oper. Comm. |view of all |project
control and
Manage strategic |parts of |reporting (YB)
via line
|Planning Manager |ELRP(RB) |groups.
Other strategic	Manage Tech.
alternates decision	Director.
making.	Review all
	products at
	"critical"
	times.
__________________|___________________|_____________|_____________
____
| | |
Resources |Review Yearly group| |Manage process
which
|Operating Plan (BB)| |produces
Yearly
|(for personnel, | |Operating Plan
(BB)

```
                     |projects, space,              |              |
                     |budgets, etc.)   |            |
                     |                 |            |
Org. as a whole      |Design and contract|          |
                     |clear charters.  |            |
                     |                 |            |
Direct Reports       |Establish contracts|Manage techn.|Manage
administration
                     |and measure output            |output and
be|and be management coach
                     |                 |tech. coach |
                     |                 |            |
All personnel        |Provide comp.    |Tech. coach |Management(?)
                     |& work environment            |              |
                     |conducive to Engrs.|          |
                     |                 |            |
Budget               |                 |            |Manage via
Controller
                     |                 |            |
Capital Equipment    |                 |            |Manage via
Controller &
                     |                 |            |Administration
Manager
                     |                 |            |
Space/facility       |Reivew LRP       |            |Manage via
Adm. Manager
                     |                 |            |
Mgmt. Tools/Sys.     |                 |            |Manage via
Adm. Manager
                     |                 |            |
Engineering          |                 |            |Manage via
Technical
Services/Tech. Ops|  |                 |Operations Manager
```

DOMAIN	COMMON	BELL	PORTNER
<u>Programs</u>			
Q & P	Set Goals		Manage Q & P Manager
"Helping" Eng. TF			
HRP; Org. Dev.	?	?	?
Tech. Training	?	?	?
<u>Interface</u>			
PPC/Corp. Mgmt.			Manage Product Mgmt. Staff
Manufacturing	?	?	?
Eng. Committee	?	?	?
Update This Doc.			

GB2.S6.63

<u>RECOMMENDATION</u>

Obtain a replacement for Si as a Product Engineering Group (PEG) manager for terminals and computers built into terminals.

Have that manager organize the work for maximum product autonomy, while building on common components and constrained by common architecture.

Build the best engineering team for Si's products!

This structure permits a team formed with Si to focus on the marketing, manufacturing and engineering aspects of products.

SI's OLD JOB

Si...

16-bit Qbus hardware
Also, VT278 hardware for WPS and Retail Products
16-bit Unibus hardware subcontract to Tewksbury

VT/LA and Terminal based hardware components (monitors/kbd)
Computing Terminals (CT), both hardware/software
Technical Director and A/D coupling

The following engineering (outside this area) is also associated with terminals and table-based, personal computing systems:

CT software
Disks, subcontracted and independently funded
WPS 278 software
VT278 software for Retail Products Group
Terminals engineering who are building 2 Computing Terminals
Modems for terminals
Special semiconductors and PDP-11 microprocessors

THE PROPOSED ENGINEERING ORGANIZATION (PRODUCT GROUP LEVEL VIEW)

Bell/Portner

(Product Engineering Group, PEG)
32-bit systems
Large computer systems
[Terminals and table-based (personal) computing system]
16-bit systems (part of Si's old job)
Networks, communications and distributed systems
Software
Mass storage
Semiconductors
Power, Packaging, Physical Interconnect

Technical Director (Standards, architecture, R&D)

(Engineering Administration Staff)
Administration
Finance
Personnel
Technical Operations
Strategic Planning
Corp. Product Management
Quality and Operations Analysis

Recording Secretary

SEVERAL POSSIBLE ORGANIZATIONS

Win suggests the following alternatives:

1. B/P manage the details of how to get Si competitive products

B/P

8 Current Product groups
CT
VT
LA
Technical Director
7 Current staff groups

2. Keep all computers together and all terminals together

B/P

7 Current Product Groups
16-bit
CT
VT
LA
Technical Director
7 Current staff groups

3. Combine CT and VT in one group and LA in another group

B/P

8 Current Product Groups
CT/VT Products
LA
Technical Director
7 Current staff groups

4a. One form of the Proposed Organization
B/P

8 Current Product Groups
Terminals and Terminal Based Systems
CT
VT/LA
Technical Director
7 Current staff groups

PROPOSED ORGANIZATION (DETAILED)

4b. Maximum autonomy for the various products

B/P

8 Current Product Groups

Terminals and Terminal Based Computing Systems
- CT
- VT
- LA
- VT278 (including hardware and ALL software)
- Common components (keyboards, modems, CRT's)
- Strong, Common Advanced Development and Architecture

Technical Director

7 Current staff groups

RATIONALE BASED ON MANY ORGANIZATIONAL DESIGN CRITERIA

Bell/Portner and Other Product Engineering Self-Preservation

Many Engineering Areas Need Our Attention

Technical Issues In Terminals and CT's Are Open
We need help here!

Protection From Me (and Passers By)

Strong, Autonomous Product Focus

Separation of Terminals and Computing Terminals

Strong and Clean Coupling With Si's Team

Strong and Clean Coupling With Manufacturing

Very Good Coupling For Shared Technology and Work

modems
power and packaging, including noise and radiation control
keyboards
monitors (although the LA's don't need them, VT/CT do)
use of roms for more intelligent terminals
common modules for terminals and computing terminals
including: comm., rom, some video, printers, mass store

architecture of communications to operate on non-DEC systems
architecture for use on DEC systems (badly missing now),
especially VT and VT (graphics)
human factors for much of the design, including editing
imaging based on dot matrices for fonts and graphics
common approach of servicing and customer installation
use and programming of standard VLSI

Printers have some unique characteristics

CT's are programming driven

Minimal Amount of Interaction With Other Parts of Engineering

Common terminal architecture interface with software

Mass storage (CT and VT)

Semiconductors (all, and all have unique VLSI too)

Ofis software (for both CT and VT)

Other operating system software for CT

The Revenues In These Market Directed Products Are Similar
to other product groups.

FY	VT	LA	CT/278	16-b	32-bit
81	.16	.16	.05	1	0.6
82	.2	.2	.06?	1.1	1.0
83	.22	.27	.13	1.2	1.5
84	.29	.3	.4	1.3	2.0

Having The 278 In The Group Is Desireable, Though Not Necessary

The Proposal Is Similar To Other Parts Of Engineering

B/P(level 2)

Mass storage (level 3)

CX (Level 4)
Big Drive Projects (level 5)
Controllers (level 5)
Specific controller project (level 6)

...
Large Computers

Venus Program
36-bit
Jupiter

...
Terminals and Terminal Based Computing Systems (Personals)

CT family of products
CT Product Management
CT Hardware manager
CT Software
CT product assurance

VT products
VT project

LA family
LA200, etc.

Components
Keyboards, monitors, etc.

Single VT278 mogul
Product manager
Software, including WPS, RPG, etc.
Hardware

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*****************
* d i g i t a l *
*****************
```

TO: DICK CLINTON   DATE: FRI 23 JAN 1981
12:06 EST
    OOD: FROM: LARRY PORTNER
                                                DEPT: CENTRAL ENGINEERING
                                                EXT: 223-2471
                                                LOC/MAIL STOP: ML12-1/T32

SUBJECT: OOD RESTRUCTURED

LP1/S7/32EMS
From: Gordon Bell and Larry Portner

Consistent with our discussions of the last several months, and our
recent organization changes, we are restructuring the formal meetings
of Engineering management as detailed below. We believe this structure
will better serve the goals of focused interactions (the group appro
priate to the meeting content) and periodic interaction of the entire
staff for coordination and communication.

```
              + ----------------------------------------------------------
              |                      +---------------------------------
              |                      | Storage
Saviers
              |                      | 32-Bit Systems
Demmer
              | PRODUCT ENGINEERING  | 36-Bit Systems
Fagerquist
              | GROUP (PEG)          | Computing Terminals
              | (Meets approximately |  and 16-bit
```

```
Lyle
              | bi-weekly)             | Software
Johnson
              |                        | SAT
Fuller*
              |                        | Recording Secretary
Clinton
              |                        +-----------------------
---------
              |                        +-----------------------
---------
              | COMPONENTS             | TOPS
Holman
 ENGINEERING  | ENGINEERING GROUP      | PI
Thompson
    STAFF     | (CEG)                  | SEG
Cudmore
(Monthly      |                        +-----------------------
---------
meetings      |                        +-----------------------
---------
approximately)|                        | Finance
Hough
              |                        | Personnel
Meyer
              | ENGINEERING FINANCE    | Administration
Rose
              | AND ADMINISTRATION     | Strategic Planning
Delagi
              | (ENG F&A)              | Operations Research
VanRoekens
              | (Meets approximately   | Si Lyle replacement
(x)
              | bi-weekly)             | SAT
Fuller*
              |                        | Recording Secretary
Clinton
              |                        +-----------------------
---------
              |
              |                        Bell/Portner
              |                        Dick Clinton, Recording
```

Secretary
+---

The meeting schedule through calendar year 1981 is attached.

Jungle meetings will be scheduled to include the appropriate groups.
Please keep currently scheduled Jungle dates on your calendar unless
otherwise informed.

The initial meetings of these groups will be used to define the focus
and objectives of the groups so that agendas can be managed and the
time of the participants well spent.

* Sam Fuller's attendance is optional.

ENGINEERING STAFF MEETING SCHEDULES 1981

JANUARY

29	Engineering Finance & Administration (EF&A)

FEBRUARY

5	Engineering Staff
12	EF&A
19	NO MEETING (Bell/Portner away)
26	Product Engineering Group (PEG)

MARCH

5	EF&A
12	PEG
19	EF&A
26	Engineering Staff

APRIL

2	EF&A
9	PEG

16	EF&A
22,23	JUNGLE
30	PEG

MAY

7	EF&A
14	PEG
21	EF&A
28	Engineering Staff

JUNE

4	EF&A
11	PEG
18	EF&A
25	Engineering Staff

JULY

2	EF&A
9	PEG
16	EF&A
22,23	JUNGLE
30	PEG

AUGUST

6	Engineering Staff
13	EF&A
20	PEG
27	EF&A

SEPTEMBER

3	Engineering Staff
10	PEG
17	EF&A
24	PEG

OCTOBER

1	EF&A
8	PEG
15	EF&A
21,22	JUNGLE
29	PEG

NOVEMBER

5	Engineering Staff
12	PEG
19	EF&A
26	THANKSGIVING

DECEMBER

3	PEG
10	EF&A
17	Engineering Staff
24	PEG
31	EF&A

GB2.S1.27

GB0002/56

d i g i t a l **i n t e r o f f i c e m e m o r a n d u m**

SUBJ: OOD ORGANIZATION ANNOUNCEMENT

Date: 5/17/79
From: Gordon Bell
Dept: OOD
MS: ML12/A51 Ext: 223-2236

TO: Operations Committee
Engineering Managers
Consulting Engineers
Product Line Managers

Effective immediately, Larry Portner will become Associate Head of Engineering. We will be jointly responsible for the management of Engineering. Under this system, I will focus on key products and technologies that further support the product strategy, and Larry will focus on operational management. Mitch Kur (Central Engineering Finance) and John Meyer (Central Engineering Personnel) will report directly to Larry. Larry will also assume direct responsibility for coordinating the activities of the Product Management Committee and working with this committee to implement a more focussed Product Managment and Planning process.

Bill Johnson will replace Larry as Manager of Software Engineering; Bill will continue to act as Technical Director until his replacement is selected.

George Plowman will assume additional responsibilties in the areas of Distributed Processing reporting to Bill Demmer as an additional step toward integrating our DECNET, communications and interconnect strategies.

The organization:

```
                           -------------------------------
                           |             |            |
                           | Bell        | Portner    |
                           |             |            |
                           -------------------------------
                                  |      |      |
     Technical Director---------| |      |-------Finance
                                         |      |-------Personnel
                                         |      |-------Product
Management Office
                                         |
             ---------------------------------------------------------
----.........
             |          |          |           |         |       |
             .
       ------------         ------------- -------------       ----------
---    ----------- --------- ---------
       |         | |        | |         | |Computer | |       | |
       |         |          |
       |Operations |        | Software  | | Mass    | |Systems | |Mid-
Range| |Large    | |LSI     |
       |         | |        | | Storage | |Development|       | Systems
       |         |Systems   | |         |
       ------------         ------------- -------------       ----------
---    ----------- --------- ---------
```

mjf

C O M P A N Y   C O N F I D E N T I A L

ENGINEERING ORGANIZATION CHART

Updated: 8/9/82

<u>VICE PRESIDENT, ENGINEERING, (Gordon Bell)</u>

<u>VICE PRESIDENT, ASSOCIATE HEAD ENGINEERING (Jack Smith)</u>

|
|**VICE PRESIDENT, ASSOCIATE HEAD ENGINEERING**
| **TECHNOLOGY, TERMINALS, AND SMALL SYSTEMS (Jack Smith)**
| |____Terminals and Workstations, Group Manager (Bill Avery)
| |____Workstations, Group Manager (George Champine)
| |____PDP-11 Bit Systems Development, Group Manager (Mike Gutman)
| |____Electro-mechanical Dev. & Support, Group Manager (Walt Hanstein)
| |____Process & Design Support, Group Manager (Don Metzger)
|
|**GROUP MANAGER, SYSTEMS ARCHITECTURE AND TECHNOLOGY (Sam Fuller)**
| |
| |____Manufacturing Automation Program (Tom Williams)
| |____West Coast Research Lab (Forest Baskett)
| |____Advanced Systems Research (Bob McKenzie)
| |____Exploratory Research Program-Acting (Dieter Huttenberger)
| |____External Research Program (Dieter Huttenberger)
| |____Systems Architecture (Bill Strecker)
| |____Software Architecture & Tools (Mahendra Patel)
| |____Standards (Gary Robinson)
| |____Systems & Technology Analysis (Linda Wright)
| |____Operations & Planning (Bill Svirsky)
| :....Personnel (Maureen Harvey)
| :....Finance (Leo Merta)
|
|**VICE PRESIDENT, SYSTEMS AND COMMUNICATIONS ENGINEERING (Bill Johnson)**
| |
| |____32 Bit Systems,Vice President (Bill Demmer)
| |____Large Systems Engineering, Vice President (Ulf Fagerquist)
| |____Distributed Systems, Group Manager (Bernie LaCroute)
| |____Central Software Engineering, Group Manager-Acting (Bill Johnson)
|
|**Vice President, Storage Systems Development (Grant Saviers)**

```
|        |
|        |____Engineering Manager, SSD Japan (Vince Bastiani)
|        |____Tape Product Development (Dave W. Brown)
|        |____Very Small/Small Disk Product Development (Paul
Bauer)
|        |____Advanced Technology and Storage Components (Mike
Riggle)
|        |____Central Staff/Operations (Bob Flynn)
|        |____Medium/Large Disks and Subsystem Product Dev.
(Tom Burniece)
|        |____SSD/EPIP (Jim Lacey)
|        |____Electronic Storage Development (Bill Coates)
|        |____Electronic Storage Development (Pete Durant)
|        :....Personnel (Jocelyn Scarborough)
|        :....Finance (Ed Sawyer)
|        |____Electronic Storage Development, Group Manager
(Pete van Roekens)
```

|

|**CONTROLLER, CENTRAL ENGINEERING (Joe Reilly)**

|

|**PERSONNEL, Manager-Acting (Larry Bornstein)**

|

|**CORPORATE PRODUCT MANAGEMENT (Rick Corben)**

|

ENGINEERING

GORDON BELL
VICE PRESIDENT
ENGINEERING

JACK SMITH
VICE PRESIDENT & ASSOC. HEAD
ENGINEERING

JIM CUDMORE
VICE PRESIDENT & GROUP MANAGER
LOW-END ENGINEERING

BILL AVERY
GROUP MANAGER
TERMINALS DEVELOPMENT

JOHN CLARKE
GROUP MANAGER
DECMATE DEVELOPMENT

BARRY JAMES FOLSOM
GROUP MANAGER
RAINBOW DEVELOPMENT

MIKE GUTMAN
GROUP MANAGER
PDP-11 SYSTEMS DEVELOPMENT

RON HAM
GROUP MANAGER

CT DEVELOPMENT

WALT HANSTEIN
GROUP MANAGER
ELECTRO MECHANICAL DEVELOPMENT & SUPPORT

SAM FULLER
CORPORATE RESEARCH & ARCHITECTURE
SENIOR GROUP MANAGER

BILL JOHNSON
VICE PRESIDENT
SYSTEMS & COMMUNICATIONS
ENGINEERING

BRIAN CROXON
GROUP MANAGER
VAX WORKSTATION PROGRAM

BILL DEMMER
VICE PRESIDENT
32-BIT SYSTEMS

ULF FAGERQUIST
VICE PRESIDENT
LARGE SYSTEMS ENGINEERING

BOB GLORIOSO
MANAGER
LARGE VAX ENGINEERING

BILL HEFFNER
BASE SYSTEMS S/W
GROUP MANAGER

BILL JOHNSON
SAC OPERATIONS (ACTING)

BERNIE LACROUTE
GROUP MANAGER
DISTRIBUTED SYSTEMS

JEFF KALB
GROUP MANAGER
LSI

DON METZGER
GROUP MANAGER
PROCESS & DESIGN SUPPORT

JOE REILLY
ENGINEERING FINANCE GROUP
CONTROLLER

GRANT SAVIERS
VICE PRESIDENT
STORAGE SYSTEMS DEVELOPMENT

LARRY BORNSTEIN
GROUP PERSONNEL MANAGER
ENGINEERING/MANUFACTURING

RICK CORBEN
CORPORATE PRODUCT
MANAGEMENT MANAGER

C O M P A N Y   C O N F I D E N T I A L

ENGINEERING ORGANIZATION CHART

Updated: 3/24/83

VICE PRESIDENT, ENGINEERING, (Gordon Bell)
VICE PRESIDENT, ASSOCIATE HEAD ENGINEERING (Jack Smith)

```
                               |
|SENIOR GROUP MANAGER, CORPORATE RESEARCH & ARCHITECTURE (Sam
Fuller)
|        |
|        |----Manufacturing Automation Program (Tom Williams)
|        |----West Coast Research Lab (Forest Baskett)
|        |----Advanced Systems Research (Bob McKenzie)
|        |----External Research Program (Dieter Huttenberger)
|        |----Standards (Gary Robinson)
|        |----Systems & Technology Analysis (Linda Wright)
|        |----Operations & Planning (Bill Svirsky)
|        |----Exploratory Research (Charle Rupp)
|        |----MCC/CSM (Tom Gannon)
|        |....Personnel (Maureen Harvey)
|        |....Finance (Donna Berard)
|        |....Software Architecture & Technology (Mahendra Patel)

|VICE PRESIDENT, SYSTEMS AND COMMUNICATIONS ENGINEERING (Bill
Johnson)
|        |
|        |----32 Bit Systems,Vice President (Bill Demmer)
|        |----Low End 32 Bit Product Market & Dev. Manager (Roy
Moffa)
|        |----Large Systems Engineering, Vice President (Ulf
Fagerquist)
|        |----Distributed Systems, Group Manager (Bernie LaCroute)
|        |----Base Systems Software, Group Manager (Bill Heffner)
|        |----Vax Workstations, Manager (Brian Croxon)
|        |----Technical Director (Mahendra Patel)
|        |....Finance (Steve Behrens)
|        |....Personnel (Les Koch)
|        |----Hardware Process (John Manzo)
|        |----Staff (Will Thompson)
|        |----Large VAX Engineering Manager (Bob Glorioso)
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```
|        |----SAC Operations (Acting) (Bill Johnson)
|    |----Central Quality Group Manager (Steve Beason)
|VICE PRESIDENT, GROUP MANAGER, LOW-END ENGINEERING (Jim Cudmore)
|
|        |----DECmate Development Group (John Clarke)
|        |----Electro Mechanical Development & Support Group (Walt
Hanstein)
|        |----Rainbow Development Group (Barry James Folsom)
|        |----CT Development Group (Ron Ham)
|        |----PDP-11 Systems Development Group (Mike Gutman)
|        |----Terminals Development Group (Bill Avery)
|        |----Group Personnel Manager (Dot Terrell)
|        |----Group Finance and Administration Manager (Pat
Spratt)
```

|**GROUP MANAGER, LSI (Jeff Kalb)**
|
| |----Group Manager, Acquisition & Testing (Dan Hamel)
| |----LSI Marketing Manager (Steve Rothman)
| |----HL Manufacturing Manager (Rod Schmidt)
| |----LSI SEG Manager (Steve Teicher)
| |----LSI Personnel Manager (Ellen Ober)
| |----Group Controller (Bob Hranek)

|**GROUP MANAGER, PROCESS & DESIGN SUPPORT (Don Metzger)**
|
| |----Group Manager, Technical Service Group (John Rose)
| |----Group Manager, Design Process (Pete Straka)
| |----Manager, Operations Support (Al Erny)
| |----Group Manager, Process Design Engineering (Dave Thorpe)
| :....Personnel Manager (Willow Shire)
| :....Finance Manager (Dick Haslett)

|**VICE PRESIDENT, STORAGE SYSTEMS DEVELOPMENT (Grant Saviers)**
| |
| |----Engineering Manager, SSD Japan (Vince Bastiani)
| |----Tape Product Development, Shrewsbury Host Manager (Dave W. Brown)
| |----Very Small/Small Disk Product Development (Paul Bauer)
| |----Advanced Technology and Storage Components (Mike Riggle)
| |----Central Staff/Operations (Bob Flynn)
| |----Medium/Large Disks and Subsystem Product Dev. (Tom Burniece)
| |----SSD/EPIP, Special Projects (Jim Lacey)
| |....Personnel (Lee Hayes)
| |....Finance (Ed Sawyer)
| |----Electronic Storage Development, Group Manager (Pete van Roekens)
| |----Japanese R & D Center (Tom Kobayashi)

|
|**GROUP PERSONNEL MANAGER, ENGINEERING/MANUFACTURING (Larry Bornstein)**

|
|**CORPORATE PRODUCT MANAGEMENT (Rick Corben)**
|
|**ENGINEERING FINANCE GROUP CONTROLLER (Joe Reilly)**

GB5.2

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|   |   |   |   |   |   |   |
| d | i | g | i | t | a | l |        i n t e r o f f i c e
|   |   |   |   |   |   |   |          m e m o r a n d u m
+---------------------------+
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SUBJ: **Organizational Goals and Constraints**

TO: OOD

Date: 10/14/80 Tue 11:55
From: Gordon Bell
Dept: OOD
MS: ML12-1/A51 Ext: 223-2236
EMS: @CORE

October 12, 1980 sent via EMS at 9+pm

Engineering Organization Goals and Constraints (10/14/80-GB)

General Principles of Organization Design

NG. Broadening or narrowing the organization
G.
Minimize # of organizational changes
G.
Minimize # of buyer/seller, matrixed based, and joint planning interfaces within engineering.
C.
Sole buyers of a given function should absorb the function
G.
Dominant buyers shall become main, planning (checking inteface) and preferably become service supplier to other PDE groups
G.

Minimize # of interfaces to marketing groups (buyers) for what is viewed by customer as fundamentally a single system (eg. Comet, VMS, disks, comm., database, Hydra, TP, etc.)

G.

Directly align hardware based systems with Mfg. as 1:1, versus 1:e, m:1, or e:m

G.

Minimize # of projects which have multiple uses

G.

Minimize # of programs (program is set of multiply dependent projects)

C.

All organizational principles adhered to in changes at the current level being addressed are transitive. That is, the next level should be able to use the same segmentation and design principles.

G.

Minimum # of sites for a given manager.

C.

No movement of workers.

General Engineering Related

G.

Maximize autonomy of product development groups (PDE), with minimum involvement of Office of Engineering (OE) groups.

C.

Minimize changes in high end where we are technologically most vulnerable and need greatest focus for long term

G.

Have a structure which supports the constantly evolving hardware changes in MOS, bipolar and ECL, with clearly identified responsibility for competitiveness at the base hardware (NOT SYSTEMS) level. Explictly understand how a broad organization structure will provide competitive base hardware. Recall our success is by providing both competitive hardware and software.

C.

Place all PDE expenses within PDE, versus OE allocations

C.

Do not add organization structure (overhead) over existing structure.

C.

Architecture with implementation groups.

Specific Projects and Programs

C.

Mass storage is supplier to hardware systems groups

C.

Semiconductor and Physcial Interconnect group are suppliers to hardware groups

C.

Provide clean structure for Terminals and TBS's, with minimum # of exptraneous functions

G.

Provide for the following explicit products and programs: Hydra, Comm. hardware, and Interconnect, PVAX, Office, and Applications (for Computer Products, Commercial and Technical)

C.

Design organization that supports the product strategy with clear alignment of responsiblity for various parts.

G.

Support product strategy by aligning parts with clear assignment to organization.

C.

Maintain standards and human interfaces across DEC supplies for files, languages, networks.

Address Current and Potential Overlaps

G.

Minimize hassle through organization to identify conflicts of: 8/11, 11Q/11U, 11/11, 11/VAX-11 co-existence, 32/36 co-existence.

GB1.S7.35
00 BURT DECGRAM ACCEPTED S 26687 O 38 29-MAR-81 20:49:55

****
* d i g i t a l *
****

TO: GROUP VP COMMITTEE: DATE: SUN 29 MAR 1981
20:43 EST
TED JOHNSON FROM: GORDON BELL
cc: MARY JANE FORBES DEPT: ENG STAFF
KEN OLSEN EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: COMMENTS ON WHAT AN ORGANIZATIONAL CHANGE MIGHT LOOK LIKE

Mary Jane will send around a memo which I suggested an eng./mfg./mkting segmentation (7/13/80) which we discussed at our July woods meeting. In essence, it was based on a level of integration approach. Semis, Pkg/pwr/physical/interconnect become technogy suppliers and are mfg.+eng. Mass storage is the same, except that it might also contain a product line to sell mass store products (I still believe in this). Similarly, the micrsos goroup would be at this level and be a combined group with both modules and probably now including the all the 11 systems as the next, competitve round are all based around the modules and semis.

Computing terminals, and dumb terminals would be a combined mfg./eng./mkt. group. All VAX systems would be a group, but containing NO mkting. The 36-bit is already a contained P/L. The office products group would be as is, but with product marketing support so that all product lines would sell office products.

It is even more essential to have a much better focus on

building
systems between the engineering and manufacturing groups.
Jake
quoted a figure of 3K to install a 30K system. The
responsibility
for this is spread all over manufacturing
and there is no way to get product design cost and focus
cause
the cpu and system manufacturing worlds are totally bent on
satisfying the 18 p/l's ... and the best way to satisfy
them is to have an incredible inventory, backed up
by an army of clerks. If you look now at Salem ad WM, there
is no mfg there, only clerks talking to one another and
swapping and communicating with P/L's. (If we establish
one more Group VP, or P/L, I believe we can safely predict
the
total demise of DEC as it consumes itself in communication.
(Can we have a Woods in Salem or WM and look at the
floor space now devoted to building?)

The stores would become part of the sales channel, and word
processing would be either part of market support in existing
P/L's or part of applications development as we know it now.

I think we should have learned something from our rpg and
wps p/l episodes:

.P/L, engineering, or any other type of group (especially a
new group vp level type group are costly as hell... I make it
about 10M or so just to have all the interfaces to the rest
of
the company (Rose Ann's 36-bit p/l is supposedly going to
cost 8m for example). These costs are more than the group
cost, it includes all the interfaces and inefficiencies of
the rest of the functions that now have to interface
with it. Therefore, I don't see having any more mkting group
vps.

.rpg, even with the best of products may not be viable.
Personally,
I continue to swear by a two tear market structure where
the tiers are seperate organizations and benefit by

the entrepeneurial drive of the small business person!
I don't think we have any particular knowledge about retailing that we could successfully build a channel like this.

.wps has a similar problem. To be successful, I believe we have to spend a fair amount in the product and manfacturing space. In doing this, it means that there is no way a start up product line can get the sales people and volume to make it. NOW WE ARE FACED WITH A BIG PROBLEM... WHAT ARE WPS AND WHAT ARE THE the other P/L's GOING TO SELL? Either we keep the P/L, lose money and the market or we figure out how to move the wps products through all channels. Frankly, I didn't work so hard to get a developement group so that we could get only 100M sales here. Given the spending of about 10M/year and the rule that product specific spending is about 1-2% for successful products, then we should be pulling about 500M to 1B out of this market per year!

(Buzz is good and the people are dedicated, but the channel is a straw and we need a fire hose!!!)
It is really crazy to talk about having a group vp who is going to run the office products, cause, as we know it, this implies selling through sales folks. I don't think any P/L is going to give up their sales folks, ergo, there's no way a group like this is going to be formed and make it. I see no way other than to consider office products as a new, fundamental product where every product group is encouraged (even required) to sell it. WPS could be effective as a P/L or not, depending on our leadership (or lack of it). (Did we learn anything from the time we had a distributed processing P/L?)

[The irony of our allocation process is that there is no way we can ever enter a new business without starting up a product line to lose money so that we can get the product done. Unfortunately, the baggage of spending to market before the product is there is costly and stupid. Yet, given our organization and behavior, this is the only way!!! Some of the folks who went to business school should of warned us about this logical inconsistency.]

You would think that any group could propose a new product area like wps that we could invest in in an incremental fashion, but since we have a product/marketing coupling scheme that is aimed at keeping our existing business strong, tthere is no way that the new product can be formed without this circuitous, costly and crazy route.

GB2.S5.33
00 BURT DECGRAM ACCEPTED S 20589 O 45 13-SEP-80 18:35:35

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* d i g i t a l *

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TO: see "TO" DISTRIBUTION
DATE: SAT 13 SEP 1980 6:28 PM EDT

FROM: GORDON BELL

cc: KEN OLSEN
DEPT: OOD

EXT: 223-2236

LOC/MAIL STOP: ML12-1/A51

SUBJECT: AN EXPERIMENT TO REDUCE HASSLE AND CLARIFY INTERFACES

Am glad for the attached, comments by Dick. Allow me to comment.

I don't really agree with Dick in toto. His view, too much optimization and too much formality and ties with other groups.

My view, no explicit formality, anyone can comment and stop. Designers can meet virtually all the goals and constraints of a design, it is rarely that they ever write them down. Hence, people have no confidence in what they are going to build, therefore probe em so as to find out what's happening. We are all pretty frustrated. Our consensus style, our DEC right to be open and to be allowed to comment on anything, and the formalization of these rights into a set of processes where everyone must (or feels they must) participate in every decision is the final blow. I don't want to change these rights, but I do want to change how we engineer and what processes we use. I also want to place a lot more freedom to act back to the line development managers. They are the ones who we reward and penalize for our products ... somehow we've forgotten this. (This means they should worry, like Dick is, how they want to accept inputs and how they propose and are reviewed, and then they implement.)

Given all this, please let me make this clear: I don't want to change a thing about our processes or how we design... YET! I want to watch a couple of small groups and "help" them in such a way that I am not the bottleneck or approver. (I especially want to make sure they get some time to design by limiting their outside participation.)

-

WHAT CAN WE DO BEFORE WE GET ORGANIZED?

Therefore, I view it as an experiment (that incidentally has to succeed), and that if successful will be installed in every part of what is now one of the biggest bureaucracies outside of the federal or state government. The intent is get back to the DEC rule:

He who proposes, Does!

Consider these corollaries, on which I would like feedback:

If someone is to propose and do, then let'em.

If your want a proposal, then ask for one.

No committees or groups (outside of direct line staff groups) are allowed to propose... cause there's no one to do.

What you propose, will be reviewed... probably more than you want. Anyone is free to comment, as such there should be open flow of information, subject to need to know.

If you have inputs, then make 'em, but not such that the proposer/ doers are going to spend all their time responding instead of doing. If you've got no power by position, then there's a high risk of being ignored unless the ideas are good. If you have power by position, recognize you can stop and/or disrupt work easily.

If you are doing, then recognize that there are a lot of good inputs out there (and a lot of bad ones too), therefore, get set to handle input 'cause you probably can't live, nor should you live in this "suggestion-rich ... opinion-rich environment" without drowning in input.

If you are doing, and are part of a group (or team I hope) then you can get a hell of a lot more done by thinking by yourself most of the time, and occasionally with one or two other persons. The main reason to meet is to agree on interfaces and to review ideas and occasionally brainstorm if you're idea poor that day.

If you are part of a group of more than one, then allow me to hypothesize (and I believe I can prove it by numerous examples) that someone has to act as leader (ty-breaker... if you will)

Given that groups need leaders (probably cause I'm old fashioned) then ideally (but not necessarily, I suspect) the leader knows every aspect of the design! (This is only if you want to produce a great product (versus a mediocre one or one that a renegade committee specified or designed for you to build.)

If you really want to specify what a product is and how it is built, then be part of an engineering group. (Engineers build.)

If you want to posit, or gather inputs for, a desirable product or want to explain a product so that someone can buy it, or analyze the total financial aspects of the product, then be part of product management or marketing.

HOW DID WE GET WHERE WE ARE? MY VIEW:

A whole gang of people have gotten into the act to discuss and review plans that are cast or in some cases can not be cast because there is no one who has enough knowledge to even propose a rational course of action. I have just witnessed this later condition where an exceedingly large gang took over the definition of what a product was to be, when it was to be shipped and what the development cost was to be ... even before a single implementor came on the scene. There is no way to build a product like this, cause the person who we ultimately measure (ie the builders) had absolutely no say in it, or even if it were possible to be built. For starters, we are going to stop this nonsense (by senior engineering management).

In the case of what we are doing in a project in which I am involved as a consultant, we are not setting up to reject input or output or make them beyond review or approval, but we are setting up to make these exchanges controlled. There are a few, well defined ports where these exchanges will take place and the developers are off designing and are not obligated to have to answer to anybody on any question or to attend extraneous meetings. Whether they build or not, will be subject to whether they pass their reviews with a quality looking product. These reviews will also be the times when we make some of the hard trade-offs.

The software group is acting under a set of goals and constraints which will be reviewed at large, ad nauseum perhaps, but the guidelines for the design will be clear. They will publish the design at well defined intervals and will accept inputs then too, and will go through the review processes. The management part of the project, as opposed to the detailed architectural design and implementation group, is dedicated to making the product (and project) work. The project management part is concerned with dealing with other groups like advanced development, (which must focus on getting technical answers to problems the development group needs answered as opposed to being inner directed), marketing requirements, and gathering data that may be relevant to design decisions. We have operated for a week with only about 1/2 day of formal meetings with the outside, and the intent is to get this time down to 1/2 day per 2 weeks where there is a formal interaction. Furthermore, all the people work (hard) every day and don't go to other meetings or interact with all the other groups. As a comment, the management group, largely directed at working with other groups seems awfully large, but clearly necessary cause there appear to be numerous, necessary interfaces.

-

I don't see why all groups don't decide to operate this way, although I would argue for minimizing the interfaces to externalities. In particular it is interesting to note that several groups where there is absolutely no reason to have any other interaction, have figured out how to structure their lives so that all they do is meet. In one project, for example, not related to a shippable product, the group is able to churn itself in such a fashion as to produce no visible output in any well defined or structured way. (This one is because it is probably too large and leaderless and they have figured out that by meeting all the time they don't have to produce a plan, ot a product or anything.) They are frustrated too because the DEC culture has a lot of hassle according to all the rumours, so given that they don't have anyone outside to hassle with, or approve or review or interact with, they have produced a microcosm which is self-hassling and self-meeting generated.

-

Note, I am only slightly frustrated on this and I am not meaning to add to everyone else's frustration by talking about it. Instead of being frustrated, I am elated at being very near a few products and seeing very bright people who know how to design and will produce, given half a chance. (There are some depressing cases too where the groups are large, have some bright people, but have no record of ever having produced much. These too are ok, because all that's needed is a smaller a size and some leadership.)

How about it folks, want to speculate on the subject?

I trust you'll exercise your rights to voice opinion.

"TO" DISTRIBUTION:

DAVE CUTLER	BOB DALEY	BILL HEFFNER
BILL KEATING	ALAN KOTOK	OOD:
DICK SNYDER	BRUCE STEWART	BILL STRECKER

ATTACHED: MEMO;41

****

* d i g i t a l *

****

TO: GORDON BELL   DATE: FRI 12 SEP 1980 7:11 AM EDT

FROM: DICK SNYDER

DEPT: 10/20 SFTWR CORP LANG

EXT: 231-5062

LOC/MAIL STOP: MR1-2/E37

SUBJECT: RE: RE: OFIS ARCHITECTURE COUPLING

Just a note on your pss in your memo. YOu like the idea of a small group going off to do something. It struck a chord in me. I have been observing an increasing level of frustration at least in Software Engineering. IN part it is due to the need to optimize in every direction (i.e., make it good but be sure to be compatible with the other 10 groups out there and by the way make sure that CSSE and others have their oar in the water). It seems to me that Engineering has grown so large so fast over the past several years (that 20% exponential growth in SWE gets big fast) that we have to face up to a decision.

We can't optimize along every dimension very well anymore (if we ever could). IN the past we merely applied more energy and more meetings

and the probme went away. Si's giant flowchart of how SPU's and the

whole funding process is supposed to work is a good picture of

the complexity. Seems to me we are at a decision point. We either

opt for the small team approach where the primary constraint

is do something well and we relax the "listen to the world and

microoptimize for every interest group" constraint (means we

will probably develop some good but not terribly compatible

products or we will have to train our management to be a lot

smarter and a lot more top-down to allow us to continue to

try to optimize everything and still ship something.

My opbservation is that these guys in the small group that McKenzie

is running are happy as hell because they are going to be allowed

to have some of the constraints relaxed which means they probably

feel like they can succeed.

GB1.S7.4

****
* d i g i t a l *
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TO: ENG STAFF:
10:12 AM EST

cc: OFFICERS:
OPERATIONS COMMITTEE:

DATE: MON 5 APR 1982

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: ENGINEERING ORGANIZATIONAL CHANGE

We are taking the next step in the evolution of the Engineering organization. The increasing size and complexity of Engineering requires that we shift our focus to four separate product groups who will report to Jack Smith and me.

TECHNOLOGY, TERMINALS AND SMALL SYSTEMS - Jack Smith, responsible for:

- The Technology Groups - Jeff Kalb managing the LSI Group and Don Metzger managing the PTD and TOP's Group consisting of Will Thompson and John Holman
- PDP-11, Terminals and Workstations Groups consisting of Mike Gutman, Bill Avery, George Champine and Walt Hanstein

STORAGE SYSTEMS - Storage Systems will continue with its present charter under Grant Saviers.

SYSTEMS AND COMMUNICATIONS - Bill Johnson will be responsible for a newly formed group of the 32-bit, 36- bit and distributed systems consisting of Bill Demmer, Ulf Fagerquist and Bernie Lacroute. The present Software engineering organization will continue to report to Bill Johnson.

TECHNICAL DIRECTOR AND RESEARCH - Sam Fuller will work with me to help the groups achieve autonomy within the constraints of our highly compatible computers and product strategy. Each group will have adequate resources for advanced development and architecture.

We believe this change will strengthen Digital in several ways:

. By identifying these four groups for decision making, we enhance the probability that the issues will be addressed expeditiously.

. This clear segmentation of responsibility will position us to interact and link more effectively with our counterparts in manufacturing and marketing.

. In addition, corporate functional managers will have closer, more direct links to the individual Engineering Product Groups.

While it is our intent to decentralize the operating focus, Engineering must and will continue to be an interdependent organization. We are committed to the development of a quality organization and our people are the most vital ingredient in this effort. Success will require your enthusiastic support through this evolution.

GB3.S4.41
00 BURT DECGRAM ACCEPTED S 27752 O 428 22-SEP-80 19:52:12

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* d i g i t a l *
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TO: OOD:

DATE: MON 22 SEP 1980 6:06 PM EDT

FROM: GORDON BELL
DEPT: OOD
EXT: 223-2236

LOC/MAIL STOP: ML12-1/A51

SUBJECT: ENGINEERING ORGANIZATION THOUGHTS, PLS COMMENT

We hope the evening meeting this week will focus on goals and constraints and the problems we might try to solve with a changing engineering organization. Between now and the October meeting, we would like to further refine these so that it can be a working meeting where we finally resolve.

-32-bit. VMS direction and conflict resolution, HYDRA priorities, Personal VAX, Systems control, M/E alignment,

-Terminal/Terminal based systems. Hardware, Operating System(s), applications and market interface

-36/32 coexistence.

-Communications, networks and Interconnect program. More intense effort, including connection with terminals

-16-bit. We can organize to go to VAX, or alternatively we can end up with more 11's. EBOD direction was positive on minimizing 11's and we should support them with an organization.

-Semiconductor and Physical Interconnect orientation. We need technical leadership in both areas. Semis also require segmentation in order to support the various systems, by size.

-Applications and Office Products organization. The office is generic (across all markets and products) and we need

leadership
by size and market. Currently this is the P/L domain and we must
help structure it.

-Product, Program, Market and System Manager clear definition and
work following the organization

-Less staff work with movement of responsibility and work back
to the Product Development Engineering (PDE) groups versus Office
of Engineering (OE) groups. This includes all areas: finance,
personnel, operations, administration, technical, tops, etc. We
have to minimize the transactions that require a lot of
negotiations (eg. $2K contracts) and only cross fund efforts of
one person or so.

-Clean coupling with manufacturing in a true 2 x 2. Ken wants to
see this n x n, including Product Management, Field Service,
Software Support,etc. Our first priority is to get the proper
alignment with the manufacturing organization!

-There are two dichotomies: a larger (wider, in span of control)
Engineering organization, vis a vis what one might infer from
assigning each of the focusses to a unique individual; and
smaller organization (fewer PDE groups) along the lines spelled
out by manufacturing. We need to discuss this.

-Overall, we must have substantially clearer charters with
well-defined interfaces, and hopefully a minimum of these
interfaces both within Engineering and between Engineering and
the rest of the Product Lines. For example, we should be

able to
structure the organization whereby the system groups only interact with the product lines (versus Mass storage, semis, physical interconnect, comm/net/interconnect, and software).

Would each of you write down the thoughts you have on this?

What do we want to accomplish in our organizational tuning?

What are some ways we might restructure to make engineering management much easier to do?

GB1.S7.17

GB3.S1.48

There's an AMA organization chart book that shows that most businesses are very wide in terms of both divisional/functional reporting relationships. Although this may not be bad per se, it seems to me that it may be symptomatic of an out of control phenomenon and growing incompetence. I believe wide organizaions are fundamentally mainly American, because we all want to be nice guys and have direct control, although our European organization shares the same desire. On the other hand, CDC uses a deep pyramid of VPs housed in a 14 story executive building to get wide fanout to its working parts. Organization theory texts recommend a width of 5-8. Smaller widths turn out to be families and cluby, while wide organizations seem to become anarchies with no real way to operate in any kind of coherent or collaborative way. Certainly there's little reason to have any kind of boss in a very wide organization--either because there's no time to interact, or the staff groups are doing the bossing.

Digital both at the OC level, and within various organizations, seems to have evolved to a very wide organization with relatively low measured productivity (NOR/person) because we make much of what we sell. Also, we have the standard motivations of power based on organizational size and position. We also evolve larger by wanting what we think is the direct control that comes from ownership instead of subcontracting to someone. Engineering has evolved to be the widest organization, and similarly each PEG organization has become increasingly wide. Our rationale is to have high product visibility of our very broad product set. Larry and I've attempted to cope with the width by two techniques:

.
Focussing on PEG as the line organization responsible for the total output of the organization. Hopefully we, however, focused on the output. This allows some meetings to be reasonably small and productive.

.
Providing each of you 2 bosses for administration and product development functions. This means that there's a mix of interaction required among us, depending on the issue.

The reasons why we seem to build wide organizations include:

0.
We simply like the interaction with a particular individual. Or, we believe they must interact with us for some historical or idiosyncratic reason. We're afraid they won't be properly managed by a subordinate.

1.
Every PEG member has a number of projects and the desire may be to have a high level reporting relationship to give the project visibility, get understanding and power.

2.
The fact that we don't want to say no to anyone who might, for some good reason, report to us. Similarly, we believe we need the information and resulting clout of another direct report to help manage. (Perhaps, because we don't trust the line individuals.)

3.
There are common, centralizable service and support

functions that can be grouped to reduce or improve overall effort.

4. We're matrixed by other groups (finance and personnel) and go on to matrix these at every level. Note, this has been the rationale for why an individual can have 2, 3, or more bosses. We've only gotten to 2, despite pleas for 3.

5. We have co-team members, which together constitute a complete product business unit. These include marketing, field service, and manufacturing. In effect this is a product divisional cut at Digital's functional organization without a head.

6. We create a function that requires matrix co-ordination at PEG-level (eg. administration, space, computing, operations).

7. There is coordination required for our product strategy, requiring more help.

8. We want consistency across many dimensions. This requires many people to manage this.

I'm concerned that wider organizations perform poorly because:

1. There's lessened communication between levels.

2. In the spirit of team building, or because of individual interest, competence, or incompetence between levels, work gets smeared over several members. The result is lost time as we all work an issue.

3.

The organizational goal, in our case product development, is diminished by the supporting team member goals and processes, e.g., college hires, IDP, product accounting, control, space, the planning process. All of these problems are important and have to be handled, but somehow we've let the collection rise to the top above our basic product development.

4.

The goals of the individual development manager, whether it be me, a PEG manager, or one of your development managers becomes muddy. It shouldn't be: Our goal is to develop products -- this means we have to understand the products and the designers who build them. This also means we have to know these critical designers and how to help them. We can't have a situation where I know these people better than you do (although, there will be cases). To a first approximation, I believe all direct reports require an equal amount of time (if you take GB/LP together, then each Eng. Staff member has interacted about 2 X 1/18 or 1/9 with the head of engineering). Clearly, neither of us could have managed such a wide organization alone.

5.

We don't get the necessary PEG work done because of the large group size. In PEG work, the issues are: common products (e.g., Ethernet, services, the overall product strategy) and processes that cross at least half the organizations. It's a waste to use meetings to manage individuals by flogging or conflict. PEG will be used to evaluate products: in a critical fashion by peers.

(I'm getting very leary of the notion of team building and teamwork because our work is basically segmented to individuals who simply have a job to do. Often teamness means not putting up blocks, or calling time to ask'em/tell'em where to go.)

6. There are simply more people.

These are just some thoughts that have been forming over the last few months, aided by numerous discussions, Venus experience, observations and some of Ken's memos on management.

What you think?

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I believe this is mainly American, because we all want to be nice guys, although our European organization shares the same desire. On the other hand, CDC uses a deep pyramid of VPs housed in a 14 story executive building to get wide fanout to its working parts. Organization theory texts recommend a width of 5-8. Smaller widths turn out to be families and cluby, while wide organizations seem to become anarchies with no real way to operate in any kind of coherent or collaborative way. Certainly there's little reason to have any kind of boss in a very wide organization - either because there's no time to interact, or the staff groups are doing the bossing.

Digital seems to have both at the OC level, and within various organizations, evolved to a very wide organization with relatively low measured productivity (NOR/person) because we make so much of what we sell. Also, we have the standard motivations of power based on organizational size and position. We also evolve larger by wanting what we think is the direct control that comes from ownership instead of subcontracting to someone. Engineering, has evolved to be about the broadest organization, and similarly each PEG organization has become increasingly wide. Our rationale is to have high product visibility of our very broad product set. Larry and I've attempted to cope with the width by two techniques:

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2.

The fact that we don't want to say no to anyone who might, for some good reason, report to us <?>. Similarly, we believe we need the information and resulting clout of another direct report to help manage. (Perhpas, we don't trust the line individuals.)

3.

There are service and support functions that can be grouped to reduce overall effort.

4.

We're matrix coordinated by external groups (Personnel and Finance) and feel we must matrix these at every level. Note, this has been the rationale for why an individual can have 2, 3, or up to 5 bosses. To my knowledge we've only gotten to 2, despite pleas for 3.

5.

We have co-team members, which together constitute complete product business units. These include

Marketing, Field Service, and Manufacturing. In effect this is a product divisional cut at Digital's functional organization.

6. We create a function that requires matrix co-ordination at PEG-level (administration, including space, computing, and operations).

7. There is coordination required for our product strategy, requiring more help.

I'm concerned that wider organizations perform poorly because:

1. There's lessened communication between levels.

2. In the spirit of team building, or because of individual interest, competence, skill or incompetence, work (such as space planning) tends to get smeared over several members. The result is lots of lost time.

3. The organizational goal, in our case product development, is diminished by the supporting team member goals and processes, e.g., college hires, IDP, product accounting, control, space, the planning process. All of these problems are important and have to be handled, but somehow we've let the collection rise to the top above our basic product development.

4. The goals of the individual development manager, whether it be me, a PEG manager, or one of your development managers becomes muddy. It shouldn't be: Our goal is to develop products -- this means we have to understand the products and the designers who build them. This also means we have to know these critical

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We don't get the necessary PEG work done because of the large group size.

I'm getting very leary of the notion of team building and teamwork because our work is basically segmented to individuals who simply have a job to do. There's no question of "teamness" because they have all the players, and the only thing we can do is cheer them as they run down the field! Often teamness means not butting up blocks, or calling time to ask'em/tel'em where to go. In the PEG world, the issues are: common products (e.g., Ethernet, services the overall product strategy) and processes that cross at least organizations. It's a waste to use meetings to manage individuals by flogging or pain conflict. PEG will be used to evaluate products in a critical fashion by peers.

****
* d i g i t a l *
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TO: ENG STAFF: DATE: SUN 14 JUN 1981
18:13 EST

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: SOME THOUGHTS ON CONTINUED ORGANIZATIONAL CLEAN-UP

As one of the diletantes in engineering, I am wondering whether we should only just have one? And I worry about me... cause I want to understand all products.

It seems we are spreading our basic products among more and more persons. Furthermore, projects are being managed and staffed with part-time persons-- a practice that is marginal at best. The result is that our whole management chain is defocused and has little or no understanding of the projects or products they manage, because the set is too broad. The only justification for this organization is because of the need for standards. Here, it seems to work for languages and other layered products, but this is the only area where it feels justified.

I'd like to see each part of your organization that is oriented to projects report as high as possible in your organization. Also, I believe we need increased project focus (versus level of effort) so that we can simply evaluate our output. Here, a project can be a product, a cad tool, 6 more nodes on the engineering network, the elmination of Journal vouchers, a One Week Turn Around Process for PWB's, etc. The point is that there is a resulting output, and a doneness criterion!

Several of our most recent project disasters have been caused by the burying of projects well below your level and you have not had the slightest idea of the disaster nor do you understand the product details. This is unacceptable.

It is vital that every product engineering manager understand the competitive situation in his product arena together with the status of every project he manages. Can we make the necessary changes to do this? Larry and I will be making several suggestions too!

GB2.S6.70

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Subject: Thoughts On An Associate Head of OOD

To: File

Date: April 18, 1979
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

I would like help in running OOD in order to free time that I might devote to working on more detailed implementation of the product strategy. In addition to the associate head, I would also like to leave the Operations Part in tact, to appoint a permanent secretary to OOD who would help in following up on dangling details, and most importantly, add the Product Manager Manager, as a supervisor for the Senior Product Managers. This would mean that OOD would consist of:

Me/the associate head/the permanent secretary

Operations (Personnel, Space, Finance, Central Svcs, EDP)

Technical Director (Arch., Tools, Diagnostics)

Product Manager-Manager

Manufacturing Interface (LSI and/or Mfg.)

Industrial Design, Packaging, Power and Systems Testing

Mass Storage and Semiconductor Memories

MOS CPU's, Small Systems and Terminals

Mid Range Systems, VAX Architecture and Interconnection & Networks

Large Systems

Software

In the next year, I believe the main things to be accomplished are to make the various groups more autonomous, minimize their interaction with each other and with any central support structure. They must be independent to a large degree, but yet we have to have the architecture in place so that the pieces they build work together when necessary. To me this means a central function which co-ordinates their plans, helps them resolve border conflicts across size, across technology, and across hardware and software.

Some of the issues I'd like help with:

Building a much better management system which includes
Long range planning
Control with Auditing
Making organizational structure changes (eg. better HW/SW integration)
Installing and repairing various processes (eg. EBOD, and especially moving from
Redbook to a continuous process with a 5 year horizon)
Putting in programs that cross organizational boundries (eg. DP, RAMP)
Organizational Development and Review
Specific organizational fires
Developing organizational interfaces with manufacturing and P/L's
Helping the Product Manager Manager get installed complete with planning,
and review

GB:swh

January 4, 1979

Lars Ortegren
Counselor,
Office of Science and Technology
Swedish Embassy
600 New Hampshire Avenue, N.W.
Washington, D. C. 20037

Dear Mr. Ortegren:

Ken Olsen asked me to reply to your letter of December 7, 1978. Enclosed is a book about the engineering of our computers and reprints of articles where we've discussed the subject of innovation. I look forward to receiving your report.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:ljp
ID#400

CC: Ken Olsen

Enclosure

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Subject: **Our Operating Systems: Can Anyone Else Make A Tree?**

To: ?

Date: 3 JAN 79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

follow up 1/17/79

Having drawn time line relationships of our hardware, software, languages, etc., let me offer the following observations at a time we need to be clear about future extensions to various systems. Since the future product strategy is based on the VAX ISP, there is much concern about whether a single operating system architecture (VMS) can be used over a wide range of system sizes, (single user...multiprocessor, Hydra, network) computing styles (timesharing, batch, real time, transaction processing). This concern is fully justified because:

0. there's no evidence (existence proof) that this has ever been done (e.g., 360, 10, 11);

1. systems are under constant pressure by our users and our own engineers, marketers, and field support people for increases in:

   a. file system;
   b. human interface;
   c. functionality batch, real time, transaction processing, timesharing;
   d. more languages with their implied needs;
   e. performance;
   f. reliability;
   g. distributed processing and network capability;
   h. market-specific functions --

commercial vs. real time.

2. all systems evolve in size 10%-20% per year. Although it is unclear how reliability and performance vary with time, increased sizes can place a higher swapping load.

In figure 1, I've tried to show a tree (taxonomy) of different system types. The basic thesis is that no matter what a system's roots are, they all tend to evolve to have identical functionality (e.g., RT as a single user to have Foreground-Background, and eventually batch when used in commercial environment; D as a real time system evolved to support IAS; M begot much of the IAS functionality and then M+ and SCS with cS an anomaly - as a compatible file-less sub-set; RSTS evolved from a single language timesharing to have batch and multiple languages; both the 10 and 20 operating systems evolved from timesharing to have batch, real time and transaction processing facilities.

We should fully understand what happened in the case of D, IAS, M/S, M+ and SCS in regard to building what I thought were to be a family of user-compatible operating systems.

<u>Possibilities for Family Members</u>

1. A single, time sequence of Fin???? releasees which will automatically have monotonically increased capability and functionality.

2. Subsets can be made by conditional assembly and system building in order to avoid the increases for all users. (E.g., 11M/S relationship). (A single version would be maintained).

3. Subsets can be made by dynamically loading (and/or distributing) the relevant subsets for particular applications.

4. Subsets can be formed both by conditional assembly and dynamic loading. This is perhaps the only way to get the reduced performance, number of processes, reliability needed to build truly <u>smaller</u> systems. I.e., various handlers, policy modules (e.g., schedulers, page management) will either be rewritten or written with conditional assembly to enable the reduced capability versions to be formed. (Multiple versions would occur.)

5. Branches for increased functionality that use common components and provide compatibility with a single user interface.

What Doesn't Work In Developing Compatible Systems

0. Sequential develoopment by independent groupd without explicit compatibility specifications (e.g., 11D - 11 M).

1. Parallel development by two groups, separated by more than one level of management, with the charter to develop two compatible systems (e.g., RT - 11/M).

2. Seeding a new branch through layering, using two independent groups (e.g., M - M+, M - TRAX, M - SCS).

Some Conclusions on VMS

Overall, I have several conclusions:

i. The only compatibility I know of, M/S was done by one group - furthermore we can only have a single VMS group, albeit one with groups working on independent branches.

ii. Taking a common base (e.g., M) will not automatically yield future upward-compatible systems.

iii. A new branch must have explicit compatibility constraints (i.e., a new release can't be both a super-set and a sub-set of the main branch).

iv. A new super-set branch should be identified in terms of specific, extended capability in order to avoid subsequent divergence with main trunk.

v. A sub-set branch must not introduce super-set, incompatibilities unless they go in the main branch.

GB:ljp

Attachment

```
      MANUAL--------            CRAFT---------
      MECHANICAL---ELECTRO-MECHANICAL


CLASS:CALCULA
 ORDER:ANALOG
  FAMILY:FIXED
   GENUS:RULE
    SPECIE:Parallel Rule
           Architect's Rule
           Engineer's Rule
   GENUS:Compass
   GENUS:Protractor
   GENUS:Drawing Instruments

  FAMILY:2-3 PART
   GENUS:GUNTER RULE
    SPECIE:  Gunter Rule
                         Navigator's
```

GENUS:SECTOR
GENUS:SLIDE RULE
SPECIE: Linear
Coggeshall
Four-sided
Circular
Spiral
GENUS:LOCATION-FINDER
SPECIE: Quadrant
Sextant
Octant
Gunnery Sight
GENUS:LINEAR MEASURE
SPECIE: Mileage Reader

FAMILY:MULTIPLE PART
GENUS:AREAL MEASURE
SPECIE: Planimeter
Platometer
GENUS:PROPORTIONAL RECORDER
SPECIE: Pantograph
GENUS:EQUATION SOLVER
SPECIE: Equation Solver
Diff.
Analyzer

??? Telemeter

```
             MANUAL-------CRAFT--------MECHANICAL----
             ELECTROMECHANICAL

CLASS:CALCULA
 ORDER:DIGITAL
  FAMILY:SINGLE REGISTER
   GENUS:BEAD
    SPECIE:Abacus
             Soroban
             Counting Table
             Counting Beads
             Quipu
             Sloty
   GENUS:PASCAL WHEEL
    SPECIE:               Pascal adder
                                       Quixsum
                                       Addometer
                                       See Calculator
    GENUS:PASCAL STRIP
     SPECIE:              Troncet
                                       Exactus
                                       Baby Calculator
                                       B.U.G. Calculator
                                       Bollee
    GENUS:KEYED PASCAL WHEEL
     SPECIE:              Comptometer
                                       Plus
                                       Parmelee
                                       Burroughs

  FAMILY:TWO REGISTER
    GENUS:KEYED WHEEL
     SPECIE:              Burroughs Printing Adding Machine
                                       Allen-Wales Printing
Adding Machine
    GENUS:ROTARY
     SPECIE               American Can

   FAMILY:3-4 REGISTER
    GENUS:STEPPED WHEEL
     SPECIE:              Leibniz Calculator
                                       Thomas Arithmometer
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Tates Arithmometer
Layton Arithmometer

GENUS:AUTOMATIC STEPPED WHEEL
SPECIE: Millionaire

GENUS:ROTARY
SPECIE: Odhner
Baldwin
Brunsviga
Curta
Thales Patent

GENUS:KEYED ROTARY
SPECIE: Monroe
Friden
Marchant

<g>Mr.
<fn>Duane
<i>
<ln>Adams
<sal>Duane
<tel>202-694-5922?
<title>
<co>ARPA
<add>1400 Wilson Boulevard
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<g>Mr.
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<co>Control Data Corp.
<add>2800 E. Old Sharkopee Rd.
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19200 Pruneridge Avenue
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<add>Bldg. 54, Room 115
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<add>Office of Basic Energy Science
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<co>Lawrence Berkeley Labs
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<co>Digital Equipment Corp.
<add>4410 El Camino

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Corporate Technology Center
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<co>Office of Naval Research
<add>Mathematical & Information Science Dept.
800 North Quincy Street
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<co>MIT
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77 Massachusetts Avenue
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<co>AMD - Advanced Micro Devices Inc.
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<g>Mr.
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<co>University of California-Berkeley
<add>Electrical Eng. & Computer Science Dept.
519 Evans Hall
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<co>Stanford University
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<add>Mathematical & Information Science Dept.
800 North Quincy St.
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<ln>Smuda
<sal>Harry
<tel>612-631-7777
<title>
<co>Sperry Univac
<add>2276 Highcrest Drive   MS 4333
<csz>Roseville, MN 55113
<entered>5/24/83
<lst>MCC-TAB
<>

<g>Mr.
<fn>Andy
<i>
<ln>Varadi
<sal>Andy
<tel>
<title>V.P., Technology of Semiconductor Division
<co>National Semiconductor Corporation
<add>2900 Semiconductor Drive
Mail Station D3655
<csz>Santa Clara, CA 95051
<entered>3/25/83
<lst>MCC-TAB
<>

<g>Mr.
<fn>Roger
<i>
<ln>Wagner
<sal>Roger
<tel>
<title>
<co>Control Data Corp.
<add>MEV 03P, 511 Eleven Ave. So.

<csz>Minneapolis, MN 55415
<entered>1/11/83
<lst>AOTF
<>

<g>Mr.
<fn>Larry
<i>
<ln>Walker
<sal>Larry
<tel>(612)631-6511
<title>
<co>Sperry Univac
<add>2276 Highcrest Rd., MS 4702
<csz>St. Paul, MN 55113
<entered>1/11/83
<lst>AOTF
<>

****
* d i g i t a l *
****

TO: KEN OLSEN DATE: SAT 30 MAY 1981
12:30 EST

FROM: GORDON BELL
cc: WIN HINDLE DEPT: ENG STAFF
PETER VAN ROEKENS EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: PROJECT TO DEMONSTRATE QUALITY AND PRODUCTIVITY

I am working in the Venus area to learn about quality and hopefully help demonstrate how it pays off in productivity.

The attached proposal seems like the best way to make the changes, and I hope to get the projects in place this summer to carry them out.

Right now, I'm thinking of a Monday Evening Summer Seminar Series (where all we serve is raw fish) that will have both speakers and case studies by our people on the processes.

Already there has been a positive effect, Will Thompson is establishing the project to get us the 1 week... which may turn out to be more like 4, versus the 8 (with unknown quality).

Also, note, I want to really clamp down on the engineers, as they have gotten unbelievably sloppy as the turn around times have gotten so long. The whole process bootstraps it's way down.

The corporate seminar may be a good place to kick it off, but right now I'm worried about being able to deliver at the intensity that's needed. Pete has had trouble getting any help from the groups to make a commitment on quality and productivity. However, I'm convinced it is the root of our whole future. BJ is the only group doing anything, or has the best understanding. Grant's group also does because of the inherent nature of errors on memories. We aren't limited by the rest of the company here at all.

As one tiny example, to demonstrate how quality and productivity
are correlated, I tried to get the journal voucher system changed
IMMEDIATELY so that we could get some instant productivity for
all our managers, just to show them we do care. So far, there
are no results: the system is apparently so bad and so
ponderous and apparently in the state of being redesigned that we
can't do anything. This is really sad and why it would be nice
to have a corporate focus and understanding about quality and
productivity. We really are fat (excessive= not quality), dumb,
and someone must be happy.

ATTACHED: MEMO;103

****
* d i g i t a l *
****

TO: ENG STAFF:
14:27 EST

DATE: FRI 29 MAY 1981

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: PROPOSED ENGINEERING PROCESS BASED ON QUALITY & PRODUCTIVITY

A project is being organized in LSG to build a one week turnaround for correctly stuffed PWB's from SUDS input. The project crosses several organizations: LSG, LSG-Manufacturing, Physical Interconnect, Semiconductors, etc.

As we start to implement a one week fast turn-around project, the greatest use of capacity and hence, hinderance to turnaround, seems to be the correction of errors that should not exist at a particular stage, especially in design.

Currently it seems we have:

. too many changes on the first pass, indicating an incomplete design which we rush because turnaround is so poor because it's fixing too many errors

. too many passes to get FCS

. too many ECO's

Already it's clear we could change our processes to significantly
improve productivity and turnaround by:

. doing it right first where it's the least costly; and
. checking the output before forwarding the results to the next stage versus having front-end checks at each step (group) to filter for and correct earlier errors.

The steps of the entire process would thus be:

Design Engineering -

. Design using a functional specification and enter design into SUDS
. Check design (logic against functional spec) using either a structural walk-through or separate checking with full sign off by an independent designer or product support or diagnostics or quality organization
. Simulate the design
. Submit test data (topology, DC, AC tests, etc.) for testing final board

Drafting (beginning of one week turnaround) -

. Accept SUDS drawing, for PWB layout, subject to having a correct design with the two sign-offs by designer and design checker
. Layout PWB with guidelines from designer. Accept NO changes at this stage
. Using PWB checking rules, check PWB for manufacturability

. Prepare plot and drill tapes, check tapes and drills against SUDS

Manufacturing -

- . Prepare plot, checking plotter if necessary
- . Build boards
- . Check board continuity against SUDS
- . Burn-in and 100 percent check all IC's
- . Insert chips into PWB and inspect
- . DC test modules
- . AC test modules
- . Send correct module to designer

While these are major changes from how we do things today, I would
like to start now to make them as I see our designs deteriorating
under increasing complexity and module loads. We are hurrying to
submit poor designs because the system is choked correcting designs.

In case of modules made using wirewrap or multiwire, I believe we must
keep the same checking discipline: Design it right, check the design,
build it right, then give it to the designer to verify that his design
was correct! Now we're using these early breadboards to do the
design!! We have to eliminate the old style designs which are done by
wire guns!

Fundamentally, the proposal is simple:

.do it right the first time and check it...otherwise don't go to the
next step; and
.stop building breadboards we know are wrong and will not work and

that have to be changed.

I propose we start this today, and in no case do I expect it to not be
in effect, September 1, 1981!

What do you think?

GB:swh
GB2.S6.20

GB2.S6.54

00 BURT DECGRAM ACCEPTED S 10098 O 203 03-SEP-81 07:54:13

****
* d i g i t a l *
****

TO: BILL AVERY   DATE: THU 3 SEP 1981 7:49 EST

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION   DEPT: ENG STAFF

EXT: 223-2236

LOC/MAIL STOP: ML12-1/A51

SUBJECT: KEN'S ALTERNATIVE MONITOR FOR THE CT

Ken just asked me to have us RELOOK at the CT monitor package BEFORE we commit to the manufacture of it within the next 2 weeks.
Will you establish what this deadline is so that we formally decide (probably at the Operations Committee) what the official
CT monitor package is?

Ken has made several sketches and Dick Gonzales is making a proto of an alternative. Ken would like Dick Schneider to get involved right now so that the package will also be appropriate from an esthetics and human factors viewpoint.

Ken is doing this packaging for the CAT computer AND because I've
constrained us to have only ONE monitor for our next computers
and terminals. We can't continue to blow or resources by massive
redo of electronics and packaging that only add inventory
and get us no new capability... hence I will not let us have many.

Before we get into the packaging redo, we ought to decide on what
is being addressed by redoing the CT package. I want Ken to
respond to this to us all by tonite, but my understanding is:

Make it small so it can fit on a clean desk and will look good.
Make it so it can be used by the professional too, but will be
unobtrusive, yet ergonomically sound
(I'd also argue that we want it small and useable with modular
desk furniture like the Westinghouse or mine. In this regard,
we need some method of mounting the tube so it can be taken off
the desk surface so as to get desk space and further
reduce clutter.)
It should be useable with both the CT and smaller CT (CAT).
It should (not a constraint but a goal) look very similar to the
larger color version that will be part of the next CT.

In this endeavor, I see the following steps:

Bill set the cutoff date.
Ken and everyone else will input goals and constraints (don't
just accept mine above).
You folks propose several alternatives and a recommendation
The OC will decide among the alternatives, based on how it

looks in various applications (You must quickly decide on just
what these are. Are they: clean desk, modular desk, seperate
terminal stand, secretarial desk/table, living room end table?
(In all cases, we have 3 times more cases: stand alone (with the
keyboard), with CT, with a smaller CT box.

Please by Friday evening get the whole design alternatives, end date, and criteria put together.

"CC" DISTRIBUTION:

BARRY JAMES FOLSOM RICHARD GONZALES AVRAM MILLER
KEN OLSEN DICK SCHNEIDER

GB2.S8.30

January 9, 1979

Richard Palais
Professor of Mathematics
Brandeis University
Waltham, MA 02154

Dear Professor Palais:

I've sent your letter on to Jerry Witmore, who's head of our Education Systems Group. They're responsible for supplying the 2020 to AMS. You should work with him in any joint venture. Also, Ulf Fagerquist, head of our Large Systems Engineering Group, would be involved as a supplier, user. I would hope we could work with you as I'm impressed with TEX and would like to bring it in-house. Hence, we also would need an interface to the Versatec.

Let me urge you to consider a computer independent interface by using a simple intermediate computer (LSI-11) and a standard serial interface to the 2020. It would hold the conversion code and drive the plotter. Hence, all programming could be done at the user level. Alternatively, there is a Versatec interface or other standard Unibus interfaces that would probably work. Hence, I see no problem of needing new hardware.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:ljp
ID#412

CC: Ulf Fagerquist
Bob Lane
Bill Segal
Jim Suyo
Jerry Witmore

PAPER COSTS (LAST 10 YEARS)

MAIL	**INCREASING AT 10%/YEAR**
	COSTS $30 MBYTES TO TRANSMIT, 1979)
BOOKS	**INCREASING AT 7%/YEAR**
PERIODICALS	**INCREASING AT 11%/YEAR**

COSTS $1 20/MBYTE (1979)

SHELVES INCREASING 7%/YEAR (WITH INFLATION)

CATALOGING $4/ITEM (1979)

HUMAN INFORMATION PROCESSING IS IMPROVING A FEW $/YEAR, WHILE COSTS ARE INCREASING

GB0005/11

Gordon Bell
Vice President of Engineering, Digital Equipment Corporation
Professor of Computer Science and Electrical Engineering (on leave)
Carnegie-Mellon University

Two highly distinct paths for establishing a national computer industry illustrate the high costs and benefits involved in achieving this goal. The most conventional approach to establishing an industry is manufacturing-directed licensing, starting with components in a bottom-up fashion. The ultimate goal of indigenous design is usually called "forward integration" of standard, components expected to have long life-times. In contrast, for rapidly evolving, or high technologies with short component life times a "top down" oriented user-based approach with the ultimate goal of indigenous design can be categorized as a "backward integration". The computer industry falls into the second category since many rapidly changing disciplines and technologies are required for building and using computers. By initiating a policy based on the second approach a country will not only rapidly establish an appropriate computer, <u>based on international standards</u>, industry but will become self-sufficient quickly, and with less imports than by taking forward integration manufacturing approach.

Backward integration necessitates the selection of one or more standard computer families and may even have a goal of establishing and indigenous architecture and programming language to further control inputs. It is desirable to <u>not</u> segment and control the market by size because emerging distributed processing systems are built more easily from a single general architecture. The adoption of an international "standard" allows rapid take-off in computational ability and is based on four criteria: 1) wide range of applications programs enabling immediate effective use; 2) cost-effectiveness and expandability as shown by various metrics and address space size; 3) availability of a family range from micro- to mainframe computer so that a small number of architectures (hopefully one), maximizes training, permits alternative computing styles to fit various problems, and results in a maximum cumulative learning curve; and 4) compatibility and accessibility through numerous sources of supply for peripheral equipment and software.

The poorest method for establishing a high technology industry is by government sanctioned, local monopolistic companies. For example, a company selected a high cost, non-standard, low performance basically obsolete computer for license from a North American that might have failed except for its exports to its foreign "licensee". This company then promised their government the following three-year, three-stage process: putting together sub-assemblies, and finally building sub-assemblies from imported circuit components under license. After five years, the local "manufacturer" was still importing finished goods, and no progress has been made toward local manufacturing. The computer was fundamentally unable to accomplish most of the tasks that were promised. The local company has a monopoly that has cost the country roughly a factor of two or $34M in balance of payments over the promised commitment and $50M over what could have been accomplished under a policy permitting competition for users and for manufacture. (See Appendix 1) Also, the users have paid a factor of 5.5 times or $400M extra for equipment because user applications, such as programming, maintenance, and operations costs (e.g. power and air conditioning) are several times greater for technically obsolete equipment. Certain applications are not possible, and where possible but not available, effort has to be expanded in doing applications.

Rather than using monopolies to establish industry, a simple policy could help establish local industry: each computer purchased would be approved by the government based on the total import cost prior to duty. The incentives to all would be clear and the system would self adjust rapidly! Alternatively, simple duties of any percentage, would work just as well, no doubt, avoiding bureaucracies, hassle and loss of productivity!

The Ongoing Computer Evolution

The computer has evolved more rapidly than any other man-made object as measured by improved price for a given component or by improved performance at a given price. By either of these measures, the rate of improvement is 20 to 30 percent per year. This means that if a given system at year (t) is 1.0, at year (t+1) it will be 0.8, and at (t+2), 0.64, and (t+3), 0.51. Every 3 years, the price halves. These measures have held constant for 20 years, and do not even take into account inflation. In contrast, nearly all consumer goods, such as automobiles, have increased in price at least an inflationary rate!

By the end of the seventies, computers have become all pervasive including many hardware technologies, some of which have necessarily evolved more rapidly than the normal rate. Major computer components are semiconductors, magnetic recording, conventional electronic sub-assemblies, various printing and xerography, video display, human speech i/o, analog i/o for process control and conventional communications. The software technologies are even broader, ranging from operating systems which administer computers to conventional computer languages in which application systems are written. Since computers can either supplement (and in some cases supplant) every other form of information processing, the almost infinite number of applications require broad technological expertise. Information processing includes all aspects of storage, transmission, switching, control, and processing. The software specialists must know the subject of the application deeply and unambiguously so that it can be made algorithmic and they must know the computer almost as well. In all fields, we continue to see manpower and training as limiting computer use.

Establishing a Computer Industry via the Forward Manufacturing Approach

The conventional manufacturing approach for establishing an industry usually cuts off external supply by sanctioning various firms to operate as monopolies and builds up internal manufacturing via licenses, joint ventures, and favored manufacturers. Only essential components and manufacturing equipment are imported. This approach is most successful when the evolution rate is low (i.e. automobiles, tv sets, radios) or where the ultimate goal is world market domination. However, in either case, the essential first step is the manufacture of all components, raw materials, and in some cases the equipment to manufacture components. For example, even though the Japanese have had the goal to dominate in computer manufacturing for 25 years, until recently they lacked the internal manufacture of critical components (e.g. semiconductors and magnetics) as well as software technology. If Japan, or any other country, starts with the goal of internal computer manufacturing to limit imports, the flow may well become increasingly more negative due to increased reliance on critical outside component and software suppliers. For example, had a country engaged in manufacturing transistorized and MSI based calculators in 1975 with imported semi-conductor components, in 1978 it would be possible to obtain the complete calculator for less than the imported component cost because with each new generation radically different parts are used. In a similar case relating to computers, more imports of raw materials occurred to build expensive disk memories and computer systems that were obsolete on completion. Purchase by??? completion date would have been cheaper since the price halves each 3 years.

Virtually every country that has operated a protected, computer industry (except recently Japan) has paid a significant price in terms of both imports and price to users. Computing with obsolete computers, has cost the country scarce resources to design, apply, and operate. This also defers economic gains of computing and facing critical applications questions. Only the government sanctioned monopolies (often owned by a few individuals) have profited!

Simultaneously establishing the manufacture of the critical base components, test equipment and component manufacturing equipment for a high technology product like computers is probably not feasible. Even manufacture of the lowest technology parts (e.g., printed circuit boards) is hazardous because these components may limit the final product as described in the calculator and computer components examples above. Manufacture of high technology components is generally not feasible because they evolve so rapidly that they do not achieve the learning curve without a significant market; require very high cost plant and equipment which is obsolete at a rapid rate: and require a highly skilled manufacturing engineering base to manage and interface with the design engineers. It's interesting to note that neither state-of-the-art (i.e. cost effectivve or least cost) disks nor semiconductors are manufactured away from their design group.

Since the critical resource for the manufacture and use of computers is educated manpower, their effective allocation has to be central to any effort in establishing a computer industry. If these limited numbers are utilized for manufacture, then there are few left to do the critical systems applications jobs. Reversing the allocation using the skilled manpower to use computers for significant and necessary tasks will lead both to a more rapid computer population and their manufacture locally.

Establishing An Industry By An Indigenous, Local Design

Most attempts to design, produce and sell computers either fail to meet their market and profit objectives or fail to be cost-effective over competitive alternatives. Many U.S. and foreign firms who at one time engaged in manufacture no longer exist in the market. Computers designed for special purpose (e.g. Military) have been shown to be particularly cost ineffective over their standard, commercial counter parts such that the distinction has finally disappeared.

While many of the scenarios described above have particularly poor effects on all aspects of an economy, a local indigenous design is likely to have the worst effect. The temptation is especially great because the art of computer design (architecture) is fascinating. By not adopting and backward integrating, untold resources are required to engage in hardware and software design that could otherwise be applied to implementing computers based on standards, or be applied directly to applications.

Establishing A Computer Industry Via the User-Directed, Backward Integration Manufacturing Approach

A policy that encourages using state-of-the-art computers to be applied in a standards-setting fashion will ultimately result in appropriate local computer manufacture. The selection of the right computer standards is essential, otherwise the situation is exactly what countries that do not have a computer industry fear--manufacturer domination.

It is interesting to note that until Japan adopted the approach of building computers to the IBM standard, its machines were uncompetitive (even in a closed market) and were ultimately withdrawn, requiring user program conversion.

The backward integration path was followed, interfacing with many manufacturers to license computer architecture know-how and hardware technology. Ultimate success occurred by an open market, by using the standard, by engineering near copies, and by its own large internal market. The standards for computer selection are:

1. Maximum range of applicability - germane to evolving applications. Leverage of internal resources can be gained by selecting the most appropriate machine family for the key range of applications.

2. Valuation balancing the conventional metrics for cost, cost/performance, and address size. A trade-off for larger address-space may offset short-term gains in cost-performance with smaller address-space.

3. Large family range of machine models from micro to mainframe. The utilization of one family versus a variety of machine-types maximizes the learning in terms of physical implementations, architecture, and software across all system ranges from the processor-on-a-chip (often called a microcomputer), through dedicated systems for special purpose use (often called a minicomputer) and to a large, shared, central system serving many users and managed by a staff (often called a mainframe). This would help achieve a critical mass of local experts.

4. Be available from numerous suppliers in a "standards-based" fashion. Ideally, each machine in a range would be the "defacto standard" machine. A defact standard has the following characteristics: a large fraction of installed units; well-defined system interfaces that manufacturers, users, and third-party suppliers understand; and many supply sources so that a user can build up systems by assemblying components via numerous fashions.

By using a standards-setting system, one is assured of having the latest models available, alternative competitive sources of supply and a method of intercommunications that has lasted and will last over time since it is understood and used by many different groups.

It is the "standards" approach that provides the method for backward integration into local manufacturing via the following steps.

1. Import complete systems and assign them to critical applications. This will help attract back any computer scientists and engineers attracted by the charisma of exciting problems using state-of-the-art computers who have left the country in what has been called the brain drain. During this period it is important to take advantage of the training systems now developed in North America, Europe, and Japan, just as the Japanese took advantage of these systems when their industry was embryonic.

2. Enlarge applications specialties to include special systems interfaces. Special hardware interfaces could be provided by users, the applications industry, and manufacturers. This would create the base knowledge for the ultimate design and manufacture of computers.

3. User and applications industry would begin to import "standard" alternative manufactured computer options (e.g., memory modules, disks, terminals) to minimize systems costs. Systems would form from components by having local final assembly and testing. By this time a critical teaching and research mass will have been reached at a significant level internally so that the appropriate computer scientists and engineers can be attracted and held. Training, research and development will be primarily nationally based, maintaining the continual need for international cross-fertilization of ideas. However, these critical nationally attained skills are necessary since many computing applications are culture-based.

4. A secondary supplier industry would develop based on both buying lower level components (e.g., integrated circuits,

disk drives) and interfacing to further reduced imports. Computer options would start to be manufactured locally both based on foreign and local designs.

If a user-directed policy were implemented, one might see the beginning of stage two within one or two years, followed rapidly by stage three. Finally local peripheral interface designs marking stage four could occur as early as four years from the time of the policy adoption.

During all periods the number of computers, useful local applications, and most importantly, computer scientists and engineers, who provide a strong intellectual base for the industry, would grow. Simply trying to assemble imported, likely-to-be-obsolete components with the manufacturing-based policy defers the applications that build up a critical mass of manpower, applications, and computers.

Appendix 1 - Case Study of Santioned Monopoly, Free Market Import and Backward Integration Strategies

In one country a sanctioned monopoly was set up to license and manufacture what was basically an obsolete computer. The following analysis of a five year period shows, in principle, the situation. It neglects any user loss of productivity because of poor computers, and any import duties (since the licensee was given duty free status).

Four cases are compared:

1. Monopoly (actual) - no manufacturing was achieved and licensee only imported finished goods.

2. Monopoly (plan) - the monopoly was to have imported finished goods the first year, put together sub-assemblies the second year, and assemble the sub-assemblies from components the third year.

3. Free Market Import - No controls, are assured. The most cost-effective system is imported.

4

. <u>Free Market Import with Backward Integration</u> - Case 3, except a policy which gives preference to minimizing import content is instituted. In the second and third year sub-assemblies are put together locally and in the fourth and fifth years sub-assemblies are built from imported components. The base design can only be changed each two years for new components!

A summary of the results of the four cases using various costs, markups, and market data is described below:

	Total Import (M$)	Local Mfg (M$)	Cost to Users
Monopoly (actual)	78.2	0	488
Monopoly (plan)	44.2	34.0	488
Free Market Import	44.1	0	88
Free Mkt Import with Mfg.	32.0	17.2	83.3

For the study, the market is assured to grow at 50%/year using the following units: 295 (first year, 443, 666, 1000, and 1500 (fifth year).

The following markups for sales and service are assured:

Monopoly (actual)	6.25
Monopoly (plan)	6.25
Free Market Import	2.0
Free Market, Local Assembly	2.5
Free Market Local Assembly and Sub-Assemblies (using imported components)	3.0

It is further assured that the following local content is possible.

Importing Finished Goods	0%
Importing Sub-assemblies	25%
Importing Components	50%

Year Price (Case)	Import Cost/ Unit (K$)	Total Import Cost (M$)	Local Mfg. (M$)	User Price (K$)	Total (M$)
Monopoly (actual)					
1	20	6	0	125	36.9
2	20	8.9	0	125	55.3
3	20	13.3	0	125	83.3
4	20	20	0	125	125
5	20	30	0	125	187.5
		78.2			488.
Monopoly (plan)					
1	20	6	0	125	36.9
2	15	6.6	2.3	125	55.3
3	10	6.7	6.7	125	83.3
4	10	10	10	125	125
5	10	15	15	125	187.5
		44.2	34.		488
Free Market Import					
1	20	6	0	40	11.8
2	16	7.1	0	32	14.2
3	12.8	8.5	0	25.6	17.0
4	10.2	10.2	0	20.4	20.4
5	8.2	12.3	0	16.4	24.6
		44.1	0		88.
Free Market Import With Staged (each two years) Local Manufacture					
1	20	6	0	40	11.8
2	12	5.3	1.8	30	13.3
3	12	8.0	2.7	30	20.
4	5.1	5.1	5.1	15.3	15.3
5	5.1	7.6	7.6	15.3	22.9
		32.0	17.2		83.3

00 BURT DECGRAM ACCEPTED S 28240 O 505 28-AUG-81
22:41:33

****
* d i g i t a l *
****

TO: ANN COURTRIGHT DATE: FRI 28 AUG 1981
22:37 EST

FROM: GORDON BELL
cc: see "CC" DISTRIBUTION
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: RE: ISSCC - J-11 PAPER

NUTS!

Get the project done. Then write it up. It is behind schedule and is likely NOT to pass the ISSCC requirements for a working chip. All that we do is signal that we are TRYING to build a product. A paper on J would be in violation of spirit of ISSCC.

We still haven't shipped a T and now are in our 5th pass. Furthermore, we will have at least 3 more with a major redesign in store if I hear the signs right.

For now, we have too much work in Hudson to do to spend writing.

"CC" DISTRIBUTION:

PATRICK BUFFET	STEVE COLEMAN	JIM CUDMORE
TED JOHNSON	ANDY KNOWLES	SI LYLE
WARD MACKENZIE	JULIUS MARCUS	JACK SHIELDS
STEVE TEICHER	MIKE TITELBAUM	

GB2.S8.34

Two Lieutenants: A Parable on A Parable

In the early days of the year 1979 there was a famous parable about two lieutenants who came back from a meeting with their commanding generals. One transmitted the message to attack a particular hill at 0700. Two got the message that there was dissension among the generals and that there was likely to be bloodshed if said hill were attacked. Two met with his group to plan a way to convince the generals not to attack the hill. The alternative plan would be delivered at 0700.

Here, endeth the first parable

Like any good parable, it is simple and has a message. The following tactical probabilities make other, interesting parables:

1. taking more than one hill, given both groups;
2. taking the hill, given both groups;
3. taking the hill or hills with only one group;
4. annihilation of the groups for the given attack forces;
5. annihilation of the generals' camp.

Furthermore, there are various situational rewards:

1. medals;
2. promotion for results at the hill or hills;
3. getting killed.

And one might believe that Two's troops included sergeants, and possibly women, who would:

1. actually go for the hill, as apparently directed;
2. go back to the generals at 0700;
3. retreat.

The final result of the attack turned out to be:

Lieutenant One's Group was annihilated and he was given a post humous dishonorable discharge.

Lieutenant Two's Group scattered. Some of the professional soldiers sold out as mercenaries, two sergeants were killed (possibly by their own troops) and got big medals, and the rest were captured, soon traded back and went home.

The camp containing the generals was captured while the generals were discussing Number One's bad luck. The general with the most stars escaped and went back from the fighting as chief of staff, bringing with him his promoted assistant, Two.

Moral, aside from being careful about getting involved with

people who fight and about knowing when to run, because parables are as complex as taking hills:
Given a few people and a simple situation, things never turn out to be as simple as one would think beforehand... or, complexity sure can kill a lot of people.

GB0001/11/HOLD

GB0004/14

| d | i | g | i | t | a | l | i n t e r o f f i c e   m e m o r a n d u m

Subject: **Pascal (e.g. UC/SD Type)**

To: Bruce Delagi, MR2-1/M64

CC: Dick Clayton, ML12-2/E71
Bill Johnson, ML12-3/A62
Bill Segal, ML3-5/E82

Date: 7/18/79 Wed
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

follow up 7/27/79

Given our interest and affinity to want Pascal, I fail to see why we're not using one of the many versions for the LA124. It's available on the 8080 and 11, and permits movement of programs (eg. LA124) to Tiny.

Why aren't we using it?

GB:swh

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Bruce Delagi MR2-1/M64

Dick Clayton ML12-2/E71 Bill Johnson ML12-3/A62

Bill Segal ML3-5/E82

```
+---------------------------+                              GB0004/50
|   |   |   |   |   |   |   |
| d | i | g | i | t | a | l |  i n t e r o f f i c e   m e m o r a n d u m
|   |   |   |   |   |   |   |
+---------------------------+
```

Subject: **Pascal Strategy**

To: Ron Brender, ML3-5/E82
Dick Clayton, ML12-2/E71
Bruce Delagi, MR2-1/M64
Don Infante, ML1-4/P14
Bill Johnson, ML12-3/A62
Bill Keating, ML12-3/A62
Si Lyle, MR1-1/M42
Stan Pearson, ML12-2/E71
Gil Steil, ML5-5/E76
Pat White, ML12-3/E51

Susan Azibert, TW/C10
Lois Frampton, ML5-5/E76
Steve Hobbs, TW/C10
Janice Kelso, ML5-5/E76
Leslie Klein, TW/C10

Date: 9/13/79 Thu
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

Follow Up: 9/28/79

Steve Lionel, TW/D08
George Poonen, ML3-2/E41

The strategy looks good, but:

1. Why don't we buy the new OMSI-11 Pascal instead of doing Micro Pascal?

2. Why staff so much on Pascal+ on VAX?

3. How are we going to keep compatibility among the products?

4. How's # 3 doing so far?

5. Will we be able to have Pascal+ be the base for the ADA run time system?

6. Why can't we bring in the current Pascal 11 now from OMSI for use internally (e.g. special LA's, new terminals)?

GB:swh

| d | i | g | i | t | a | l | i n t e r o f f i c e   m e m o r a n d u m

Subject: **Pascal/VAX**

To: Bill Demmer, TW/D19
Larry Portner, ML12-3/A62

CC: Bernie Lacroute, TW/A08
Jerry Witmore, PK3-1/M40

Date: 18 OCT 78
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

follow up 11/1/78

Who's responsible for watching/co-ordinating Pascal on VAX?

How's the project coming?

Can we get them here for a design review?

GB:ljp

October 10, 1978

Mr. Stuart Patterson
National Center for Atmospheric Research
Atmospheric Technology Division
P.O. Box 3000
Boulder, Colorado 80307

Dear Mr. Patterson:

Let me take this opportunity to thank you and your staff at NCAR for the fine hospitality and interaction on the 3rd. It was truly an honor to talk about VAX with such an outstanding group. The trip through the computation center and seeing the Cray 1 was a high point.

It was intriguing to speculate how we might use smaller computers (such as VAX), located within an individual scientific group, to provide similar levels of service (for over 90% of the users) to that obtained with the Cray 1. I hope Dawn can get some benchmarks and understanding of the NCAR user profile from you. Such a system will, of course, exacerbate the need for networking. Here, I hope you might avail yourself of some of the understanding we have of networking within the Denver office and also visit our network group.

In order to really get a better understanding of your future needs, I'd like to get you to write down and present us with various scenarios of how you see the NCAR computation needs developing with time. We could then understand and respond to your needs. Could I ask you to come and present this view some time when you're in the area? This would also be the basis of seeing whether we could help in the network area.

Again, thanks for the hospitality.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:ljp
ID#0290

CC: Bob Anundson
Dawn Boyd
John Mucci

November 26, 1984

Mr. John Payne
National Semiconductor Corporation
2900 Semiconductor Drive
Santa Clara, CA 95051

Dear John:

I'm glad that there is increasing concern about National's future microprocessors. I'll be in the Valley during the week of the 10th of December and hope we can discuss the progress and direction then. I see three critical issues:

1. Get the 332 done and out by May
2. Establish the overall goals and constraints for the 532 project now. Follow this up within a month with a review of the functional specification and high level design. My target, is described below, but may not be aggressive enough.
3. Deciding on a longer term, hardwired architecture, which has 32000 data-type, operating system and language compatiblity to compete with the so called, reduced instruction sets, including MIPS Co.

The 532 described below is needed within two years, in order to be only a year late!

Here's some background data that we might start from:

```
      Machine Implm.  Clock
                                  Ticks/     Speed*   Mips
                      (ns.)  (Mhz) instr.
VAX
750         u       250    4   11         .75    .375
780         up      200    5   10        1.0     .5
8600        u4p      80   12.5  6**      4.2    2.1

32000
32032       userial 100?  10   27         .75    .375
32332                                    1.9
32532       u        30   33   15        4.4    2.2

Risc II     hardwire       83  12        8      2.0      1.0
(1.5)
MIPS Co."   250      4     4   2.0       1.0 (1.5)
```

* Note the 780 is commonly rated at 1 Mips, but actually runs less than 0.5 Mip when averaged over a long period. The rating comes from doubling the number which roughly corresponds to the number of 370 instructions which would have to be executed to do the same work.

** The 8600 (Venus) has a multiple stage pipeline, each of which is very complex to fetch (Ibox), Execute and do floating point. In addition, there's a special interface (Mbox) to interface the cache and memory.

Note the large number of ticks required to interpret the average instructions in the 032. Some recent benchmarks show that the 032 is probably able to keep up to a VAX 750 if you ignore the slow floating point in the 032 and use the same, poor UNIX compilers. I'd like to see the Whetstone numbers you have here.

The 532 above would use a package that would let you get all the 32 bit or possibly 64 bit data and 32 bit addresse lines in and out rapidly. The design should be incredibly simple and brute forced, not piplelined. Note most of the performance comes from the technology (3.3), the other performance gain should come from a 32-bit organization (2) and a wider microprogram control. The MMU should be on chip, like the Microvax chip, in order to avoid the package and handshake delays. I assume this can be done with double level metal, 2 micron CMOS, and most certainly 1.25 micron CMOS. I think it is also crucial to utilize Weitek in your planning to reduce the internal work.

I believe it is possible to build an ECL Risc that's 10-20 times faster than a 780 for programs (but may require 1.5 times the number of instructions) using a 25 mhz clock. This would have about 3-4 ticks per instruction, and could be implemented in CMOS. An article by Jean Yates is enclosed which describes the opportunity of Riscs.

While it is crucial to persue all three paths in parallel I would like to concentrate mostly on the first two on this visit to insure they are on the right track. Then we should explore ways to get a faster architecture.

Sincerely,

Gordon Bell
Chief Technical Officer

CC: Ken Fisher
Randy Parker
Dick Sanguini
Charles Sporck

Enclosure

G BELL SYSTEM PRICE MODEL (3/75)

SYSTEM PRICE ($) PER BYTE OF MAIN MEMORY

$$= 3 \times 5 \times 8 \times .005 \times .79^{t-1972} \times \text{NO. OF BYTES}$$

$$= .6 \times .79^{t-1972} \times \text{NO. OF BYTES}$$

<u>WHERE</u>

3 IS MARKUP (ROUGHLY)

5 IS FRACTION OF SYSTEM IN PRIMARY MEMORY

(TENDING TO BE INAPPROPRIATE BASE VARIABLE)

8 BITS/BYTE

.005 IS COST OF A BIT IN 1972

.79 IS 21% PRICE DECLINE PER YEAR

1972 IS BASE YEAR

SOME SYSTEM PRICES AT VARIOUS TIMES USING THE GB 3/75 MODEL:

BYTES	1978	1980	1982
1	0.146	0.091	0.057
8K	1.2K	745.0	467.0
65K (QBUS LIMIT)	9.6K	5.9K	3.7K
256K (UBUS LIMIT)	28.3K	23.9K	14.9K
1M	153.0K	95.4K	59.8K
2M (11/74 BUS LIMIT)	306.0K	190.8K	119.5K
8M	1,225.0K	763.0K	478.0K

FUTURE DIRECTION IN 1985'S COMPUTING

J BELL MODEL 17 OCT. 1979 [GB]

I. FUNCTIONAL AND PERFORMANCE

SEMICONDUCTOR DENSITY DOUBLES EVERY YEAR.
FUNCTION PROPORTIONAL TO MEMORY SIZE
TERMINAL CAPABILITIES WILL IMPROVE COLOR GRAPHICS, HARDCOPY
VOICE I/O COMMON
PERFORMANCE X3 /5 YEARS [24% YEAR]

II. EASE OF USE

PROGRAMING ENVIRONMENTS WILL GET BETTER (VIA LARGE ADDRESS SPACE)

DIFFERENT TECHNIQUES TO PROGRAM (LESS PROCEDURES)

PROGRAM GENERATIONS

ENGLISH LANGUAGE PROGRAMMING

TEACH BY SHOWING ALA ROBOTS

[NO PROGRAMMING: USE PACKAGES]

III. ACQUISITION COST

. FACTOR OF 3 EVERY 5 YEARS - [20%/YEAR]
. Mp FACTOR OF 10 EVERY 5 YEARS - [37%/YEAR]
. DISKS DECLINE AT SAME RATE AS ?
. MOVE ATTENTION TO PACKAGING AND POWER

IV. OPERATING COSTS

. ATTEND TO POWER AND SERVICING
. HIGHER PAPER COSTS MAY DRIVE TO ONLINE AND VIDEO STORE

V. RELIABILITY (YES - THERE ARE TECHNIQUES)

VI. SERVICEABILITY (REMOTE DIAGNOSIS)

VII. COMPATIBILITY (YES AND FAMILINESS TOO)

THREE RIVERS PERQ

C:=(

Pc (WCS:$3K/4K BYTE; ADDRESS SIZE: 32 BITS; ISP:P-CODE);

Mp (256 KBYTE);

Ms (12 MBYTE);

T (RS232, IEEE 488; SPEECH OUT);

T CRT (8 1/2" X 11", 768 X 1024);

$19,500 DISCOUNT: 30%/100;

OPTIONS:

(Ms(FLOPPY); Ms (24M BYTE)

T(PACKET SWITCH; 10 MB/SEC; $2K)

T(UNIBUS)))

CMU CSD SPICE (PERSONAL SCIENTIFIC COMPUTER) ENVIRONMENT

. SET OF 200 PERSONAL COMPUTERS,

C PERSONAL: = (

(Pc APPROXIMATELY 1 MIP; MICROPROGAM: >16KW;

ADDRESS-SIZE: 30 TO 32 BITS)

Mp (>1 MBYTE)

Ms (100 MBYTE)

T.DISPLAY (RESOLUTION: 1K X 1K; COLOR)

T.CAMERA; T.AUDIO;

PRICE: $\$10K_{1985}$)

. NETWORK: 1 TO 10 MB/SEC

. SHARED FILE SYSTEM INCLUDING VIDEO DISK

. HARD COPY SYSTEM

. SPICE ENVIRONMENT

CMU SPICE ADVANTAGES

1. LARGE, CYCLE-INTENSIVE PROGRAMS CAN BE RUN EFFICIENTLY (NO SWAPPING OF N USERS)

2. MICROCODE TO EACH TASK

3. HIGH RESOLUTION GRAPHICS (PERMITS WORK ON VLSI LAYOUT)

4. NATURAL COMMUNICATION

VOICE AND VIDEO

5. EACH USER HAS A BIG COMPUTER TO SELF

6. RELIABILITY

7. EXTENDABILITY IS REALLY MODULAR

CMU ASSUMES

TIMESHARING IS ENDING

SMALL, HIGH VOLUME SYSTEMS WILL EVOLVE TO BE EMBEDDED IN TERMINAL

NO EVOLUTION OF CENTRAL SYSTEMS TO

SOLVE RESPONSE TIME; PROVIDE MORE; BEST SHARING

PROVIDE DIGITIZED AND RECOGNIZED AUDIO (AT + T FUNCTION?) -

STORE, TRANSMIT AND PROCESS VIDEO

(BECAUSE LOCAL TRANSDUCTION/PROCESSING IS NECESSARY)

<u>CMU SPICE SCENARIOS</u>

1. DOCUMENTATION PRODUCTION INCLUDING <u>ALL</u> FIGURES COMPLETE PAGE LAYOUT

2. PROGRAM DEVELOPMENT USING COLOR, EMACS-LIKE, CO-ORDINATION WITH TEAM/MANAGEMENT

3. PROGRAM DEBUGGING

4. VLSI DESIGN

5. MULTI-MEDIA COMMUNICATION (TEXT, FIGURES, SPEECH)

6. NON-INTRUSIVE COMMUNICATION

7. TELEPHONE ANSWERING SYSTEM

8. INFORMATION DISTRIBUTION

WHAT IS CMU CSD SAYING?

WANT / NEED? MANY MORE CYCLES/SEC; Mp; Ms (CURRENTLY 200 USERS SHARE 2 KA, KL, 3-780'S) TO:

DRIVE MUCH BETTER SCOPES AT FULL DATA RATE (Pc)

EMACS TYPE EDITING (Pc, Mp, Ms)

ABILITY TO MANAGE A TELEPHONE AND VOICE (Pc)

PICTURES (AND GRAPH) STORAGE, TRANSMISSION AND PROCESSING. (Pc, Mp, Ms)

WANT A CENTRAL FACILITY FOR FILES, PRINTING

DON'T SEE A NEED FOR A HIERARCHY OF CAPABILITIES OF PROCESSING

HOW DOES A PERSONAL SYSTEM DIFFER FROM A SHARED ONE?

. TO A USER, NO DIFFERENCE EXCEPT:
CONSTANT RESPONSE TIME
LOTS OF RESOURCES (Pc, Mp, AND Ms) TO THROW AT TERMINAL,
SPEECH, VIDEO

. IS ECONOMY OF SCALE OF WHAT MATTERS DISAPPEARING?
Pc -> 0
Mp -> 0
Ms = CONSTANT; SIZE INCREASES
.ECONOMY OF SCALE
.PERFORMANCE LIMITED BY MECHANISM
T.CRT -> 0
= CONSTANT; SIZE INCREASES
T.COMM = CONSTANT;
= INCREASING; UNAVAILIBILITY
T.LOCAL AREA NETS = ?

. LOTS OF RESEARCH QUESTIONS
MAKES EXPLICIT PROBLEM OF MULTIPLE, NEED TO CO-OPERATE/INTER-COMMUNICATE
DIST. DATA BASES
DIST. PROGRAMS AND PROGRAMMING
INTERFACING OTHER SYSTEMS

. IN SUMMARY
WE ARE TAKING LARGE SYSTEMS PROGRAMS THAT WERE EXECUTABLE ON CENTRAL SYSTEM AND BRINGING THEM DOWN TO OPERATE ON THE MANY INDIVIDUAL- AND GROUP-LEVEL COMPUTERS.

THE DEDICATED PROCESSING WILL PERMIT SYSTEMS TO BE BUILT WE NOW DON'T UNDERSTAND.

MUCH GREATER FOCUS ON:
EASE OF USE

```
.___.___.___.___.___.___.___.
!   !   !   !   !   !   !   !
! d ! i ! g ! i ! t ! a ! l !          I n t e r o f f i c e
M e m o
!___!___!___!___!___!___!___!
```

TO: see "TO" DISTRIBUTION   DATE: FRI 18 FEB 1983
1:19 PM EST

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5191336734

SUBJECT: FOCUS ON A MICROVAX PC

GB4.S1.42

We're driving like crazy to get 1 or 2 significant PC's based on MicroVAX and the Qbus. The first implementation is with Cutler's 2-board MicroVAX.

The options are:

. the disks, including floppy (for loading)

. the connection to an Ethernet and some other net (if necessary)

. Cutler's MicroVAX, followed by MicroVAX chip & board

. Two or Three Crt options:

  . low resolution - probably 15" monitor or CT-compatible screen
  . hi resolution - 19" monitor

. color (simple)

. Board to interface a laser printer to make a print server

We need to go back and address our technical market who are buying HP, Apollo, the IBM 9000, Sunworkstation, and are looking forward to the Apple Lisa.

Will you provide the box?

At this time we're trying to get 3 MicroVAX-based PC's.

1. Rainbow III - Barry will get CP/M to be transportable and move to a 32-bit micro. They'll probably do this for a 68020, which will be in the same time frame. This will be a portable operating system.

2. Pro 750 -

3. The Qbus-based PC's using your box.

If we play our cards right, the situation will be:

1. CP/M - It will evolve to be multi-user, and ultimately transportable to 68K - and MicroVAX.

2. UNIX - on 68K, Intel, 11's, VAX, IBM 370.

3. Vanity systems (eg. Apple, Atari)

4. One language, no O/S (eg. TRS).

5. DEC-VMS compatible - permitting dynamic movement of files and programs. Let's continue this and keep our compatibility, quality and coherence.

"TO" DISTRIBUTION:

JIM CUDMORE	WIN HINDLE	BILL JOHNSON
ED KRAMER	KEN OLSEN	JACK SHIELDS
JACK SMITH		

WPS USERS - Leave HP mode and type <CR>

These 5 slides (definitions) may be of interest to you. They try to segment what and how computing is (and may be) done.

A TIMESHARING COMPUTER consists of:
.processor and primary memory,
.secondary memory for programs and data,
.communications links to other computers and to
.human interface terminals (eg. CRT and keyboard).

A timesharing computer is used interactively by several persons in a shared fashion. The computer belongs to a group, while the terminal ususally belongs to an individual.

A PERSONAL COMPUTER consists of:
.processor and primary memory,
.secondary memory for programs and data,
.communications link to other computers, and
.human interface components (eg. CRT and keyboard).

A personal computer is used interactively by one person at a time. The computer usually belongs to an individual. (LINC is the first to satisfy this defintion, if you ignore the addtional constraint that says a PC must be portable!)

A CENTRAL FACILITY (mainframe) provides:
.network communications among computing nodes, with conventions for exchanging data,
.archival storage for group and personal facilities,
.large, shared, central data bases,
.large, special facilities beyond group or person (eg. printing, plotting, high performance processing, electronic mail),
.general computation on a service bureau basis.

A GROUP LEVEL FACILITY (timeshared minicomputer) provides:
.ability to be part of communicating network,
.intra-group communications via the facility,
.shared programs and data for a single group,
.special facilities for the group (eg. microprocessor debug, simulation, printing, plotting, processing),
.shared, general computation for members of the group.

A PERSONAL FACILITY (personal computer) provides:
.ability to be part of communicating network,
.private programs and data for an individual,
.fast response for simple human interactive (eg. editing) tasks.

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* d i g i t a l *
****

TO: see "TO" DISTRIBUTION DATE: SUN 23 MAY 1982 4:22 PM EDT

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION DEPT: ENG STAFF

EXT: 223-2236

LOC/MAIL STOP: ML12-1/A51

SUBJECT: MAKING COST-EFFECTIVE PC'S. LIKE SONY?

The SEG proposal to get a chip of the month out is vital to our success. The recent Sony announcement very likely is a result of intensive custom LSI. Note that they use VAX's and 4 years ago when I visited were already doing much custom work for consumer electronics. Their president, Iwama, was proud of the fact he had worked with Leo Esaki and that Sony was the first to pick up the Western Electric patents.

If you look at their recent, portable stuff, it is really VLSI intensive and probably CMOS to boot. It would not be a surprise if this is what it's all about.

Recently Avram showed that we have 2 x the chips as the IBM PC. We do more, but the issue may come to cost, reliablity and uniqueness or not. In this case, IBM probably had no customs. Clearly guys like Apple don't use customs, or if they do it's joint with another vendor.

Right now we are in an abyss that the chip a month program has to get us out of:
1. We believe we can do our own chips, yet we don't
2. We've cut ourselves off with working with the outside
   to any great degree

3. We don't use standard chips because of our uniqueness needs
4. We've stopped outside customs that gave us uniquenss in the vt100 and la120

SEG is going to need help and every product group is resposnible
for its own competitive destiny, without having the right skills, attitudes and sufficent targets.

Now that we have the PWB and cabinet turnaround times down, using the QTA, we have to have a CQTA!

Avram, What's your guess here vis a vis looking at their Typecorder and Word Processor? Is the Sony PC another breakthrough in cost and functionality?

"TO" DISTRIBUTION:

JEFF KALB AVRAM MILLER STEVE TEICHER

"CC" DISTRIBUTION:
BILL AVERY KEN OLSEN PEG: JACK SMITH

GB3.S5.43
****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION DATE: MON 29 SEP 1980 10:18 AM EDT

FROM: GORDON BELL
cc: see "CC" DISTRIBUTION DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: PDP-11 PROGRAM ENVIRONMENT ON VMS

Several events have prompted the following proposal:

1. Wondering what a 370 in a terminal would be and do, vis a vis use with a large 370 mainframe.

2. Speculating significantly better software support systems for our microprocessor systems. (Also noting that Intel is supporting their 8086's on VMS...smart people.)

3. Terrified at building the KO Jr. (65Kbyte + 2 - 200 Kbyte disks) and KO Sr. (256Kbyte + disks + 5 Mbyte disks) software on them.

4. Thinking about how we might get rid of 7000 PDT 150's.

5. Wondering how to build and debug software for intelligent terminals (especially the new ones for the commercial group).

6. Thinking how vax on a chip and in a terminal would work with a centrally supported type vax. Wishing that 11's were vax's, but remembering that vax does execute 11 programs damn fast.

Fundamentally, I'm proposing a bare, full function, virtual 11 environment for building 11 programs on vms. In addition, it might be sufficiently good so as to be useful for executing particular programs in production mode...though not a goal.

It would look like a simulator that was used at one time on the 10 to do 11 development before there was 11 software, and have:

1. The mass storage, terminals, and communications to vax with processor, including interrupts. It would run at faster than 11 speed for the small processors. Most likely it would have a terminal to control it and a terminal simulating the real one.

2. Software environment to load, run and debug programs in the simulated environment. It would allow monitoring of the whole state including the files and comm lines.

3. Ability to load and monitor a real 11 when ready.

4. Fallback of a really good monitoring and support capability enabling control of a real, local 11 such as the KO or PDT or computer on a board (a harder case). This is double, but still tricky cause it requires vms to have a monitor to access all the state of the system and to be able to have breakpoints, etc.

It would be aimed at applications 2-5 above, especially 3 & 5.

What's the chance of getting something like this together out of the SSC effort in order to support the effort on getting lots of software quickly for the PDT 150, and the KO?

What would it have precisely?

Would it really make things a lot more productive...not

waiting for
disks, assemblies, etc. or having to have the software development
environment anywhere near the thing being developed?

What youse think?

GB1.S6.59

"TO" DISTRIBUTION:

ANTON CHERNOFF	BOB DALEY	GIL STEIL
BRUCE STEWART	BOB TRAVIS	

"CC" DISTRIBUTION:

JOE CARCHIDI	DICK CLAYTON	DAVE CUTLER
DICK HUSTVEDT	KURT FRIEDRICH	SAM FULLER
BILL HEFFNER	BILL JOHNSON	BILL KEATING
ALAN KOTOK	SI LYLE	WARD MACKENZIE
JACK MACKEEN	JACK MILESKI	AVRAM MILLER
LARRY PORTNER	HERB SHANZER	

GB0001/29

| d | i | g | i | t | a | l | i n t e r o f f i c e   m e m o r a n d u m

Subject: **11/23 Fonz Announcement**

To: Dick Clayton, ML12-2/E71
Bill Green, ML1-4/E34
Bernie Lacroute, TW/A08
Roy Moffa, ML1-2/H26

Date: 28 FEB 79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

Jack Smith, ML1-4/A54
Mike Titelbaum, ML1-2/E65

follow up 3/9/79

I hear that we have all but announced this. What's the story? Why was this announced without Marketing Committee approval?

What are our options now?

Can we delay announcement and get the PAX in it (especially since there's a problem in semiconductor capacity)?

Certainly we don't need the 11/24 early...and, can we save some engineering money? We do need Fonz to be built in to other products. Could we give them high priority?

GB:ljp

00 BURT DECGRAM ACCEPTED S 17829 O 25 10-MAY-81 16:48:32

****
* d i g i t a l *
****

TO: HERB SHANZER

DATE: SUN 10 MAY 1981 16:45 EST

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION

DEPT: ENG STAFF

EXT: 223-2236

LOC/MAIL STOP: ML12-1/A51

SUBJECT: KEN'S COMMERCIAL 11/23 PACKAGE

I hope you'll keep abreast of this. It looks interesting (provided we can remove the contact paper). If we do it, it should offer a significant payoff in terms of cost. The big saving I see is making the long box in a high volume plant
and then shipping the manuals, software (on disks) and frame from FAT. The disk drives would come directly from high volume.

The site merge of the parts would cut the inventory and wip down considerably. (It's too bad we simply don't simply assign an inventory carrying charge to PL's to encourage them to do the right thing.)

The package should be able to handle a 23B 9 slot backplane. We also might consider taking the DF03 modems out of their boxes and use a single PS (if the 23 one will do it), to further clean up and cost reduce the whole system.

Am anxious to see what the costs and a working system would look like.
gordon

"CC" DISTRIBUTION:

BRIAN FITZGERALD RICHARD GONZALES IRWIN JACOBS
SI LYLE KEN OLSEN

GB2.S6.39

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+---------------------------+                        GB0001/43
|   |   |   |   |   |   |   |
| d | i | g | i | t | a | l |   i n t e r o f f i c e   m e m o r a n d u m
|   |   |   |   |   |   |   |
+---------------------------+
```

Subject: **Post Mortem on 11/70 CIS**

To: Bill Demmer, TW/D19 Date: 3/12/79

Dave Rodgers, TW/C04 From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

I hope in putting the 11/70 with CIS away, you will write-up a history as you understand it. As I go back many years on this project, I find us always pushing against doing the extensions. This is understandable. However, some of the marketing people occasionally say this has been the problem on the project. My analysis is somewhat different, I believe any machine or architecture can be extended <u>once</u>. In this case, the extension was the second/third one beyond the original 11/45 and well beyond the range of the design options due to nature of the two extensions. Alternatively, was it because of two design options for mP and CIS?

We (I especially) learn from history. Is it too painful or too useless to try to make an internal history of the project that we can all learn from in the future?

GB:ljp

GB0002/3

| d | i | g | i | t | a | l | interoffice memorandum

Subject: **Why We Probably Have to Do the 11/70 On a Chip**

To: Marketing Committee
OOD
Bruce Delagi, MR2-1/M64
Sam Fuller, TW/A08
Bernie Lacroute, TW/A08

Date: 4/3/79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

Jack MacKeen, MR2-2/M65
Jim Marshall, TW/A03
Roy Moffa, ML1-2/H26
Stan Pearson, ML12-2/E38
Bill Strecker, TW/A08
Mike Titelbaum, ML1-2/E65
Roy Moffa, ML1-2/H26

Although there are many arguments why we have to carry out this expensive chip development effort, the following summarizes my thoughts:

1. It's a classic follow-on, constant cost product for our module (DCG) business. Here, we have a large base built on the 03 ('75), and 23/24 ('79). Jaws (the proposed 11/70 on a chip), available in '82 would support this large, user base.

2. It would be used in many places as a major cost reduction. As an 11/70, the cost reduction at just the box (no memory) would be in the order of 9K! No other cost reduction project could get anywhere near this leverage.

3. There will be some obvious uses for it as it becomes available, based on the fact that the Fonz chips will create markets internally. These include use in the mass storage controllers, Hydra front end (Mercury), as special speech and signal processors, and the terminals (e.g., graphics) evolve to need this kind of power by then.

4. There will be many uses for standard 11 systems at the lower cost put in highly integrated systems. These would run RSTS, SCS, RSX, and TRAX.

5. It is the way to build our systems in this time frame using one engine. In retrospect, we could have probably avoided the 11/44 and covered the space with an 11/24 if the memory

space were extended to >128KW. The speed of the Fonz is adequate, but the memory space is not. A similar situation will no doubt exist as the need for the 11/44 follow-on (called 11/XX) is identified. This is the way to do it.

6. Just as the 8 is the really low end now, so too will be the 11 until we get the price of VAX systems down. I don't see this happening until '85 or so.

7. By identifying it, hopefully we can avoid doing enhancements to the Fonz.

8. It is getting to be clear that we can't get a VLSI-VAX in this time frame. The specific details will be forthcoming on VAX as we learn how difficult the project is. This is both a hardware and a software base maturity issue.

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Dick Clayton	ML12-2/E71	Jim Cudmore	ML1-5/E30
Bill Demmer	TW/D19	Ulf Fagerquist	MR1-2/E78
Bill Hanson	ML1-4/P11	Win Hindle	ML10-2/A53
Bill Johnson	ML3-5/H33	Ted Johnson	PK3-2/A55
John Kevill	ML3-6/E94	Andy Knowles	ML10-2/A52
John Leng	MR1-1/F35	Bill Long	ML10-2/A57
Julius Marcus	MK2/C37	John Meyer	ML12-1/A11
Ken Olsen	ML10-2/A50	Stan Olsen	MK1-2/A57
Larry Portner	ML12-3/A62	Bob Puffer	ML12-2/E38
Jack Shields	PK3-2/A58	Bill Thompson	PK3-2/C12

Bruce Delagi	MR2-1/M64	Sam Fuller	TW/A08
Bernie Lacroute	TW/A08	Jack MacKeen	MR2-2/M65
Jim Marshall	TW/A03	Roy Moffa	ML1-2/H26
Stan Pearson	ML12-2/E71	Bill Strecker	TW/A08
Mike Titelbaum	ML1-2/E65	Roy Moffa	ML1-2/H26

****
* d i g i t a l *
****

TO: BILL DEMMER DATE: MON 25 MAY 1981
23:53 EST
ULF FAGERQUIST FROM: GORDON BELL
PAULINE NIST DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: WHAT IF THE 780 WERE REALIZED USING MCA'S OR NEW TTL/FAST LOGIC?

Let's talk tomorrow. Bob has been off doing a quick study as to how fast an MCA translitteration of the 780 would run. His rough answer: 2.5 x a 780. If we had done this, it would have shipped 2 years before venus, at a small fraction of the development and start-up costs. I am concerned that we don't understand how to compute time/cost/performance (that's why I wrote the little essay in Computer Engineering whichh apparently no one read). Anyway, the bottom line is that a 780/mca would have roughly a price/performance ratio of 250K/2.5 or 100K, where the 780 is the standard base. Venus will have price/perf. of 320K/4 or 80K. Since this ratio should get better at .8 per year, then a 2 year delay should be .8 x .8 or .64 either lower cost or higher performance.

The point of this is: We seemed to have screwed up in not making this product. Now, with some faster TTL coming out, maybe we could do a direct substitution of FAST ttl and get a speedup of say 2, with virtually no redesign, but by using the new parts.

Could you look at this one?

I think we ought to spend a little more time on the mca version too and see if the Stewart numbers can be improved any. I think these should be kept alive until there is some better feeling about Venus.

GB2.S6.50

Mr. Alec Peltier 15 August 1980
Special Assistant to Counsel General
Operations Branch
American Embassy
London
England

Dear Mr. Peltier:

Reference your conversation with Richard Goldstein on August 15 regarding Dr. Maurice Wilkes. I wish to extend my personal appreciation for your efforts on this matter.

I am writing to explain our situation regarding Professor Maurice V. Wilkes with whom we have made arrangements to join the staff of our Corporate Research Group.

Professor Wilkes has been a towering figure in computer engineering and computer science from the invention of computers until the present day. He is one of the small handful of men who originated the modern computer; he was personally responsible for the construction of EDSAC 1 which was working in May 1949. Some of the concepts first proposed by him, such as "microprogramming," have continued to grow in importance until today virtually all computers manufactured in the world are designed using this technique which he created.

For the last decade Professor Wilkes has been Head of the Computer Laboratory at the University of Cambridge (England), where he was previously Director of the Mathematical Laboratory for a quarter of a century. I will not attempt to list all of the honors and awards which he has received over the years; this information is available from standard reference works such as Who's Who. Suffice it to say that he has been one of the intellectual leaders and respected senior statesman in computing for the last three decades. He is a Fellow of the Royal Society, a Fellow of the Institute of

Electrical and Electronics Engineers, a Fellow of the British Computer Society, of which he was the first President, and a foreign associate of the U.S. National Academy of Engineering. He received the Turing Award and the Harry Goode Memorial Award, two of the highest honors in American computing. He has received honorary Doctorates from five universities in three countries, together with other honors from around the world, including recently being named as a foreign associate of the U. S. Academy of Sciences. In summary, he is a distinguished scientist and engineer of world reputation, possessing unique background and qualifications not available elsewhere.

Dr. Wilkes is urgently needed to run our research program on techniques for making computer systems more secure. This program is not only important for us as a major computer manufacturer, but also may have a significant impact on U.S. leadership in computer technology throughout the world. Dr. Wilkes' presence is necessary to move this work forward. Also, we need his interaction and leadership across all our research.

Dr. Wilkes is scheduled to leave England the last week of August and will start to work here September 2. He has made all personal arrangements including letting his house in London and renting a house here in Massachusetts. We were lead to believe several months ago that his visa was in order but he was told by your office a few days ago that it would be 1 to 3 months before he could get his permanent visa. This is totally unacceptable. Please check into this urgent matter, expedite, and return TWX the status of this situation. Your help is most urgently requested in this matter.

I have known and interacted with Dr. Wilkes for many years. We need him here. Won't you please, please help us? What other information do you need? I will be calling you and Dr. Brewster after you have received this.

Sincerely,

Gordon Bell
Vice President, Engineering
DIGITAL EQUIPMENT CORPORATION
Maynard, Mass. 01460
Telex No: 948457

cc: Richard Goldstein
Attorney at Law
Suite 606
335 Broadway
New York, New York 10013

GB1.S5.69

REFERENCE:

Peltier & Brewster: Telex code: FORN 266777
Brester Tel #: 499-9000 London

Richard Goldstein: Telex code: FORN 620292

+--------------+ ID#0161
| **d i g i t a l** | **I N T E R O F F I C E M E M O**
+--------------

SUBJ: People to Place

TO: John Meyer   Date: 7/10/78
From: Gordon Bell
CC: OOD Dept: Office of Development
MS: ML12/A51 Ext: 2236

There are a number of people casting about for jobs either within OOD or in other parts of the organization. These are the ones I'm aware of:

1. Bruce--try Stan or Larry's (commercial organization). We discussed a job with systems (hardware and software responsibility). Also a job with customer/end use would be preferable. He needs to know how to motivate a set of unrelated projects...as distinct from a highly focused program which I believe he could successfully manage.

2. Stan Pearson--I don't know. Somehow we aren't giving him the strokes here. I've been awfully impressed with what he is doing in the RAD committee for example, but we've signalled that he has to go to line management. I believe we desperately need him in the planning role and we have to make this rewarding.

3. Peter Jessel--I can't tell what he wants to do. I believe he is good in focussed Advanced Development and might be good in R and D. Ulf should talk to him, as Jim has been unable to do anything. Whatever Dick is going to do the small systems areas might create a need. I said talk to both Dick and Bill regarding the systems job. (Here my reasoning is that if Dick's only customer is Bill,

maybe he should turn the function over to Bill.) Also, Peter might like to get more involved in end use (DCG, Stan, Commercial) as he believes the realignment will be more useful to product definition. He is also talking to Telco.

There are undoubtedly more. Please make a list of other people...the unhappy or the groping. Assign them to various people. I am tired of losing people who get in this mode and that we make find themselves. I expect them to be settled in or out of their current jobs by the first of September.

gb

D I G I T A L   INTEROFFICE MEMORANDUM

DIST:

Dick Clayton	ML12-2/E71	Jim Cudmore	ML1-5/E30
Bill Demmer	TW/D19	Ulf Fagerquist	MR1-2/E78
Bill Johnson	ML21-3/E87	John Kevill	ML1-3/E58
John Meyer	ML12-1/A11	Larry Portner	ML12-3/A62
Bob Puffer	ML12-2/E38		

ID#434

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Subject: **Doing Business With The People's Republic of China**

To: Carl Janzen, AK
Ted Johnson, PK3-2/A55

Date: 26 JAN 79
From: Jean Bow
Loc: PK1/E33

As a DEC employee, I would like to support DEC and help you in deciding about, and hopefully doing business in China. I'm going to China April 11 for one month and could present DEC products and meet people.

I understand from Gordon Bell that you are formulating our trade policy and that you will meet with me in regard to a possible assignment.

Should DEC Try to do Business with China?
Yes. China's desire to modernize her industry, agriculture, science and medicine via western technology has opened up a vast potential market for DEC. I believe DEC has the unique know-how and adaptability in building special systems (hardware and software) to solve difficult problems. Indeed, China has many difficult problems at present that could be solved by the innovative use of computers. Therefore, China should be given a chance to listen to what DEC has to offer prior to her commitment to our competitors, both U.S. and Japanese.

Making Contact
The purpose of my forthcoming trip to China is to visit my family, whom I have not seen for 30 years. I also intend to visit government research centers, universities, laboratories, hospitals and manufacturers. I am prepared to take courses here, if necessary, and give informal lectures on the practical aspects of our computers and how to use them. I do have a technical background as you can see (attached). For example, how to organize and manage computer data centers, how to teach practical mini courses on using computer software, and the difference between university and business data centers, etc. I will have opportunities to establish contacts and personal rapport with various key Chinese personnel. In addition, I will be able to plan and establish contacts in advance from Boston as soon as you can give me some guidance. Please take advantage of my enthusiasm. I want to help.

JB:ljp

Attachment

DOCNO8/21

Digital **Interoffice Memo**

Subject: **Peripheral Buy Out/Getting Co-operative Vendors:Versetec Case Study**

To: Distribution

Date: 20 SEP 76
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

F/U 9/28

Given our limited resources, particularly in PL Engineering, F.S. and Software Support, I'd like to suggest we limit our product offering higher volume, supported products. This would have precluded our offering the Versetec printer, for example.

0. We don't make much on it, and it adversely affects PLC.
1. It's expensive for the graphics user.
2. Customers don't buy it because it's too expensive.
3. We don't support it well because we don't have good margins (i.e., both poor hardware and software).
4. Versetec has a good product with hardware and software support.
5. We offer the obsolete (100 pt) version.

Therefore:

LET'S NOT DISTRIBUTE THE VERSETEC PRINTER BUT LET'S HELP THEM SUPPLY PRINTERS TO OUR COMPUTERS!

Everybody wins! Also we could offer Calcomp plotters in this same way.

Instead of adding a new printer to the VS60, let's co-operate to get a good product that we do not make. What other

products should be bought/attached out?
Why not just offer this and not process it through our books?

GB:ljp

Distribution

OOD
Ed Corell
John Hall
Ed Kramer
Bill McBride
Bob Peyton
Bill Thompson
Sam Bosch
Jack Gilmore
Win Hindle
Jesse Lipcon
Ken Olsen
Grant Saviers
Allan Wallack

FROM: GORDON BELL DATE: SAT 9 FEB 1980 9:34 AM EST
DEPT: OOD
EXT: 223-2236
TO: GEORGE THISSELL
JIM BELL
BERNIE LACROUTE
JACK MILESKI
STAN PEARSON
DICK SNYDER
BILL HEFFNER
BILL KEATING
OOD:
PEEBLES VIA J BELL

SUBJECT: GEORGE IS PROBABLY RIGHT

Somehow we have to get the personal VAX project going quickly in order to deal with this problem of one-ness and the built-in complexity that it might imply. The intent of the single VMS is to be able to run a program at any level so as to preserve programs, and more importantly data across the various systems. The thing that can vary is the user interface and the packaging of the system and the documentation to reflect the specific uses of the variations.

George is absolutely right on the evolution of a complex system.
It implies tons of manuals, and expensive system programmer experts, high support and massive overheads that only the CS depts can afford because the people are free and can deal with the complexity. Also, large organizations want them
to keep their staffs challenged.

Personally, I have had waged and lost all the battles in this regard by trying to get a manual written for a user (here, I have wanted to try the simple experiment of putting all you need to know if all you know is APL, BASIC, PASCAL, or Fortan,
and simply want to login, create, run (with a library), and debug your program in a single manual). This would have made VAX simple for all who touch it in 95% of the cases. Alas, it
doesn't cover all the intricies of the file system, loader, debugging, writing macro programs, user defined commands, and administering the system. Not only have I lost the battle, but
I found out that we can't even get manuals like this written because the typesetting system and writers are not enough in control of their words that it is a 2+ year project...instead of simply moving a few files from previous manuals around. We
are somewhere in the early 1970's in our manual writing and typesetting capability it feels like.

Yes...we need some work here, and a plan. The systems organizations
as we have them now will never deal with this cause there are hundreds of other issues like Dock Merge that have to be dealt
with. Somehow it is in the domain of the Technical Director of
SW, and we need real leadership here to keep us from going

down the current path that will inevitably mean a set of new systems to cope with the complexity.

PS
The IBM approach ain't right...cause it means no movement of computing styles, files, programs, and a mess in the complexity due to the fact that SNA won't be that good in solving the Interconnect problem. I still believe in the concept of where we could go, but it takes a belief and design to do it. The personal VAX is a start.
... assuming it starts someday. (The test is how big the manuals
are.)

George, I'm delighted you have bought some programs from the outside and potentially have saved us t to mkt and precious development resources. Given that we share a common problem/
vision here, how can you in addition help guide us?

Anybody worried about this besides George and I?

ATTACHED: MEMO;76

TO: ROGER CADY DATE: FRI 8 FEB 1980
1:11 PM EST
FROM: GEORGE THISSELL
cc: see "CC" DISTRIBUTION DEPT: SOFTWARE
ENGINEERING
EXT: 223-7698
LOC/MAIL STOP: ML12-3
A62

SUBJECT: RE. DEC UNIQUENESS

Read your note and will throw out a couple of comments-

Think we're striving for ease of use for our large customers by
expanding on the generality of the Operating System so as to

minimize their training,networking, interchange, etc, problems.
Unfortunately a by-product of generality is to give up some of
the "approachable,friendly, and easy to use" characteristics that the single function user can have in 11 Land (single user
is RT-11, T/S is RSTS, multi programmed real time is RSX...)I suspect that a large part of this ease of use is in the manuals
which are describing a smaller functionality and are therefor easier to read....

It's worrisome in terms of the single function prospect that we're putting so many eggs into the one Operating System approach
which by definition is more complex than a system dedicated to a
subset of the universe. The system your data base prospect gets
will not only be able to run DBMS-32 but also Transaction Processing, Real Time, Time Sharing, etc which is great for the
General Motors Programming Shop but complicates life for the single function guy. Maybe what's needed most is really good Tech
Writers who produce sets of single function system manuals?

It's even more worrisome that IBM seems to be trying to get where
we came from: the image of the S38 is Data Base; the 8100 is Real
Time; the 4300 is GP; etc. And they seem to feel that SNA will solve
all their compatibility problems? At any rate it seems intuitively
clear to me that whatever DB system you may develop on VMS just
has to be more complicated than say the S38 with its more narrow focus.Better manuals and prebuilt systems can help, but....

Maybe you've guessed by now that I question the one Operating System approach; you're right I do! On the other hand I don't advocate the chaos of the 11 Land where Operating Systems continue to proliferate, but rather a rigidly planned set of compatible, functional subsets of VMS. I would think this would return "ease of use" to the single function user while VMS would continue to be the GP system needed by the GM's of the world.

I'll also question the notion that 1 OS is easier to maintain than several(when blaspheming why not go all the way). I'll argue that there's a powerful synergism of complexity that more than makes up for the extra drivers and manuals. In five years we're going to need some pretty smart people to maintain VMS (Remember when OS370 went critical; ie fixing 1 bug was introducing 1.x bugs? or when the TOPS-10 solution was to throw away 1000 SPR reports?)

In sum then I'm suggesting that the multi function capability required by the one Operating System approach promotes ease of use for our large customers at the corporate levels but has to cost the single function user in terms of complexity. We can mitigate this to an extent with prebuilding systems and more precisely focusing our manuals but nothing's free;controlled additions to the O/S lineup could help on the ease of use axis.

Regards

"CC" DISTRIBUTION:

GORDON BELL* BILL JOHNSON JACK MILESKI

RON HAM

GB1.S1.69

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+---------------------------+          COMPANY CONFIDENTIAL
           GB3.S2.25
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SUBJ: NOMINATION: BILL JOHNSON, VICE PRESIDENT OF SOFTWARE ENGINEERING

TO: OPERATIONS COMMITTEE

Date: 2/16/82 Tue 9:46
From: Gordon Bell & Jack Smith
MS: ML12-1/A51 Ext: 223-2236

We would like to recommend that Bill Johnson be appointed Vice President of Software Engineering. BJ fulfils the agreed upon criteria*.

BJ has the largest engineering group, and due to the complexity of the interconnection of the components has the most difficult management job. In this regard, we are known for quality and creatively compatible systems. He is an excellent manager, managing by inspection, and knows what goes on in the products and within the projects.

The recent announcements of the 782, VAX Information Architecture, and Office are indicative of the performance of our creative and productive software engineering group.

BJ is pivotal to our product future.

Due to BJ's wide experience in both hardware and software engineering, he is a widely sought after person. He can handle a wide variety of future assignments.

* "Officer Criteria

Past (a) sustained, excellent performance in key positions

(b) major contributions to DEC

Future

(c) strong belief that person will make contributions in future

Future factor is the most critical."

CANDIDATE: Bill (B.J.) Johnson Sponsor: Gordon Bell

Jack Smith

CURRENT POSITION: Manager of Software Engineering

ACCOMPLISHMENTS: B.J. has been our fast track performer; in rapid succession he has been Manager of Diagnostic Programming, Technology Director for Central Engineering, and Manager of software Engineering. In all of these roles he has demonstrated leadership and strong technical and organizational skills. His role in software is to manage the largest, most complex (organizationally) Engineering group. He has increased focus in quality and advanced development, and software methodology.

He has put into effective operation Reading and DECwest. We believe that all groups are operating very effectively.

FUTURE: B.J. will continue to be a fast track performer. He is rapidly acquiring a broad perspective of DEC's business which when allied with his hardware and software technical skills makes him extremely valuable.

FAGERQUIST

5/510

Hooper, Don	2080 + Itel
Kotok, Alan	KA,KI,KL, Venus
Melanson, Ron	
McClure, David	DECnet
Elkind, Bob	
Fossum	780,Venus

DEMMER

8/462

Stewart, Bob	45,70,780	
McInnis, Don	750, Nautilus	*
Titelbaum, Mike	05,03,23	*
Lim, Arthur		
Jenkins, Steve	45,70,780,BI,Nautilus	
	*/2	
Li	750	
Meinerth,		
Steely		

AVERY

	6/464	
Miller, Avram	CT,+	*
Forrester, Ned	VT100,VT200 video,	
Gonzles, Dick	Minc, CT, VT,	*
Lomicka, Roy	LA36,120,LA100+,VT micro	
Rudy, Jeff	Editors,	
Folsom, Barry	VT18X	

LACROUTE

	5/189	
Rodgers, Dave	780,I/C program, NI, pluto	*
Lauck, Tony	DECnet arch	
Ermolovitch	NI construction	
Wilson, Andy	IAS,	
Schzecjeim, J		

GUTMAN

	3/100
Lipcon, Jesse	
Gaubatz, Don	
White, Don	

FULLER

Strecker, Bill	70 cache, VAX arch, DEC arch
Glorioso, Bob	Venus,
Dileep	

SAVIERS

TO: LARRY BORNSTEIN DATE: SAT 17 APR 1982
6:43 PM EST
PEG: FROM: GORDON BELL
JACK SMITH DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: HIRING FROM WITHIN AND WITHOUT, AND OUT-PLACEMENT

Bill Thompson really probed at me on the issue of approving many hires. I've been doing it, assuming that you folks are doing this within budget! At the same time, I know that we are going to have to let some people go, if things continue to deteriorate bookings-wise. Jack is dealing with his group and I'm approving the Nautilus expansion. I also approved a very strong technical person (and manager) for Sam, along with the 6 people for the California startup.

I had a request for a former general manager and VP which I think both Jack and I should look at, cause it looks like there will be good managers available with similar experience within DEC. It's unclear as to the quality because the person had been running their videodisc effort and hence I'd question his technical judgement and esthetics. The OC is asking members to identify high quality people for reassignment. They are also asking for the budget to be made 2 ways for FY83: one as is; one if some of the marginal people can be identified and put in a holding place for reassignment. This should also be done for engineering too.

In short, we gotta really put on the brakes. There are many people that are going to be identified for reassignment that we might have and that we want transferred. We do have to keep our commitment to the colleges and strong technical contributors because they are what really make the products.

Any managers are going to have to be screened thoroughly, and unless they possess very strong technical skills, I don't intend to approve them.

GB3.S4.31
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* d i g i t a l *
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TO: OPERATIONS COMMITTEE: DATE: TUE 19 MAY 1981 8:22 EST
LARRY PORTNER FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: A PROPOSAL FOR EVALUATION OF DIRECT REPORTS IN JUNE

We recently evaluated the direct reports within engineering using the salary, proposed salary, and proposed stock. In addition, Don Ames provided the stock value available in 1982 on an if sold basis, treating all past stock grants as compensation. The data was suprising and useful! In addition, I believe we should have the total value of all remaining stock to be used as a guide.

We asked each person to rank order their candidates together with the justification of the stock shares. The criteria used were:

1 exceptional performance
2 criticality to continued success and who were not proportionally compensated or recognized
3 position in the organization and who might receive stock assuming they were doing an adequate job

The method we used for the evaluation was to:

1 have each person present their candidates in order of importance (what amounts to the LAST person that one would throw out of a lifeboat)

2 have the whole group comment on the candidates and collectively decide on the shares for the candidate. This of course required additional stock shares.

3 these new requirements were then merged back into the initial list so that we could compare across organizations, and

4 finally we made a single pass of the complete list from the largest number to the smallest number. At this time, the total number was reduced, as we found there were persons within each group that were reduced (this amounts to finding persons we didn't need in the boat at all).

We found that the past data was useful in a several cases: there were critical persons we always want in the boat with us and who are neither compensated very well nor who have many shares. Also, there were a bunch of harmless folks with us who are doing little to move the boat, and who would probably not be missed if they fell overboard. In fact, we found that we were paying some riders $120K, while our key people were only getting $60K. Since the initial recommendations were to add some more to the riders, in proportion to their position in the organization, the final recommendations came out nothing like this.

Therefore, I propose that in the June meeting, we come with the

personnel list which includes: name, salary, proposed salary,
percent increase, rating, stock compensation this coming
year,
remaining stock compensation for all following years, and the
proposed stock grants, together with the justification as to
why
each person occupies the critical position in the boat.

I recommend that we use a similar procedure in June.

Gordon

In addition, we observed that stock value to a person varies
by a
factor of 20 to 40. If a person is really committed to DEC,
then
the value is at least the spread x 10 x (2 - 4), or 15K to
30K
per 100 shares! If the person isn't committed, the value is
only
the spread he can sell next year, or about $750. When we
ultimately grant the stock, we should accompany it with a
sales
pitch!

GB2.S5.57
Engineering Review
Gordon Bell/Larry Portner
4/21/81 Tue

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                                                 |JC  |RC  |BD  |WD
                                                 |WF  |UF  |JH  |RH
                                                 |WJ  |BL  |SL  |JM
                                                 |JR  |GS  |ST  |WT
                                                 |PVR      :
Products produced by their org
                                      Quality    |    |    |    |
                                             |   |    |    |    |
                                             |   |    |    |    |
                                             |   |    |    |
                Functionality,competitiveness    |    |    |    |
                                             |   |    |    |    |
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Mkt. Positioning Knowledge & Strategy					
Cost					
Uniqueness					

Develop Process within their org

Eng. Support (CAD, etc.)processes					
Cost control					
Schedule control					
Quality/utility of A/D					
Productivity of group					

Organization/people within their org

General health (doesn't feel good?)					

Personnel processes (hrp,idp,etc.)					
Successor/depth					
Education/skill mix/up-to-dateness					
Person development					
Interface of org to others					
Customer services					
Manufacturing					
Marketing					
Other eng (con)					
To bosses					
The person					
Leadership to troops					

Mkt understanding					
Prob.solving/ideas/innovativeness					
Corp.understanding & view					
Personal development					

FROM: GORDON BELL DATE: FRI 26 OCT 1979
1:24 PM EST
DEPT: OOD
EXT: 223-2236
TO: JOHN MEYER
SHEL DAVIS
cc: OOD:
OOD: @CLEM

SUBJECT: KEEPING VERSUS RECRUITING -- FOLLOW-UP 11/2/79

GB0005/33/EMS

We suggested that someone be assigned, effective immediately, to the problem of understanding why (all the ways) we lose people through attrition and then educate our managers. Keeping the people we have is cheaper than recruiting. Should this person be part of the recruiting group?

GB:swh

FROM: GORDON BELL DATE: TUE 16 OCT 1979 2:29 PM EST
DEPT: OOD
EXT: 223-2236
TO: LARRY PORTNER
    BILL JOHNSON
cc: BOB DALEY
    JOHN MEYER
    TERRY POTTER
    SAM FULLER

SUBJECT: BRUCE HURWITZ'S RESIGNATION

GB0005/12/EMS

I just got a call from Al Saloky on Brice Hurwitz's resignation to go to Wang at a big increase. The concern is: Bruce will take people, the group needs a manager, the friction among performance group is high and other groups depend on them. What's being done to address these issues? Let's BE QUICK! and RIGHT!

GB:swh

WPS USERS - Enter HP mode and then type <CR> 00 BURT
DECGRAM ACCEPTED S 22785 O 417 05-JUN-81 15:18:02

****
* d i g i t a l *
****

TO: ENG STAFF & DIRRPT: DATE: FRI 5 JUN 1981 12:54 EST
    ENGRG. USERS: FROM: GORDON BELL
    OPERATIONS COMMITTEE: DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: 16-BIT PROGRAM OFFICE MANAGER

We are very pleased to announce the appointment of Mike Gutman as
Manager of the PDP-11 Program Office reporting directly to Gordon
Bell and Larry Portner.

The Program Office covers the development of all PDP-11 based products from microprocessors to large systems for technical, real time and commercial systems.

The PDP-11 Program Office will be responsible for determining the
strategies for PDP-11 products, the line management of QBus and
Ubus hardware development and support, and the resource allocation of all hardware and software projects.

There will be a transition period as Mike works out of his current job in Storage Systems and he will take over the Program
Office on a full-time basis by the start of the 1982 fiscal year.
Mike will be announcing the PDP-11 Program Office organization at
a later date.

Mike came to Digital 7 years ago to help found the Components Group. For 3 years, he was Product Manager and then Engineering
Manager of the Memory Systems Group. For the last 3 years, he
has been Storage Group Product Manager.

He received both his Bachelors and Masters degrees in Electrical
Engineering from Worcester Poly Tech. He and his wife Lois have
4 daughters and reside in Framingham.

We look forward to seeing Mike in this challenging and demanding role and hope he can count on your support.

GB2.S6.66

****
* d i g i t a l *
****

TO: KEN OLSEN DATE: THU 9 APR 1981
20:57 EST

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: SOME FOLKS WE MIGHT GET TO WORK HERE

I'd like you to call Erich Bloch (home 914-763-5969, or work 696-1900 x 3401)... and ask him to come for lunch, etc.
or visit our semi place, or something. I'll do the hosting...
in detail. I have great expectations that he can easily do my job, and that we should get him here. He has considerable
experience and intellect. Also, he's a recent (1 year) club (NAE) membrer.

Intend to invite Corell in to chat with us: Jack, Grant (for Colorado
job), Larray, Esten, and I and Si. John Piepietro is handling.
Possibilities include having him run and eng/mfg group for all
of printing terminals... or an eng. only role.

We are pushing to get Jeff Kalb here, former DG VP of Eng.
Jack and Jim (Cudmore) are leading.

GB2.S5.61
****
* d i g i t a l *

****

TO: STEVE TEICHER
9:36 PM EDT

cc: CHAD CUTLER
ALAN KOTOK
BILL STRECKER

DATE: WED 13 AUG 1980

FROM: GORDON BELL
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: RE: PROMOTING CRAIG MUDGE TO SENIOR CONSULTANT

The criteria in my head is two, significant technical accomplishments. Strecker (11/70, memory hierarchies modelling
general case, and vax architecture), Kotok(10 architecture guidance, our telephone system, many 10 implementations, and the ecl gate array push), Cutler (11/M, VMS and now a new compiler technology that promises to be backbone of much of future compilers). I would like to meet with the senior consultants on this and maybe go over names of all the people we have that fit this highest category. Believe he has done very solid work on the 60 FP and WCS, and Nebula advanced development, and in Managing the cal tech inteface including the idea of formal ports. Although I don't believe we have to wait for Scorpio, I do believe the transfer of the MOS work into production this year could constitute a second major accomplishment. Certainly the book was useful too.

This issue is so hot that I want you to keep pushing but I think it is essential to get with the Senior Consulting Engineers to get a bit more formality. I'll get this set up quick!

Senior Consultants how do you feel on this?
Who are we missing?
What do you think the criteria should be?
(Note, I'm putting some pretty strenuous criteria that goes beyond promotion of full professor with tenure in the academic
world.)

I also consider both Riggle and Fred Hertrich to be fitting of the title, although Mike has a manager's title and Fred isn't in the company.

PLEASE LET'S JUST KEEP THESE MEMOS VERY, VERY CLOSE TO OUR BODIES AND POSSIBLY NOT MAKE COPIES OF THEM!

Can we try exploring this a bit more this way and then get together? Also, how about a telephone conference tomorrow?

GB1.S6.19

THOUGHTS (REASONS) ON X'S DECISION TO LEAVE DEC

	DEC (stay)	GO TO TWO Pi
$	-45K + 1000 Shares stock Perceives no way to get salary structure of high growth	+59K + up to 60% bonus believes $100K in 2+ years $18K/year of education expense for children Company will be profitable -No equity (Philips wholly owns)
RISK/REWARD	+Finish project, will then be more valuable	+Chance of a lifetime (now 40) +Likes risks
AGE	-Time for change	40
PLACE TO LIVE	+10 acre farm (grew up on one)	-high priced, high density
CONTRACT	+++I pointed out that he has a contract with O/C which he is breaking.	
AUTONOMY & SIZE	-Large. Impersonal.Decision affect many. +Believes we can provide	+Small is beautiful. +Small group vs large company

much autonomy with time |++Wants to be the responsible person.
-Views Mfg. & F/S as |-Could be Philips & Signetics controlled?
bureaucracies that are |
impenetrable and inflexible |

TITLE |+VP Engineering

POWER +More budget |
More people |
More sales/leverage of |
products used |

WORK +great project |-370 (likes to be proud of product
-Worried about our commitment | and product destiny)
to really support project |

FEAR -Could be afraid of project?? |

WORKERS +Likes people, but worked |+new people to work with
for same boss 9 years. |
Wants new boss in 1 1/2 |
years (or when project is |
well along) |

WHY LOOKED When project Q was redirected in May, he went on street. Offer
from Two Pi is delayed response.

February 19, 1980

Minna Post Peyser
Minna Post Peyser and Associates
Northview Estates - Lake Oscawana
Putnam Valley, New York 10579

Dear Ms. Peyser:

Thanks for sending the information on your citizenship EDUCATION FOR PARTICIPATION IN THE COMMUNICATION AGE Seminar.

You certainly have identified a possible future issue. The panelists have interesting backgrounds and will clearly help put on a provocative seminar.

Since I'm already over committed to building computers I can't attend.

Good luck in identifying the issues and trying to get the various disciplines to somehow communicate with one another...no doubt a first step.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:swh
GB1.S2.11

THE BASIS OF SUPERCOMPUTERS:
SEMICONDUCTOR AND PACKAGING TECHNOLOGY

RELATIONSHIP OF SEMICONDUCTOR AND PACKAGING TECHNOLOGY TO PERFORMANCE

Semiconductor logic circuits and memory chips and the ability to interconnect them densely is the basis for today's pipelined supercomputers. For the last 20 years, Cray has taken "off the shelf" transistors and integrated circuits and packaged them creatively, forming a very dense structure to achieve the fastest speed clocks and therefore, the fastest computers. In addition, Cray has also organized his computers from a number of computers, processors and functional units to operate in parallel, giving greater performance.

For machines just being characterized, the Cray X-MP (a quad, multiprocessor) and the Fujitsu V-200, the clocks are 9.5 ns. and 7.5 ns respectively. The peak performance of the V-200 is about twice the Cray uniprocessor for the Livermore loops. The speed difference is probably attributable to a better vectorizing compiler for the V-200. The clock difference is due to Fujitsu's impressive semiconductor technology and the packaging capablity evolved from Amdahl. The X-MP is simply an evolution of the low density semiconductors used in the Cray 1. Virtually all computers today use Japanese high speed MOS and CMOS memories.

A Cray 2 uniprocessor, appears to be a breadboard for the Cray 3, and will be delivered soon to Livermore. It uses the fluorocarbon cooling bath and has a 4 ns. clock. The commercial version, the Cray 3 might be ready by '86. NEC's machine which will be introduced next year has a 6 ns. clock. Cray is currently exploring GaAs for increased speed and lower power.

Since the V-200 is IBM compatible, with a large virtual memory, Fujitsu is likely to create a new market, and begin a major erosion of the U.S. dominated supercomputer market unless the X-MP can be parallel processed, or new, faster models introduced quickly. Because the V-200 and corresponding Hitachi machines are IBM compatible, they will make an impact on supercomputers as we have known them.

THE JAPANESE POSITION IN SEMICONDUCTORS

Japan's semiconductor technology lead is increasing. All major manufacturers have operated submicron facilities for up to three years. Since these facilities represent a discontinuity in equipment for cleanliness, lithography, handling, etc., semiconductors are likely to be our technological blindside <u>unless</u> a major discontinuity is introduced to offset their effort. Today, the Japanese have closed the gap in manufacturing equipment by introducing their own, non-exportable equipment. The tight coupling between producer and consumer of semiconductors within a single company in Japan is also another interesting facet.

Note the situation in these directly critical semiconductor areas:

1. <u>CMOS for RAM and gate arrays;</u> Japan is several years ahead because U. S. suppliers were slow to make the transition from NMOS to CMOS. The best U. S. gate array supplier, LSI Logic, uses Toshiba chips. Toshiba has the most advanced CMOS facilities today in both manufacturing and research.

   While today's supercomputers are <u>not</u> CMOS based, one company, ETL is basing its future on a large, CMOS gate array.

2. <u>evolution of ECL;</u> Current and projected ECL gate arrays have continued to outperform U.S. produced devices. While efforts in this area are decreasing, evolutionary devices could enable the current Japanese supercomputers to be "evolved" again with relative ease.

3. <u>revolutionary HEMT and revolutionary GaAs devices;</u> The Japanese continue to build and describe high speed circuits at various conferences. Cray is working with GaAs; however, chip manufacturers are required to make the technology viable.

4. <u>packaging;</u> Trilogy's ECL circuits and packaging represented the most advanced design, but is currently "on hold" because of the company developed a design

that went beyond their ability to manage and process the complex design. Only a few efforts exist outside of IBM and are aimed at the necessary interconnect and packaging densities.

While not directly relevant, these areas are of similar importance:

5. conventional microprocessors; These are dominated by U. S. "Semicomputer" manufacturers quite likely because the Japanese are unwilling to make the architectural and software investments when the return is so low. It is much easier to copy the architectures and produce compatible chips.

Microprocessor Opportunity and Potential Blindside

Because of the low cost, reasonable speed (compared with minis and mainframes) and rapid rate of progress compared to conventional computers, the microprocessor represents two technological opportunities that could impact supercomputers and represents a unique opportunity for the U.S.:

5a. The PC provides about the same number of floating point operations per dollar as a Cray for a number of scientific problems, whereas a mainframe is an order of magnitude more expensive. High performance, scientifically oriented micros, would provide cost-effective computation for a much wider class of users, and it could reduce the dependence of some supercomputer users by offering an order of magnitude better performance/price.

5b. A substantial number of multiprocessors have been built which provide substantially better performance/price than large computers. Also, several multiprocessor computers have been built which provide performance that deliver power in the same range as supercomputers, but at substantially lower prices.

6. microprocessor peripherals; While not directly relevant to supercomputers, peripherals indicate the state of the art in design complexity. Many of the

major chips are designed in Japan such as the NEC graphics and disk controllers for the IBM PC.

7. <u>Computer</u> <u>Aided</u> <u>Design:</u> CAD has been developed by U. S. Universities. The programs move almost instantaneously across all borders, creating an even more powerful industry in Japan.

Today's CAD systems are aimed at chips or small, board-level systems. CAD for large systems appear to grow exponentially in complexity and size. An opportunity exists in this area, if simpler methods can be found to deal with the large system size without increasing the CAD or designer complexity. In this way a larger number of ideas could be explored without requiring the massive engineering resources of the large, Japanese companies.

8. <u>electro-optical</u> <u>technology;</u> Some effort should be made to access the likelihood that this technology offers for both computation and for interconnections.

RECOMMENDATIONS TO MOVE TO TECHNOLOGICAL PARITY

Several alternatives have been suggested to establish submicron facilities, beyond those at AT&T and IBM. The Semiconductor Industry Association, SIA, has recently focused on long term research through its research company, SRC which is supporting basic research in universities (and supplying additional engineers).

If the technology for future supercomputers will come from the SIA member companies following an evolutionary path based on CMOS, then the current direction must be acclerated. If the technology requires evolutionary materials and circuits, then an additional effort is required because of the commodity focus of the semiconductor industry.

We recommend following as many of the following alternatives as possible:

1. Startups. An entrepreneurial energy driven, industrial/venture capital financed company, such as Picotech, proposed by Integrated Circuit Engineering Corp., ICE, a market research firm in Phoenix. This would be located in the New Jersey and New York area and presumbably "pull" technical people from AT&T, IBM, RCA Labs, etc. to produced 0.5 and 0.25 micron chips. With the right leaders, this would could be the "best" solution. A facility in Silicon Valley would lack people with submicron experience.

1a.Picotech, Japan would be an interesting alternative. A company would be formed in Japan which would draw on the experienced semiconductor leaders and utilize Japanese process equipment.

2. An SRC or national effort.

a. Form an effort as part of, but in addition to, Microelectronics Center of North Carolina, MCNC done in conjunction with Semiconductor Research Company, SRC.

b. Some other SRC initiative directed at an aggressive submicron chip facility.

c. A National Laboratory for Submicron Device Circuits.

3. Synergy with VHSIC Phase 2. Use VHSIC's second stage results which are targetted at producing the first 0.5 micron chips beginning in two years. The first VHSIC phase obtained 1.25 micron chips within a 3 year timeframe because this was simply a transfer of technology from commercial advanced development to an expensive military line where the government can pay an order of magnitude more for chips. Since current facilities are not in place for submicron fabrication, the effort is unlikely to be successful in time for making competitive supercomputers.

4. Industry. An incentive program which would establish submicron facilities in ALL current semiconductor vendors who are working on high speed circuitry. A special effort should be directed at sorting out the viability and timing of GaAs. If VHSIC is involved in GaAs, the experience gained in this effort should be made available to the commercial industry in order to have cost-effective chips.

5. CAD aimed at small systems could be extended for sets of chips which are necessary for supercomputers.

6. Revolutionary, But Trivial Microprocessors for PCs and Multis. Providing substantially better microprocessors than currently exist or are likely to evolve. The evolution of microprocessors from Intel, Motorola and National has been slow. The key parameters for building effective computers are address size and floating point performance have improved much slower than the semiconductor parameters would predict. The architecture for micros has followed the time worn evolutionary paths of minis and mainframes, and this is not appropriate now because the memory speed and internal clock times for micros are almost identical, given a poor mismatch between processor and memory.

Today's micros need to be abandoned and a simpler load/store architecture that is characteristic of the Cray designs is needed, but with floating point arithmetic and large virtual address. Both Stanford and Berkeley have built the MIPS and RISC chips which are small in transistor count, but these need to be available for widescale use. A program to make this transition within 2-3 years, providing 10 - 20 million instructions per second would have far greater impact on supercomputers than any other factor as described above for use in PC's and multiprocessor structures.

It should be noted that these multiprocessor computers do not provide a lasting uniqueness, but rather, lower the barrier of building supercomputers. Furthermore, any country can make a substantially better micro than those on the market (and in development) today, and with known interconnection techniques achieve substantial parallelism. This represents another technological blindsiding giving a 2 - 3 year lead.

7. <u>Packaging.</u> This crucial area needs to be examined seperately and an action plan formulated.

GB15.7
October 5, 1981

Mr. K. Teer
Mr. H. Bosma
N.V. Philips
Natuurkundig Laboratorium
5621 CT Eindhoven
The Netherlands

Dear Mr. K. Teer and Mr. H. Bosma:

Let me take this opportunity to thank you and your colleagues for the hospitality extended to me last week in Eindhoven.

I enjoyed being able to present a view of computing to you and your colleagues last Monday. The Computer System and

VLSI research was very impressive and the work seems to parallel our own.

Again, thanks for the hospitality.

Sincerely,

Gordon Bell
Vice President
Engineering

GB3.S1.8

CC: Dick Van der Wel

May 2, 1978

Montgomery Phister, Jr.
Systems Consulting
307 12th Street
Santa Monica, California 90402

Dear Monty:

I'm sorry I didn't thank you for critiquing the essays. I've been working on the Computer Engineering book, hence I haven't done anything else except try to keep DEC's engineering running. A draft copy of the book is being sent to you. Also, I'm sending the Direct Sales Catalog and the Hardware Accessories Catalog.

In the future, let me suggest you go directly to the local office (where I'll introduce you) and pick out the catalogs you need.

Sorry I can't help more at this time, but I hope things get better when we get the book out.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:ljp

CC: Bob Long

June 29, 1978

Ms. Judith Pickett
Counsel
Conservation Law Foundation
of New England, Inc.
3 Joy Street
Boston, MA 02108

Dear Ms. Pickett:

Ken handed me your letter. Bob Puffer, of our organization, has responsibility for the mill and I'm sure would be delighted to walk around the mill pond and mill with you. In particular, to see the restoration we've done. It's been the subject of several architectural studies.

We're delighted that you're interested in solving our parking problem and want to get your ideas.

You may be interested in the history. Enclosed are two pamphlets our project printed.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:ljp
ID#0148

Enclosures (2)

GB0003/60

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|   |   |   |   |   |   |   |
+---------------------------+
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Subject: **Picturephone Meeting Service and Our Video Conferencing**

To: O/C
OOD
Jim Bell, ML3-2/E41
Murray Copp, PK1/A10
Al Crawford, PK3-2/F34
Ralph Dement, PK1/A10
Jack Gilmore, MK1-1/J14
Dave Hunt, ML1-4/A97
Dick Kalin, MK1-2/L02
Ken King, ML3-2/E41
Alan Kotok, ML3-5/H33

Date: 6/24/79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext:223-2236

Follow-Up: 7/9/79

Several of us visited ATT's Picturephone Meeting room in Boston. It is one of a dozen (Atl, Bos, Chi, Det, La, Ny, Phl, Pgh, Sf, Wdc) or so linked together by full duplex color video channels. Apparently up to 4 of the rooms can be connected for an even larger conference. The cost per hour varies from about $150 to $390 (NY to LA).

The rooms hold 6 at a table, plus about 10 in a row behind, and another row of chairs can be installed. Apparently 24 have made it in a room, assuming the air conditioning is on better than when we visited. It has the following:

. 3 cameras that are voice actuated that cover pairs of the 6 at the table
. 1 camera to give a panorama of the room, when no one is speaking
. 1 camera with tilt and zoom to cover a presentor at a whiteboard area
. 1 camera with zoom to cover back or top lighted viewgraphs or opaque stuff
. 1 camera on a slide projector
. 1 camera can be brought into the room for special use
. a tv videorecorder for input or recording the proceedings of a channel
. a Tektronix hardcopy output of the incoming channel
. several consoles where the camera channels can be selected
. 2 tv screens for viewing incoming and outgoing video

Each of the participants wears a neck mike, hence there is great audio. The numerous cameras make for lots of action to hold attention of the conferees. The person who manages a transmission has little to do, and in fact can do nothing and the voice actuation and presentor can do it all. This means there's not another person in the room to manage the conferencing.

I talked to people at BTL Friday and discussed the changes to subsequent rooms. Hitachi is building a digital encoder to get the color tv down to 5 MBS so it can use the regular network. There was some notion of a large (60") screen, which seems essential because the 2 TV screens were only 25" or so. Also, it would be worthwhile having some automatic or easy to use videomixing so that static material such as slides or viewgraphs can be mixed with the conferees.

What I would like to see:

. Let's make a concerted attempt to use the existing videoconference facility of AT&T's...and log our reactions, find out its use and limitations.

. Put in place these rooms as per what BTL will provide and a network among the NE sites assuming it pays on the basis of transportation costs (the worst case).

. Work with BTL to see just whether we can get down to a cheap, 50 bps link so that it can also be used among widely separated domestic facilities (eg. ML-CX).

AT&T hypes it for: product introduction and sales, especially to multiple sites; personnel interviews...it looks very good for this in certain cases where the interviewee has a hard time coming to visit; design reviews and technical problem solving between two groups; staff meetings such as regional sales or service (note with 4 sites, the travel time could be significantly reduced in our case). It has even been used for depositions.

GB:swh

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Al Bertocchi PK3-2/A56 Shel Davis PK3-
1/C21
Win Hindle ML10-2/A53 Ted Johnson PK3-
2/A55
Andy Knowles ML10-2/A52 John Leng MR1-
1/A65
Bill Long ML10-2/A57 Julius Marcus MK1-
2/C37
Ken Olsen ML10-2/A50 Stan Olsen MK1-
2/C36
Jack Shields PK3-2/A58 Jack Smith ML1-
4/A54
Bill Thompson MS/C12

Dick Clayton ML12-2/E71 Jim Cudmore ML1-
5/E30
Bill Demmer TW/D19 Ulf Fagerquist MR1-
2/E78
Sam Fuller TW/A08 John Holman PK3-
1/P84
Bill Johnson ML12-3/A62 Mitch Kur ML12-
2/A16
John Meyer ML12-1/A11 Larry Pornter ML12-
3/A62
Bob Puffer ML12-2/E38 Grant Saviers ML3-
6/E94

Jim Bell ML3-2/E41 Murray Copp
PK1/A10
Al Crawford PK3-2/F34 Ralph Dement
PK1/A10
Jack Gilmore MK1-1/J14 Dave Hunt ML1-
4/A97
Dick Kalin MK1-2/L02 Ken King ML3-

2/E41

Alan Kotok ML3-5/H33

Why can't these be identical in terms of power supply, electronics, and overall package? I assume they differ by a rom for the different positioners. I don't see why the form factors aren't identical such that either could be put in a cabinet slot.

What you say?

ROM: GORDON BELL DATE: WED 31 OCT 1979 11:33 AM EST
DEPT: OOD
EXT: 223-2236
TO: DAVE CUTLER
cc: LARRY PORTNER
ANDY KNOWLES
BILL JOHNSON
SI LYLE
BILL PICOTT @MR16

SUBJECT: PL/1 AT DECUS

GB0005/44/EMS

Certainly we must abide with PPC decision to not announce PL/1 or make a product commitment at DECUS.

Since we often describe R+D efforts, it seems totally appropriate to discuss your work as such and get feedback you might want.

I believe a talk on "The Structure of a PL/1 Compiler for VAX" or "PL/1 Code Generators for VAX" or "An Experimental PL/1 for VAX" would be good and should get on the program. Let's describe the work.

GB:swh

FROM: GORDON BELL DATE: WED 31 OCT 1979 9:00 AM EST
DEPT: OOD
EXT: 223-2236
TO: LARRY PORTNER

BILL JOHNSON
SI LYLE

SUBJECT: PL/1 FOLLOW UP: 11/9/79

GB0005/43/EMS

What's the story on VAX-Basic? I've been pushing to get a presentation there. We have a good product and must start to describe it. Let's go.

GB:swh
00 BURT DECGRAM ACCEPTED S 29041 O 30 29-AUG-81 17:03:40

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* d i g i t a l *
****

TO: BILL DEMMER DATE: SAT 29 AUG 1981
17:00 EST

FROM: GORDON BELL
cc: see "CC" DISTRIBUTION DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: HOW CAN WE GET A REALISTIC GEMINI/SCORPIO/NAUTILUS PLAN?

Having just looked at the potential competitors, it's clear that they are based on the emerging 32-bit micros (Motorola and its Japanes licensees, Intel, Zilog and its partner) which will permit the construction of systems that are competitive with all systems we build up to and including the 780 and multi-780's! Also, these machines will be available BEFORE Gemini, Scorpio and Nautiuls!

I'm not confident that we're going to get the competitive machines of Gemini/Scorpio/Nautilus, even within the normal 6 quarter slip times. Is there a meaningful basis for producing schedules since there are many undefined and very high risk parts? Is the management overcommitted too? We ought to not overlook these signs:

HUDSON

1. Tiny has had 5 passes and will require a complete redesign... it is also several years late.
2. J is behind schedule.
3. We were just surprised to have to design our own very complex rom/ram for the microcode. This a very advanced design.
4. BI looks like an even more risky and complex chip than the now 3 chips of Scorpio.
5. DECSIM has slipped and parts are one year late. It's needed.
6. We are behind in hiring and we are constantly adding people to maintain the schedule. A/D resources have to be used.
7. Plans and commitments are made independent of the doer because hiring is behind the commits (I.e. he who plans does not do).
8. A complex organization with lack of project role clarity.
9. All effort is on MOS, little involvement in the gate array.
10. Scorpio is the FIRST state of the art design we've tried.

PACKAGING, POWER AND PHYSICAL INTERCONNECT

1. Management is only by level of effort with no measureable programs.
2. No reporting of direction or progress outside the organization
3. No evidence as to doability of technology cause there's no communication or project.

MID RANGE SYSTEMS

1. Large FCC workload

2. A non-zero work backlog for CI, the 750 and other projects.
3. Lack of systems manufacturing interface and rapport (not critical until there is something to build)
4. Lack of recognition of the incredible work load ahead implied by the Gemini/Scorpio/Nautilus Program (too many CPU designers and no systems, and option module designers)
5. A PP/PI plan (wish) without a manufacturing engineer
6. A requirement for a sophisticated engineering process and no CAD gurus or managers
7. A basically arcane engineering process with process responsiblity buried 2-3 levels below Demmer
8. Lengthening project gestation times, giving less competitive products without the accompanying understanding
9. A Nautilus plan requiring the use of chips at the limit of their capability AND well beyond the needs that all other users will put them to. This was same problem with the MCA!
10. A Nautilus plan requiring a sophisticated CAD CHAS-like system for: drawing, communication, much checking (due to chip use), q/c, project scheduling, testing, etc.
11. A Nautilus plan of sufficient length to burn out people

WE HAVE MANY POSITIVES
The Hudson folks are working hard and are very good. Also, CHAS was just released on schedule and may be a breakthrough in tools that even MOS designers may use.

We have very talented designers, and they can do very good work if we don't overcommit and frustrate them. They can be frustrated by:
1. changes, false starts and lack of resources at the beginning,

2. a long project caused by poor planning and poor processes,
3. a long project because we can't get it manufactured.

The managers are very good with fine records of accomplishment both on technology and to schedule.

The architecture and the software are ready, and we have: VAX, VMS, BI, CI, NI and SI products. We have a SUVAX prototype. It is clear what components we must have. These are our real aces!

The system possiblities are quite clear, even though our planning is yet to catch up with this. (I don't advocate building a planning staff as it's too late.)

Bill,
I do not have an answer, but certainly have a concern about the enormous work load ahead and the underlap and overlap of organizations, products and projects... amounting to lack of clarity. None of the negatives taken alone are a problem, but the collection of them is frightening.

The project set is larger than the original VAX Project!!

We need to be calm. We need to understand. And, we need a believable plan!

"CC" DISTRIBUTION:

BRIAN CROXON	JIM CUDMORE	JEFF KALB
DEMETRIOS LIGNOS	JIM MARSHALL	DON MCINNIS
JOHN MEYER	JOHN O'KEEFE	LARRY PORTNER
STEVE TEICHER	WILL THOMPSON	

GB2.S8.32

John Alexanderson
MK

Bill Chalmers
MR2-2/M67

Bruno Durr
PK3-2/S56

Jack Gilmore
MK

John Holman
PK3-1/P84

Irwin Jacobs
MK

Ed Kramer
MR2-4/M16

Bob Lane
HD

John Leng
MR1-1/F35

Bill Long
PK3-1/A60

Jack MacKeen
MR2-2/M65

Julius Marcus
MK2/C37

Stan Olsen
MK1-2/A57

Jack Shields
PK3-2/A58

Charlie Spector
ML5-2/M40

Bill Thompson
ML12-1/F41

Gerry Witmore
ML5-2/M40

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

John Alexanderson	MK	Bill Chalmers	MR2-2/M67
Bruno Durr	PK3-2/S56	Jack Gilmore	MK
John Holman	PK3-1/P84	Irwin Jacobs	MK
Ed Kramer	MR2-4/M16	Bob Lane	HD
John Leng	MR1-1/F35	Bill Long	ML10-2/A57
Jack MacKeen	MR2-2/M65	Julius Marcus	MK2/C37
Stan Olsen	MK1-2/A57	Jack Shields	PK3-2/A58
Charlie Spector	ML5-2/M40	Bill Thompson	ML12-1/F41
Gerry Witmore	ML5-2/M40		

d i g i t a l **i n t e r o f f i c e m e m o r a n d u m**

Subject: **Your August SW Report**

To: George Plowman, ML5-5/E97 Date: 10 OCT 78
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

1. Get with Ted re SWS/Sales Support findings.

2. Get PPG's help.

GB:ljp

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION DATE: WED 7 APR 1982 8:51 AM EST
FROM: GORDON BELL
cc: see "CC" DISTRIBUTION DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: PLUTO'S GREAT. LET'S SELL IT WIDELY AS THE COMM. COMPUTER!

It was great to see Pluto in operation yesterday. It looks like we finally have a Corporate communications server product after 10 years of trying to get one. The mechanics too are a landmark and the ability to stack and have 96 lines in a small space is really great. We have a basis for future communications system products using the packaging to eliminate the intermediate cables.

It's the first unpack and stack system.

It's clear to me we ought to consider selling it as a communications computer in other than NI contexts without the UNA. In this regard we'll clearly want the J in there as line speeds increase. Also there'll be a demand for higher speed lines and doing interfaces to high speed common carriers to couple LANs. Similarly, you're planning the multidrop hdlc to get the cost per terminal interfaced down even further.

I think it's time to take the cover off it and start talking to people like the phone company and OEMs who need good communications hardware. Clearly we ought to be able to clobber the 8100 and the other IBM kludges that do comm! Let's do it. There clearly has to be a market for it as our customers have been building communications systems for years with our relatively crude hardware. Now they ought to be able to do much better! Let's figure out how we can sell it. Clearly there'll be a demand for other components that can stack on it like a disk. It's by far the neatest package I've seen from Digital. Congratulations.

"TO" DISTRIBUTION:

JOHN ADAMS	JOHN GILBERT	RICHARD GONZALES
MIKE GUTMAN	JIM O'LAUGHLIN	BERNIE LACROUTE
JOHN MCNAMARA	DAVE RODGERS	

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JACK SMITH BILL STRECKER

GB3.S4.39
****
* d i g i t a l *
****

TO: BERNIE LACROUTE DATE: TUE 6 OCT 1981
15:34 EST
DAVE RODGERS FROM: GORDON BELL
cc: LARRY PORTNER DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: GETTING A REAL START ON PLUTO, GATEWAYS, ETC.

Pluto scares me. I see lots of paper and little real content on its
REAL (future vs. past) competitiveness, or what it is, or most
importantly, how it's going to be built. Now I see a second Product
Manager: US Paper!

For starters, I'd approach it as an evolutionary design by building it
now using current hardware (DMC lar serial line interfaces),
then evolve to support UNA and the Protocol Assist Module/line units.
In this way, you have an automatic backup to a standard 11 with a UNA,
cause all that PAM, etc. hardware will demand very large diagnostics
and a big handler change.

Also, the folks building the CATS and the old 10/20 DN may know
something that could be used to design this.

The sequence:
1. Get a host (10/20/VAX or whatever)/Pluto environment using today's hardware that supports PLUTO SW development, down line loading and debugging. (Decide on how to handle the multiple host development/down line loading and debugging environment).

2. Get a PLUTO environment that works with 1.
2A. Buld a PAM SW interface
3. Develop and TEST as concentrator while
3A. developing and testing a separate, parallel RJE (line printer part).
4. Replace the standard D(L,H,...Z) with the PAM.
5. Replace the DMR with UNA

We're doing the review soon. At that time, please give me a demo of 1 and 2. Note that this base software 1 and 2 has to be done and has to be completely general before you can build any gateways, servers, repeaters, etc.

GB3.S1.32

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+--------------------------+
```

Subject: **VAX PMS Structure**

To: Bill Demmer, TW/D19
Sam Fuller, TW/A08

Date: 6 DEC 78
From: Gordon Bell

Bernie Lacroute, TW/A08
Wayne Rosing, TW/C03

Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

CC: Ulf Fagerquist, MR1-2/E78
Mike Gutman, ML3-6/E94
Bill Johnson, ML21-3/E87
John Kevill, ML3-6/E94
Pat White, ML12-3/E51

I'm appalled at the lack of any PMS Architecture of VAX. (I saw Bernie's input to Mass Store.)

Surely there are more ways than SBI, CMI, ICCS (only 1 version?), Unibus, and New I/O Bus to interconnect the range of VAX systems to disks? What about Massbus and the inevitable Nebula Backplane?

This will be a good lesson (case study) in losing money. There are now no standards!

Ulf and Bill, please get together to help, not sink, John (and Bill).

As an aside, Bernie suggests no CCD in HSC or no optimization. This, I believe is only because there is no performance data on VAX, our customers are in honeymoon period and not yet complaining.

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST: Bill Demmer TW/D19 Ulf Fagerquist MR1-2/E78
Sam Fuller TW/A08 Mike Gutman ML3-6/E94
Bill Johnson ML21-3/E87 John Kevill ML3-6/E94
Bernie Lacroute TW/A08 Wayne Rosing TW/C03
Pat White ML12-3/E51
6B

Founder and VP of R&D, Prime Computer 1972-1979
Under Bill's technical leadership, a significant minicomputer company was formed that grew from 0 to about one-half billon dollars revenue. The Prime minicomputer had the FIRST computer implementation of a 32-bit, virtual address with Multics style computing at a fraction of the cost. The entire product line which Bill managed, before leaving consisted of wide range of compatible minicomputers which were used for a wide range of applications (general purpose to office automation).

In 1978, VAX was introduced as a 32-bit minicomputer; today all minis and micros have been extended to 32-bits, but Prime was the first to extend the addressing of small computers and provide a virtual memory program environment.

Commercial development, in 1975, of first token-passing, local area network. (The first implementation of IEEE 802.5 will occur in 1984.)

Citation

For technical vision and leadership in computing that established the first minicomputers with large virtual addresses and the first company of a new industry of distributed, co-operating workstations.

6a

Founder, Chairman and CEO, Apollo Computer, 1980 - present

Under Bill's entrepreneurial and technical leadership, a new industry has been formed based on powerful, fully distributed workstations. The Apollo environment typifies distributed computing of the future.

The Apollo Domain environment provides computing directly at the user's Workstation, thus avoiding the response-time bottleneck of timesharing for what is highly interactive work. In addition to the workstation, the environment consists of a token passing ring (similar to IEEE 802.5, but at least 4 years earlier) to interconnect the stations. A 48-bit name space permits all workstations to communicate and share resources (especially files) with one another.

Apollo was the FIRST company to provide this environment. Now 150 new workstation companies have been formed to compete with some segment of Apollo. In addition, traditional companies such as IBM and DEC are attempting to provide similar products. Apollo still maintains the leadership position.

6 explanation

The Apollo environment is the FIRST commercial implementation of the fully distributed cluster outside of a laboratory environment (Xerox Palo Alto Reseach Center; Ethernet interconnecting Alto workstations). This kind of environment will be the main style of computing of the 90's. Only two companies appear to be providing products which are similar, but less extensive than the Apollo environment (eg. SUN Microsystems, Silicon Graphics). A proposal in 1979, at Carnegie Mellon University, SPICE, offered such an environment, but only now is it partially operational. The Apollo product(s) constitute a system formed from hardware (various workstations), a local area network, and distributed operating system-- any one of which are a significant.

The above examples illustrate the engineering difficulty necessary to make the Apollo Domain Environment and set of products, i.e. the work is well beyond what can be done by 100's of startups or capable research groups. Bill lead this effort!

Apollo started in '80, and introduced their first product within the first year. The company has just reached $100M annual sales, and should reach the billion dollar level by 1988.

1980-Apollo Domain, Distributed Computing Workstation Environment

Demonstrated vision and technical leadership to found a company to develop a computer system that is generally viewed as the successor to time sharing. See "Architecture of Apollo Domain."

1975-Prime Token-passing local area network

Delivered first, commercial high speed, token passing ring local area network. See Reference Manual for Primos.

1974-Prime Virtual Memory Minicomputer

Delivered first implementation of large, virtual memory on a minicomputer. One of first companies to do systems programming in a high level language (subset of PL/1). See Reference Manual for Prime 400.

7 additonal

1973-Prime
First product with demand paging on a 16-bit minicomputer. See Reference Manual for Prime 300.

1968-Honeywell
Consulted on the 16-bit computer that ultimately became the Series 16 minicomputer.

1968-NASA
Demonstrated demand paging on a minicomputer.

1968-NASA
Pioneered in the use of higher level languages for implementing operating systems by using Fortran as the implementation language for a NASA system.

1966-MIT
Pioneered a first course in systems programming with text.

7 next page

Bill has demonstrated exceptional technical vision, followed by leadership to implement the vision resulting in two key 'firsts" in computing which others have followed.

In the case of Prime, a recent study (which will be published shortly by me in Computer), showed that of 100 companies that began making minicomputers in the early 70's, only the startups Prime and DG remained autonomous. 75% of the companies failed. Only 8 companies succeed to any degree: Prime, DG, DEC, IBM, HP, Interdata, Harris, and SEL.

In the case of Apollo, they were clearly first and everyone is following. In this case, I expect a much more brutal fallout of companies. Of the 150, I expect only Apollo and perhaps 2 others will win. I expect DEC, IBM and perhaps 2 of today's computer companies to produce products that will compete with Apollo.

Bill's leadership as an engeering entrpreneur should weigh heavily in favor of his becoming and IEEE Fellow, because I believe this combination of superb engineer/leader/entrpreneur is who we want as leaders and role fellows in engineering.

Enclosed is a set of notes I took from a lecture Bill gave to the IEEE Engineering Management Chapter (12/83). It shows why Apollo is no. 1, and why Bill would be an asset as a Fellow of the IEEE.

Bill Poduska: On Apollo
Lecture to IEEE Eng. Mgmt. Chapter, 12/13/83
slides, (comments), [GB comments]

THE APOLLO BUSINESS PLAN

Business Plan
$100M by 1985. (Will achieve 4 Q run rate by early '84. Poised to be running at $1B by 1988.)
Marketplace
Computing Professionals, especially engineers. Productivity based, and the natural successor to timesharing. (3.5M engineers who potentially could be

twice as productive is the market goal. This amounts to 100B market. Trick is to convince public to part with money. This was easy because the buying decision is initially under 100K and is incremental. Model was positied by various universities including CMU. Take advantage of micro and evolving, poor performance of timesharing.)

Product

Network of dedicated Computers. The technology of the '80's. (MIT taxonomy: It's a NEW product to an OLD marketplace. It's a Workstation with 16 Mby VA, 4 Mby Mp, 154 Mby Ms, 1000x1000 x 1 to 8 planes x 2 for image backup. Operating system allows paging over a 12 Mbit/s LAN with 48-bit address in full transparent mode. pages: 1 Kby, average of 4 pages transferred. Apollo's own LAN has 280 nodes. Is busy 10%. Price: $40K monochrome.)

(Product strategy: [straight from computer engineering. Introduce a product, go up in performance, go down in price and form a wedge of **compatible, LAN'd** products.] '81 monochrome 40K; '82, color, flt pt, 100K; '83 desktop mainfram at 10K to 20K; Oct 83 fully compatible TTL version of 68K giving more Whetstones than a VAX 780. Soon a 100-150K product. Easy to add a node. They are predicated on NO BACKWARD INTEGRATION. THEY ARE A SYSTEMS COMPANY...). [RECALL WE MAKE WHAT WE SELL, NOT WHAT WE CAN BUY.]

[They simply exploit mini lethurgy and inability to move on micros. Apollo is clearly working on an ECL version!]

People

Used seasoned Professionals and entrepreneurs. Now 1.3Kp. (Company started in 5/80 with FCS 3/81 to Harvard. The Operating Committee has 8p with 3 Prime, 2 DG, 2 DEC, 1 outside Computer industry. Six had been founders before. The average age at startup time was 42! The average age for all startups is 32! Bill is now 45. Apollo ONLY hired quality people... most of whom had done it before.)

[Apollo is simply going to pick off the cream from DEC, Prime, etc. (I believe DG has its act together and is not vulnerable now.) in much the same way that the mini folks (DEC, DG, Prime) used Honeywell as the basis to start to build their companies. The issue of the average age of a company, particularly the top management is quite interesting.]

Money

Venture financing to be a public, profitable company. (The company is now selling at $32 with 22 Msh, giving a 700M market value. 80% of the people in the company are shareholders. 60 are Millionaires via the stock.)

MANAGEMENT PRINCIPLES

Risk

Use time line management; have plan A, B and A+. (Tradeoff cost, functionality NOT schedule. Be able to work with a slower part, but if a faster one comes along, also be able to exploit it. Not all breaks are bad. Whenever people work hard, they end up getting lots of good breaks too.)

Organizational focus

Functional based

Products look like organizations [Conway's famous law.] (Take lots of time for organizational design.)

Management is a contact sport (Air hostilities, but get the hate out in 24 hours.)

People Principles

Justice and share the rewards

Fun (Don't think that it's the end goal that's it. Achieving the goal is ALL the fun.)

Excellence!

TOOLS AND MEASURES (PREDICTION VS FACT... have a plan)

Money

P&L and Balance Sheets (are your friends. Understand and use them.)

People

Oranization Chart with names and dates (Put responsiblities here.)

Time

Schedule (has names and resources on it)

Time Line Management for resources
Bad Tools
Marathon Staff meetings that are problem solving sessions. (Charlie Spector taught them to have short, 2 hour, meetings that have problem identification and reporting. No problem solving on line. People are to do this.)
Committee design reviews

THE ENTREPRENEURIAL STEP

New ideas
Market driven, technology driven, Opportunity (exploit some pathological phenomena such as lack of parts, or high prices)
The Business Plan (note the first slide)
Business
Marketplace
Product
People
$
(Poduska as VC: business plans must be less than 10 pages. Have never read or known anyone who has read a business plan over 10 pages long. Go for Grade A people only. Grade B people with a grade A plan loses. Grade A people have fire in the belly and steel in the eyes.)
Selling the Plan
Value of the investor. (The VC system works!)
Seperate investors and management. (Keep the investors independent of the management! VCs know nothing about management. A business without management is useless, and VCs are now beginning to realize this more and more.)
Everyone must win
Pace and timing (Be in it for the long race.)

RISK AND REWARDS

Rewards
Ego- achievement
$- capital gains (Watch for $'s not for the % of the company. Control always rests with the management, NOT with votes.)

Risks
Ego- failure
$- no way (People may be out of a job 3 months.)

ELEMENTS OF SUCCESS AND FAILURE

Success
Ego drive
Faith in the idea
Trust in the people
Humility and humanity

Failure
Misjudgement (technical and people)
Mismangement
Unrecognized success (giving up too soon
Lack of courage

People
More important than the idea
More interesting than bits, bytes, nanos

Q&A
lots, eg.
Q: How will you keep Apollo from becoming large and lithurgic?
A: The key is to use some form of entrepreneurism. People like the personal challenge of proposing something and the freedom to carry it out with the corresponding risks and rewards.

Other thoughts (by GB)
My simple model of computer generations has to be extended to include people (leadership) and new organizations as I see incredible new highs and lows of performance.

Apollo is an archetype of the phenomenon that creates a new generation and industry... even though it is simply a replacement (New product to old market) designed to eat a large segment of the mini market. It is clear that old organizations rarely make it from generation to generation (eg. BUNCH to build minis). This can be seen by looking at every level of integration and systems including: logic technology, computer, software and various peripheral vendors. The notable exception is IBM who has moved out by significantly stronger leadership at the top.

Gordon Bell, Decmember 17, 1983

June 1, 1978

Mr. Bill Pohlman
INTEL
3065 Bowers Avenue
Santa Clara, California 95051

Dear Bill:

It was good to talk with you again on Tuesday regarding your kind offer to write a chapter for the update of Computer Structures by Professor Dan Siewiorek. You will of course be free to publish the chapter elsewhere and to get any other co-authors involved in the writing. We would encourage and urge the publication in the regular technical literature. I'm enclosing a copy of Computer Structures and a copy of the recent PDP-10 paper which may be useful as models.

I believe the article should cover the interaction of technology, architecture and use surrounding Intel's 8008...8086. The peripherals chips and bus are of interest too. I don't believe the 8086 should be more than 1/2 the chapter and the article should cover all the Intel machines back to the 8008 and any other machines that are relevant to the evolution of the microprocessor. The 8080 should be emphasized, particularly because it became a standard.

We need a first draft by September 1. Although the size is up to you, I believe that it would take 10-15 book pages or up to 45 typewritten pages to do justice to the subject.

If there are any questions, please contact me or Dan Siewiorek.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:ljp

CC: Bill Davidow, Intel
Dan Siewiorek

Enclosures (2)

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a n d u m
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+---------------------------+
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Subject: **Policy on 10's, 20's and VAX's Within Engineering**

To: Bob Puffer

CC: OOD,
Al Crawford, PK3-2/F34
Rattan Dhar, MR1-1/M42
Bob Grimes, ML1-5/B90
Bill Keating, ML12-3/A62

Date: 2/14/79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

follow up 3/8/79 (OOD Mtg.)

Given the strategy, we need the above. Can you get someone to deal with this and give us a report at OOD in early March. Both Al Crawford and Bob Grimes have made commitments and have policies with respect to VAX (see the attached). I think we need a similar set of statements and we need to know who should make them...and implement them.

I don't have any detailed thoughts, but would like to get a general direction such as:

0. Probably plan to minimize the buying of more 10's. Buy VAX's instead.

1. Let's look at applications which we say will always run on 10's unchanged! Let's not rewrite them, but use them till we don't need them or they're obsolete (e.g., PC Layout).

2. Establish a network so that as work builds up on a given 10, we can off load it on VAXs and place new work there rather than having any kind of massive migration program. For example, the new PC Layout program should be moved to VAX because we're out of 10 address space. This will free up a lot of 10 capacity.

3. No programming anywhere in anything other than VAX languages (common Bliss, Fortran, Cobol, APL--betting on the cum of a good, compatible APL, etc.)...but specify!

Whoever is going to manage this would have the whole thing planned, and all I want you to do is to identify the person or persons within engineering.

GB:ljp

Attachment

D I G I T A L INTEROFFICE MEMORANDUM

DIST:	Al Crawford	PK3-2/F34	Rattan Dhar	MR1-1/M42
	Bob Grimes	ML1-5/B90	Bill Keating	ML12-3/A62
	Dick Clayton	ML12-2/E71	Jim Cudmore	ML1-5/E30
	Bill Demmer	TW/D19	Ulf Fagerquist	MR1-2/E78
	Bill Johnson	ML3-5/H33	John Kevill	ML3-6/E94
	John Meyer	ML12-1/A11	Larry Portner	ML12-3/A62
	Bob Puffer	ML12-2/E38		

GORDON BELL
Vice President, Engineering
Digital Equipment Corporation

OBSERVATIONS ON GENERATING COMPUTER GENERATIONS

ABSTRACT

We've implemented thousands of species of the computer in a few, basically evolutionary technologies. These technologies mark the generations. The evolutionary process is cyclic and includes the technology, the architecture and implementation of species, followed by use which in turn generates increased demand for better technology, permitting evolutionary new computer structures.

Since new generations spring from new technologies and often different people, a new generation most likely follows the time-worn path of early pioneers. New generation builders tend to relearn the same lessons about technology limits,

architecture, its evolution including the "wheel of reincarnation" for specialized functions, multiprocessors, etc.

GB5.33

CENTRAL ENGINEERING MASSACHUSETTS POPULATION PROJECT ON FY80 THRU FY84

SITE	CURRENT POPULATION	FY80	FY81	FY82	FY83	FY84
MARLBORO	412	453	450	450	450	450
MILL	1777	1600	1840	2116	2000	2000
TEWKSBURY	606	650	550	610	680	700
MISC.	40	40	40	40	40	40
HUDSON (FY82)		350	420	504	604	725
SITE Y (FY83)					432	700
?MARLBORO EXPANSION			50	100	155	215
TEWKSBURY OVER FLOW						61
TOTAL	2838	3093	3350	3820	4361	4891
SITE B (OUT OF STATE) (?)					291	
TOTAL						4600

NUMBER GIVEN TO FP&E WAS 4800

+---------------+
! **d i g i t a l ! i n t e r o f f i c e   m e m o r a n d u m**
+---------------+

Subject: **Portability and Waterloo's Widget, Watfor, Watfiv and Watbal on Series 1**

To: Bell Heffner, Bill Keating,
John Leng, Jerry Witmore

Date: 31 MAY 78
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

CC: OOD, Gus Ashton, Denny Doyle,
Ed Fauvre, Win Hindle, Ted Johnson,
Andy Knowles, Gordon McConnell,
George Plowman, Ron Smart, Bob Trocchi,

follow up 6/14/78

I just talked with Professor Wes Graham at the University of Waterloo. He believes we're not too responsive in selling these products when compared to the system he put on (ported over to) the Series 1. Still, he wants this software on VAX.

His people have made 4 trips to IBM to train 100+ salesmen/trip and IBM has sold 100 Series 1 systems as a result of his products (we've sold less than 100). He would like us to get interested in pushing the products on 11's. (He'll also send us data as to the number of systems that run his software--even though he believes three times this number should with some reasonable selling and promotion!) Is there any way we could do this and at least give the customer the option of an 11 over IBM? IBM is also mounting a major sales effort to push this product.

As an aside, he said there is a faction within IBM that was pushing a 32-bit architecture for Series 1 that is now saying "I told you so" when we announced VAX! We apparently sucked IBM into a small, low end, 16-bit architecture -- when others within IBM think its too little, too late.

Portability and DEC

These systems were written in a portable way and moved over to Series 1 in a rather straight-forward fashion! Portability is being used more and more (e.g., UC/San Diego with PASCAL, Bell Labs with Unix and C). (Note much 10 and 11 software has been "ported" from other machines too!) Somehow, not only are we not developing portable software internally, but we often have multiple redundant efforts for software (e.g., many 11 Cobols and a new non-ported Cobols on VAX+ 10). Although Cobol may be the wrong example, there have to be good examples (e.g., the new Editor).

This year (FY79) I, again, want from Software Engineering:

1. Clear statement on where we (numerically) are vis a vis the language used to implement systems together with a policy!

2. Portability considered on each piece of software (i.e., what systems it is for and when will it move.

3. In DECnet, especially, there could be a complete overhaul of software, tools and policies considering high level languages and testing.

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST: Bill Heffner TW/C10 Bill Keating ML12-
3/A62
John Leng MR1-1/A65 Jerry Witmore PK3-
1/M40

Jim Bell ML3-2/E41 Dick Clayton ML12-
2/E71
Jim Cudmore ML1-5/E30 Bill Demmer TW/D19
Ulf Fagerquist MR1-2/E78 John Kevill ML1-
3/E58
John Meyer ML12-1/A11 Larry Portner ML12-
3/A62
Bob Puffer ML12-2/E38

Gus Ashton ML5-2/M40 Denny Doyle KA
Ed Fauvre MK-2/C36 Win Hindle ML5-
2/A53
Ted Johnson PK3-2/A55 Andy Knowles MR2-
2/A52
Gordon McConnell KA George Plowman ML5-
5/E97
Ron Smart AK Bob Trocchi PK3-
1/M40
Jerry Witmore PK3-1/M40

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a n d u m
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+---------------------------+
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SUBJ: POST OFFICE AND MAIL COLLECTOR

Date: 2/28/79 Wed
From: Gordon Bell
Dept: Office of Development

TO: Don Alusic

Al Crawford MS: ML12-1/a51 ext: 223-2236

George Plowman

Follow up: 3/16/79

I hope that your Post Office program will deal with the problem that is now bugging me: I have two places to look for mail since the ARPAnet isn't connected to our systems.

Is it possible to have some background jobs in Post Office that will go out to specific computers like CMU10A and pick up my mail on a periodic basis?

Also, I would like mail delivered to the user community there, but the Post Office does that, I gather.

GB:mjf

Post v N Computing: A 10 YEAR, DIRECTED RESEARCH PROGRAM AND NATIONAL FACILITIES AIMED AT PARALLEL PROCESSING

A Draft Outline*

Proposal(s)**

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ntive references to previous and ongoing work and bibliographic references have been omitted. While we believe the general is correct, specific tactics such as the applications to focus on, will be subject to change with the final proposal(s). We now th conceptual and detailed critiques.

The final proposal must come from the program group dedicated to produce the results. Thus we solicit:

- o sites
- o individual researchers and a program director
- o applications and other research projects

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OVERVIEW

egan as an exercise by positing a computing environment we believe is attainable in 10 years based on parallelism
c of the single, von Neumann machine and then asking ourselves:

Are we doing anything significant to understand and build this environment?

overwhelming:

most industrial research appears to be aimed at incrementally improving today's products and processes; while

academic research is aimed at basic research and the mechanism of getting grants, producing papers and Ph.D's.

f this program is to develop the technology and build next generation computers by establishing several National Laboratories
cience and engineering research within the U.S. military, academic and industrial community. This technology is essential:

1. for defense;

to improve the declining computer and semicomputer part of the U.S. Information Processing Industry which now constitutes
d supports much of our economy directly and via exports; and

3. as a basis for
uch of the 21st Century Industries.

echnology position in the computers and semicomputer industry is a national crisis. As such, this necessitates these unique
program:

1. collaboration
nong national science, defense, university and industrial applied research, often called technology, in a fashion not unlike the
ISIC program;

2. National

boratories so that limited machine and people resources can be shared, unlike the VHSIC program;

3. a large, fast

twork including access both for experimentation and to extend the program to other research sites;

4. construction of

ototypes by industry for evaluation within the research community;

5. technology

nsfer by industrial residents at the laboratories;

6. tighter

upling of application (need), architecture, construction and use by co-location in order to rapidly engineer, build and test ideas. is speeds up migration of ideas to use by applying engineering resources earlier.

will be the hub of a goal directed research program aimed at new VLSI-based, highly parallel computing structures. Parallel ems, including: specialized processors and hardware algorithms, multiprocessors, multicomputers, dataflow and high speed ork based meshes will be built and evaluated. Evolutionary projections show a performance increase in processing of only a 1) to 11 (Fig. 2) over the next 10 years. In contrast, the Japanese Fifth Generation Research Project, is aimed at producing high llel computers with a factor of 100 to 1000 more computing power for conventional and Knowledge Based computing systems .

goal of the program is VLSIzation, the ability to transfer an algorithm, simulated within the computing environment, to VLSI the foundry time in much the way programs are currently compiled. By it's nature, this structure adds inherent parallelism to e national facilities would also support the goal that computers would do a substantial part of the VLSI design. Research in the ting structures we target will rely on accomplishment of these goals.

er generation is marked by concurrence of technology and needs causing a new computing structure and resulting in new use. driving need is for the ability to transmit, store, and process (understand) the same information as people, including voice, es and images. Images are a major data type of this research program because of the links with people. The research need is hardware and technology and by the potential of Knowledge Based Systems requiring much higher performance. These must be gnal processing to assimilate voice and images.

ould be organized in 3 phases, covering roughly a decade, in order to focus the work in a timely fashion. Generations have en 7-10 years and consist of two periods: specification and construction; followed by use and evaluation. The immediate he most powerful, high speed network of general purpose computers would start the program in the use and evaluation phase. n application of this facility would then be applied to produce new VLSIzed computing structures by the end of this first phase. se would apply these newer structures, forming the basis for new designs in the final program phase.

MOTIVATION FOR THE PROGRAM

the combined Information Processing Industries is now declining relative to Japan. While there are many reasons for the re noteworthy and represent the motivation for this program:

1. The U.S. (and rld) funding for basic and applied research is large. This mechanism produces far more results than can be applied.

2. There is NO S. effort or policy aimed at systematically examining the basic research results and refining them so they can be applied to oducts. The cost to do applied research on even a small fraction of the basic research is usually far greater than the original work d is well beyond the scope of a single company or a laboratory. Furthermore, most laboratories doing research can only carry eas to the paper stage because of the engineering nature of the final stages to build and test the idea. Thus, overfunding search relative to applied research means a "spilling" of knowledge that forms the basis of a significant industry.

3. U.S. companies ve not worked collaboratively to develop these technologies because of legal and cultural reasons.

4. U.S. industry s been especially short sighted in its funding of this phase of research. Now, many short term, mundane product opportunities g. another Z80 + CP/M based personal computer) exist to attract resources resulting in further decline. This is further fueled by e venture capital market and increased R&D tax credits which in turn produce even more mundane products.

5. An inadequate pply of people and equipment exist to carry out the work in industry and the research organizations.

6. A research ogram aimed at parallelism requires interaction and co-location with a user community.

ne effectiveness of the Japanese collaborative research programs and believe we must emulate them. Both France and the U.K. d programs aimed at the next computer generation. Note the past and present programs in the Information Processing area:

1. Pattern formation Processing- voice and vision

2. VLSI- improved
ocessing characteristics (eg. 64K and 256K rams resulted in a 2 year lead over U.S. industry)

3.
Supercomputers- high speed technology

4.
Optoelectronics- just established

5. Standard
nicomputer for NTT- Fujitsu, NEC and Hitachi

6. Fifth

eneration Computer- Fujitsu, NEC, Hitachi, Mitsubishi, Matsushita, Oki, Sharp. ICOT Lab and 10 year program were established. e first phase builds Relational Database and Prolog machines.

7. Local Area

etwork standards as part of the Fifth Generation.

8. Next

neration research and technology program.

THE RESEARCH PROGRAM CONTENT

ECTIVES

dertaken with the expectation that the confluence of the disciplines of parallel processing applied to image processing, and ineering, and implemented using VLSI will prove fertile. It, and the resulting VLSIzation process, that of first understanding am and tasks and then VLSI'ing them, may well be a major characteristic of the next generation computing systems, which the e Fifth Computer Generation.* The establishment of a quasi-competitive, but coordinated program of research using common es is intended to stimulate a national understanding of such systems and their potential application.

ed at a fundamental understanding of parallelism and its application to a class of problems critical both to the growth of the stry in this country and to the maintenance of a preeminant US position in intelligence based military systems.

AND USING THE FACILITIES: PHASE ONE

focus will be on installing and applying parallel approaches to image procesing and logic/circuit/process simulation problems, flow. We think it is vital to understand the range of dataflow from theory to practice across a wide range of applications. In its dataflow can be viewed as a formalized, generalization of pipelining that is conventionally used for graphics and image process. eral form, dataflow looks appealing for logic simulation, signal routing, and conventional array processing type tasks where a rallelism exists, but cannot be exploited due to the difficulty of expressing algorithms in conventional languages. It is indeed ataflow-specific machines <u>will not</u> exist, instead dataflow languages will enable programs to be written for large, multiprocessors. l be based on a high performance local area network to interconnect the central machines, including:

. supercomputers,

. experimental achines (dataflow and conventional multiprocessors and multicomputers), and

. the CDC AFP.*

erate with <u>fixed microprograms</u> to simulate several computer structures including dataflow computers. This will enable begin now and to understand the limits and use of dataflow architecture, for example. These efforts must be put to the test of applications in order that the tradeoffs discovered be relevant to solve.

), believes that the current generation, number 5, is based on powerful personal computers interconnected via local area
Japanese are working on the sixth generation, beginning in the late '80's.

have real applications on which to "benchmark" various designs. The following applications cover some of the possible ary and industrial problems: scanning electron microscopic image enhancement, automated assembly inspection, target ligital system design and construction (eg. logic simulation, routing and IC signature analysis). The actual applications should be final proposal.

l results have focused on using a dataflow architecture to examine its limits, the network and facilities we envision are much and will be used as alternative ways of computing.

ELOPMENT OF THE CENTRAL FACILITIES

hat the central research facilities will be enriched further over time by including, as additional research tools, the fruits of the program particularly focussed on realizing more powerful forms of processor interconnect and process (or operator based) ation. It is expectd, further, that several realizations of parallel solutions to specific application image processing problems will d (in VLSI) and included in the central research environment.

NG PARALLELISM: PHASE TWO

hase of the program here proposed, the principle results will include a deep understanding of the dimensions and metrics that ace of parallel computing - costs, performance, programming expense, and reliability. The proposed facilities provide a rich set ealizations for parallel computing - ranging from tightly coupled multiprocessors to conventional Local Area Networks. We do t the kind of interconnect for switching is a particularly fruitful area of study because it is really an economic issue that shifts with ulation, market demand, and supply. Thus, the goal is to provide various structures for evaluation and use very rapidly, but not interconnect possibilities!

and knowledge engineering efforts are expected to yield their most important results in the last phase of the program. stones are established throughout the research effort: discerning the computational (and data management) primitives rrent rules-based expert systems languages, establishing an effective integration of image and symbolic information into a e (consistent with the data management primitives noted above), realizing a VLSI implementation of a highly parallel, post von puter structure for expert systems, trying it out on (say) a SEM analysis problem, a fully automated VLSI design, and finally on an or (semiconductor) process/crisis management (or threat evaluation and reconnaissance mission). These will, in turn, provide ing needed for a second VLSI implementation of the expert system engine above.

ingredient of effective VLSI implementations supporting the research goals of this program we need the 1990's VLSI equivalent he Guttenberg Press but of the linotype machine and the automatic typesetter. The process would be completely controlled by small group. The most important element of this program then is the development of the capability for (fully) automated VLSI om representations of parallel algorithms simulated on the parallel computing facilities proposed. At first, this will likely be by conventional supercomputers and the dataflow machine simulators running at the central facility.

design capabilities will be made to stand the test of real use in VLSI implementatins of (at least one) dataflow machine. The achine will be based on the measurement and analysis of simulated dataflow machines running applications as noted earlier. pabilities will be also tested in VLSI realizations of IC signature analysis dataflow algorithms and the mobile object identification jects implemented previously. The culmination of efforts in image encoding and compressions will be a special purpose VLSI that provides full motion video-conferencing within the bounds of a 56 Kbps phone line, for example.

A FACILITY TO UNDERSTAND AND EXPLOIT PARALLELISM

applications usually result from having new, higher performance computers allowing solution of problems that previously were y intractable. Performance increases in computing come from two sources: technology improvements and increased is program is aimed at understanding and exploiting parallelism to gain performance.

s to parallelism in two ways.

nmodity processors allow the low cost construction of the most cost effective systems. That is the Mips/chip of microprocessors rips the densest, high performance ECL gate arrays.

Second, VLSIzation is an inherently parallel process - standard algorithms are off loaded.

pts to improve performance through highly parallel structures has been relatively disappointing. We believe the major reason progress is the high real and personal cost to build and evaluate parallel structures. This program supports systematic research nt on the following alternatives. In this regard, we posit this fundamental hypothesis: <u>in order for a new computer structure to a user, and hence ultimately developed and exist, it must offer an order of magnitude improvent in performance over his d of computation.</u>

OCESSING (AND VLSIZATION)

order of magnitude or more speed improvement has resulted from looking at the execution times of particular work and then are to carry out the function. VLSIzation is a realization that this evolutionary process exists and is an attempt to formalize the

s of "off-loading" using special function hardware:

1. Floating point

rdware versus a software interpreter

2. Channels, I/O

ocessors and I/O Computers versus interrupt and hardwired I/O

3. Display

ocessors

4. Array Signal

ocessors

5. Front end

ommunications) and back end (disk, file and database) computers

g from a computation on a particular kind of data occurs.

n a requirement for a new computing structure. The function is then "off-loaded" in specialized hardware that operates in e general purpose computer.

eral purpose, very high speed system, the resulting, specialized structures can be totally simulated before they are committed to n this way the designer can interact with the structure in a quickly iteractive fashion instead of waiting at each iteration for system (re) integration.

ORS

w computer class is formed, there are strong arguments to build multiprocessors for performance reasons. Invariably, others rformance Uniprocessors at the same time and deliver more power via the strictly sequential approach. Multiprocessors were e early 60's, with Burroughs probably delivering the first one (B5000). By the early 70's Burrough's, CDC, DEC, GE, IBM and uilt 2 - 4 processor multiprocessors. Unfortunately, these were either used in an asymmetrical fashion, or at most they were nary multiprogramming environment. In no cases was parallel processing of a single task provided.

n investigated parallel processing of a single task with a 16 procesor multiprocessor and showed that for various tasks speed-ups By 1975 two 16 processor systems were built by BTL and at CMU. The CMU system was predicted on the 11/40 minicomputer, ord the construction, and speed-ups of up to 10 were observed in various algorithms.

d Flexible Processor is an ideal machine to investigate the use of multiprocessors and multicomputers since the interconnection puters is via very high speed local links (ultra LAN) and shared memory. It can be used in many ways, including:

1. a 16 computer ultiprocessor;

2. a 16 processor ultiprocessor;

3. a fixed, rpreter for particular structures (eg. dataflow); or

4. a particular, dicated pipeline processing configuration (eg. image processing).

ories are building systems with up to several hundred microprocessors.

multiprocessor, the successor to the S1, with 16 supercomputer class processors. As soon as the processor's available, it should the multiprocessor case for evaluation, since the processors are both tightly coupled and have very fast inter processor mechanisms. This should be within the next three years.

ffering a 64 processor multiprocessor which requires investigation. We strongly recommend the installation of this machine in rder to work on the multiprocessor problem.

artz, et al at NYU has proposed the Ultra-Computer, a multiprocessor with up to 16,000 VLSI microprocessors. Just as soon as we easonable number of processors together, construction should begin on this very large multiprocessor.

hat one can produce conventional parallel processors which should be able to deliver up to a factor of four, for specially coded ctor of 10 is possible, but there has to be a significant amount of research to make this automatically possible. Studies continue amounts of parallelism in algorithms that we have no way of exploiting.

t the optimistic (Fifth Generation) projection for computing power speed-up over the next decade could be accomplished simply parallel processing using multiprocessors and not by semiconductor and packaging technology if a significant effort were ubtedly the dataflow language is an important part of this effort to represent, control and thereby exploit this form of

TERS

een done formally with arrays of tightly coupled multicomputers where independent computers (Pc-Mp pairs) operate and communicate with one another by sending messages. By 1980, CM*, a multicomputer system based on the LSI-11 with 5 clusters of 10 computers was constructed, and speedups of up to 30 were observed for particular problems, including tion. Because there is less interconnection among the computers, it is more difficult to predict the performance: the algorithm ully partitioned across computers rather than distributed in memory.

FP, we believe that other multicomputers should be constructed and used, particularly those with several hundred computers. l support the construction of several, (say 6) different multicomputer alternatives.

CHITECTURES

dataflow computers have been proposed, only a half dozen computers have been built. The performance of dataflow ot understood, although the use of dataflow graphs and languages to express parallelism is promising. In particular, dataflow most useful in expressing signal processing operations. For example, the AFP is programmed using a dataflow-like representation essing tasks. Individual computer modules can be assigned to various processing stages of say a digital filtering task. The AFP also deal to simulate static dataflow architectures and their application. It would be microprogrammed to be a general purpose ne using separate computer modules in a functional fashion: matching store, switching, processing, and i/o.

AND CONVENTIONAL LOCAL AREA NETWORKS

works, LANs, are systems which normally allow the physical distribution of functional, server components to cover a local ea (eg. a building, or campus). The functional servers roughly correspond to various parts of a shared system: person servers rkstations/terminals), file servers, print servers, and communicatins servers. The communications is via message passing le the curent 10 Mbit/sec LANs are relatively slow, they are well matched to today's, slow terminals, personal computers and for networking.

ve also posited that LANs can be used to provide high performance, parallel processing. We too believe higher speed LANs are nterconect architecture for new computer structures. The higher speed, 100 Mbit/s LANs will be the basis for interconnecting puters in a hierarchy as shown in the facilities section (Fig. 3).

tra-LAN as a major architectural component and standard for truly fast, highly parallel structures of this next generation. Note at interconnects the AFP provides transmission at about 2 Gbits/sec for each computer node connected for the tightly connected us, the AFP would be used for some studies of this type of LAN-based architecture.

the hierarchy of three LANs is summarized:

Ultra-LAN	2 Gbits x p	AFP's processor intercommunication; as first basis for an ultra-LAN architecture
Fast-LAN	100 Mbits	Facility computer intercommunication and center to remote sites, forming a single cluster
LAN	10 Mbits	Individual workstations to form centers

CESSING FOR KNOWLEDGE BASED SYSTEMS

widely agreed that Knowledge based Systems can exploit parallelism. For Rule Based Systems, it is believed that many rules can parallel. The research will be aimed at first answering the question, and then simulating and evaluating the resulting structure. sed to simulate such a structure, provided this approach looks worthwhile.

THE RESEARCH PROGRAM FORM

l, DIRECTION AND RELATIONSHIP TO ONGOING RESEARCH

e, together with a board of directors would contract the research in a fairly structured fashion. While research of this type is not e today in computer science, we believe it can and must be done effectively by a joint industry and computer science research t. Industry can be effective at providing facilities and systems that have been traditionally absent from the research laboratories. the major motivation for the proposal.

the research project is to provide a large infusion of computing systems to support existing, more basic and unstructured work, ics.

ould not be to change the nature of the existing unstructured research to be highly focused and goal directd, but rather to nal resources so that both the structured project and unstructued work could co-exist and complement one another.

uld be aimed at very similar research targets in order to get the benefit of "friendly competition". Similarly, several approaches ined within a center. This approach was successful in the mid-70's in speech research and should be the "model" direction. peech research resulted in few, commercialized industrial or military applications, because the research coupling between ndustrial research was poor. Unfortunately, the final transfer phase of research was terminated before the program ended.* It een basic research and applications research that the program is fundamentally addressing. It is interesting to note that NEC ed development operating separately, but concurrently with the ARPA program. The result is that NEC provides recognition

e that a better model to follow is VHSIC. It is crucial that the participants be able to exploit the technology for commercial and tions propitiously. Unlike VHSIC, we believe that the work should be done at a few sites with movement of personnel.

OFFICE

is research is a fairly close weave. The environments are, indeed, established anticipating that unexpected leverage and will yeild significant results not included in the program plan. However, it is precisely the existance of a structured program and n of its several work flows that will enable this to occur. The program office is responsible for the successive development of the ources as it can find them and coordinating efforts so work can easily build upon what came before.

munication with Allen Newell and Raj Reddy at CMM.

ffice will set adequate standards so that ideas meet no unnecessary boundaries between the workers and the worksites in this , stable agreement on the common rules, language, workstation, the network and the general computational support structure he most important contributions of the program office, the goal is to use this commonality of interface to allow pyramiding of reful not to pyramid risk.

ses applications to test ideas, and uses realizations of those ideas to build the next generation applications. It even uses these emselves to acomplish future generation realizations fueling the next cycle. The central facilities are the place that application ng ideas, the realizations themselves, and the applications for testing ideas all come together. This must all flow forward rather k into a deadlocking interdependencies. The opportunity and expectation for people to build on each others work as it becomes key. In the natural uncertainties inherent in this ambitious program of research, there must be enough alternative paths so an use their wits to find a critically helpful piece of another's work or another's facility wherever it may turn up.

ffice must have the ability to facilitate the construction of important engineering breadboards so that systems can be rapidly built We envision utilizing the industrial sponsors for this breadboarding.

ffice is deliberately kept small to force most standards to be developed collaboratively with the groups doing the work. The g for the parallel computing facilities is very light in the expectation that site personnel will be provided by the host institution. le, Appendix 3, provides a more detailed breakdown.

EFICIARIES

as conceived in order to improve this flow of basic and applied research into industrial research and eventually into products. ficiaries are those who use these ideas to eventually build products. Products will not come directly from this program.

and, virtually everyone will benefit by the program:

1. the U.S.

chnology will be drastically improved - thereby improving defense and the economy;

2. the

searchers will be more effective and productive by having more meaningful work;

3. certain

search will be published; and

4. researchers

ll still migrate from the coupled programs, being attracted by venture capital, and build higher technology products.

ANSFERING THE TECHNOLOGY

tive means of technology transfer is through the transfer of people. Program sponsors will each have the right to place people in the program. It is expected that assignments be for a three year interval and that the assigned person return to the sponsoring epared to produce the competitive products of the late 80's.

operative working environment among the members of a project team, intellectual property rights for the work done as a team ies of the host institution will be controlled by the policies of the host institution. However, each program sponsor will have the xclusive license at reasonable terms.

the transfer will occur when the sites and industry collaborate on fabricating a design that a site has specified.

, chips produced as part of a research project would be licensed to the sponsors. The "rights" to chips and software produced as ch program are indeed not clear at this time and vary among the institutions. This area would have to be worked out between and the program.

sms for technology transfer include sponsor access to prototypes, distribution of published technical reports and invitations to ars.

e held quarterly for program sponsors with invited speakers from universities, government and industry.

kers the organizers of the seminars will have the freedom to draw on the wide range of topics encompassed by the program,

. Pattern and

age processing applications

. A. I. algorithm

search

. Multi-

ocessor architectural developments

. CAD/CAM

ftware systems

. VLSI design

ocess advancements

FACILITIES

ERARCHIES OF AREA NETWORKS

ould be organized around at least central research computation centers containing a variety of production and experimental ems (nodes) interconnected via 100 Mb/s links and forming the central facility for a hierarchical set of closely coupled, high ocal area networks. The centers will be linked to several campuses via the highest available links so that they could be used in a on "as if local" computation centers.

contain supercomputers, AFP's and experimental computers.

proposing ARPA-net II. This must come into operation relatively soon, to be used to interconnect the more remote research to gh bandwidth, such as several video channels would be needed to avoid limiting the interaction between sites. Here, the goal ovide only millisecond delays between processes operating on separated machines.

CILITY

cts would be designing many VLSI chips, the facility would need a way to build state of the art VLSI chips from mask design. this plished by a multi-year committment of appropriate existing capacity to the needs of the program.

ould start immediately and be coupled to existing computer science and computer engineering research facilities and programs. n is strictly on the basis of the intensity and quality of work in VLSI, image processing, parallel computing and AI. Either more or Berkeley Laboratories would be ideal sites for the computation center which would link to Stanford, SRI, and MIT, MITRE or Lincoln Laboratory could be the basis of an East Coast facility. Los Alamos has the largest network of s and support computers including storage and image production. If a central site were Los Alamos, this would force the nd installation of high speed links to other sites.

ENTERS

ery imcomplete list of application centers is included as an example of how work would be contracted by the program office to rs throughout the country.

r Performance Interprocessor Or Communications Structure

, Univ. Illinois)

low Simulation And Parallel Algorithm Compilers

ence, MIT, Berkeley)

Design Automation For Parallel Computation

Lincoln Laboratory, Berkeley)

----

e Enhance/Map/Encode/Compress

lard, Univ. Maryland, LASL, Lawrence)

re Extract/Target ID/Automated Inspection

GE, SRI, Univ. Texas)

e And Symbol Knowledge Representation/Expert System

ford, MIT)

DELIVERABLES

mpassed is broken into three classes shown in the Deliverables Table. Within each class there are families of projects and finally emselves. The program runs about ten years broken into rough phase transitions at the end of 1985 and 1989. The work in the the research environment and work standards in place and develops the first generation tools and applications. The second several machine realizations that use the tools and runs the test bed applications. In this phase, the research facilities are he machines realized by program efforts. These are in turn, the base of the second generation tools and applications. Finally, provides refinements and solves the hard problems that depended on the new understandings generated in the first two phases .

DELIVERABLES TABLE

A

P

P '82 '83 '84 '85 '86 '87 '88 '89 '90 '91 '92

L

I

C reconfigurable 100 MBy/s LAN 256cpu @ 100 MBy/s LAN

A 256 cpu @ 10 MBy/s LAN

T 1000 cpu @ 100MBy/s LAN

I

O simulator ok hotspot analysis

N VLSI dataflow machine

S dataflow compiler

|

E parallel logic simulator running on Dataflow simulator

N VLSI parallel compiler expert system for VLSI design

V

I

R pick 1 rules language next generation rules language

O common workstation (LISP?)

N 1,10,100 MBy/s LAN's parallel rules VLSI 2nd implementation

M

E 1 MBy/s NAN & gate

N AFP AI-VLSI support facilities VLSI dataflow on 100 MBy/s

T I II III IC signature analysis array

|

D 256 cpu node on 10 MBy 4096 cpu node on 100

E SEM enhancement dataflow

V

E Full motion video-conferencing in 56Kb/s

L ($500)

O IC signature analysis dataflow

M SEM scan analysis expert system

E

N

T parallel rules language primatives expert systems for

process/crisis mgt.

T image/info=knowledge

O

O

L

MOTIVATING SUMMARY

e motivation for this approach is timeliness and effectiveness:

1. THE RESEARCH

OGRAM SHOULD START NOW

2. WE NEED

OUPLING OF INDUSTRIAL R&D AND APPLICATIONS WITH COMPUTER SCIENCE RESEARCH

3. WE CAN BUILD

N EXISTING RESEARCH PROGRAMS AND COMPUTERS

at we start now on the research program, as our computer science research has been drifting these last few years as both mputer science research have both gotten large, diffused, and independent of one another. Significant industrial research Bell Labs and Japanese companies is non-existent and there is no coupling of basic and industrial research. For example, we better coupling of Bell Labs work to the Japanese computer industry via NTT's, ECL, than between Bell Labs and the U.S. lustry. Furthermore, both the academic and industrial research communities are now poorly coupled to real applications. We ogram focus of some of the existing research efforts into a goal directed system will enhance their productivity and enable the a vital Information Industry for the 21st Century.

APPENDIX 1

SOME CRITICAL GLOBAL QUESTIONS (AND ANASWERS)

1. Why is the tablishment of national facilities the correct way to attach the parallel problem?

. No single lab now has critical mass or focus in anyone area - currently all resources are difused.

. The lab(s) and programs operate together to do the work.

. Users, architects, and builders must couple.

2. What impact ll this proposed program have on existing research facilities? Programs?

. The intent is to build on, and extend current facilities by additionla resouces. We believe that this program is close enough to some of the existing.

2a. What about the extra space required for these facilities?

. We don't ow.

3. How will this effort help the basic problem of a shortage of qualified researchers?

. It is hoped that a "program" will stimulate the demand to produce more researches over the long term.

. Short term, the focus should increase everyone's effectiveness.

. We hope to apply industrial researchers to the problem that are now difused and often operate as a sub-critical mass.

4. Who is supposed to benefit from this proposal and in what specific ways?

(See Section on Program Beneficiaries)

5. Is there a nationla crisis and exactly what is it?

(See section on Motivation for the Program)

6.What evidence do you have to support the level of funding which is projected as being adequate to achieve the goals?

This is really a draft outline for concrete proposals. From this we expect specific sites to be established and operated in very rgetted areas: such as parallel knowledge based systems, high performance parallel processing and parallel image processing.

7. What, exactly is the overall objection of the program?

(See the first sentence of this document)

APPENDIX 2

WHY USE CDC'S ADVANCED FLEXIBLE PROCESSOR?

e AFP has demonstrated high performance in digital image and signal -

s. For example, a processor system can transform the every co-ordinate of a million point picture in 1/30 second. Several
operation today. It includes various support software including simulators.

e design, build and then use. A machine as fast and general as AFP would require at least 5 years to build. By using the current
l purpose research tool, we can gain at least 5 years on starting such a program from scratch. To illustrate, consider the several
cts that could use AFP today to simulate architectures. Since we need to evaluate these architectures by using them, we could
benefits and drawbacks of these machines five years (or so) sooner by adopting the AFP as a hardware simulation base.

ovides a very fast, flexible, microprogrammed set of up to 16 computer modules for experimenting in various parallel computing
rious type. A single, AFP microprogrammed processor provides the following capability:

. 20 to 800
ops in 16 parallel, 16-bit arithmetic and logic units

. Microprogrammed control

. Access to 32
egaword (256 Megabyte block oriented memory)

. 2 X 1 Gbits/sec
mmunication with neighbors in ring

processor and multicomputer structure are both provided since, the sixteen processors can be interconnected both to a common
memory and to adjacent processors.

us be used as a tool to study several different computer structures that we believe are much of the basis of the next generation.

so highly parallel, including having functional units with side effects, we believe it will not be imcroporgrammed to any great nvision is that it would operate in several configurations, with fixed microprograms to behave as:

1. Set of

croprogrammed pipelined, functional units within each processor. Four units can be initiated every 20 nanoseconds, although average of seven units operate in parallel for most problems. Because of the difficulty of programming this highly parallel ucture, the most important benefit, or side-effect will be understanding in how to do it effectively. Because the croprogramming so heavily pipelined, we believe a better understanding of dataflow techniques for expressing algorithms will sult from the use. Nearly all high performance machines are pipelined; hence, we believe AFP is a good vehicle to get a better derstanding of pipelining.

2. 16 processor

ltiprocessor with shared memory and very fast interprocessor intercommunication. Here, the processors will be programmed be particular ISP, such C. If C could become the basis of the machine, then UNIX could be run.

3. Set of 16

mputer Modules microprogrammed for particular functions. AFP was designed to be operated in this mode for image ocessing.

4. A dataflow

mputer. This is a special case of item 3 whereby particular computers are programmed to behave as the various functionla units a dataflow computer.

5. A set of

ecial, parallel processing architectures using individual, microprogrammed processors as the functional units of the particular uctures. In this mode, AFP turns out to be a very good emulator of relatively complex VLSI chips.

6. An

perimental Ultra-LAN based architecture. To examine how computers can be coupled effectively and work together on a task, e AFP looks like an ideal for study.

APENDIX 3

ROUGH BUDGET

xpenses are estimated at approximately $18M/year running from 1982 through 1989. Equipment is expensed as delivered. In three "competitive but collaborative" groups are charged with each project family.

	#	Heads	Total	Expenses	($M)
	Sites	(ea.site)	Heads	Manpower	Equip
ns/Structures	2	5	10	1	-
allel Computation	1	1	1	.1	-
sign Automation	1	3	3	.3	-
ting Environment	1	2	2	.2	15
Knowledge/	1	3	3	.3	-
	6		19	1.9	15

	# Sites	Heads (ea. site)	Total Heads	Expenses ($M) Manpower	Equip.
ns/Structures	2	5	10	1	5
allel Computation	3	3	9	.9	-
sign Automation	2	5	10	1	-
ting Environment	2	2	4	.4	10
Knowledge	3	5	15	1.5	-
ment Studies	1	3	3	.3	-
ion Studies	1	5	5	.5	-
	14		56	5.6	15

	# Sites	Heads (ea. site)	Total Heads	Expenses ($M) Manpower	Equip.
ns/Structures	2	6	12	1.2	5
allel Computation	3	3	9	.9	-
sign Automation	2	5	10	1.0	-
ting Environment	3	2	6	.6	8
Knowledge	3	5	15	1.5	-
ment Studies	2	5	10	1.0	-
ion Studies	3	5	15	1.5	-
	18		77	7.7	13

	# Sites	Heads (ea. site)	Total Heads	Expenses Manpower	($M) Equip.

ns/Structures	2	6	12	1.2	5
llel Computation	3	3	9	.9	-
sign Automation	2	5	10	1.0	-
ting Environment	3	2	6	.6	5
Knowledge	3	5	10	1.0	-
ment Studies	2	5	10	1.0	-
ion Studies	3	5	15	1.5	-
	18		77	7.7	10

	#	Heads	Total	Expenses	($M)
	Sites	(ea. site)	Heads	Manpower	Equip.
ns/Structures	2	6	12	1.2	5
allel Computation	3	3	9	.9	1
sign Automation	2	5	10	1.0	0
ting Environment	2	2	6	.6	5
Knowledge	3	5	15	1.5	-
ment Studies	2	5	10	1.0	1
ion Studies	3	5	15	1.5	-
	18		77	7.7	12

	#	Heads	Total	Expenses	($M)
	Sites	(ea. site)	Heads	Manpower	Equip.
ns/Structures	2	6	12	1.2	5

allel Computation	3	3	9	.9	-
sign Automation	2	5	10	1.0	-
ting Environment	2	2	6	.6	5
Knowledge	3	5	15	1.5	-
ment Studies	2	5	15	1.5	-
ion Studies	3	5	15	1.5	-

	18		77	7.7	10

	# Sites	Heads (ea. site)	Total Heads	Expenses Manpower	($M) Equip.
s/Structures	2	5	10	1	4
allel Computation	2	3	6	.6	-
sign Automation	2	5	10	1	-
ting Environment	3	2	6	.6	5
Knowledge	3	5	15	1.5	-
ment Studies	1	5	5	.5	-
ion Studies	3	5	15	1.5	-
	16		67	6.7	9

#	Heads	Total	Expenses	($M)

	Sites	(ea. site)	Heads	Manpower	Equip.
ns/Structures	2	5	10	1	1
allel Computation	1	2	2	.2	-
sign Automation	1	5	5	.5	-
ting Environment	3	2	6	.6	5
Knowledge	1	5	5	.5	-
ment Studies	1	1	1	.1	-
ion Studies	1	5	5	.5	-
	--				
	10		34	3.4	6

	# Sites	Heads (ea. site)	Total Heads	Expenses Manpower	($M) Equip.
ns/Structures	2	5	10	1	-
allel Computation	-	-	-	-	-
sign Automation	1	2	2	.2	-
ting Environment	2	2	4	.4	3
Knowledge	-	-	-	-	-
ment Studies	-	-	-	-	-
ion Studies	1	2	2	.2	-
	6		18	1.8	3

	#	Heads	Total	Expenses	($M)
	Sites	(ea. site)	Heads	Manpower	Equip.
ns/Structures	1	5	5	.5	-
allel Computation	-	-	-	-	-
sign Automation	1	1	1	.1	-
ting Environment	1	2	2	.2	1.8
Knowledge	-	-	-	-	-
ment Studies	-	-	-	-	-
ion Studies	-	-	-	-	-
	--				
	3		8	.8	1.8

GB3.S7.3

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M e m o
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TO: see "TO" DISTRIBUTION   DATE: WED 1 JUN 1983
1:38 PM DST

FROM: GORDON BELL

cc: BILL DEMMER
BILL JOHNSON
TOM EGGERS @LTNX

DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5201608918

SUBJECT: 784/PPA AT STANFORD

GB5.48

I think we made some progress getting Stanford to get their act together so it can be used. It's clear to me that CMU is 10 years
ahead in thinking about parallelism, especially applied to multiprocessors (ala C.mmp and Cm*).

The vision is pretty much along the strategy (dream) I outlined for
PPA: get a 784 in now so that the ultimate software writing and
testing can be started instead of waiting two years till PPA arrives.
The 784 should "simulate" the ultimate machine with n processors and
be able to output what the actual running time would be.

The users there would include:

1. Heuristic Program Project's Machine Architecture Research. This 3 year program, with Bruce as one of the team members, is aimed at examining the performance and parallelism of AI applications as the basis of the next generation architectures. This work is badly needed because I view we have NO understanding about LISP performance, the desireability of special P's for LISP, whether or how LISP can be extended for mP's, etc. This work would also include running on PPA to verify conjectures.

2. John Hennesy's Single Assignment Language for Multiprocessors.

   VAX is currently the host; having PPA would let them accelerate their research by several years. I believe this will turn out to be the way to get performance from mP's. This is also probably the path to build a "parallel LISP" -- not by starting from each of the baroque dialects.

3. Dave Cheriton's distributed processing is quite different, but PPA could be the best vehicle for experimentation because it can provide the most rapid communication.

4. Many applications: Tom Binford - Pixel and image processing; Hennesy - circuit and logic simulation; plus many others in computer science, electrical engineering and the center for integrated systems.

5. Jeff Ullman - experimentations in parallel algorithms.

Bruce is coordinating the 784/PPA procurement and our part of the
program both within Stanford and DEC.

"TO" DISTRIBUTION:

FOREST BASKETT	BRUCE DELAGI	SAM FULLER
TOM GANNON	BILL STRECKER	

WPS USERS - Leave HP mode and type <CR>

00 CORE DECGRAM ACCEPTED S 003812 O 404 27-APR-83
15:21:13

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!   !   !   !   !   !   !   !
! d ! i ! g ! i ! t ! a ! l !          I n t e r o f f i c e
M e m o
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TO: BILL DEMMER   DATE: WED 27 APR 1983
1:34 PM DST
    PRODUCT STRAT COMM: FROM: GORDON BELL
cc: see "CC" DISTRIBUTION   DEPT: ENG STAFF
                                             EXT: 223-2236
                                             LOC/MAIL STOP: ML12-
1/A51

                                             MESSAGE ID:
5198151615

SUBJECT: STRATEGY (OR BETTER CALL IT DREAM) FOR A HOT MACHINE

We appear to be making excellent progress in the design of
PPA (the 32
processor MicroVAX) which would have the power of roughly a
CRAY 1.
The performance picture doesn't appear to be appreciably
different
than what is given in the attached EMS.

It is becoming increasingly clear that the real limit to PPA
is the
problem of either modifying existing programs or re-
programming to
take advantage of parallelism. Therefore, we must have a
strong
program which puts 4 processor machines in the hands of users
so that
the programming can start. Otherwise, the acceptance in the

market
will be delayed two years until the real machine is in the market.

THE DREAM FOR PPA
Would like to see the following timetable:
    Q184 Ship several 784 (quad mP's) to the test sites so they can be
        used for parallel program development during the next 1.5
        years:
        CMU-Joint development. CMU to use in their Supercomputer
           workbench, and to test the parallel processor AI machine.
        LLL-Debug phyics programs for the Cray mP, and the S1 (16Pc).
        LASL-Physics applications.
        LBL-Physics applications, but move the techniques they've
           learned on their Midas system over to VAX/VMS... help us.
        Illinois-Get them started on our system versus doing their own.
           Kuck knows more about compiling for these machines than
           anyone around.
        NYU-Some bright folks. Save them from trying to build their
           ultracomputer and get them to work on the hard problem of
           software. Currently they plan an 8 Pc in 3 years on their
           way to 16000 Pc's.
        Cornell-Ken Wilson, Nobel Prize winner, has been advocating.
        Stanford-Might get them to want one for AI.

MIT-Might get them to want one for AI, etc. We really need
someone to work on parallel processing for AI languages.
Concurrent Prolog and Scheme (a LISP) dialect are candidate
languages which permit expressing parallelism.
PURDUE, YALE-Has work in this area.
Q384 Ship really good software so that applications can be
developed on PPA. This would include the ability to "simulate"
PPA such that a user can run at 4 x 780 speed and measure the
performance as if it were on an n processor machine.
Q185 Ship first MicroVAX PPA to a test site.
Q385 Ship PPAs to test sites. Verify that PPA matches the results
that were obtained by the 784 and that their software really
runs as predicted.
Q186 Begin shipping PPAs at a volume (eg. 780) rate, thus creating
a new level of price/performance, and performance (for this
price band) that has been heretofore unattainable.

What you think?
Are there other places? (eg. Schlumberger)

"CC" DISTRIBUTION:

CFM/TAB:	TOM GANNON	ED KRAMER
BILL LONG	BILL STRECKER	TOM EGGERS
@LTNX		

ATTACHED: MEMO;104

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TO: see "TO" DISTRIBUTION
O
Pcc: ROSE ANN GIORDANO
ED KRAMER
BILL LONG

DATE: WED 16 FEB 1983
8:56 AM EST
FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5191131339

SUBJECT: BETTER COST, PERFORMANCE AND PERFORMANCE/$

GB4.S1.24

Cycles for the Masses is beginning to look up. The following table
indicates we have some very interesting possibilities for competitive
machines everywhere. It also shows we are in a new computer
generation, the Fifth, as the cost decreases by a factor of 10 or
performance increases by a factor of 10. This gives a factor of 5-50
in performance/cost over where we are today. Note the following
table of machines.

	Time	Price($M)	Perf.	Mflops	flops/$	# Users
Microvax W/S	85	0.01	0.9	0.45	45.0	1

Scorpio	85	.04	0.9	.45	11.0	5- 500
780	78	0.4	1.0	0.5	1.25	5- 500
790	6/84	0.5	5.0	2.5	5.0	5- 500
Nautilus	4/85	0.25	4.0	2.0	8.0	5- 500
dual proc.		0.4	8.0	4.0	10.0	
PPA	6/85	0.25	40.0	20.0	80.0	5- 500
Titan (proto)	12/83	0.1	10.0	5.0	50.0	1- ?
KL	74	0.75	1.3	0.66	0.9	10- 500
Jupiter	+30(mos)	0.75	6.0	3.0	4.0	10- 500
Cray 1	76	10.0	40.0	20.0	2.0	50-1000
with vectors			100.0	200.0	10.0	
Cray 2/XMP	85	10.0	120.0	60.0	6.0	
with vectors			300.0	600.0	30.0	

Notice there are several ways to get a performance:

1. Supercomputers (eg. Cray) operate in batch mode. At LLNL, a large user gets a maximum of 1 hr/day. Therefore, if one of our systems can deliver only 1/8 to 1/24 the performance, the price performance is likely to be better with a Supermini depending on the problem. In a real environment, most users would rather have something else so they can escape from the center.

2. Supermini, operated as a personal or with a small number of users.

3. The new, powerful microprocessor based personal computer with 750-780 performance. This gives a user the most power. I believe our technical marketplace wants this.

4. The new, shared, Supermicro such as Scorpio - These computers have the best cost/user, but will the added sharing be worth it versus the low cost PC's? This is quite attractive.

5. New, specialized facilities such as PPA, a 32 processor based on MicroVAX, FPS-164, XYCAD for high performance batch. All are quite interesting.

Performance/price depends on the fraction of a system that can be dedicated to a user. With MicroVAX PC - the price may be in the don't care range 10K-20K (or 10% of a professional's salary) but the performance is at 780 level. Therefore, work will migrate both from supers and superminis.

We have some incredible opportunities. It would seem desireable that
we first simply consider Titan and PPA as purely computational
processors, although Titan would eventually be a PC when it has
software. They would be operated as servers running, say Fortran, to
off-load KL's or VAXen via CI.

This VLSI generation is going to generate many more kinds of computers
than ever. Supers, Mainframes, and Superminis are all going to feel
the impact of Supermicros, PC's and interesting specials.

Bottom Line

We've entered an era (the Fifth Generation) driven by the powerful
microprocessor and this drastically changes the price,
price/performance and maximum performance of the systems we can build.

The numbers should reinforce the gut feel that the Fifth Generation is
going to be exciting.

"TO" DISTRIBUTION:

BILL AVERY	CFM TASK FORCE:	BILL DEMMER
ULF FAGERQUIST	BARRY JAMES FOLSOM	BILL JOHNSON
DEMETRIOS LIGNOS	AVRAM MILLER	OPERATIONS COMMITTEE:

00 CORE DECGRAM ACCEPTED S 000860 O 106 02-APR-83 18:12:21

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! d ! i ! g ! i ! t ! a ! l !        I n t e r o f f i c e
M e m o
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TO: SAM FULLER DATE: SAT 2 APR 1983
6:06 PM EST
TOM GANNON FROM: GORDON BELL
BILL STRECKER DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

MESSAGE ID:
5195610346

SUBJECT: DISCUSSION WITH RAJ RE PPA AND DEC/CMU RELATIONSHIP

GB5.26

Just talked with Raj an hour or so He says that Kahn and Adams
say the money's in the bank and they are going ahead with CMU part.

I had pushed Allen re the notion that they would go someplace else with our ideas. Raj said no. They only discussions they
are having are with Fairchild building a proprietary chip with
th new Fairchild 1 micron CMOS technolgy. CMU would do the architecture and Fairchild the implementation. It would be based around the Forgie/Newell ideas.

He also talked about Intel's interest in supplying a 432 redesign which Intel ispnding a 100M on, courtesy of Siemens. apparently it has caches everywhere to make it perform.

He discussed the PPA concerns:
want more bus bandwidth so that on next go around 256 Pc's

are
possible.
Want to have a 10-100 x Cray on the 3rd version, by 1992. He wants us to think about evolving the design several times and to try and plan for it.
Wants 1 Gigabyte or so.
Worried about cache size too small

He needs a letter from one of us (It should be from BJ/Demmer/Strecker)
describing our intent and how we want to work with CMU. Raj will
send a template via Siewiorek this week.

He now buys into the 784, provided we can get a big, shared memory. I concur. We somehow have to get a memory of reasonable
size. Is there any work here? What's the limiting factor? Here, they would take it with the small one, provided we can get
an upgrade soon Tom, can you help here? This has to be a problem
that can be solved, and really must be solved to have a good running system (suitable for either production or simulation of PPA).

PRE-COMPUTER EXHIBIT OF ANALOG, DIGITAL AND TABULAR ARITHMETIC UNITS

Napier's Bones
Tables of Products, etc.
Burringhton's Book
Handbook of Chemistry and Physics
Book on Instruments
Rule
Slide Rule
Sector
Planometer (Platometer)
2 Fuller Slide Rules
Modem 20", 10", 6" Slide Rules
Circular Slide Rules (to buy)
Desk Slide Rule for Conversions

<u>Digital</u>
3 (Abacus and Soroban)
Anthometer
Millionaire
Australian Hand-Held Calculator
Pascal-Type Adder
Comptometer
Burroughs Comptometer
2 Adding Machines
2 Mechanical Scientific Calculators

First Electronic Calculator (Friden)
First HP Calculator (HP35)

C O M P A N Y   C O N F I D E N T I A L

Preliminary Draft for Commment by Digital Engineering Community

HEURISTICS AND COMMENTS FOR BUILDING GREAT PRODUCTS
Gordon Bell, Vice President, Engineering

Product goodness is somewhat like pornography, it can't fully be described, but we're told people know it when they see it. If we can agree on heuristics about product goodness and how to achieve it - then we're clearly ahead. Five sets of dimensions for building great products need be attended to (roughly in order of importance):
. a responsible, productive and creative engineering group;
. product and design metrics (competitiveness);
. design goals and constraints;
. product evolution, revolution and death; and
. the ability to get the product built and sold.

ENGINEERING GROUP
As a company managed primarily by engineers, groups are encouraged to form and design products. With this right, are responsibilities.

The Team must have:
. a_chief_designer/chief_programmer_to_formulate_and_lead the resolution of the problems encountered in the design; No matter how large the project, it must be lead from a "single head". We often make two errors in leadership: having no clear technical leader/problem resolver, and abdicating to a committee.

Committees do not do design! They are never held responsible, nor are they rewarded or punished. Committees can review.

. management who understand_the_product_space_and_who_has engineered_successful_products; The two most important jobs are:
  . making sure that everyone knows their job; and
  . setting and reviewing work on a timely basis, ie. MBO.
. team skills and resources to implement the proposal so that we adhere to the cardinal rule of Digital, "He Who Proposes, Does"; A plan must include the chief designer, team, project organization and resources (eg. computers). Supporting skills and disciplines are essential in the respective product areas, eg. ergonometrics, acoustics, radiation, microprogramming, data bases, security, reliability.
. an_understanding_of_the_design,_design_production_(eg. CAD) processes,_and_manufacturing__processes; Learning curves apply to all processes! The organization must be staffed with people who understand the product, the design process (CAD and management discipline) and the production introduction process. One or two out of three isn't enough.

Behaviorally, the team must:
. do_it_right_the_first_time; Being correct has the highest payoff everywhere: timeliness, quality, lack of rework, and mfg. cost.

. execute_the_project_in_a_timely_fashion; Virtually ALL of our projects are late because we start too late, don't get it done on time because some critical invention is required, take too long to get it introduced, etc. For the very long, very late projects, the failure is lack of planning, tools and organization. Finally, people burn out. This suggests we:
  . limit_projects_to_two_years_by_a_small_team. We often make an aggressive business plan, then hire the team. They then find out they have neither tools nor technology to do the project.
  . not_predicate_a_project_on_scheduling_inventions_in_the_design, process_and_CAD_areas. If we can't see how to do the work in 2 years, then let's not start the project! This means the product must be cut down to fit the tools, people and process. Advanced developement is to insure that we can do development.
. have a_written_design_methodology that includes: all design processes in the form of manuals, design conventions, conflict resolution, criteria for task completion, PERT structure, etc.;
. be_open_and_have_external_reviews,_and_clearly_written_product descriptions_for_inspection; For new product areas, we require breadboards in addition to the above heuristics. When the

product gestation time equals the generation time, a full advanced development effort is the only way to be successful.
- start_small,_be_reviewed_and_grow_on_its_demonstrated_success;
- learn, in order to handle the increase in complexity that comes with technology. Until there's a formal sabbatical program, individuals would do well to consider taking the equivalent of a semester of technical courses each 10 years.

PRODUCT METRICS KNOWLEDGE includes:
- products_for_which_there'll_be_no_competitor;
- all_product_cost_metrics (cost, cost of ownership, cost to operate and use);
- all_product_performance_and_cost/performance_metrics; These are the goodness measures of a product and tell how easily it will be to sell, and if we have improved. Cost and performance is measured against a state-of-the-art line represented by the first shipment of a more advanced product. Alternatively, when there's no direct comparison, the time goodness is determined from the day the product could have shipped. For example, because of parts availability, Nebula and CT could have shipped two and three years ago based on component availability.
- reasons_why_the_product_will_succeed against present and likely future competition; sure success in the market is to introduce a needed function (eg. 32-bit address) by which all other products have to be measured.
- major_competitor_products by cost, performance and functionality; This should cover the past and future five years.
- leading_edge, innovative, small_company_products;
- productivity, quality and design_process metrics for projects.

DESIGN GOALS AND CONSTRAINTS
Design constraints are generally set as various kinds of standards. These are useful because they limit the choice of often trivial design decisions, and let us deal with important free choices, the goals.

Goals are vitally important because they target our uniqueness.

Poor "mind-set" standards can create poor products, even though they may have made sense at one time. The historical English measures is a good case in point. Currently, the 19" rack and the metal boxes Digital makes to fit in them, and then ship on pallets to customers, act as constraints on building cost-effective PDP-11 Systems. This historical "mind set" standard often impedes the ability to produce products that meet the 20% per year cost decline curve.

. Goals_and_constraints must be_written_down_and_updated_from_the day_the_project_starts. Virtually every product failure and period of product floundering is a result of no clear goals and constraints since everyone has a different idea of the product.
. A_product_can_only_have_a_few_goals_and_constraints. The ranking is usually: it must work and have improved cost of ownership, be the shortest time to market, highest performance and lowest cost.

We must adhere to standards which we either follow or set!
. If_a_standard_exists,_follow_it_or_change_it_for_all! We lost the IEEE Floating Point format. It is likely we will eventually have to support it.
. If_a_standard_is_forming_go_all_out_to_set_it. When formed, then follow it. We didn't make DDCMP a standard. When HDLC came, we didn't use it. The result: expensive, low performance products.

Standards can be grouped into four distinct sets:
. DEC Engineering Standards; These cover most physical structures and design practice for producibility, and assimilate critical external standards, such as UL, VDE, and FCC.
. professional society, industry and area information processing standards, from EIA, CBEMA, ECMA, ANSI, ISO etc. such as Cobol '74, Codasyl, IEEE 488;
. defacto industry wide information processing and communication standards such as IBM SNA, Visicalc;
. standards implied by the architecture of existing DEC products to insure our customer software investments are preserved include:
    . architecture of computers, terminals, mass store and communications links; Our current ISP's include 8, 11's, 10/20, VAX, 8048, 8080, 8086, 68000; VT52, VT100, keyboards, Regis; MCP; HDLC, CI, NI, SI.
    . physical interconnect busses for computers and for interconnecting them CT, Q, U, NI, CI, etc. These insure that future system products can evolve from component and computer options between generations.
    . operating system interface file commands, command language, human interface, calling sequence, screen/form management, keyboard, etc.

. Products_must_be_designed_for_easy_translation_into_in_any natural_language_since_we_are_an_international_company.
. All_products_must_have_be_customer_installable_and_maintainable.
. Portability_is_an_important_goal. Personal computers must be portable! We must achieve this for all systems ASAP!

WHEN TO CREATE, WHEN TO EVOLVE AND WHEN TO STOP PRODUCTS
Engineering is responsible for designing evolutionary products in our markets AND for producing products that are natural to our tradition of supplying the most interactive, cost-effective computing. If a new product such as personal computing emerges and we do not have a product, engineering has failed, independent of being asked for it!

Given all the constraints, can we ever create a new product, or is everything just an evolutionary extension of the past? If revolutionary do we know or care where product ideas come from? The important aspect about product ideas is:

. Ideas_must_exist_to_have_products! If we don't have ideas to redefine or extend a market, then we should not build a product.

It is hard to determine whether something is an evolution or just an extension. The critically successful products are likely to occur the second time around. Some examples: PDP 6,KA10,KI10,KL10,2080; Tops 10,Tenex,TOPS20; PDP5,8,8S,8I/L,8E/F/M; OS8-RT11; 11/20,40,34,44; RSX-A... M, M+; TSS-8,RSTS; various versions of Fortran, Cobol and Basic follow this; LA30,36,120; VT05,50/52,100, 101 etc.; RK05,RL01/2.

. A_product_tree_MUST_be_maintained_by_each_engineering_group showing roots, gestation time and life.

Goodness_and_Greatness = NO CRAPPY PRODUCTS!
All products whether they be revolutionary, creating a new base, or evolutionary, should:

. be elegant and high quality; Russ Doane's working definition is: "every feature contributes two benefits", like a double pun. Quality means no excess. Elegant, high quality designs, do double duty with a minimum use of resources. Quality is also the absence of errors, by being right the first time so that it doesn't have to be inspected or redone.
. offer_at_least_a_factor_of_two_in_terms_of_cost-effectiveness over_a_current_product; We have classic failures because a CPU cost has been minimized, only to find the total system cost has barely changed 10% and the total cost to the customer is only 5% lower! If each product is unique then we will have funds to build good products.
. be_based_on_an_idea_which_will_offer_an_attribute_or_set_of attributes_that_no_existing_products_have; For example, the goals and constraints for VAX included factor of two algorithm encoding and also offering ability to write a single program in multiple languages. VT100 got distinction by offering 132 columns and smooth scrolling.
. build_in_generality,_and_extensibility; Historically we have not been sufficiently able to predict how applications will evolve, hence generality and extensibility allow us and our customers to deal with changing needs. Extendable products also permit mid-life kickers to products. We have built several dead end products with the intent of lower product cost, only to find that

no one wants the particular collection of options. In reality, even the $200 calculators offer a family of modular printer and mass storage options. For example, our 1-bit PDP-14 had no arithmetic ability, nor could it be a general purpose computer.

As customers used it, ad hoc extensions were needed to count, compare, etc. and it finally evolved into a really poor, general purpose digital computer.

. be_a_complete_system,_not_piece_parts; The total system is what the user sees. A word processing system for example includes: memory, keyboard, tube, modems, cpu, documentation including how to unpack it, the programs, table (if there is one, if not then the method of using at the customer table), and shipping boxes.

. be_a_great_system_because_the_components_are_great; We should not depend on system markups and software functionality to cover poor components and high overhead.

. if_we_don't_make_it,_buy_it; We must carefully decide what components to make versus buy. It is very hard for an organization to be competitive without competing in the marketplace, hence unless we sell it, we should buy it.

Product_Evolution

A product family evolution is described on page 10 of Computer Engineering along the paths of lower cost, and relatively constant performance; constant cost and higher performance; and higher cost and performance. In looking at our successful evolutions:

. lower_cost_products_require_additional functionality_too; A lower cost product, with constant performance or constant function is risky because a new customer base and new way of marketing may be required. Some other company may, however, be successful with the concept. The PDP-8, based on new technology, was radically more successful than its higher priced predecessor, the PDP-5, because it was 2/3 the price and 6 times more performance. The PDP-8/S was a failure at 2/3 the price and 15 less performance than the PDP-8. There are similar stories about the LA 34, VT50/52 and PDT as replacement products.

. constant_cost,_higher_performance_products_are_likely_to_be_the most_useful; Economics of use, the marketing channel and customer base are already established and a more powerful system such as the LA120 will allow higher productivity (see Computer Engineering for the understanding and economics). In the 11's there was a successful evolution: 20, 40, 34 anChied 44. Not the 60. The 11/70 was probably our greatest success; it was billed as a mid-life kicker to the 11/45-55.

Revolutionary_New_Product_Bases

. A new product base, such as a new ISP, physical interconnection, Operating System, approach to building Office Products, must start_a_family_tree_from_which_significant_evolution_can_occur. The investment for a point product is so high that the product is very likely not to payoff. In every case where we have successful evolutionary products, the successors are more successful than the first member of the family. Point products with no follow-on will probably fail all roi tests.

Product_Termination

. A_product_evolution_is_likely_to_need_termination_after successive_implementations,_because_new_concepts_in_use_have obsoleted_its_underlying_structure. All structures decay with

evolution, and the trick is to identify the last member of a family, such as the 132 column card, and then not build it. This holds for physical components, processors, terminals, mass storage, operating systems, languages and applications. Some of the signs of product obsolescence:

    . It has been extended at least once, and future extensions render it virtually unintelligible.
    . Better products using other bases are available.

SELLING AND BUILDING THE PRODUCT

"Buy in" of the product can come at any time. However, if all the other rules are adhered to, there is no guarantee that it will be promoted, or that customers will find out about it and buy it. Some rules about selling it:

. it_has_to_be_producible_and_work, AND be useful to software; This, although seemingly trivial rule, is often overlooked when explaining why a product is good or not. If it is a piece of hardware that requires software to support it, the hardware must be available to the programmers who must support it. Software engineers approach new hardware with much caution! The often ask: is it significant? is it needed? why isn't it compatible with the past? If a hardware is viewed with distrust by software engineers it may be met with the same distrust by customers!

. a_business_plan_with_orders_and_marketing_plans_from_several marketing_persons_and_groups_needs_to_be_in_place; Just as it is unwise to depend on a single opinion in engineering for design and review, it is even more important that several different groups are intending to sell the product. Individual marketers are just as fallible as unchecked engineers. This rule can and must be violated for revolutionary products!

. never_build_a_product_for_a_single_customer, although a particular customer may be used as an archetype user; predicating a product on one sale is the one sure way to fail! Paraphrasing a remark by former GM executive Charles Wilson: if it's good for General Motors, it may only be good for GM.
. it_must_be_done_in_a_timely_fashion according to the committed schedule, price and functions as previously described;
. it_must_be_understandable_and_easy_to_use. The small size, complete hardware books were the DEC trademark that established the minicomputer. We must revive these such that a particular user never need access more than one.   Simplicity must be the rule for our documentation.

What heuristics are missing? What heuristics do you disagree with?

What heuristics could be removed? reordered?

Could I please have your feedback before this becomes a final draft?

3/13/82 Sat 19:47:01 GB3.S2.5

OTHER PREMISES AND CONSIDERATIONS

1. OUR BASE PRODUCTS ARE OK, EXCEPT THERE ARE TOO MANY. GO FOR BETTER

LONG TERM STRATEGY. SKIP HOLE FILLING WHICH INCREASES CLUTTER.

2. WE'RE SUPPORTING TOO MANY SYSTEMS.

3. NATURAL PRESSURE THROUGH SALES, DECUS, MARKETING AND DEVELOPERS

REQUIRES ALL SYSTEMS TO BE SUPPORTED AND ENHANCED FOREVER.

4. NATURAL MARKET PRESSURE FORCES MORE GENERALITY INTO EXISTING

PRODUCTS. THIS DETRACTS FROM MOVING TO APPLICATIONG.

5. A "GREAT SYSTEM" WILL ATTRACT LANGUAGES (COMMON, EXOTIC AND

SPECIAL APPLICATIONS) AND APPLICATIONS BY EXTERNAL USERS AND THIRD

PARTY COMPANIES. TOO MANY SYSTEMS BY A MANUFACTURER WILL DETRACT FROM

THIS NATURAL MAGNET.

6. ALTHOUGH WE DON'T HAVE A PRECISE UNDERSTANDING OF VAX ACCEPTANCE,

IT FEELS LIKE "A GREAT SYSTEM" (LOVED BY KNOWLEDGEABLE USERS,

INSTALLS EASILY, WORKS AND IS EASY TO USE). IT'S EXCITING

ARCHITECTURALLY AND FITS WITH 11'S. THERE'S PRESSURE TO EXTEND IT

WITH MORE PERFORMANCE AND AT LOWER (11/34) COST.

7. EVEN WITH TOPS 20, THE 2020 HASN'T FOUND ITS NICHE YET.

draft press release

DIGITAL ACCELLERATES 32-BIT STRATEGY

ST. LOUIS, MO -- 23 MAY 83 -- Digital Equipment Corporation announced today that it is accelerating its program for moving users of its 36-bit products over to its more broadly-based 32-bit architecture.

Speaking at the Spring symposium of DECUS (Digital Equipment Computer Users) held at the (name of hotel) here, Winston Hindle, Vice President Corporate Operations, told 00000 members
of Digital's users group that the company has decided to" divert its development resourcEs away from a follow-on 36-bit machine and into accellerated development of hardware, software and communications
capabilities to enhance our already-formidable offering of 32-bit products.

"It has taken longer than originally planned to develop a follow-on to our existing DECsystem 10/20 family and it looks like
we're still three years away," Hindle told the users. "So, we have decided instead to shift some resources and speed up the development
of software and communications tools that will allow DECsystem 10s and
20s to be more easily integrated into our corporate architecture.

"We think the needs of our customers would be better served by concentrating our high-end development efforts around our more broadly-based VAX architecture," Hindle said.

...hype VAX, clusters, LANs....
****
* d i g i t a l *
****

TO: DICK CLAYTON DATE: FRI 1 FEB 1980
9:17 AM ART CAMPBELL FROM: GORDON
BELL
cc: STAN PEARSON DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1
A51

SUBJECT: PRICE VS. FUNCTUALITY FACTS

We (you) could add much insight to BOD (us) by taking a number of the products which change in price or function (you have a metric) and plot log (price) vs. log (volume) for a given functionality (e.g. LA30, LA36, LA34), and (DS210, VT78, VT278 [projected]). This should begin to answer some arguments and might give us great business insight re predicting volumes in turn of coefficients of elasticity (e.g. 20% lower cost doubles volumes). Then, we might also use price not cost to set operating points for factories rather than redesigning every product for 20% lower cost. These kinds of things are probably only done in only in business schools, but since I'm only an engineer it probably doesn't have any application to us...or does it? At least the data shouldn't hurt anyone and would make me feel better about affects if price, functionality on volume.

GB:swh
GB1.S1.47

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! d ! i ! g ! i ! t ! a ! l !        I n t e r o f f i c e
M e m o
!___!___!___!___!___!___!___!
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TO: BILL AVERY
RON CRISS
FRED ENGEL
JOHN RING
JACK SMITH

DATE: WED 16 FEB 1983
2:14 PM EST
FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

MESSAGE ID:
5191132290

SUBJECT: WHEN DO WE MEET ON THIS?

I got the Celi/Lomicka report.

Please get us (and your users) together to settle on the goals.

My priority is: quality (i.e. works), time to market, performance, range (print-no buffering to graphics server)... cost. Please select type 3 using an F (J's an upgrade) for the base work, with the option to go to type 2 if a limited product is possible -- but wait till it runs to decide. We'll use the MicroVAX board when it arrives. I don't see why we have to use Seahorse I since the processor isn't doing anything except routing. I assume the main controller is a 68K.

We need a product . . . yesterday !.

ATTACHED: MEMO;28


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! d ! i ! g ! i ! t ! a ! l !          I n t e r o f f i c e
M e m o
!___!___!___!___!___!___!___!
```

TO: GORDON BELL   DATE: FRI 11 FEB 1983
2:51 PM EST
    BILL JOHNSON   FROM: RON CRISS
    BERNIE LACROUTE   DEPT: 10/20 SWE
                                                              EXT: 231-5243
                                                              LOC/MAIL STOP: MR1-2/L8

                                                              MESSAGE ID: 5190625107

SUBJECT: THE PRINT SERVER PROGRAM

I think the print server program needs alot of overall direction. As a part of my new job I intend to assume the role of program manager. I would like to know that I have your support before I stick my neck out too far. If I don't hear from you by the 15th of February, I'll assume you have no problems with this.

Thanks, Ron

11-FEB-83 21:17:40 S 04767 MLCG
MLCG MESSAGE ID: 5190662774

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! d ! i ! g ! i ! t ! a ! l !          I n t e r o f f i c e
M e m o
!___!___!___!___!___!___!___!
```

TO: JIM CUDMORE
9:52 AM DST
BILL JOHNSON
cc: EMC:

DATE: THU 5 MAY 1983
FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5198964599

SUBJECT: REDUNDANT PRINT SERVER EFFORTS FROM NOD

GB5.20

The only 4-8 laser print controllers / print servers I know of are:

1. Craig James, John Celi, Roy Lomicka, Mickey Smith -- Printer group

2. Baum, Conroy, Feinberg, Friday, Fultyn, Laurune, Lint, Samberg --
Consortia of people who have a working prototype .

3. Brian Reid, Forest Baskett - Western Research Lab A/D project

4. Ron Criss's Server Group under Bernie (wait>2 years!)

5. Barry Folsom -- Omninet Shared Printer (get it soon)

6. CT clusters -- has/had a print server project?

7. MicroVAX / Seahorse I -- Server

8. Office ? Old typesetting group on LN01

9. A VAX based print/plot server that Marlboro uses for its

computation network.

I really don't expect to ever see a modern DEC print server that can
print graphics, multifont as a product given our perfect record of
producing nothing in this area, (including the LN01) there are
undoubtedly more internal efforts at each site to serve comp centers
and CAD groups.

Is there anyway to get a product? Or more engineering budget to
support these redundant, folks?

```
+---------------------------+                             GB5.65
|   |   |   |   |   |   |   |
| d | i | g | i | t | a | l |                 i n t e r o f f i c e
|   |   |   |   |   |   |   |                   m e m o r a n d u m
+---------------------------+
```

SUBJ: PRINT STATION WE MUST REDIRECT IT

TO: JIM CUDMORE
SAM FULLER
BILL JOHNSON
JACK SMITH

Date: 6/13/83 Mon
From: Gordon Bell
Dept: Eng. Staff
MS: ML12-1/A51 Ext: 223-2236
EMS: @CORE

The attached memo fairly accurately reflects our meeting.

At the meeting, I felt we should continue on our present course to build the current print server interface, while having a simpler controller built in parallel for software development.

Today, I feel we should DROP the design because the product and project are so far beyond our capabilities. We would go on some kind of buyout or to a much simpler plan. One of our software groups has an operational breadboard of a printer, and this might be the basis of a product, too.

A MUCH SIMPLER PRODUCT AND PLAN

We might change the project, reflecting a much simpler product structure on which the group has a chance, to implement. There is no way that the current group, with this set of specifications, abilities and processes could ever come close to building an operational design in anything under 3 years, not ONE. In general, the approach is similar to the recent redirection to get a Personal VAX based on the Qbus, and that approach we should have used for the PRO, Pluto and VS100... all of which are roughly 2-3 years late, and uncompetitive using better tools and a more experienced staff.

In making the change, we should in parallel train people in hierarchical design for complex systems, and provide them with the managment and process tools to be successful. I see a problem not unlike Jupiter. (I suspect this may be the reason why the LA200 has taken many years and will never ship.)

The approach:

- Clarify the distributed organization, and make sure there is adequate management to undertake this complex projectt.
- The print server should be renamed to be an Ethernet-based Print Station to more properly reflect its function and structure. The product functions have to be drastically cut.
- The server will NOT queue print jobs, but operates as a printer attached to Ethernet. It doesn't have a disk or console. Seasoftware permits very nice debugging from remote VAXen. Fonts, and station programs are nicely stored on a remote VAX.
- The station will be based on Seahorse I (followed automatically by II). Seahorse I operates in prototype mode TODAY with a VAX, Seasoftware, an NI, and a Unibus to Qbus adapter.
- The hardware for this first product should be greatly simplified so that we can get a completely debugged system up asap. This would correspond to the current products on the market. Fundamentally, the design approach is several stages:
   1. get the product built as quickly as possible in software, while using rigorous design methods with

specs. We will ship this unless it's too slow. If it is too slow, then microcode Seahorse to have the bitblt function. This will get the text-only print mode to be clearly acceptable.
2. when we understand the functions well enough and the amount of processing they require, selectively move the functions into hardware.
3. replace Seahorse I with Seahorse II (for cost reasons). A bounded version with MicroVAX, NI, etc. may be considered when we understand the current design space AFTER building a product.
4. VLSIzation of a function such as line drawing or bitblt might be considered when we understand performance.

. acquire and use the Adobe system for graphics description and font generation. It may be run partially in the station.

TODAY, USING THE LN01

C-T.printer-

PROPOSED STRUCTURE

```
C...C
!___!__ (Ethernet)
 !
 T.print_station
```

Where T.print_station :=

```
------- (Ethernet)
!
K.qna Pc Mp K.laser-T.print_engine-    (Pc :=
Pc.Seahorse!Pc.Microvax)
!_____!__!__!___(Qbus)
```

and K.laser is a double buffer memory which alternates between printing and being loaded by the processor. Pc accesses the Mp.

The current design has two gp processors and their associated busses, neither of which do very much except talk to each other and prepare work for a third, microprogrammed processor, which also controls a complex chip for line drawing. This design is based on one MicroVAX, and no special hardware in the first, potentially slow implementation. There are several ways to speed the design up:

- doing more operations in the hosts in preparing documents
- microcoded pixel operations
- some form of the current microprogrammed machine, or one special hardware operator to do a time consuming operation

WHY I THINK THE PROJECT HAS TO BE REDIRECTED

The reasons for this are not whimsical, but based on several previous projects, including Venus, Jupiter, VS100, Pluto, HSC and PRO.

- There's no definition or spec on what the system is supposed to do. Likewise, functional specs are non-existent for each hardware and software sub-component.

  The sketchy hardware specs are non-hierarchical, incomplete (memory sizes or locations aren't given, busses and links to busses are missing, etc.), conflicting, informal, etc. There isn't a manual for the various microcode machines or the hardware. I've seen nothing on software!

- There's no analytic data backing up any of the design, nor is there any data showing how each of the subsystems must perform.

- The design I see is incomplete (as reflected by the lack of specs), even though there's hardware coming. Flaky, incomplete hardware is a giant millstone! As such, it is precisely in the state of Jupiter when it was cancelled, even though much hardware was built and some of it running for 2 years.

. The design is far too complex to ever operate with this level of rigor in the organization, specifications and tools to carry out the design.

. The printer group is evolving to take on this major software effort, while lacking software engineering personnel and practices.

. We should have done PRO this way. Put on the Qbus, get the software operating, ship, and then cost reduce if necessary with a new bus, accelerators, etc.

. The VS100 and Pluto have similar structures: seperate 68000's, accelerator hardware with microcode and specialized software. ALL have taken more than 3 years, NONE perform acceptably, nor do we know why. On VS100, two of the processors are now acknowledged to be redundant.

I'm not advocating a large organization. This one is already larger than DECwest, and the project is of similar size. The quality of the project is over an order of magnitude poorer in every respect. As such, it is unlikely to ever reach completion.

Jim,
I think you have to lead us through this one. We badly need this printer. If it's available outside, and the project can be entirely software, then that's the easiest way out. Alternatively, we can go the painful route of training the people rather than giving up on them and never being competitive or able to build complex systems. Frankly, I think there are enough bright engineers among the intellectually bankrupt management structure that it's worth what will be a very difficult project and process. Success is probably some combination of the two.

Since the distribution of function and the need to print what our workstations produce is such a key part of the product structure, I have no choice but to help. What do you want from me?

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00 CORE DECGRAM ACCEPTED S 003759 O 639 12-JUL-82
22:07:48

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION DATE: MON 12 JUL 1982
10:06 PM EDT

FROM: GORDON BELL
cc: OPERATIONS COMMITTEE: DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

MESSAGE ID:
5169285011

SUBJECT: SOMEHOW FINDING $'S TO BREADBOARD THE LQP/SHEET FEEDER

I really liked what I saw. Somehow we have to move post
haste
to get a breadboard to see if there are any flaws in it and

how hard it will be as a project. The intriguing thing is that
we could take the WHOLE Spinwriter lqp market away from Diabolo,
NEC, Qume and C Itoh. This ought to be a major incentive to go balls out and get it. Also the add on ribbon/belt market would be enormous.

Let's get to working breadboards immediately. What will we NOT
do in order to get this one?

"TO" DISTRIBUTION:

BILL AVERY	JOHN RING	JACK SMITH

WPS USERS - Leave HP mode and type <CR>

GB0004/39

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+---------------------------+
|   |   |   |   |   |   |   |
| d | i | g | i | t | a | l |   i n t e r o f f i c e   m e m o r
a n d u m
|   |   |   |   |   |   |   |
+---------------------------+
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SUBJ: The Centronics Quietwriter--Is it for us?

Date: 8/21/79
From: Gordon Bell
MS: ML12-1/A51 Ext: 223-2236

TO: Jim Bell, Dick Clayton, Henry Crouse, Bob Glorioso, Gene Jones, Walt Tetschner, Art Williams, Bill Zimmer, OOD

Although I'm enthusiastic that the Quietwriter could be a major alternative to the Selectric or daisy wheel impact printers, it is important that we do a thorough evaluation. Right now it looks good, but then at this stage of engineering, many things always look good. It seems like the alternatives can be ranked:

	Selectric Dot Matrix	Daisy Wheel		Quietwriter
quality	1	2	1?,2?	3...but rapidly improving
noise	4	3	1	2
font variability	4	3	2	1
graphics ability	3	3	2?	1
reliability	3	4	1?	2
best cost	?	?	?	?

So the issues are: the cost differences may not be significant, the Quietwriter's quality is unknown, but unless it gets to Selectric level, it is probably not worth pursuing, and it feels like Dot Matrix will come up rapidly because everyone is working on it in one form or another. I resent the fact that we have to really evaluate the Quietwriter because life would have been soo simple proceeding along the matrix path.

I hope this adds some balance to my position. Let's go flat out to evaluate the Quietwriter, cause it could be significant for the short (5 years?) time frame. We do need the quality most likely for mail and for personal communications. In the long run I believe dot matrix will win.

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION DATE: TUE 6 JAN 1981 2:55 PM EST

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION DEPT: OOD

EXT: 223-2236

LOC/MAIL STOP: ML12-1/A51

SUBJECT: SHEET FEED VS. ROLL OR FOLDED FORM FEED: AN OPPORTUNITY!

If we could go to ALL sheet feed it seems it would offer incredible opportunity for us.

Having only sheets, permits:

0. Handling all kinds of paper including envelopes, thereby allowing us to get rid of the lingering typewriters in the office.

1. Any paper can be used.

2. It's right. It avoids the cruddy roll paper where it's impossible to get to be 11" long. It avoids the messy bursting and stripping required in the folded/form feed.

3. It's unique and represents a competition knock-off.

4. By using cartridges, paper types can be switched early.

5. Eliminates the "box" or "roll" and is easy to place anywhere.

6. A different style/shape of printer can be made!

What do you think?

GB:swh
GB2.S1.7

"TO" DISTRIBUTION:

SI LYLE BILL PICOTT ART WILLIAMS

"CC" DISTRIBUTION:

BUZZ BROOKS ART CAMPBELL BOB GRAY
KEN OLSEN STAN OLSEN

00 CORE DECGRAM ACCEPTED S 006313 O 356 13-JUN-83 18:34:15

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.___.___.___.___.___.___.___.
!   !   !   !   !   !   !   !
! d ! i ! g ! i ! t ! a ! l !
!___!___!___!___!___!___!___!
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I n t e r o f f i c e M e m o

TO: JACK SHIELDS

DATE: MON 13 JUN 1983 3:20 PM DST

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION

DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

MESSAGE ID:
5202828350

SUBJECT: WE HAVE TO SELL PRO'S AND CI CLUSTERS

GB6.3

Jack,

I think we need a major amount of help from you in regard to selling
PRO and the CI Clusters. For starters, we really need an audit, by
your committee about what's been going on. The goal is to make much
more sales and PROFIT. My analysis follows.

CI CLUSTERS PROBLEM
A lack cluster announcement considering that we have a major product.
I think the problem is that there's NO product manager for Clusters,
and it simply gets done somewhere in the bowels of VAX base products
marketing. Note clusters is:

- hardware options on the 750 and 780
- some cable and a connector (probably a Product Manager for it)
- VMS 3b.n, part of a release
- HSC which is clearly and seperately hyped

Note the absence of anyone who cares whether this works as a system,
or that this collection can be sold as a significant system whose
whole is greater than the sum of the parts. Rick Case's memo showed
that we could promote it as the whole which is at least equal to the
sum of its parts in terms of performance! Colorado recently just

tried it all together. (There was no one there who took the system
responsiblity.)

Fundamentally, we need your help to judge what so far is an non-existent act, and then help us get it together.

PRO PROBLEM (OPPORTUNITY)
PRO was late with its software, and it has been poorly advertised
internally. Rumours abound. For example, it's incompatible with RSX
and VMS, and there's a new PRO out soon on the Qbus. (This one hasn't
been started yet.) All of these problems mean poor sales.

It's vital that we have a set of products that get customers onto DEC
standards and files. PRO has great compatibility with Operating
System interfaces and file systems with VMS and multi-user RSX. A
great variety of programs from Fortran to third party software run
compatibly across the PRO-RSX-VMS trio. No other system or vendor has
the compatibility across PC's, team, group and mainframes like PRO
does. PRO will still ship about $100M this year, but is below plan
and still needs more care and pulling.

Again, I think we need an audit, and help from your committee.
Please help.
Gordon

"CC" DISTRIBUTION:

JIM CUDMORE	BILL DEMMER	RON HAM
BILL JOHNSON	MKTG/SLS STRAT COM:	JACK SMITH

ATTACHED: MEMO;61

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.___.___.___.___.___.___.___.
!   !   !   !   !   !   !   !
! d ! i ! g ! i ! t ! a ! l !        I n t e r o f f i c e
M e m o
!___!___!___!___!___!___!___!
```

TO: see "TO" DISTRIBUTION
4:03 PM DST

cc: see "CC" DISTRIBUTION

DATE: MON 6 JUN 1983

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5202115201

SUBJECT: CI CLUSTERS, OUR HOTTEST PRODUCT. NOW WHAT?

It's incredibly disturbing to see such a lackluster approach to the marketing and sales, especially since we seem to need the revenue.
The announcement should have been front page news!

In Colorado, they're running a maximum configuration VAX Cluster with:

    12-780's
     4-HSC's, with
         2 x 24-Dual ported R81's (over 20 Gigabytes)

It was very impressive in terms of performance and reliability... now that it has been tested. Also, American Bell has some running and gave a very strong endorsement at DECUS.

Recall that 5 years ago HYDRA was started as the most important project to build a competitive (especially with Tandem) system, providing high reliability and incremental upgrade. Also, we

have a
unique product in the HSC disk server. IT's HERE now.

While one might observe that we're following Land's guideline that
"marketing is what you do when you don't have a product", since
    1. we've put all of our marketing and sales attention on PC's
    2. VAX clusters are good enough to sell themselves.
However, I think we need someway to tell the world we have this unique
product. Also, it might be possible to get sales from competitors
like IBM because of our uniqueness.

Marketing and Sales Committee, is there anyway to promote this great
product?

How about at least a review at your committee?

Can Rose Ann get this marketing charter, given the clear marketing
failure to date?

"TO" DISTRIBUTION:

DICK BERUBE	BILL DEMMER	ED KRAMER
MKTG/SLS STRAT COM:	BRUCE RYAN	JACK SHIELDS

"CC" DISTRIBUTION:

TOM BURNIECE	JOE CARCHIDI	ROSE ANN GIORDANO
BILL HEFFNER	DICK HUSTVEDT	PRODUCT STRAT COMM:

EXPLICIT PROBLEM

WE ARE POSED TO SPEND TOO MUCH IN ENGINEERING!

REAL PROBLEM(S)

1. THE RELEASE OF NEW PRODUCTS CAUSES HIGH START-UP EXPENSES IN OTHER AREAS.

2. WE HAVE TOO MANY OVERLAPPING, INCOMPATIBLE BASE HARDWARE AND SOFTWARE ARCHITECTURES.

. OUR CUSTOMERS/SALES PEOPLE CAN'T DECIDE

. WE DON'T HAVE THE SALES VOLUME (GIVEN A LOWER GROWTH) TO HAVE COMPETITIVE PRODUCTS

. PRODUCTS ARE 1/2 STARTED (OR 1/2 DONE)

. WE HAVE NO PLAN FOR IMPROVING COMPATIBILITY AND SAVING OF OUR OWN, BUT ESPECIALLY OUR CUSTOMER'S SOFTWARE INVESTMENTS

3. WE HAVE NO FLEXIBILITY FOR ANY ESSENTIAL PRODUCTS (E.G., LOW COST,LETTER QUALITY, ELECTRONIC TYPEWRITER).

4. WE HAVE NO FLEXIBILITY TO RESPOND TO ANY THREAT FROM WHAT COMPETITORS USING 21-BIT MICROS MIGHT PRODUCE!

5. WE SAY WE WANT APPLICATIONS, BUT WE INVEST ELSEWHERE (ESPECIALLY BASE SYSTEMS).

<!S>

<problem> <respon><where> <deadline> <priority>

R - Responsible
V - Vital
I/W - Interested & Watching
T - Trusting

Problem as of Dec 28, 1978	Resp. Priority	Memo
Wisconsin Machine	Mucci, Strecker, Demmer TI 5	
HSC/NDS Def.	Platz, Saviers	

	TI 1		
Hydra Def.	PVR/LP	V	
	TI 0		
Interconnection/Comm. Def.	Sam		
	TI 1		
LSIVAX Def.	RC		
	TI 1		
Graphics Display Def.	?McBride, Halio		
	TI 5		
LQ Display Def.	Williams		
	IF 5		
LQ Printer Def.	Williams		
	IF 5		
Low End Priorities/No Toby	Clayton, Pearson, Moffa	cc:Ulf	
	TI 1		
Interconnection/ARPA	Sam		
	TI 4		
High End VAX	Ulf		10/20/78
	TI 1		
Allocations of Funds	Puffer	R	
	GB 5		
Product Strategy	GB	R	
	GB 1		
OOD Org.Changes/SW Charter	GB/RP	R	
Disk Strategy Change	JK	S	
	TI 0		
SW Strategy Change	LP		
	TI 0		
Engineering Morale	GB		
	GB 5		
Products Strategy Products	GB		
	GB 1		
Products Strategy Issues	GB		
	GB 1		
Internal VAX for Mfg., CIS,			
Eng.			see
Org. Comp. Status & Plans			
Library	Andy		10/18/78
EBOD Process	Andy, Bob, Tomasic		
	TI 1		
Architectural Ext. for			
Technical	Strecker		yes
Architectural Ext. for Cobol	Rudy, Strecker		yes

-- CAD

Review	BJ/Kusik		
	TI 5		
LSI Status Review	JC/Green		
	TI 0		
Performance Understanding			
of VMS	Potter		
	TI 5		
Strecker/Kotok Dinner			
	GB 9		

Engineering Corporate Sem. 3/1/79	Puffer GB 5		
Ron Ham	Justin TI 1	Pers	
Commenting on 38/8100/...IBM	? GB 10		
National-11 Law Suit	Siekman GB 10		
Getting PM's Effective	RP TI 1		
Eliminating FA&T	Ulf TI 1		
Communicating LA34's with FAX	Delagi, Glorioso, Williams IF 10		
Electronic Mail	Alusic TI 10		
Importing TEX	Glorioso, Lane, Gilmore GB 10		
Another Museum Panel	H 1		
Getting Museum Parts	H 1		
Dec. 18 BOD Presentation	GB 1		12/18/78
Los Alamos Talk	GB 5		
BTL	GB 5		
Japan Paper	GB 10		

<!S>
<deadline> <problem> <where>
<priority>
TITLE: <title>

G BELL Problems 2/6/83 Sun 3:18:15

AI: Product opportunities, VAXlisp, Scheme?, Prolog
AO/MCC: leader, Stanford AI location, Gate array std.
Answer: barker, burks, c smith (Fox), yates, argonne
architecture: cfm, mC(gipper), mP(PPA), microprog(AI,Fortran),
  RISC(Titan, Unsafe)
articles: electronics (not Vent cap), fortune,
BI: cost, schedule, common parts for si,bi,dr; a std.
Biography: interview
BUS: buy/use/sell policy; DECSET stop; TAP review

CFM: gipper, llnl, inside director, meeting
Chip sales: Fujitsu and J, Ward, bi?,
CMU-CSD Clusters: interfacing it
Database opportunities: Bachman, Bernsteing/Goodman, charters
DATAFLOW: conference
education: MIT, Cont. educ., MIT, management ed
Gate arrays: formal interfaces between cos (MCC), funds?
Japanese 5g: AO, Nilsson/Feigenbaum

LANs: servers,
LDP: getting a range of products
LSG: what machine?, Rose ann to sell VAX, make S1
mangement: heuristics, complexity study, gestation time, prod. good,
courses
MDC: getting process, discrete and terminals
MicroVAX PC's: getting a Qbus controller, Rainbow III, PC 470, SH/WS
MIT: PC, cont educ and Ken
Mudge: 100K "free" chip
Networks business: Rose Ann, Field
Office: Review it, compatiblity of editors, OA books
Organization: cpu+systems (bj), corp, e+m

PC talk by Adele Goldberg
PDP-11: Market task force, Worldbus
People: Bachman, Hughes
Portable C's: LA12, Jim King, Tiny Mite/
PPA: leadership, CMU deal, LLNL, def. and use as misd
Print interface to Qbus for server:

QDM: who to drive?, complexity, define the force,
Research group: sam, when?
Reviews sites: walk-throughs of mill
Scorpio: manufacturing readiness? (DL request), org review,
standards: bi vs multibus, microvax,
Stanford: AI request for help, PC's
TX-0: getting it up

VMS Clusters: name, a big announce
VMS supersystems/applications: thissel conference

Venus: s1 technology?
Videodisk or DAD: necessary for software distr., MVPC (Hustvedt)
Workstation group: how?, MicroVAX, b/w and color
Yale: opportunities (cs, ee, vlsi, parallelism)

<category>
<problem>ENGINEERING
<respon>
<memo>
<deadline>
<where>
<priority>
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<deadline>
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<deadline>
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<priority>V 0
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<category>ENGINEERING
<problem>High End Vax, 10/20 migration
<respon>Ulf
<memo>10/20/78
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<problem>Hydra
<respon>PVR

<deadline>
<where>
<priority>V 0
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<problem>Graphics Display Definition
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<respon>Alusic
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<respon>Clayton
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<respon>BJ/Kusik
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<respon>Cudmore/Green
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<where>
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<respon>Glorioso,Lane,Gilmore
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<category>ENGINEERING
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<where>
<priority>I 5
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<category>
<problem>
<respon>
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<problem>Org.Comp.Status/Plans Library
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<category>HOBBY
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<respon>SUPNICK
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<category>HOBBY
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<priority>H 1
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<memo>
<deadline>
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<respon>Jim/Ulf
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<respon>
<memo>
<deadline>
<where>
<priority>GB 10
<>

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<problem>Phil. of budget,org.,mgmt
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<priority>
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<category>
<problem>
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<deadline>
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<category>TALK
<problem>NAVAL RESEARCH LABORATORY
<respon>JAMES R. SLAGLE, NRL
<memo>4-43/79
<deadline>FALL 79
<where>WASHINGTON DC
<priority>
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<category>TALK
<problem>ACM - Distributed Processing
<respon>
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<deadline>2/28/80
<where>ADL?
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<category>
<problem>
<respon>
<memo>

<deadline>
<where>
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<memo>
<deadline>3/20/80
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<problem>TI, Mostek, Intel, Motorola, Harris
<respon>
<memo>
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<where>
<priority>
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<category>VISIT
<problem>CMU Distinguished Lecture Series
<respon>Habermann
<memo>
<deadline>80-81 Series
<where>
<priority>
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<category>VISIT
<problem>Syracuse U (Prof. Oldfield)
<respon>
<memo>
<deadline>?
<where>
<priority>
<>

<category>VISIT
<problem>U of New Mexico, Albq., collogquia, 2:00P on Tuesday or Thursday
<respon>Prof. Daniel Petersen
<memo>Y 8-27 (1979)
<deadline>?
<where>Albq.
<priority>
<>
if <category>=TALK
or =VISIT
then process record
IMPROVING THE INTERFACE AND STRUCTURE OF SYSTEM'S MANUFACTURING
AND ENGINEERING

PROBLEMS
The gestation times for system products has been increasing to unacceptable levels, given the rapid change in technology. Our competitiveness is decreasing, given our organization structure, processes and the interface between engineering and manfacturing! Recent major slips in Nebula, Comet, the 24 and 44, together with gestation times of 36 - 60 months for products involving no special lsi are typical. In contrast, comparable complexity products are released in 12 - 18 months shorter times in the mass storage and terminals areas. The interface in the Large Systems Group (MR) seems to be fine, given co-location and a clear, manufacturing organization. It is unclear how the Distributed Systems Group (Lacroute) is aligned with its Manfacturing counterparts... although it is clear, the product gestation times there are too long.

Similarly, the productivity in manufacturing is not increasing at all, despite higher quality products, customer merging, and a higher materials percentage.

ACTION

The responsible folks (Hanson, Thorpe, Demmer and Gutman) need significant help in rethinking how we are going to build competitive products. Larry and I would like a one day Woods with you to review and brainstorm this issue. Shel's needed.

SYMPTOMS AND OBSERVATIONS ON LENGTHENING PRODUCT GESTATION TIMES

. gestation times have risen from 12-18 months in the mid 60's when we were all in 1 building and built our own modules, to 24 months when we had multiple sites and used conventional I/C's, to our present 36 months when conventional I/C's are involved and when many plant stages are involved. For Comet, 17 manufacturing groups were involved in a product built on our gate arrays... and the gestation time, already 5 years is still not complete (the floating point unit isn't out)! Nebula has taken 60 months, whereas the 780 only required 30 months. Let's cut gestation time in systems by 12-18 months.

. engineering has lost several key designers because they do not get the key engineering reward: Seeing a Product Ship. (Computer designers may be like mathematicians, in that they do their best work before age 30. They can continue in an uninterrupted fashion at this rate, given they have continue to design. These long gestation times impair getting the competitive designs from these few, creative individuals!)

. there is a major misalignment of goals between engineering and manufacturing. Engineering is measured on product competitiveness (cost, performance and timeliness) while manufacturing measures are inventory and capacity.

In the specific case of Nebula, there is not a joint goal of shipping Nebula on the newly revised and elongated schedule.

. technology for manufacturing can not be applied. We need drastic rethinking in the way we manufacture and test modules, but there's no one here to couple with at the system's level. For example, specifying and testing modules would produce drastically better quality. I believe IBM manufactures this way, and the result is a factor of three better reliablity at the module level. In order to do this, we must have co-operation, together with better specifications from both organizations.

. we simply aren't getting enough performance from manufacturing. Given that Nebula is shipping in May, and has been operating for two years, we should be able to estimate the costs quite accurately (no more than 10% ... not 25%!)

. there is a major misalignment of organization structure between engineering and manufacturing. While Larry and I do not know every design engineer, we do know the whole management chain and the KEY designers for every major project. For Nebula engineering: B/P, Demmer, Croxon, Breslin (Nebula program), Barry (cpu), Okin (designer)... 7 levels below KO).

For Nebula Mfg: Smith, Hanson, Thorpe, 16-Bit Program Manager (with no line responsibility), Several Plants reporting via different paths with divided responsibility which engineering must co-ordinate, New-Product Start-Up group, Nebula Startup, head, Nebula start-up engineers, coupled to Nebula startup workers, given the project is distributed throught the volume plant. This is a chain of at least 9 people, many of whom have no ability to direct either via power or funding.

. clear manufacturing organizational responsiblity is not present to cover the plants and groups within a plant on a product basis. Note the above, unclear responsibility and escalation path with respect to problems and schedules.

. we are evolving to a very large manufacturing size and bureaurcracy because of our apparently unwritten rules to build everything ourselves. This strategy should be under constant review. Response times of large organizations generally decrease and we seem to be no exception. We are following in the tradition of NCR and Burroughs, and are evolving completely counter to an organization like Apple which has $300M sales for 1500 people, for a productivity of $200K per person, versus our $50K. Apple and the Japanese solve many of the response time and organizational drive problems by the two tier supplier structure based on subcontracting ALL SUB ASSEMBLIES. IBM gets higher productivity by massive automation.

. THE SYSTEM has evolved to be completely unresponsive to new products and the number of organization levels has caused us to arrive at a point where escalation via either the engineering or manufacturing chain never occurs! (Recall the basic statement that our gestation times are lenghtening, yet no one is telling us this except a few impatient engineering troops as they walk out the door!)

. we are not staffing the start-up teams with people with computer systems understanding. Our systems are becoming more complex and manufacturing people must be skilled in electronic systems manufacturing (modules, sub-assembly, systems integration, firmware, software, manuals and testing). It is ludicrous to have the Nebula manufacturing manager come from the GE Turbine Division! In contrast, this would never happen in disk manufacturing.

. we have an estimate from TEAC (Japan) of 6 months to get a customer mergeable unit equivalent to the RX02. Our schedule is 14 months. (I just looked at an equivalent system product with an aggressive? 122 week schedule!)

We almost have adequate gestation times for mass storage and terminals where there is clear alignment of products with the organization. Bill Hanson's response is "Boy are they going to have problems when they get big!". A better reaction would be: "Let's learn from them, segment and have clear responsiblity and alignment of products with the organization." In this way we get focus, response time and lower costs via learning curves.

. we have a similar set of problems solely within the engineering processes surrounding the design, fabrication and testing of basic products. (We intend to make these processes competitive.)

. we have a similar set of problem interfaces in the software release process. (We intend to solve this.)

. manufacturing management attitudes toward change appear to be fundamentally top-down directive, versus define and then provide a framework to solve the problems which are beyond a single individual's ability to solve. Fundamentally Engineering Management does not believe that the Top Down Directive approach to the troops 9 levels down will solve this problem! We believe the structure is fundamentally wrong, and the troops can not fix the system no matter how we command them to... only we can start the fix, i. e. lead, then they can tell us how.

Now is the time, but are there any leaders?

Thanks for inviting me to speak. I was grateful to accept for several reasons:

.I wanted to thank BJ and John for putting this on, and you for attending. Even though I love products a lot, I've come to realize that they cannot be built without these processes. We now spend significantly more to develop the processes than the products.

. I wanted to communicate with you since the plumbing operation I had about 5 weeks ago, and to say that I'm doing fine. I drove to see the doctor today and don't have to go back for amonth. The only stress we have here is trying to convince Gwen to cut down on butter (which we eat very little of), but the DR. was of little help becasue he wouldn't even agree that I should change my diet. Given the cost of being in a hospital, I tried to get a modular jack implant at the same time, but apparently these aren't available yet from the telephone stores. I could have used one since I got back.

A friend called today and asked whether it made much difference given the technology to remain in touch: telephone, electronic mail and wps. I feel in touch, even though I couldn't get Ken to build me a portable DECmate while I spent almost a month in the hospital. It is great to be home and to have the conveniences of wps and ems also its nice to reaffirm how much can get done via telephone and a few meeetings.

In general, I feel quite good and things should be more normal in another month, although I feel fine now. I believe I operate my life at a constant pain, call it isopainer lines where what I measure is about 1 bell's worth. That is, I'm feeling fine physically, but this now gives my psyche time to think and act. I'm trying to work on only a few things right now that are either quite interesting from a life long standpoint, or that have to be fixed. The PPA's in the former category, and getting us a Workstation that performs and is cost-effective during my lifetime is in the later. I'm glad the workstation group is there, because I sure want very hot response time from it. On the other hand, we've trying for about 4 years to get one, while I've watched PERQ, Apollo, IBM, HP, a dozen companies including people who've worked here and are now building them at Apple and Masscomp.

I feel like I'm talking to an already reformed group who understand complexity in design and the whole notion of Quality Design Methodolgy, and the real sinners (the folks who muddle through because they build simple things and are able to ultimately get the mods made that will ultimate let a system hobble around) aren't here. I made several calls and threats to try to round them up from the low end and the disk groups, but to no avail. Dave Cutler and I were discussing this this morning and he's giving indivdual instruction to his hardware folks who are beginning to realize that hardware and software design are pretty much the same.

CGB April 4 1983

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Subject: **Proposal/Clarification of New Product Announcement/Commitment Policy**

To: Marketing Committee

CC: OOD,
Si Lyle, MR1-1/M42
Jerry Witmore, PK3-1/M40

Date: 20 FEB 79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

follow up 3/2

I'd like to change what is apparently our policy with respect to product announcements.

Apparently it is:

1. Marketing Committee has to approve whether a committed project (e.g., Comet) can be discussed with customers if it involves price and delivery.

2. A Group Vice President can permit a project (e.g., Dolphin-36) to be described. We have apparently sold (are committed to) Dolphin-36 to Intel, Schlumberger, BNR, Phillips, Mobil and several universities. This seems strange.

Let me propose:

The Product Manager is responsible for maintaining a statement of what we can say to customers and to the field about <u>all</u> unannounced products. Changes to the policy should be approved by the PPC.

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Dick Clayton	ML12-2/E71	Jim Cudmore	ML1-5/E30
Bill Demmer	TW/D19	Ulf Fagerquist	MR1-2/E78
Bill Hanson	ML1-4/P11	Win Hindle	ML10-2/A53
Bill Johnson	ML3-5/H33	Ted Johnson	PK3-2/A55
John Kevill	ML3-6/E94	Andy Knowles	ML10-2/A52
John Leng	MR1-1/F35	Bill Long	ML10-2/A57
Si Lyle	MR1-1/M42	Julius Marcus	MK2/C37
John Meyer	ML12-1/A11	Ken Olsen	ML10-2/A50
Stan Olsen	MK1-2/A57	Larry Portner	ML12-3/A62
Bob Puffer	ML12-2/E38	Jack Shields	PK3-2/A58
Bill Thompson	PK3-2/C12	Jerry Witmore	PK3-1/M40

We've been waiting to get the 11/23 out quickly via the stores. Apparently, if we price lower, there's going to be a conflict between the TOEM and store products.

Ken's suggested having two products. I'm opposed to this because
I think the TOEM should get the deal too because he is locked in.

Is it feasible to have the dual product strategy?

FROM: GORDON BELL DATE: WED 16 JAN 1980
4:44 PM EST
DEPT: OOD
EXT: 223-2236
TO: STEVE TEICHER
BERNIE LACROUTE
MIKE GUTMAN
STAN PEARSON
JOHN ADAMS
GLENN REYER
JOHN ROSE

SUBJECT: PRODUCT HISTORY DATA FOLLOW UP: 1/17 1:00 PM

Please supply me with the Original First Customership and First Revenue ship date, breadboard date, and hold dates (when/if product was put on hold), any change in FCS/FRS dates, and any cancellations of the following products.

Bernie Lacroute

MERCURY	VMS R3	11/24	11/44
COMET	MA780	KE780	NEBULA
HYDRA	VAX/VMS R2	DMP-11	DMV-11
DZ11-H	LIBRA	BI	CI
NI			

Glenn Reyer

COBOL V4.1 (WAS COBOL V4B) TRAX

Steve Teicher

SCORPIO

John Rose

VAX-11 FORTRAN V2 RSX-11M PLUS V1.0

John Adams

DMP-11	DMV-11	DZ11-H	LIBRA

Mike Gutman

HSC-50	RX03	AZTEC	TU58-CA
RM80	RA80	UDA50	RL04
MSV11-K/L	MSV11-P MEMORY (FONZ-11 STD. ARRAY)		

Stan Pearson

11/23	LA24	VT125	PDT-150
VT101	T-11	J-11	PDT-130

Please be sure that the date of the change is included with each of the changed dates.

I need this information by 1:00 p.m. tommorrow - January 17.

Gordon

GB1.S1.18
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* d i g i t a l *
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TO: see "TO" DISTRIBUTION DATE: SUN 16 MAY 1982 1:40 PM EDT

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: PRODUCT LAYERS WHERE EVERY GROUP SELLS IN & OUT

BASE PRODUCTS FOR SYSTEMS BUILDERS
Physical inter-connect, packaging (internal sales), accessories
Semiconductors and board products

Mass memory components and systems (eg. HSC)
Video Terminals and W/S sans computing
Printing components, Print terminals, Printing systems
Communications components, systems and Networks
Personal Computers
16-bit Computer Systems
32-bit Computer Systems
36-bit Computer Systems

PREDOMINATELY SOFTWARE PRODUCTS (For system builder & final user)

Generic Business products (DB, TP, Forms,Cobol
Generic Office Products (WP, Mail, T/S, Vcalc)
Generic Tech (graphs, Fortran, RDB, stat, sim,
Sci-Vcalc

TECHNICAL PROF. ENVIRONMENTS BY PROFESSION

Electronic Eng
Mechanical Eng
Elec Power Eng
Civil Eng
Life Sci
Low Eng Physicists

MFG. PROF. ENVIRONMENT BY TYPE
discrete, continuous, shop floor, EDP

SB AND DISTRIBUTED BUSINESS
hardware store
distributor
order processing
insurance office (SB and LB agents)

EDUCATION TOOLS AND PRODUCTS (By location) indust, secondary, primary, home, college

HOME
MILITARY ENVIRONMENT PRODUCTS
Language-ized products (for country)
Specialized Products (for customer)

This even simplified to the extent that in the case of office products, we want them on virtually ALL products just like Fortran or Cobol. Thus, Office sells to base systems and has to be a part of the technical generic products.

THE NEED FOR THE RIGHT PRODUCT GROUPING AND LEVELS
We must have the right number of product groups and levels to balance the wonderful compatiblity our customers love and we sell and product redundancy (for example, we have editors for:
   system programmer,
   office,
   typesetter,
   technical professional,
   education market)
against too many interdepencencies. Grouping and managing the right groups gets focus on products we sell, not the ones we buy either internally or externally. We must recognize a trait in engineers to want to redesign the base (eg. new logic, new ISP, new O/S, new lanaguage and programming environment) before they start to design they product! This is especially easy to rationalize when the measures and rewards permit and encourage trivial product differentiation.

With the exception of the first level, EVERY level OFFERS a

product both to the inside and outside creating interdependencies. The wise builder will take layered products,
the foolish will build the base over.

Rewards have to be based on elegant products we sell, rather than
the trivial re-invention and evolution of someone else's product.

"TO" DISTRIBUTION:

HENRY ANCONA	BRUCE DELAGI	WIN HINDLE
KEN OLSEN	JACK SHIELDS	RON SMART
JACK SMITH		

GB3.S5.31

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* d i g i t a l *
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TO: WIN HINDLE
KEN OLSEN
JACK SHIELDS
JACK SMITH

DATE: SAT 10 APR 1982 1:07 PM EST
FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: DATA ON REASON FOR PRODUCT LINE MANAGERS

Ken's read once memo has the essence of an idea we want to use to
base our resegmentation of products and markets on. I tried to
make a chart, but rather than doing it as a SWAG, let's get the
study task force to give us the poop so we'll have it Tues.

Here's the chart we need:
Table of Products versus who distributes them. The table gives

%'s for each PL.

The P/L groupings:
PL90, ASG, CSS, Network systems (Jack Shield's new P/L)
Joel, Barry x 2, Jake, Rose Ann, TPG
Tech OEM Systems, Comml OEM systems, Micros
LDP, EDU, ESG, GSG
Telco, Mfg, CIS, Publishing, Broadcasting, office

The Product groupings:
ASG, LA, VT, Decmate, XT, CP/M
Disks, tapes, printers (shows % where CSS is low vol. supplier)
16 bit: boards, iron systems for unix, rt, m, rsts
32-bit: board (Microvax), Workstations, real time, commercial,
high reliability
36-bit of all kinds
Communications components and systems (DECnet, Ethernet, pluto, etc.)
Office Software
Product line unique software (here the entries say how it's done:
referral (EDU), DEC-built (DECset), DEC 3rd party joint (Eng).
Special hardware
Special software

I think we'll find something we've shown before: successful P/L's have a small number of products and/or customers. End user P/L's have to add value, understand the products (we use the word applications) as in Engineering. Products which go to ALL P/L's as in a cash cow mode (the 11 now?), can also lose if we let it.

We've got to keep this drive going to clean up the product and distribution act so as to focus on how we get the most products to the most customers. I'm convinced we have the products and more are coming.

GB3.S4.37

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SUBJ: PM...MANAGER AND STRATEGY (OR INTERCONNECT) COORDINATOR

Date: 2/28/79 Wed
From: Gordon Bell
TO: Bob Puffer
Dept: Office of Development
MS: ML12-1/A51 Ext:
223-2236
cc: OOD

I talked with Ken about the Pm...M job. He wants it to get done by a routine approval at a not too distant OC meeting. He would like it pre-sold and written down. Included would be the duties and a process description about who approves. (The POTS process would be assured, and written in too, if not through, by then.) He is worried about taking things into manufacturing before they are ready...so NO is a necessary part of it. Can you hold this discussion and include the PM's that report to OOD? Since a number of us will be absent on Thursday, it would be timely to hold the meeting and keep it to a small group. As a separate issue, we should get a candidate list, and their standing (i.e. who thinks what) in the environment.

It is increasingly clear that we need someone (Strategy Program Manager, Strategy Coordinator for?) to work on tieing the loose ends of the strategy together. Of highest priority is the Interconnect, which I believe is not going well at all. There is no schedule, priorities, etc. and virtually every group is involved but in a pretty nebulous way. In this later regard, I believe interconnect is of higher priority than several of our terminal or system products, because it is the only way to get at what IBM is doing. The whole ball here includes what the hardware is, then the software and finally what systems and when various device support will take place (e.g. serial connection to the unit record devices, such as line printers). This person is needed now before the final Red book is put to bed.

Any candidates?

GB:mjf

ID#0282

d i g i t a l interoffice memorandum

Subject: **Product Managers: How Many?**

To: OOD

Date: 25 SEP 78
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

I'd like a simple measure and understanding of how many PMs we need so that we can proceed to fill critical slots. Rather than being coerced by Dick who must make an offer now to an outstanding candidate, I'd like to get some quick measures. John and Ulf have similar needs so we can look at the data on Thursday.

For starters, I'd certainly like a simple set of metrics from each of you at a +/- 20% guess level in a table listing:

1. The PM's, PMM's, and PMMM's in your area.

2. What products and model variations each is responsible for;

3. What is rough $ volume as per 78 product results and 79 forecast and $/PM.

4. How many were sold.

5. Number of P/L customers.

6. How large the engineering group,

its budget, is for each product and percent spent on PM in the area.

As a side benefit, this'll help us focus on just what each of us is responsible for.

(In the case of PMs in other groups such as DCG that are managing our products, please note that the budget or management is someplace else.)

GB:ljp
00 BURT DECGRAM ACCEPTED S 20885 O 33 23-MAR-81 06:59:44

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* d i g i t a l *
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TO: RICK CORBEN   DATE: MON 23 MAR 1981 6:52 EST
    ENG STAFF: FROM: GORDON BELL
cc: STEVE COLEMAN   DEPT: ENG STAFF
    TED JOHNSON   EXT: 223-2236
                                   LOC/MAIL STOP: ML12-1/A51

SUBJECT: PRODUCT PLAQUES AND OC WOODS COMMENTS

There is universal concern about making an environment that supports engineering. The minutes will be forthcoming, but the immediate items:

1. Five task forces are going to be created to help us, headed by five members of the OC. They are: organizational interfaces, processes (redtape) that impede engineering products, interfacing to determine products, the lack of resources ($, computers, space), and a look at our organizations.

2. We want to kick off an awareness program of building a substantially better company so that we can be more competitive. We brainstormed a set of rules, and these

will be polished and then discussed with our staffs, who in turn will discuss them with their staffs. Here, I'd like to append the relevant rules to the memo on "Heuristics for Building Great Products", together with your input, and then use the two documents (OC, and Heuristics) as the base for discussion within engineering.

3. I presented the Transitions in computing, together with targets of where we should be. This took 1.5 hours and people were very attentive.

4. At the April Woods, we will present the Operations Committee with the Base Plan, in the form of several plaques that can be posted on the OC Conference Room wall... and at the various sites responsible for the implementation. This was done in 74, as we outlined the projects to 79. The old ones are in my office if you want to look at what they are. Then, there were only 2 plaques, the 11 system models over price (log scale 1-100K) and time, and the 3 families of single user, rsts, and real time operating system. Now, we would use the new price bands. For the components, there is not a range, but instead a point price, and hence let's use trees to show them (where position of branch represents price, leafs are products, or process and start of branch is start of design, the death of product or process would terminate the branch). This is represented in the DEC computer family tree poster where we have the 4 basic computer families.

We will produce the following 15 or so plaques, each of which would show products in the next 5 years (end of 86), and starting in beginning of FY80. The plaques would reside in the OC Conference Room, and be the basis of subsequent reviews and discussion.

- 36-bit
- VAX hardware systems; VMX capability, user capability including languages data management, nets, etc. (2-3 plaques) Here, I'd like to see enough plaques so as to show the whole family, complete with all products.
- 11 rack and stack and boards; 11 operating systems (2)
- Personal computers including pdt, 278 together with a line for user capabilities such as tms
- Office Products Systems
- LA's, Printers and VT's
- Communications Hardware; Communications/Networking Systems. It's not clear how to represent. One method might be to show three or four bands for DEC (including cx/dx), DEC via NI, IBM and International interconnect capability. Within each band, there would be each of the operating systems (rt, m/m+, ias, rsts, 10, 20, vax, 8) together with the products (eg. phase III, 3270). (2 plaques)
- Disks (where the families, as I understand them, are RK, RP/RM, R8x, RL, RX, Aztec),
- Tapes,
- Chips (here use the 3 or 4 basic processes as the different trees, with branches showing evolution to different geometries and chips or chip sets (eg.

Comet)
as the leafs)

- Packaging. Trees will help to show the forest.
- Power. Trees can probably help here too.
- Physical interconnect (various trees would show new structures such as substrates). There would be a pwb tree with branches representing new capability which are both layers and spacing/line width. Here, we also want to represent on the same graph our capabilities for laying out these in CAD.

These graphs should be the main foil of the presentations, as it enables us to talk about the what, where and when of our prodcuts in many cases. It would also show the risks of unacceptable gestation times. Also, B and C would show where we get by increasing investment. There may be others, but these are the necessary ones. In many cases we have them done, or have data to get them into this form easily.

5. There is also an agreement to review each major group once per year at the Operations Committee, in terms of the plaques.

6. There was a discussion of marketing the low end products, but there was no proposal, nor a resolution. It's clear that the engineering priorities are to drive to get great products. When we've got them, I'm convinced the

marketing will fall out of this.

Overall, it was the most constructive meeting we've had for sometime... albeit intense.

GB2.S5.23

ENGINEERING STRATEGY PRESENTATION

CHANGING PRODUCT, MARKET AND TECHNOLOGY

THE STRATEGY AND DISTRIBUTED COMPUTING

THE SOFTWARE SYSTEMS

REVENUE AND RELATED ENGINEERING EXPENSES

THE PRODUCT RANGE VERSUS TIME

PRODUCT STRATEGY

PROVIDE A HOMOGENEOUS DISTRIBUTED COMPUTING NETWORK ENVIRONMENT BY

1985 SO A USER CAN COMPUTE, WITHOUT REPROGRAMMING ON A DYNAMIC BASIS

AT:

. A COMPUTER IN A TERMINAL

. A SMALL, GROUP-LEVEL COMPUTER

. A LARGE, CENTRAL MACHINE(S) WITH MOST COST-EFFECTIVE PERFORMANCE AND LARGE, COMMON DATA-BASE

IMPLICATIONS

. FOCUS ON THE DISTRIBUTED COMPUTING ENVIRONMENT AND RELIABLE COMPUTING

. BUILD 11 HARDWARE FOR LOW END SYSTEMS WHERE VAX IS CURRENTLY

TOO COSTLY

. BUILDING 11 AND VAX COMPATIBLE PRODUCTS SO THAT TIMESHARING, REAL TIME AND COMMERCIAL PROGRAMS RUN ON EITHER VAX-11 OR 11

. STANDARDIZATION

NETWORKS INTERFACE TO IBM AND INTERNATIONAL STANDARDS

APPLICATIONS THROUGH DEC-COMPATIBLE LANGUAGES

- WORD PROCESSING, MAIL, TYPESETTING FOR THE OFFICE
- PROFESSION-BASED GRAPHICS CRT-CALCULATORS
- GENERAL TOOLS (E.G., PROJECT CONTROL, SIMULATION) MANY PROFESSIONALS

AIMED AT

- TRANSACTION PROCESSING
- GENERAL MANAGEMENT LIBRARIES

P/L SPECIFIC APPLICATIONS

COST-EFFECTIVE PDP-8, 10 AND 20 SYSTEMS BY:

- BUILDING HARDWARE FOR CURRENT OPERATING SYSTEMS

. MAKING MARKET SUPPORT AND DEC-STANDARD LANGUAGE ENHANCEMENTS

00 BURT DECGRAM ACCEPTED S 32482 O 66 17-JUN-80 09:45:41

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* d i g i t a l *
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TO: OPERATIONS COMMITTEE: DATE: TUE 17 JUN 1980 9:43 AM EDT

FROM: GORDON BELL

cc: OOD: DEPT: OOD

EXT: 223-2236

LOC/MAIL STOP: ML12-1/A51

SUBJECT: PRODUCT STRATEGY VS BUSINESS AS USUAL

I certainly believe Bill has posed the right questions. We continue to have to make short term decisions, such as the WS200 based on the 8, that further erode our capacity our ability to provide good service and take customers down a path that we ultimately can't support or deliver according to their expectations.

Ultimately these users will probably want to switch.

When IBM made the 360 decision they didn't support all their past machines... as such there was a risk. Honeywell moved in to support the 1401 base and it kept them going for awhile.
Univac and Burroughs have a hodgepodge of oldies, none of which are particularly effective, but could have been consolidated
to give better overally support. Their customer, the government
has been locked in to them with no alternative. Now, the government is saying we are going to only buy the 370''s because it is available from many sources.
IBM has been doing their product introductions generatlly right in a business sense by knowing when to stop previous

products. This is just another reason as why they are number 1.
(As an aside, the government trend to 370 as their standard computer may have business implications mightn't it? Would others make the same decision, especially in light of an alternative source of supply from Japan?)

In our case, we lock people in. To the extent we lock them into something that is not in their long term best interest, they will have to change. When they do change it will be with a vengence to the best thing that is available then. Propogating all our oldies increases the likelihood of their eventual loss as a customer.

It is especially disheartening to see us lock in potential users to vax, to put out machines I can't really get enthusiastic about, and to not get the personal vax out. In this later one, there are emerging a several machines that users will flock to.
The interest in the Perq is very high, with all the universities ordering them and the Navy attempting to outfit its newest nuclear carrier with it. Meanwhile, we can't get it out.

Somehow, it might be useful to frame this as a classic business strategic question of old versus new product line... but the answer is even more tricky because of the effect of lastingness of software. (For example making only vax processors and letting the add-on market supply the rest might be the best way to go.
In this way we can supply the whole market with everything, past and future.)

ATTACHED: MEMO;48

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TO: GORDON BELL
5:23 PM EDT
    ANDY KNOWLES
    JULIUS MARCUS
    JACK SMITH

DATE: MON 16 JUN 1980

FROM: BILL DEMMER
DEPT: DISTRIBUTED MID-SYS
EXT: 247-2112
LOC/MAIL STOP: TW/D19

SUBJECT: 32 BIT MARKETPLACE - SOME VACATION THOUGHTS

Ken has been admonishing us not to lose our lead in the 32 bit
market. Have we an agressive enough marketing, engineering and
manufacturing strategy with supporting implementation priorities
to achieve this? Or, in our usual attempts to partially satisfy
everyone are we risking high leverage future business with
allocations being made on individual tactical needs not any
strategic thrust?

An example or two of such things (primarily as "food for
thought") might be:

a) Marketing-Manufacturing: Should we continue to open up a
new plug compatible (VAX) memory and disk business as we are
currently allowing or should we consider closing this off at the
expense of permitting greater penetration on the 11/70 and
DEC10/20 systems.

b) Marketing-Engineering: Is there a strong enough marketing
swing to 32 bits such that we could re-evaluate the actual

need
for new high end PDP-11s and DEC10/20s? (eg, Right now our
priorities are such that we are cutting back on the DECnet
X25
type coexistence support and deferring VENUS options in order
to
maintain our plans for new DEC10/20 CPUs.)

c)   Any other view across our marketing strategy that would
shed
more light on the strength of our current 32 bit strategy as
we
are implementing it versus what it might be if we wanted to
set a
clear goal of maintaining our leadership position.

GB1.S5.7
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* d i g i t a l *
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TO: BILL KEATING   DATE: SUN 16 MAY 1982
2:16 PM EDT
                                                FROM: GORDON BELL
cc: BOB GLORIOSO   DEPT: ENG STAFF
    BILL JOHNSON   EXT: 223-2236
    PEG: LOC/MAIL STOP: ML12-
1/A51

SUBJECT: RE SW PRODUCTIVITY AND A JOB SHOP CONTROL SYSTEM TO
DO IT

My hot idea for the greatest boon to productivity is still
a shop floor control system that forces the whole project
to report on the status, including writers, printers, sws,
managers, product managers, etc. This would let everyone
know without having to get together to bs about the project.'

Venus still is the best place to install this project where
everyone is on the machine and we could reduce the need
for many of the meetings etc just by having a program go
looking at all the files, tasks etc and where they are.

In this way we get every day an automatic update for the state of the design.   I've been asking to understand the "state of the design" for a year... we know much about it now.

Now, I think we want a tool that gives the instantaneous state of the design at all times and for all projects. This target comes directly from the fact that as engineers, information is our sole product and that information is in a computer at all times. Furthermore, the target of the compete set of information we are trying to produce is known, Therefore, it must be possible for a program to tell us how close we are to completely generating the information.

Can I get anyone interested in the notion of the Engineering, Job Floor Control System???

Think of the creativity we can release when we don't have to have the tedious meetings with all the tedious schedules and dates just to find out where things are? Why should the engineer have to tell someone what is already in the machine? (This is like having to fill out the forms again and again when the system already knows it.)

GB3.S5.33
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* d i g i t a l *
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TO: DICK BERUBE   DATE: SUN 6 JUN 1982 2:45 PM EDT
    AL CRAWFORD   FROM: GORDON BELL
    OPERATIONS COMMITTEE: DEPT: ENG STAFF
    PEG: EXT: 223-2236
                                             LOC/MAIL STOP: ML12-1/A51

SUBJECT: PRODUCTIVITY VIA FEWER, BUT HIGHER QUALITY MESSAGES

Messages are often more expensive to read than to send!

Today's
incoming mail prompted these suggestions:

0. When writing, THINK FIRST OF THE READER. Will he understand, waste time, be discouraged or moved to action?
1. Too many messages are being sent; MANY MESSAGES CAN BE CUT OUT. SEND MESSAGES only ONCE, NOT BY EMS AND MAIL.
2. Messages need not be distributed so widely. CUT THE LIST! CIRCULATING a single document IS A GOOD ALTERNATIVE TO REPRODUCTION. Much of what we reproduce and distribute is neither timely nor requires filing, only adds cost.
3. A physical distribution list of 10 pages with a message of 1/4 page is not uncommon. Knowing who's on a distribution list is essential for short lists, but for general announcements, a list can be summarized (eg. 525 key people, or number by group and site). THE DISTRIBUTION LIST MUST BE NO LONGER THAN THE MESSAGE!
4. Many long distribution lists are also wrong. Gwen used a 3200 item mailing list with 500 duplicates or errors. Fixing the list gave an immediate 15% productivity increase! CLEAN LISTS.
5. Let's all STICK TO ONE PAGE FOR PRINTED MESSAGES! A one page, printed EMS body carries 46 lines. A 24 line screen is a nice size for messages requiring fast response.
6. A several page report requires greater time for a reader because of its complexity. A SUMMARY IS REQUIRED so that the reader can plan his time.
7. DIGEST, ABSTRACT, ANALYZE AND CRITIQUE INFORMATION WHEN "PASSING IT ON". Just got a thoughtful set of "press clippings" from an announcement, but would have liked one

page which analyzed how we did instead.
8. SEND SUMMARIES: MAKE FULL REPORTS AVAILABLE ON REQUEST (eg.
trip reports, clippings, backup tables, experimental data).
9. MINIMIZE SENDING VISUAL AIDS as written messages since the
media are different. If you want the viewgraphs to be read,
then re-edit to increase density and understanding.
10. If you can't be interesting, BE reasonably CORRECT. Even as
an injuneer, I have lo tolurance for mistspellings and poor
gramer, unless it's an off-the-wall EMS message.

Hope this is helpful.

Warning: Violators will be persecuted!

GB3.S5.40

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* d i g i t a l *
****

TO: ENG STAFF: DATE: WED 15 APR 1981 14:39 EST

FROM: GORDON BELL

cc: WIN HINDLE DEPT: ENG STAFF

JIM LAWLESS EXT: 223-2236

LOC/MAIL STOP: ML12-1/A51

SUBJECT: WHAT'S THE RATIO OF DEVELOPMENT COST/NOR FOR A PRODUCT

We have Burp metrics for all products showing 1 ~ 2 percent for this
ratio. It's unclear whether this ratio should be small or large.
Until Jim Lawless challenged me, I thought the ratio was just the same

fraction, say f, we spend on engineering.

The percent turns out to be a function of the product development time and product life. There's no doubt, a formula, but I didn't try to derive it. Try this case of DEC growing 30 percent each year, a product development that takes three years and then is produced for five years:

- The product costs (1 + 1.3 + 1.69 = 4) x f to develop.
- The product revenue is (2.2 + 2.8 + 3.7 + 4.8 + 6.3 = 20).
- The development cost/nor ratio = .25 x f.
- If f = 5.5 percent, then the ratio is 1.375 for all products, since our Burps include a 100 percent overhead in them.

GB:swh
GB2.S5.15

GB0001/33

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| d | i | g | i | t | a | l |   i n t e r o f f i c e   m e m o r a n d u m
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Subject: **Our Market/Product-Positioning/Growth Dilemma**

To: Marketing Committee
OOD

Date: 3/19/79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

Right now we must be especially concerned about the large 3+ decade price range of systems required in our many, varied (applications) markets. Consider the following viewpoints.

<u>We've got to lose market share</u> which in turn usually means higher costs overall, and possibly lower profits because:

a. DEC future growth at 26%/year is lower than the past 36%/year growth (see Fig. 1).

b. The technology improvements continue to open up a new low end at an increasing rate. Note the range increase as shown in Fig. 2, and the range factor, ignoring the terminals and 10/20 is plotted in Fig. 1. Prices of low end <u>systems</u> decline at 10% to 20% per year, limited only by the mass storage capability whether it be ram, bubbles, tape, floppy, etc.

c. Over most of our market price range (i.e., applications) the market growth rate is constant or increasing.

d. Our market and sales strength seems to be (ordered) in the following price bands:

i. 100K-250K (11/70, 2020, 780)
ii. 40K-100K (11/34)
iii. 1K-2.5K (terminals)
iv. >400K [both bands 250-625-1.6] (36-bit)
v. 16K-40K (low end 11/34 box and OEM RL based, plus Datasystems)
vi. 6.25K-16K (PDT, WP)
vii. 2.5-6.25 - almost non-existent, except for hardware-only components; small PDT's are here and the new WPS should be

e. Note, the market share,

base and growth is highly diverse over our range of interest, as shown in Fig. 3.

f. It's impossible to grow enough to keep market share in all these price areas. Therefore, we should understand the ultimate deleterious effect. By contrast, see Fig. 1, all our competitors (except IBM - who has divisions) seem to be in a narrower range, growing faster and are more profitable.

<u>At last IBM has noticed us</u> and is descending over the price-performance space like a bunch of locusts whose population is growing exponentially. For some time it's clear we've been exempt from IBM competition as they used to have really crappy products in this space. Now they're interested in the same growth, system size, and computing style we see.

a. The <u>useful</u> (i.e., 148-class with 0.5 Mbyte memory) 360/370 has come into the under 250K, mini market. Figures 3, 4, and 5 show how this series has stopped at the price boundary as more software is added and larger memories have been needed. Now even IBM can't fill all these primary memories with operating system and the cost has broken through with the lower cost/byte memory. Also, with the latest announcements, they have for the first time, machines that are competitive with the 10/20.

b. They have a mini with the Series 1 positioning at the 04/34 (one of our key strenths). The new enhancements get the price down to broaden its coverage into the 03. They may go after chips here, too. They'd really be smart to get an independent semi-house to make chips available.

c. The System 38 is targeted at the 11/70 class machine, our highest revenue earner.

d. The 8100 is targeted both at the 34 and 70 to do the system's off loading that many of our minis are sold for.

e. They're building user personal computers in the 5100.

Costs to engineer systems of a given price are increasing with time from several perspectives as can be seen in Figure 6. (I'll verify these costs later.) The cost of the minimal mini is rising from the situation in 1972 where it was built from standard MSI components.

a. IBM and semiconductor technology opportunities are raising the ante at the higher ends by using gate arrays to build higher performance, more cost effective (lower cost) systems. These cost proportionally more because:

i. Special gate arrays are required, increasing the number of circuit types.

ii. The machine is higher speed by more parallelism and is therefore more complex.

iii. More RAMP features are required.

iv. Mid life extensions should be built in to protect and extend the investment.

b. Intel and semiconductor technology opportunities are raising the ante at the low end because we must have DEC ISP chips for small systems. Gordon Moore has observed that the number of man-months/chip to design a chip is doubling every 2.7 years. These chips aren't taking advantage of maximum densities, either.

c. Our product size, system structure and diverse markets engender almost unbounded commitments (see the typical situation for the Large Systems' area shown in Fig. 7). The total number of products announced, is approximately the product of:

base hardware x
special front-end, back end hardware x
operating systems x
network options x
applications and data base hardware and software options x
any CSS products

i. There are many base hardware systems, tending to include other special hardware each of which has to be tested in a combinatorial fashion.

ii. Depending on the system size and the dedicatedness (versus general purposeness), we seem to take on a lifetime system enhancement-support commitment (see attachment for large). For example, only recently have we been able to decommit TOPS 10 enhancements on KA10's.

d. We have multiple families, all of which our customers expect, to be evolved and their ranges expanded forever! This means that whatever problem we think exists above, it is actually 4 x worse. Or ignoring ranges that have only one product in them 2-3 x worse than first glance.

There are several reasons to focus on <250K systems.

a. With the newly announced Federal Channel standard, the price line is 250K to define a mainframe. The 780 is excluded.

b. Various government groups can purchase computers under 250-300K without OMB approval.

c. For many large organizations, a selling price under $250K doesn't require the authorizations that a $500K purchase requires.

d. IBM isn't as strong here now as they seem to be headed for.

DEC's ability to introduct new products is actually more limited and more expensive than we think because all products tend to be marketed through all groups.

The expanding 3+ decades range of products presents a problem because:

a. Field Service, Software Support, Sales and Manufacturing are faced with much of the product introduction complexity and costs (paralleling development cost) that engineering faces.

b. Although we design many products, the introduction cycle and ability to absorb is clearly one limit.

c. With the high rate of growth and turnover in all groups, including sales. For example, it's impossible to believe that no matter how we segment, a salesman is being asked to cover and leave too wide a range.

d. It feels like we need the much better segmentation according to size, because costs over the whole P and L vary greatly by size! In engineering I'm attempting to have much clearer segmentation through funds firewalling and organizational segmentation! (I feel we need the same in the other organizations.)

GB:ljp

Attachments

D I G I T A L   INTEROFFICE MEMORANDUM

DIST:

Dick Clayton	ML12-2/E71	Jim Cudmore	ML1-5/E30
Bill Demmer	TW/D19	Ulf Fagerquist	MR1-2/E78
Bill Hanson	ML1-4/P11	Win Hindle	ML10-2/A53
Bill Johnson	ML3-5/H33	Ted Johnson	PK3-2/A55
John Kevill	ML3-6/E94	Andy Knowles	ML10-2/A52
John Leng	MR1-1/F35	Bill Long	ML10-2/A57
Julius Marcus	MK2/C37	John Meyer	ML12-1/A11
Ken Olsen	ML10-2/A50	Stan Olsen	MK1-2/A57
Larry Portner	ML12-3/A62	Bob Puffer	ML12-2/E38
Jack Shields	PK3-2/A58	Bill Thompson	PK3-2/C12

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SUBJ: HOSTILE FEELING TOWARD OUR PRODUCTS. **READ AND/OR DESTROY**

Date: 2/28/79 Wed
From: Gordon Bell
TO: Distribution
Dept: Office of Development
MS: ML12-1/A51   Ext:

223-2236

The following was typed on a Selectric, last Sunday. It came direct from my heart: "Can we get better products?

As a DEC user, I'm frustrated because I'm now using a Selectric (that's never failed!). My WPS78 is down, the second time in a month. It's the VT52. I know the more it's worked on the more unreliable it will get with all of its screws, connections etc. (I suspect electric discharge as the culprit.) I long for a replacement.

I can't call into EMS because either it is down, or my terminal won't answer it properly. (I can call CMU so I think it could be EMS.) However, it is clear that the infamous acoustic coupler may be the culprit, because I have been able to tweak a knob and get it to work before. Now, I don't have the time.

We're going to get killed with more products like these. If I ever had any doubt about quality and duty to make things work as highest priority, being a user sure makes things straight.

I hope each of you have a terminal that you personally use...we have to.

P.S. I'd been looking forward to (wondering about) a single universal terminal to get rid of the two I have. Now, it's clear I need three terminals because with this quality, two isn't enough.

P.S.S. I tried it later on, and the WPS works now. Clearly a static discharge that put it in an untenable state. (I lost the file I was editing...which seems strange.)

P.S.S.S. EMS was apparently being worked on; why should it answer?"

GB:mjf

Distribution
OOD
cc: Chuck Bickoff
Roy Clites
Al Crawford
Bruce Delagi

Jack Gilmore
Len Halio
Roy Moffa
Jack Shields
Tom Stockebrand

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Dick Clayton	ML12-2/E71	Jim Cudmore	ML1-5/E30
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Bill Johnson	ML3-5/H33	John Kevill	ML3-6/E94
John Meyer	ML12-1/A11	Larry Portner	ML12-3/A62
Bob Puffer	ML12-2/E38		
Chuck Bickoff	MR2-1/M64	Roy Clites	ML5-5/E97
Al Crawford	PK3-2/F34	Bruce Delagi	MR2-1/M64
Jack Gilmore	MK1-1/J14	Len Halio	ML1-2/H26
Roy Moffa	ML1-2/H26	Jack Shields	PK3-2/A58
Tom Stockebrand	AB		

GB3.S10.17

00 CORE DECGRAM ACCEPTED S 000329 O 52 14-NOV-82 17:04:01

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! d ! i ! g ! i ! t ! a ! l !        I n t e r o f f i c e  M e m o
!___!___!___!___!___!___!___!
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TO: ALAN KOTOK

DATE: SUN 14 NOV 1982 4:35

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION

DEPT: ENG STAFF

EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

MESSAGE ID:
5181784483

SUBJECT: RE: YOUR MEMO OF NOV 8 "WINNING HIGH END CPUS FOR THE 80'S"

Am excited about VENUS and the incredible progress it made and
certainly and don't believe BJ or anyone else seriously thinks
that Venus isn't going to be a major product. Just replacing all the SBI based 780's in the same floor space to run the current peripherals is probably going to seperate it from Nautilus.

As to the follow on work and what we base the next machines on,
that's the subject of some work, but I don't see waiting around
very long to decide. BJ has to go balls out to get the next VAX's started to get us back in the ball game competitively and see if we can regain some of the losses like ATT who are leaving us. I believe the key parameter of a design is simply
how well it is documented and how robust it is. I believe we can not screw up Nautilus in terms of documentation hierarchy, because this will turn out to be the key parameter as to what we re-realize (Nautilus or Venus). I want an expert
system that will do this design, therefore, we need a minimum amount of information so that an expert program can handle it.

As to SAFE, I simply have asked BJ to make sure that it is not conducted in Marlboro because you folks have lots of work and the next technology to do right now. Also, I'm pretty convinced that there aren't a plethora of interesting non-microprogrammed machines around, and I certainly don't want more than one of them. Forest is building a very fast machine, and if he's successful, then we'll build many... and they'll do much of what VAX is used for now!

If you want to explore this space, then I'd like to get it focussed somewhere in either BJ or Sam's organization.

For now the party line:

1. VAX is it. We're going to extend the architecture as long as no extra state or wild new data paths are implied (don't want to make the same mistake as the latest KL enhances.)

2. We're going to implement VAX's like crazy using some aggressive technology and good engineering. We need some decent CPUs!

3. The PPA looks like an interesting machine that can be used to get more cycles. We're going to build it.

4. TITAN is our next architecture, especially if it turns out to benchmark as well as I think it will. At the small size, it should really out compute just about everything.

5. Strecker is looking at whether there are any techniques to enable VAX to be implemented for direct, not microprogrammed
execution in order to get more speed.

Just visited a number of customers and they love VAX and want a high speed follow-on. Inside, we piss and moan about needing
a new architecture because VAX is too hard to do, and every group wants to throw it out and start over. Unfortunately, I see no evidence that VAX is particularly hard to implement as compared with every architecture I see (Cray, 370, Eagle, Prime, 6600, Jupiter (a super complex ISP))... I do see a major need for good engineering when implementing VAX because it can't be done in an undisciplined way.
Meanwhile, if direct execution of an architecture turns out the way to go, Forest will tell us quite soon.

"CC" DISTRIBUTION:

ULF FAGERQUIST BOB GLORIOSO BILL JOHNSON
MRSVAX/KL1031/KOTOK

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SUBJ: A Competitive Set of Products

TO: OC
EMC
PEG

Date: 8 NOV 1982
From: Gordon Bell
Dept: Eng. Staff
MS: ML12-1/A51 Ext: 223-2236

BASIC SITUATION
.Businesses/products have been added. We're in too many now!
.We have poorly managed existing high priority projects.
.The result is a major slip in competitiveness across the board, this in turn causes more, short term, poor products to form.
.We must FIRST, staff a winning set of products, then backfill,
as needed with short term and less critical, less competitive ones

REDUNDANCY IS THE CURSE: when two (poor) is less than one (great)
.VAX and the 11
By slipping J, we can not start MicroVAX products. The result is that J is too little, too late and MicroVAX could be too late
.VAX and the 10/20
By slipping the high end products, we've merely deferred the question of the next 36-bit machine
.Industry Standard (or not) and 11/PDP-8 Personal Computers
Surely all the time we spent on channels would have been simpler

with fewer products. Learning curves say that we'll pay 20%
more for having 3 personal computers than one great one.
We need a competitive follow on to the PC 350 with 32 bits
.The question of a 68,000 product will probably come up soon too
.11 Systems and Boards for Systems are generally overlap

WHAT WOULD I CUT?

Why bother with the repackages of VAX's to get cost? Cut the prices as needed. I don't see speeding up the 780 versus PPA!

Clearly reduce 8, 11 board/system/PC, 36-bit to get the critical essential, competitive products staffed.

Admit to not doing something, such as the small PC, or cut one of the 3 PC's to get a low cost one in a different price band! Why two on top of each other?

There are redundancies in the typesetting/office area, and we might face having a strong LDP, ESG and MDC, versus weaker ones which include MEDICAL, ECS, Typesetting and Small Business.

The overlap in commercial and the COEM products can now be reduced when the need for product uniqueness for a channel is removed.

GETTING OUT OF THE PRODUCT MALAISE: ENTER, THE NEW DIGITAL

I think we have to build substantially more aggressive, competitive products. In many cases, the groups aren't really aware of their competitive position... but the NEW DIGITAL should fix this as we demand that they be responsible.

Now is the time to act to have great products.

THE COMPETITIVE SITUATION IN PRODUCTS

I only see only two competitive products, and they are based on futures: Nautilus and MicroVAX (2-2.5 years away, but look good). We have major competitive problems in virtually every area:

<u>VAX</u> (2 years away from possibly catching up)

VENUS is twice 780 cost, but it now looks doable by June 84!
NAUTILUS looks like an excellent 780 replacement, but 2+ years
NAUTILUS II, Jan. 86 FCS must start now (2-4) x Nautilus
NAUTILUS III, Jan. 87 FCS must start now (2 x Nautilus II)

SCORPIO CLUSTERS are essential. Having invested in this interconnect and software, we can now make it payoff!

SCORPIO-BASED Systems are simply not aggressive enough in cost and content. We will miss a major window without the options.
LOW END VAX needed against new micros, to be solved by MicroVAX
The projects must be started.
BOARDS AND CHIPS require a major investment and commitment to
behave as the competitors do

WORKSTATIONS are 2 years behind Appollo and with less power
WORKSTATIONS with Color are needed too
MICROVAX based WORKSTATION must be started

LARGE, PARALLEL PROCESSOR BASED ON MICROVAX. Risky, but could have very high payoff in getting us back to be recognized
as a leader in computing that we had when VAX was new

<u>PDP-11</u> (Major underpower now; parity if Jaws attains speed)
Sales indicate a complete movement from the 11!

Is it the products or are we not selling them? cost too low?
A new operating system for boards is too little too late
We can not fund both board and boards for systems
Opportunities for 11 upgrades exist!

BOARDS
See PDP-11. Require a 32-bit product. Many 16-bits don't equal 32-bits!

PC's
IBM, HP and everone else has 68,000 based machines
How can we win with having so many, particularly if they are me too or technically inferior? marketing? distribution? mfg?
MicroVAX PC 470 could provide the edge, but it isn't started!
Very Low Cost PC. Can we? Do we offer anything at all?

TERMINALS (Can we do fewer, better?)
VIDEO: Not leading in technology or cost
PRINTING: Budget, work, strategy and need are all incongruent!

UNIX

We have a strong development group, and they'd like to build good products.

LSG

We've sold what may be an unbuildable product, added new customer commitments and converted VAX customers to the 10/20, but are a bit closer in having a way to let customers compute on other DEC machines. We could probably learn from Honeywell and Univac who have similar, but larger 36-bit products and customer bases. Burroughs, CDC and NCR experience relevant?

LDP

We sell VAX systems. People buy their lab equipment elsewhere.

No awareness or drive to the real time aspect of laboratory, and propagating MINC, which was a significant product for us.

ECS

A major leadership gap exists because it's predicated on having and selling the lowest cost personal computer. We've never had this, and we NEVER will for an extended period of time.

We need a winning way to sell products here and we need some products, but aren't working on the critical ones.

ESG

Buyout is fine, but customers want integrated systems.

MDC

Real time equipment appears to be needed to win

SMALL BUSINESS COMPUTERS

Another Market without a product! (Remember the stores plan?)

WORD AND INFORMATION PROCESSING

Products can compete, but we don't seem to sell enough

to pay
 New WP/OA products are not visible enough to see competitively,   but given the age of current products, we must have follow-ons!
 There are major overlaps which Julius is addressing now.

```
                                ACCELERATE/SQUEEZE/
PRODUCT            MUST         RE-CONSIDER                     DROP
_________________________________________________________________
_____________

VT'S          |-220,240,Modems    |All                   |
              |_____________________|______________________ |
              |-Qbus Controller for                      |Are special
chips still|VT220/VT240 cost
              |Seahorse I/PC      |viable in light of    |reductions
(too little
              |(in VT group?)     |non-use in VS100 (and |too little
- cost
              |_____________________|VC100) and new chips?
              |reduction is tooling!)
              |-VC100 (in VT group?)|                    |
              |                   |                      |
_________________________________________________________________
_____________ LA/LP/LN            |LN03 Print Server     |LN01T,     |-
Laser printer engine
              | and P.O. Engine   |                      |  (B.O.
Commodities)
              |LA/3 (Ridiculous   |                      |- Base Prod.
Mkt.
              | Schedule; retrofit                       |    |- Large
ECO's -- Send
              | on LA12(HR)       |                      |  people to
school to
              |LA200 (At last ... |                      |  do it
right
              | or drop it. Is it |                      |- LA50
Replacement
              | competition?)     |                      |  (B.O.
Commodities)
              |                   |                      |- I/O Fox
Scanner
              |                   |                      |  (Buyout)
_________________________________________________________________
_____________ DECmate             |- DECmate II LP       |       |- RD
              |- DECmate II (19"  |                      |- 8086 (let
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Rainbow do
             |- VT125 emulator   |                      |  it
             |                   |                      |- SBS !
             |                   |                      |- DIBS
             |                   |                      |- multi-user
SBS
             |                   |                      |  (use
11's!!)
____________________________________________________________________
_____________ Rainbow            |                      |- clarity
with other   |
             |                   |  DEC products        |
____________________________________________________________________
_____________ Central            |                      |  Yes       |
Resources|   |                   |
____________________________________________________________________
_____________
Pro          |- get Pro performance|- J-11; V2/V3     |-
Microswitch
             |  up to get sales  |                      |- Cost
reductions
             |                   |                      |  (they
generally lose)
             |- get selective    |                      |- clusters
(use VMS
             |  generic and      |                      |  servers -
don't
             |  professional     |                      |  cluster
CT's)
             |  applications if you|                    |- MicroVMS
CT (VC100
             |  can decide what  |                      |  and
MicroVAX/WS/PC
             |  CT's to do       |                      |  will be
used instead)
____________________________________________________________________
_____________
PDP-11       |MicroVAX, LCP's,QNA                       |Boards,
SBC's, Support                   |- Orion-U (too little
             |                   |                      |  too late)
             |                   |                      |- Implement
software
             |                   |                      |
reductions!
             |                   |                      | ($7M in
```

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support is
                  |                         |                           |  too high!)
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______________ Work-                |- VS100                    |-VS300      |
stations      |- Pearl              |-Support effort (with  |
              |                     | people) to make Qbus              |
              |                     | graphics on Seahorse I|
              |                     | workstation in VT   |
              |                     | group                     |

______________ VAX                  |- Clusters                 |- Support |-
MFA (TVG has no $)
mid-range|- LCN (it's cheap)        |- accelerate N II          |
              |- Superstar (we and                              |            |
              |  our customers need                             |            |
              |  it!)               |                           |
              |- MicroVAX BI        |- Scorpio                  |
              |  and BI             |                           |

______________ Large VAX|- Venus    |                           |- don't
expand

______________
36-bit        |- KLINI/KLIPA        |                           |- no Jupiter
              |- more aggressive    |                           |
              |  co-existence and|                              |
              |  migration (like    |                           |
              |  what birds do)     |                           |

______________
MicroVAX      |                     |- YES                      |
 program      |                     |                           |

______________ Software             |- DECwest and              |Programmer
productivity|
              |  reproduce it       |(what is it?)              |
              |  elsewhere with same|                           |
              |  cost=effectiveness                             |            |
              |- MicroVMS / PC      |                           |
              |- Human interface    |                           |

______________
Dist.Sys.|    |                     |- Poseidon or Neptune
              |                     |                           |- Octart
chip (buy it!)
              |                     |                           |
```

STORAGE

```
_____________________________________________________________________
_____________ Low End             |- Aztec                |- all else|-
RDZX (do A/D first
             |                    | (become most cost-  |  to see
feasibility)
             |                    | effective buying org.)|- Eland
             |                    |                     |- Saber
             |                    |                     |- Aztec II
appears
             |                    |                     |
uncompetitive
             |                    |                     |  (note Maya
+ RDZX)
_____________________________________________________________________
_____________ Tapes               |- Maya               ||- DAD (note
while
             |  (How to accelerate?|                    |  this has
high payoff
             |  When can we see it                      |    |  for SW
reproduction
             |  run?)             |                     |  and other
             |                    |                     |
applications, we need
             |                    |                     |  to cut
costs
             |                    |                     |  somewhere
or show
             |                    |                     |  payoff.
Use IVIS
             |                    |                     |  instead.)
_____________________________________________________________________
_____________ CX                  |- HSC (why still so  |           |
             |  expensive?)       |                     |
             |                    |                     |
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4/20/83
GB5.11

```
+---------------------------+                                GB0001/49
|   |   |   |   |   |   |   |   |
| d | i | g | i | t | a | l |   i n t e r o f f i c e   m e m o r
a n d u m
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```

Subject: **Helping Old Products Die**

To: John Holman, PK3-1/P84
Bob Lane, MK1-2/B11
Stan Olsen, MK1-2/C36

Date: 3/19/79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

follow up 4/2/79

How can we get together to get TPL to be more aggressive in managing the peripherals that go into TPL? Engineering is not very good about planning product phase-out of these products that have to be "added-on", i.e., disks, tapes, and perhaps even some terminals. Right now, for example, we are clogged in the disk area because we still support RP02's as a standard product. This gets in the way of manufacturing etc. Nevertheless, these products still have to be available to add-on to systems in the field. Rather than manufacture again, we should buy back and refurbish. We can use new disk subsystem trade-ins to get the old products back. Grant Saviers has expressed ideas about such a business. Let me urge you to talk with him, because it could really mean high profit to the corporation and much satisfaction to our customers.

As a separate issue, I would like to urge us to explore how some of the low volume software (e.g., APL) could be TPL'd or CSS's. We get these low volume packages and they clog the engineering support and budget system. However, we believe they can be profitable if managed as a small business. The way it is now, they all look like losers.

Could I implore you to meet with Grant on the peripherals business; and Larry and Jack Mileski on the low volume software business?

GB:ljp

CC: Mike Gutman, ML3-6/E94
Win Hindle, ML10-2/A53
John Kevill, ML3-6/E94
Andy Knowles, ML10-2/A52
Larry Portner, ML12-3/A62
Grant Saviers, CZ
Mike Tomasic, ML12-2/E71

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION DATE: FRI 22 FEB 1980
3:26 PM EST

FROM: GORDON BELL
cc: see "CC" DISTRIBUTION DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1
A51

SUBJECT: THE DILEMMA OF NEEDING MORE PRODUCTS (>1 PAGE) F/U
2/29

I have strong empathy with the products your customers are requesting.
It seems as you improve the coupling, the effect is to get more
requests. We should all be very uncomfortable with sucking too much
out of the advanced development pipe for products, because that's
going to take us increasingly down the tubes. I wonder whether there
are any alternatives?

At the high end is there any way to get work started in the RP07
follow on? (There are currently no high-end products after the
07...unless it can be shown that gangs of 81's will do it (is the 81

adequately funded?)

In the low end, it feels too tight with 8 requests for 2 or 3 project
funds...and the need as nearly as I can tell is for low cost floppy
for most. The RX02 cost makes us really uncompetitive in the store.
We need cost before anything else too. I can't see why we don't
simply only pursue cost reduction in floppies, getting whatever
density is relatively free (adding no more than 5% - 10% to system
cost). I have trouble understanding the need for Aztec because of
size. We haven't packaged a floppy in anything other than a 19" rack,
so why bother? The RL02 looks great - it's cheap and will fit in
anything that our floppies fit in. Maybe you should wait on Aztec
until we have a small systems package that requires something other
than a 19" form factor. Could we package a pair of RL02's on any
other way to make them appear less bulky (e.g. a foot stool)?

In the midrange, somehow the 180 MB removeable is the killer in the
budget. As far as I can tell because we had been buying out that
capacity drive in the RM's an I don't understand why we don't
continue?

I hope there is an effect of the NI, but right now, I don't believe
the details are well enough laid out to comment.

The LSI plan still looks non-existent. I don't buy what I've heard.
It's too NIH, too product specific and too custom. Somehow

it feels
like we need more commonality than the 2901, and the 8080 across
disks.

Can ROI be used at all as a measure of goodness? Don't all disks or
tapes taken alone has incredibly high ROI? When you look at the ROI
of a system, given a year longer and with the disk tooling, I believe
the picture changes. Is it worthwhile to ever run an ROI on a disk
alone? In essence, let's go back to the make/buy criteria guidelines
we made several years ago (the memo is attached). In summary, the
only reason to make them is if they are good enough to sell alone in
the OEM market, OR we have to get the source of supply. Can you help
your systems customers a bit more by giving them the option of make,
buy, buy with option to make (for second sourceness or for source of
supply)? They might have chosen say 2 disks that are buyouts versus
one later that is apparently cheaper. At this point you have to look
at the ROI like crazy because of the field stocking/spares, and number
of system issues when you introduce two versus one.

I don't think your system buyers are going to help with funds. They
are going to continue to spend their budgets for
Processor-Memory-Controller (PMC) kernel products and to take what you
give and complain.

Is there anything besides a big $ transfusion to help?

GB:swh
GB1.S2.4
Attachment

```
+---------------------------+ GB0001/52
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| d | i | g | i | t | a | l |   i n t e r o f f i c e   m e
m o r a n d u m
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Subject: Make vs Buy Guidelines Update (from 3/5/76)

To: File

Date: 3/28/79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

What DEC SELLS not what it BUILDS is the more important issue for continuing success. In a rapidly changing industry where technologies can quickly become obsolete, it is essential that DEC maintain flexibility and not become over committed to any particular technology or process. As we make more and more of the items we sell, we become more rigid. Opportunities in the marketplace can be delayed or lost forever. Opportunities to cost reduce by building more inside will stay with us. The following guideline is intended to help us focus on these issues.

1. DEC wants to build unique products that offer specific advantages

to its customers. Profitability alone is not sufficient.

2. High ROI by itself is no reason to build anything (e.g., it robs resources from other, more essential projects).

3. The general rule should be, if we don't make it now, buy it.

4. Proposals to build must explicitly demonstrate that:

    a. project will result in a quantum jump in technology or

    b. needed to introduce (or confine) a vital technology to DEC or

    c. present or developing vendors are unable to supply demands of ON-GOING high production item.

5. All proposals to build should address and be screened by at least the following criteria:

    a. DEC's forecasted needs exceed the volume of at least the smallest economically viable vendor.

    b. DEC's engineering resources to accomplish task is at least comparable to vendor.

    c. Incremental NOR/employee will be above the corporate average for the effort. [We should strive to increase "PRODUCTIVITY".]

    d. Hardware products can be sold through the Components Group. [The product is inherently good enough to stand on its own.]

e. ROI analysis of not only the results of pursuing the project
but the corresponding results when using the vendors part.

f. Level-of-integration of the project. [We should tend to
increase level-of-integration-focus on MAKING what we sell--NOT what we BUY.]

g. The resulting incremental NOR to development cost ratio
compare with Corporate NOR to total engineering ratio budgets.
[Won't become an engineering sink.]

6. We must have a "buy out" advocate to test analysis (in Manufacturing, Purchasing, and Engineering?).

7. Proposals to "make" must be explicit with respect to the level-of-integration covered (i.e., which parts). "Making" is not a carte blanche licensing to make everything.

"TO" DISTRIBUTION:

GRANT SAVIERS MIKE GUTMAN MIKE RIGGLE

"CC" DISTRIBUTION:

DICK CLAYTON BRUCE DELAGI ULF FAGERQUIST
PER HJERPPE BERNIE LACROUTE DAVE RODGERS
BILL DEMMER HERB SHANZER STAN PEARSON
SI LYLE MITCH KUR

DECgram not delivered - TEXT error: MESSAGE TOO LONG

****
* d i g i t a l *
****

TO: KEN OLSEN DATE: SUN 15 MAR 1981
16:55 EST

FROM: GORDON BELL
cc: see "CC" DISTRIBUTION DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: HEURISTICS FOR GREAT PRODUCTS: 5, WITH 30+ DETAILS

HEURISTICS FOR BUILDING GREAT PRODUCTS

Products goodness is somewhat like pornography, it can't fully be described, but we're told people know it when they see it. There are lots of heuristics in the book, Computer Engineering. Since quality and competitive products must be our number one focus in these next generations, these heuristics are intended to help us.
Only the five following need be attended to:

- .a responsible, productive and creative engineering group;
- .understanding product metrics (competitiveness);
- .understanding the design constraints;
- .knowing when to create new direction, when to evolve, and when to break with the past; and
- .ability to get the product built and sold.

ENGINEERING GROUP
As a company whose management includes mostly engineers, we encourage engineering groups to form and design products. With this right of organizing, there are some responsibilities:

- .understanding leadership who understands the product space and who has engineered successful products;
- .having skills and disciplines required in the respective product area, eg. ergonometrics, acoustics, radiation, microprogramming, data bases, security, reliability;

.having skills on board to make the proposal so that we adhere to the cardinal rule of Digital, "He Who Proposes, Does"; Approving a plan, based on no implementers violates this.

.having open-ness, external reviews, clearly written descriptions of the product for inspection;

.as a corollary of being prepared with leadership and skills, we occasionally enter very new areas, requiring research and advanced development; Product commitment should not be made until fully operational breadboards exist.

.as a corollary, start up groups with no previous or poor previous track record, may need review.

PRODUCT METRICS

Since most of our products are evolutionary, engineering is responsible for knowing their product area, in terms of:

.major competitor cost, performance and functions together with what they will introduce over the next 5 years;

.leading edge, innovative small company product introductions.

DESIGN CONSTRAINTS

Design constraints such as acoustics, radiation, are basically useful because they limit choice of often trivial design decisions. We should meet the following design constraints, and if unacceptable, go about an orderly change:

.DEC Engineering Standards covering most physical structures and design practice for producibility; These assimilate the critical external standards such as VDE, and FCC as rapidly as possible.

.information processing and communications standards, such as Cobol, Codasyl, IEEE 488, EIA;

.information processing standards as determined by the key
supplier, such as IBM SNA;   For example, all eight
versions of VISICALC we are implementing, should be
compatible with external VISICALCs.

.the architecture of existing DEC products; For example,
future editors should be compatible with the past editors,
unless it can be shown experimentally that there is a
significant (x2) benefit to change. These include:

.ISPs of the 8, several 11's, 10/2, VAX-11, 8048, 8080 and
are likely to include a 16-bit micro;

.physical busses for interconnect; Fundamentally this
insures that future products can evolve.

.file, command language, human interface, calling
sequence, screen/form management, keyboard, etc.

.we must not be undone by historically poor standards which
constrain us to poor products; Currently, the 19" rack and
the metal boxes we put in it, and then ship on pallets to
our customers, act as constraints on building
cost-effective PDP-11 Systems. This "mind set" standard is
impeding our ability to produce products that meet the 20%
cost decline. A target should be the shipment of systems
in cardboard boxes which the customer assembles.

.ability to be implemented easily in any natural language,
given that we are selling products in all countries.

WHEN TO CREATE A NEW PRODUCT DIRECTION OR WHEN TO EVOLVE THE OLD

Given all the constraints, can we ever create a new product, or
is everything just an evolutionary extension of the past? Also
do we know or care where product ideas come from? There are a
whole set of places to look for products, but that's another

set
of heuristics, and the object of these heuristics is simplicity.
The important aspect about product ideas is:

- .Ideas must exist to have products!

It is hard to determine whether something is an evolution or just an extension. If you look at our family tree of products, like the one for our computing systems, and which every product group should have and maintain, the critically successful products all occur the second time around. Some examples: 6,KA,KI,KL,2080; Tops 10,Tenex,20; 5,8,8S,8I/L,8E/F/M; OS8-RT11; 11-20,40,34; RSX-A... M; TSS-8,RSTS; various versions of Fortran, Cobol and Basic all follow this; LA30,36,120; VT05,50/52,100; RK05,RL01/2.

Some heuristics in designing good products:

- .all products whether they be revolutionary (we have yet to have any that are really in this category), or creating a new base, or evolutionary, should:
  - .offer at least a factor of two in terms of cost-effectiveness over a current product; If we build unique products that do not compete with ourselves, then we will have funds to build really good products.
  - .be based on an idea which will offer an attribute or set of attributes that no existing products have; For example, the goals and constraints for VAX included factor of two algorithm encoding and also offering ability to write a single program in multiple languages. VT100 got distinction by going to 132 columns and doing smooth scrolling.

.build in generality, and extensibiility; We have not, historically been sufficently able to predict how applications will evolve, hence generality and extensibility allow us and our customers to deal with changing needs. We have built several dead end products with the intent of lower product cost, only to find that no one wants the particular collection of options. In reality, even the $200 calculators offer a familty of modular printer and mass storage options. For example, our 1-bit PDP-14 had no ability to do arithmetic or execute general purpose programs. As it began to be used, ad hoc extensions were installed to count, compare, etc. and it evolved into a digital computer.

.build complete systems, not piece parts. The total system is what the user sees. A word processing system for example includes: mass storage, keyboard, tube, mdoems, cpu, documentation including how to unpack it, the programs, table (if there is one, if not then the method of using at the customer table), and shipping boxes.

.a new product base, such as a new ISP, physical interconnection specification, Operating System, approach to building Office Products must:

.start a family tree for which we expect significant evolution to occur on, otherwise the investment for a point product is so short term and hence is likely to not payoff. In every case where we have successful evolutionary products, the successors are more successful than the first member of the family.

- a product family can evolve several ways as described on page 10 of Computer Engineering; The evolutionary paths are lower cost, and relatively constant performance; constant cost and higher performance; and higher cost and performance. In looking at our successful evolutions:
  - lower cost products can't get by without adding functionality too, as in the VT100;
  - constant cost, higher performance products are likely to be most useful, as economics of use are already established and a more powerful system such as the LA120 will allow more work to get done;

- a product evolution is likely to need termination after sucessive implementations, because new concepts in use have obsoleted its underlying structure. All structures decay with evolution, and the trick is to know what the last member of a family is, such as the 132 column card, and then not build it. This holds for physical components, processors, terminals, mass storage, operating systems, languages and applications. Some of the signs of product obsolescence:
  - it has been extended at least once, and future extensions render it virtually uninteligible; (For example, PDP-8 memory addressing and ISP was extended three times.)
  - there are significantly better products available using another base;

SELLING AND BUILDING THE PRODUCT

Buy in of the product can come at any time. However, if all the
other rules are adhered to, there is no guarantee that it will be
promoted, or that customers will find out about it and buy it.
Some rules about selling it:

- .it has to be producible and work; This, although seemingly trivial rule is often overlooked when explaining why a product is good or not.
- .there should have been a business plan that several different marketing groups have contributed to in terms of ordering and selling; Just as it is unwise to depend on a single opinion in engineering for design and review, it is evenn more important that several different groups are intending to sell the product. Individual marketers are just as fallible as unchecked engineers.
- .never build a product for a single customer, although a particular customer may be used as an archetype user. Predicating a product on a sale is the one sure way to fail!
- .it should be done in a timely fashion according to the committed schedule, at the committed price and with the committed functions.

Now isn't it clear why building great products should be so easy?

Are there any heuristics that should be added? or are patently
wrong? or need clarification?

Comments please!

The first paragraph with the 5 points says it all, but in
case there's need for detail, there are another 30 or so

which
follow... in the words of Mies van der Rohe, "God is in the details".

gordon

"CC" DISTRIBUTION:

RICK CORBEN	BOB DOCKSER	ENG STAFF:
MIKE GUTMAN	AVRAM MILLER	OPERATIONS
COMMITTEE:		
BILL PICOTT	OLLIE STONE	

GB2.S5.20

00 BURT DECGRAM ACCEPTED S 2807 O 75 08-FEB-80 11:17:17
FROM: GORDON BELL   DATE: FRI 8 FEB 1980 11:13 AM EST
DEPT: OOD
EXT: 223-2236
TO: JACK MACKEEN @MR16
    MARKETING COMMITTEE:
    MARKETING COMMITTEE: @CLEM
cc: LARRY PORTNER
    DICK CLAYTON

SUBJECT: ARE OUR PRODUCTS/INTRO STRATEGY WRONG IN LE?

Have just learned that one can't buy an 11/23 in Europe because P/L's and Europe have determined that small systems are too expensive to sell. DCG is the only outlet and it is OEM mainly. Some of my university friends would like them and I think there would be eventual payoff by letting them know that DEC does build microcomputers, something that they would never otherwise know. There outlet is via the reseller.

It seems to me we ought to consider the following:
1. Stop development of small systems because they clearly can't be marketed through our current channels.

2. Build a channel for small system and only or predominantly sell them through this channel.
3. Treat this as a special case of good times, and not introd.
the product at the systems level at all. Let the resellers eg. Plessey have all the 23 modules and let them sell the 23's instead.
4. Offer 02's at the systems levels (apparently they exist) and
then price an upgrade kit to 23's when the board becomes avail.

Given that the recent set of poor market showings in PDT, 78??,
03's?, and now 23's at systems levels, should we do some rethinking? Eg. form a low end product line? Make only a single PL responsible for a product (eg. Minc)?

I am experiencing the same proble in the introduction of the personal VAX...namely ESG is clearly the lead P/L, and it would
be good to introduce it there first. Also, I think in this case
we have a real leadership product as the Personal Professional
Computer for the serious computer user with a big problem or work that they want to run.

Someday we ought to discuss these issues calmly.

GB1.S1.67
00 BURT DECGRAM ACCEPTED S 36897 O 01 10-MAR-81 16:01:18

****
* d i g i t a l *
****

TO: ENG STAFF: DATE: THU 5 MAR 1981 21:46 EST
    AVRAM MILLER   FROM: GORDON BELL
    STAN PEARSON   DEPT: ENG STAFF

BILL PICOTT EXT: 223-2236
BRUCE STEWART LOC/MAIL STOP: ML12-1/A51

SUBJECT: WINNING, GREAT PRODUCTS: A CONSTRAINT ON OUR PRODUCT STRATEGY

After having approved a P/L plan at the December review of the LR Plan by the Operations Committee, one of our P/L's has just reduced their commitment to sell products in excess of 10% over last year. This amounts to a 90M$ reduction in NOR and a 4.5M$ reduction in engineering spending may result. The reason for this that was given was more competition and that our new products being introduced in early 82 have slipped a bit, plus they don't look so hot (when they come out).

In this case, I don't expect anything of the Product Line and it's possible that there may be other new products and that it's too hard to sell anything. Hence, the NOR may slip more.
Where we end up in sales is purely a game of chance because the only way that they can sell anything is if there is some feature that seperates our product from everyone else.

I believe they are right, and probably should go even further and suggest we close down the factories unless they get these kind of products. Unfortunately, they were part of the large mass of product managers, engineering strategists, and marketers who partipated in the generation of the product strategy. With such a mass, we clearly have a question of who is responsible. I want to make this clear:

I hold the engineering manager for a product, or product area solely responsible for the success of a product.

The issue then is what went wrong?
The products, now don't look good enough to be bought without what others might think of as marketing. In this case, the area looks "commodity like" and we don't have anything to

differentiate us. This is clearly our responsibility!

Therefore, I want us to stop building products that we do not believe are going to be great products. This means no mid life kickers, unless, like the 70 they enhance performance and really extend the product life. The new products in this example are fundamentally cost reductions, and golden rule products in a new, questionable market area. (Please refer to p12 of Computer Engineering for the economics of why products should evolve along performance rather than price... in a constrained engineering budget if you haven't read it.)

Therefore, the constraint on products are: fit the strategy; and
NO CRAPPY PRODUCTS. WE ARE ONLY GOING TO BUILD THE BEST PRODUCTS WE CAN!

(In the ensuing several months, I want to review several of the things we are doing against this criteria.   I know buy in and all those groupie words are nice, but when the going gets rough, the nice folks who buy in are the first to sell out. When that happens and we're all that's left, it's clear to me that the responsibility is once again solely ours for the generation of good products. If we don't think we can do it then maybe we should just sell ones others build or perhaps buy they product from Tokyo or wherever and avoid all the risk and hassle.)

In our presentation in April, we have to be honest. If the product is marginal, then let's not do it... independent of who's bought in... cause it's clear who's the first to sell out.

PS
The NOR reduction episode happened on Monday. On Wed. evening we
met with Andy about the Technical Group use of CT. He's not buying, cause it isn't good enough. This I respect! It's regretable that one of our customers had to tell us that our prouduct isn't good enough!

PSS
I don't want to hear the issue of we aren't spending enough money, and what do you expect. In the disaster areas, we have
spent incredible amounts of money, it's just that it's all been
to get marginal and/or half-done products.. The new rules will
stop this: we won't do any of them; someone of you have product
area responsiblity and you must make the appropriate proposals
(and breadboards) to get us good products.

Please join me in building quality products.

Any problem with the clarity or rationale of going this way?
Comments, please.
Are the rules clear?

GB2.S5.19
7 June 1983

Professor John Zysman
Assoc. Professor of Political Science
  and Director of BRIE
University of California at Berkeley
Berkeley, California 94720

Dear Professor Zysman:

I thoroughly enjoyed your BRIE conference several weeks ago, Saturday. Many thanks for letting me attend, and I'm especially indebted to Regis McKenna for inviting me. I hope that BRIE can make the essential inroads to some form of reciprocity with Japan through its various approaches.

Several years ago when visiting Brazil, I outlined a development policy for going into computers. They, of course, didn't follow it, but instead went the traditional evolutionary path, making all the errors and it required significantly larger investment. Furthermore, it ensured their delay into modern computing. A copy of the paper is enclosed. I'm sending it because it's really on the industrial development of computers.

I didn't understand then that it had any bearing on the current industry in the U.S. and abroad. Ironically, the paper most applies to Silicon Valley today, for what's happening, is based both on a backward (not like the Japanese forward) integration policy where standards are adopted to minimize development, and maximize added value. That is, it called out what's now happening. We see: the Multibus, C, the 8086 --> 68,000 --> ? (virtual memory), several operating system (UNIX, CP/M, MDOS), and languages, etc. as standards.

Also there are generic applications suppliers such as typesetting, WPS, spreadsheets, graphics. Applications industries are springing up based on the knowledge of a field of application - the clearest and now the most difficult being CAD or VLSI CAD. Finally, there are the integrator-distributors (eg. Convergent Technology, Osborne, each Japanese company, Digital, IBM). This is a complete fragmentation by levels of integration to gain expertise, take a few risks and share rewards, unlike anything in previous computer generations where system suppliers virtually did the whole job. This is what traditional suppliers of all types didn't really foresee very well. This is why an Apple can grow at an unprecedented rate. Also, I doubt if many of them see it yet!

The observation about this industry restructure in the 4th and 5th generations (VLSI) as being quite different from the transitions through the evolutionary 2nd (transistors) and 3rd (integrated circuit) generations might be useful in your work. I think I see it clearly.

Again, thanks for a stimulating day.

Sincerely,

Gordon Bell
Vice President Engineering

GB5.61

CC: Regis McKenna, Robert Noyce

Enclosure - Establishing National High
Technology Industries (E.G. Computers)

ID#431

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Subject: **Professor Lee and China**

To: Carl Janzen, AK
Ted Johnson, PK3-2/A55

CC: Jean Bow, PK1/E33
Mario Mummolo, WA
Ken Olsen, ML10-2/A50
Dick Yen, TA

Date: 24 JAN 79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

Follow up 2/7/79

Professor Francis Lee of MIT is going to spend his next year's sabbatical in China at Peking and Shanghai Universities.

He wants to set up a version of his lab installed there.

There is also an order for 11/70's, 11/60's, and a PDP-10 that he's getting together.

He wants our help in the bookkeeping of this order. Can we get someone from sales to interface with him?

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST:	Jean Bow	PK1/E33	Carl Janzen	AK
	Ted Johnson	PK3-2/A55	Mario Mummolo	WA
	Ken Olsen	ML10-2/A50	Dick Yen	TA
				ID#430

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Subject: **Professor Lee's MIT LSI-11 Microcomputer Lab**

To: Distribution

Date: 24 JAN 79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

follow up 2/7/79

Professor Francis Lee gave me an update of the status of his Real Time Computer and Control Course. He told me that many of the other universities were really jealous because they turn out 600 students/year (more than CMU, Berkeley, Stanford and Illinois combined) and use LSI-11's!

The course:

1. Taught in PASCAL (not UC/SD) and when the programs run into performance problems, they go into assembly language.

2. Problems start with oven control and move to motors and displays. The later requires microcode in WCS. They also use 1 Board 8080's for some problems.

We'll be invited to see the lab and we should get structured to take advantage of their results. Let's take advantage of this work!

He wants to export the lab (including the 11 WCS that the Commerce Department is sitting on) to China when he goes there on sabbatical.

Shouldn't we try to export this system in order to get more students hooked on 11's? (With this, Tiny and Fonz are critical!!)

GB:ljp

Distribution

Jean Bow	PK1/E33	Jack MacKeen	MR2-2/M65
Dick Clayton	ML12-2/E71	Roy Moffa	ML1-2/H26
Bruce Delagi	MR2-1/M64	Mario Mummolo	WA
Carl Janzen	AK	Don Nelsen	WZ2
Ted Johnson	PK3-2/A55	Ken Olsen	ML10-2/A50
Ken King	ML3-2/E41	Mike Titelbaum	ML1-2/E65
Andy Knowles	ML10-2/A52	Jerry Witmore	PK3-1/M40
John Leng	MR1-1/A65	Dick Yen, TA	

D I G I T A L INTEROFFICE MEMORANDUM

Distribution

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John Leng	MR1-1/A65	Dick Yen, TA	

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* d i g i t a l *
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TO: BILL JOHNSON

DATE: TUE 1 JUN 1982 10:59 PM EDT

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5165125146

SUBJECT: MY READING OF MCNAMARA AND WHAT PROJECTS TO DO

His comments are: Engineers want to create; Be on the best team; and Be rewarded. This means: 1. Shorter cycles; 2. Be more graceful about cancellations; 3. Improve facilities; and 4. Pay more attention to education.

The only thing I commented on to our management was that there were projects we obviously can't do, due to budget restrictions... this may be a graceful way of saying that we should kill some products.

All my issues are totally in line with McNamara:
Engineers want to do very good products and complete them.
You might look at the forecasts
versus actuals of the software sold. Somehow quantity isn't always the answer.
1. The 4G funding is really obscenely large. The only good thing about it is that something like this is needed because the phase review process just about kills any creative ideas that might come out of our engineers. However, the large list was awfully mundane and redundant.
2. Redirecting the software effort in office is simply taking the lead from the troops who have all left the project. Your latest leader there is hurt because he has a marginal record of management of software engineering, and we have not given him even more to do so that he has an excuse to fail. I was sold on him until you told me he was pouting because he didn't have the works. This effort has been a mess to date and I don't have much hope, given the latest leader comments.
3. I still say DECalc is immoral and should be illegal if there were decent laws applying to software. If this were a hardware question that we owned, we would have sued the company (as we did in the case of Lockheed). This a poor copy of an original. McNamara says do great things.

For some reason, we can't really innovate very effectively in new areas. I think it may be that we are too decoupled from the market, or it may be that there isn't the right front end case where people can invent and propose. I see lots of copying of the mundane (eg. >= 2 mail systems per operating system; or 4 new office type editors on VS, CT (2), and VMS), but not a really good 4 G effort that takes advantage of VMS. I had endless conversations with Don WilWilson et al, but got nowhere except to see a copy of the

Visicalc work (and a poor one at that!).

I also thing the DECset was a collosal mistake that we should try to extricate ourselves from. Talk to our internal users (eg. Patti Anklan). I have no ego needs to think that we can beat Knuth or Brian Reid at typesetting; I know these guys and they are very, very good.

Then, there are the Japanese. I predict they'll be good.

Avram is buying out. I think that we should do more of this. Since we have a strategy of compatibility between CT and VMS, it's clear we should have the system run both on VAX and CT. How are we going to handle this?

What about ADA? Here, we've really spent a lot of time and nonow with Ike gone, I see that we have no unfair competitive advantage. Pascal, which is mucho late on VAX and which was tolerated (even though Cutler told you to knock it off) and should be reviewed.

WPS USERS - Leave HP mode and type <CR>

00 CORE DECGRAM ACCEPTED S 001980 O 192 02-JUN-82 16:03:49

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION   DATE: WED 2 JUN 1982
4:03 PM EDT

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5165225545

SUBJECT: PROLOG TODAY!

Please make this happen now. This is a bargain. I'd like to sell Prologs to Japan and the universities and exercise it now.

"TO" DISTRIBUTION:

DICK ECKHOUSE   SAM FULLER   DIETER HUTTENBERGER
PETER JESSEL   BILL KEATING   BILL STRECKER

WPS USERS - Leave HP mode and type <CR>

+---------------+
! **d i g i t a l !   i n t e r o f f i c e   m e m o r a n d u m**
+---------------+

Subject: **Reasonable Promotion for VAX Now; and NCC**

To: Bill Demmer, Bernie Lacroute

CC: Win Hindle, Ted Johnson,
Andy Knowles, Ken Olsen

Date: 28 APRIL 78
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

I've now talked to a half dozen potential customers of VAX. None have really heard about it. The technical summary is excellent! Let's produce them in mass (in small manual version) and ship them out at NCC and other places. Flush any notion of the slick brochures -- use the summary so our potential buyers will keep the information.

Given the knowledge of our salesmen on VAX, their reluctance and temperament to sell, the lack of any ads, and any deep central market support in the fragmented P/Ls -- the machine has to sell itself. The manuals are good and can, but they have to be made and distributed!

Our first few users are happy; the machine is really great -- but we have to do something to keep the sales happening by themselves and allow our customers to order machines easily!

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST: Bill Demmer TW Win Hindle ML5-2/A53
Ted Johnson PK3-2/A55 Andy Knowles MR2-2/A52
Bernie Lacroute TW Ken Olsen ML12-1/A50

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| d | i | g | i | t | a | l |   i n t e r o f f i c e   m e m o r a n d u m
|   |   |   |   |   |   |   |
+---------------------------+
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Subject: **Responsibility for Promotional Literature**

To: Allan Kent, ML3-6/H27

Date: 10/22/79 Mon
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

RE: Your memo of 10/10/79 (AK:25:79), Responsibility for Promotional Literature, Andy Knowles, Si Lyle, and I would like more data.

GB:swh

3 possibilities:

proprietary, like ct, but even more so because vlsi protects it

proprietary, but our oems can build special hardware. here we have to sell chips to them. no way of protecting the creation of a 3rd party business.

open standard by licensing the bi chip as second source. several vendors have expressed interest: siemens, motorola (says vme's nowhere), national, abi

September 1, 1977

Board of Standard Reviews
American National Standards Institute
1430 Broadway
New York, New York 10018

Subject: **PROPOSED ANSI BSR X3.67 SPECIFICATION FOR I/O CHANNEL INTERFACE**

SUMMARY

We are strongly against this standard because of its past, present and future cost and performance merits. In addition we speculate that it will be useless, unenforceable and have a deleterious effect on computer architecture and the computer industry. The standard doesn't specify controller designs; thus two conforming controllers will most likely be incompatible and useless across systems of different manufacturers.

Technically the standard is poor and contrary to the current and future technology design alternatives (e.g., easier to specify serial links). We believe it requires extra hardware over alternatives, and the partitioning of logic appears to significantly increase software complexity. It seems to have the worst cost/performance characteristics of the interfaces we know. We aren't planning to use it on any of our future systems. We believe future i/o systems will be message-oriented and the various i/o control functions (including diagnostics, file management) will migrate to the subsystem.

The standard may be unenforceable due to the nature of parallel interfaces. Fundamentally, it is a syntactic specification and there must be semantics too! Since the standard doesn't cover the specific controller/device designs, it is inadequate to make controllers that will work across mainframes made by different manufacturers. Even the Japanese, who originally adopted it and proposed to extend it, seem to have abandoned the standard.

The standard, per se, may wipe out several mainframe vendors if they adhere to the letter and intent since only IBM, IBM plug compatible vendors, and the Japanese, who have IBM compatibility, benefit. Because of the standard, (not as it stands -- but rather making identical IBM controllers) all designs are forced to that of IBM. Since IBM has significantly higher volume, and the knowledge for manufacture, significant manufacturing and field learning means much lower costs. While the effect might possibly be to reduce IBM's prices here, the effect on other mainframes may be annihilation. Lower costs from other vendors are because they are not IBM compatible! Overall, the standard seems to be at the expense of other users and non-IBM vendors.

There is a high likelihood that the standard will cost the computer consumers more. Any savings have already occurred as IBM has lowered prices and redistributed prices to be more competitive on a component-by-component basis. Even if IBM compatible controllers, not covered by the standard are put on other mainframes, the software is different and the market here is negligible when one considers the myriad of low volume operating systems. By supplying low volume components that have to be backward engineered into designs, the cost will most likely be redistributed (and hidden to the users in the form of unreliability and user-supplied system design and integration).

The standard, if misapplied to other, smaller peripherals where the interface is a high fraction of the cost, would most certainly increase prices. Any cost savings, for disks, are artificial simply because the add-on vendors are not paying for software (i.e., diagnostics, file systems and operating systems). The net effect will merely be a rebundling of costs. As the mainframe vendors supply parts to the standard, any technology gain will be slowed down.

The computer industry is complex and this form of standardization is very likely to effect its performance adversely. There are standards that can be made in the interface area which may be of higher priority and provide greater impact for the future. Although the proposal has been in the environment for some time, the goals, method of implementation and effects have not been stated and analyzed.

DETAILED POSITION

We've been against this interface for a number of years, and the feelings about it are now more intense that there is a possibility that it might become a computer industry standard. The concerns are:

1. Technically, it is poor and contrary to the direction of current and future technology and design alternatives:

   a. Extra hardware. It introduces another component, the i/o processor (Pio) - i.e., the IBM Channel into systems. This concept isn't used in either minis or our larger machines like the PDP-10. Virtually none of the successful larger computers use it (e.g., Univac's 1108, and the CDC's 6600 and 7600 derived computers have a simpler interface that is driven by peripheral computers). This is illustrated in fig. 1. The figure doesn't fully illustrate the magnitude of the problem. The hardware in the whole 11/34 support computer (used in DECsystems 10 and 20) is less than the hardware needed to support two ends of a channel interface! For high speed devices usually only 1 disk controller is attached per Pio, creating a second needless interface and more hardware (Pio + K vs K).

   b. Extra software and software complexity. We "conjecture" that the additional i/o processor, with its different ISP (Instruction Set Processor), introduces an extra level of software that doesn't exist in other operating systems. This occurs because the processor isn't a full computer (e.g., the CDC computers), nor is it totally passive (e.g., a wire) and hence requires supervision and constant intercommunication between Pc (the Central Processor) and Pio. Pio doesn't have enough capability to diagnose itself. The result may be that IBM's operating systems are larger than those of other manufacturers.

c. <u>Poor interface cost and performance</u>. Of the interfaces which have about the same number of wires, this channel has the poorest cost/performance characteristics. This is shown in figs. 2 and 3 where we have tried to evaluate the relative interface costs now (and in 1980). In addition to the interfaces, other costs for the i/o sub-system include: Pio (the IBM Channel) - DEC doesn't have them; the controller (about the same in the 2 cases) and which can vary from a few circuits to a cabinet of logic; interfaces to device(s); and the device.

For low cost devices (e.g., serial teletypes) this interface cost is nearly all (95%) of the cost of the controller even for the Unibus.

d. <u>Inadequate performance lessens future utility</u>. The performance appears to be inadequate for the faster disks and non-rotating memories (e.g., solid state and magnetic bubble devices) that are likely to appear in the near term. It is still unclear how the non-rotating devices will be connected. They may be integrated into the disks to cache disk accesses (in which case we do need faster device data rates between Mp and K); or they may be integrated into the primary memory system in which case no external busses would appear; or they may require higher data rate busses (e.g., Massbus).

e. <u>High speed serial is more appropriate to the future</u>. We believe DEC and the computer industry must go rapidly to serial intercommunications, that are message oriented in order (a) to improve reliability, (b) provide true interconnectability by being truly specifiable, and (c) to provide more freedom in equipment location. The fiber optic technology, for example, significantly increases reliability by eliminating common mode noise, by being specifiable, and by having clearer definitions for each component.

This serial approach is supported by semiconductor technology trends of 60-100% increase in complexity per year with only small increases in power dissipation and pin count. The cost of power, semiconductors to drive cables, cabling, and air conditioning is increasing at least as fast as inflation.

A high speed serial interface such as those used by the communications industry for digital communications (e.g., T1 through T4) is probably the only good, well-defined (enforceable) interface due to the precision and simplicity of the electrical specification.

f. <u>Future</u>

functional migration. With the greater logic complexity there should be significant migration of functions to the secondary memory systems. As a minimum, this would include the diagnostics, memory access optimization, and error/fault management; but we believe it will also include the file system and possibly a database management system. This transition will probably occur by 1980. The "channel" concept will be archaic and inhibit the migration.

g. Against future integrated packaging trends. We believe it is possible to include a complete, 500 Kword DECsystem 10/20 in the base of a disk cabinet by 1980. Here we would not have a channel, an interface, a controller; instead, a single interface to a few drives would be integrated into the design...and take up much of the space. It would be ridiculous to add a needless structure to provide an interface point that would dwarf the hardware.

h. Against future integrated memory hierarchy possibilities. Some of the memory hierarchy alternatives described in (d) would be impossible using the proposed bus structure.

2. The standard may be either unenforceable, or unusable.

a. Parallel interfaces are perhaps unspecifiable. The nature of a parallel interface, timing, and the states at both the channel (transmitter) and controller (receiver) is such that the number of states is essentially infinite, and unspecifiable. It's hard to believe that a specification can cover all of them...or even the problem of electrical transmission. In effect, all the incorrect (error) states have to be specified too.

For example, although we (and other vendors) have been delivering controllers to meet the Unibus specification for 7 years, we consider the specification barely adequate, and only within the last year did we feel progress had been made in getting it clear enough for a design specification.

b. Devices have to be specified also. The channel interface per se, does not cover device to device compatibility. It covers only a few status bits in the devices. Hence, there is no guaranteed compatibility among the "standard" controllers.

Any amount of movement of intelligence would negate compatibility of what is a syntactic specification. Devices need additional syntax and specific implementations would cause additional meanings to be needed. (A good example of this is microcomputer PL/1 dialects. Several companies use the syntax of PL/1 for languages which are semantically incompatible. and even two programs with identical syntax give different results.)

A new device with different capability requires additional commands, thereby introducing semantics to what is a syntactic standard. For example, the movement of the error correction function between the device and a program in primary memory requires a totally different approach than with existing controllers. Note that a program in the central processor, or a program in the device controller, or a program in the channel may carry out a given function, and still meet the specification but can be totally incompatible. By convention, IBM places this function in the controller (except for errors in data fields), whereas in our small computers, we place all of this function in the device driver software.

The conclusion could be that the ANSI Standards Committee must take on the design, specification and testing of i/o architecture, controllers and devices. This standard shows that it's prepared to take on only a part of IBM's.

c. Even the Japanese believe it to be useless. A recent ISO communication (IAC/77-16: ISO TC 97N Feb. 77) proposes that a serial protocol be the standard. This document concludes that 8 years of standardization effort have been wasted due to a poor standard.

3. <u>Adherence to this specification may, quite possibly, cause several mid- and high-end vendors to withdraw products or to withdraw from the market</u>.

The net effect of such an action would be to increase system prices for equipment in this price range...no matter who supplies the disks. Fundamentally, these businesses are <u>dictated by</u> the IBM high support cost style of doing business and only differ by the architectures and being able to position products that differ from IBM's. This standard would force more cost, and nearly total compatibility with the 360/370 and hence the competitive prices would either move up to IBM's or a vendor would be forced out. For example, RCA tried this strategy. Amdahl is a counter example that has existed for one year; Amdahl has stated that IBM believes it doesn't make adequate profit in the high end part of its business. Also, Amdahl now has the capability to track and modify IBM's software.

Thus, to be compatible with IBM as this standard dictates, means we should all build 360's and 370's. While this might appear to save money for some buyers, it wouldn't permit the minicomputer or microcomputer industries to exist. While it is too early to tell, I believe the substantial behemoth computers that exist in the bureaucratic, IBM trained, computation centers in industry, universities, and possibly Government have limited life. <u>This standard perpetuates inaccessible, centrally controlled computing as we know it, and brings all other computing down to this level. Even IBM is beginning to supply small systems for distributed computing...further rendering the standard useless</u>.

<u>No IBM System, except 360/370, including Series 1 use the standard</u>. If there was economy of scale, goodness, or it was usable, then surely IBM would use it somewhere else (e.g., Series 1, Systems 3...15 32/34).

a. <u>IBM only benefits</u>. Among mainframe manufacturers, the standard is only beneficial to IBM and the IBM plug-compatible mainframe vendors who are already there now. To other vendors, it is a make-work activity that will only cause a diversion of resources and hasten their demise.

Because of "learning curves" other vendors will be forced to produce the same goods as IBM, but without the value of the learning in manufacturing or in maintenance IBM has experienced; hence, our cost can easily be a factor of 4 or more higher. The exact numbers would have to be based on say a 10% cost decline associated with each cumulative doubling of units produced!

b. <u>The Japanese could (most likely) benefit</u>. The Japanese, who also copied the 370 architecture and provided some superset capabilities to permit the one-way flow of programs, may also ultimately benefit in the various world markets. Now they don't support standardizing this I/O Channel precisely because they believe it's bad.

c. <u>DECsystem 10/20 would be jeopardized as a marketable computer</u>. In the case of the DECsystem 20, where we have a price edge (with comparable or better performance) of a factor of two, the alternatives are really poor for us. They, at first glance, appear to consist of: withdrawings from the market entirely; not marketing to users who require conformance to the standard; making a simple adapter to meet the spec; and going completely to the IBM Channel design. Since the DECsystem 10/20 group is small, meeting the standard entirely would rob it of future (sustaining) development.

A simple adapter to convert between the Massbus and the standard would risk our competitive position and provide poor performance through an interface we would have to evolve. There clearly isn't adequate time to do this before the effective date for the standard.

For the DECsystem 10/20 we would anticipate a price for a simple adapter to be $45,000. The number of systems containing the IBM Channel we forecast to sell is so low that poor reliability and poor performance might result.

We estimate our development cost including support, for 1 device class, to be about 1.36 million with about .3 million per extra device class for capital equipment and special micro-programming/programming. From a development viewpoint, these costs could bring development to a standstill. In fact, it would probably be better not to market to the Government. (If the DECsystem 20 maintains its current market position, we estimate the price to the Government by buying alternative systems will cost the Government an additional $30M in 1979.)

We use the

PDP-11 for low speed peripherals on DECsystem 10/20 since minicomputer peripheral costs are much lower. Thus, these peripherals are significantly cheaper than those for the 360/370! If low speed peripherals were forced to a Multiplexor bus, it would take virtually all the development resources to build the necessary communications, unit record, tape, disk and other controllers. If we put adequate development resources into meeting the specification, then we will have higher manufacturing cost for peripherals (than IBM). Because of software support costs and the semantic compatibility problem discussed herein there would be no way for us to market products that could be placed on IBM's computers. (Nor is this DEC's strategy.)

(Note that IBM clearly has the manufacturing cost advantage through learning curves in the large systems area and since it sets the support levels (costs), there is virtually no market.)

d. <u>Government use will be at expense of other users</u>. In addition to inequities forced on computer system vendors, consider the effects on other users. Since the collective influence of the Government purchaser is so much larger than any other single user, it can effectively cause vendors to be more responsive to it. Unless there is widespread support among the user community for the interface standard (little has surfaced since the standard was first proposed), then the Government representatives are clearly trying to benefit themselves at the expense of all other users. The damage to the users, as well as to most system vendors, will certainly outweigh any possible benefits. This move must certainly add to the problem of credibility in Government. So far the information processing standards have been quite positive, yet this one appears to be totally destructive (at least to us). The recent comments by Tom Pyke in Data Communications are in total disharmony with the proposed standard.

In fact, it would seem that the expected benefits are suspect. If other users (most of them IBM users) cannot find a reason to support the standard, it is unlikely that a benefit exists for any user.

4. <u>Although a standard might save the Government 100 million according to rumors, we seriously doubt that these savings would take place, and it is quite likely to cost more</u>.

a. <u>The savings have already occurred via IBM/add-ons</u>. Any savings by competition has already occurred in 360/370 via independent peripheral vendor competition. For other systems suppliers, we already have arrays of 3rd party competitors! Engaging in this make-work standard will only add to our costs (prices) and delay introduction of more significant products.

b. Unique software is still required for each system. Because each system is fundamentally incompatible (due to semantics) each third party supplier will still have to supply unique software for each different operating system and its releases for a given hardware system. In the case of the smaller system vendors, the competitive base won't be any larger than it is now because the cost to generate the software won't be worth the return to the third party supplier, nor will the system's vendors be able to supply to each other. This will also result in: poor performance when added-on to; inadequate reliability; maintenance by the user, as low volume designs persist.

c. Controller compatibility is not guaranteed among mainframes even with standard. The standard does not guarantee that a controller which has been designed for one system (e.g., IBM) can be connected to another system (e.g., DEC) since the standard doesn't define all bits in all controllers for all possible priced systems. Hence, the proposed standard does not provide a scheme whereby a disk sub-system can be moved among computers of different vendors.

d. <u>IBM total systems prices haven't decreased as rapidly as disk prices</u>. Although we don't have the data, it seems that the prices for IBM systems have not decreased as rapidly as disk prices since the competitive disk vendors have appeared. The prices of disks have decreased rapidly, but apparently have been offset by varying the prices on other components (including the software). Quite possibly the markup is more even now across components, or it is artificially high in the processor where there is less competition.

e. <u>The cost of ownership most likely will increase</u>. Although the purchase price of a system might possibly decline over what it is now, the cost of ownership (by having the user become the system designer, integrator and maintainer) will probably increase. Again, this results from having only a few systems (and poor learning curves) hence higher prices due to inexperience. If this standard is enforced, there must be records to measure the total costs and compare costs for various ownership/maintenance strategies--especially in Government!

f. <u>Increased component count would increase minicomputer prices</u>. If this standard were to be applied in the smaller systems (e.g., the large minicomputers) the costs would be substantially greater because of the additional components. The net effect on minis would be to constrain them to the larger computer prices. This would impede the trend of rapidly decreasing minicomputer prices.

g. <u>The standard is poorer for low cost peripherals</u>. While it appears that the intent of this standard is to use the channel interface for only disks and tapes, it was designed by IBM to interface everything. If extended here, this would be a fundamentally bad move. As described above, it is cheaper for us to make peripheral interfaces for minis only and to connect the mini to the DECsystem 10.

h. _Mainframe development costs would rise, therefore system prices_. A manufacturer adhering to the standard would spend resources (thereby increasing his costs and prices) resulting in fewer systems sales (e.g., to the Government) because of the increased price. Fewer add-ons would result, due to problems mentioned above and the lower volume.

i. _Semantics and devices must be specified to have full compatibility_. A manufacturer can adhere to the standard and still not provide an add-on port, due to software as mentioned in (4 b, c) above. The semantics are as important as the syntax.

j. Software copyright protection is inadequate to protect supplier investments. If a standards-based marketplace could be effected, then software protection would have to be enforced to a more significant degree than it now is. (This would cause a redistribution of costs that might not so clearly benefit anyone.) An operating system is never totally unbundled or bundled, nor is it clear how the cost of a component (e.g., a disk driver) can be fully unbundled. This is especially prevalent as other suppliers provide higher performance (e.g., seek optimization) and these are quite tied into the operating system.

k. Prices will be rebundled and increase. The concern with standards and interfaces at this level, especially when this one is fully sorted out as to semantics and the internal software interfaces, will be more costly to everyone concerned, simply because we will all be working on the specification of what appears to be rather arbitrary interfaces (i.e., the operating system, handlers, diagnostics, file systems, etc.). If a manufacturer were to fully adhere to the standard, it would be reasonable for him to bundle the file system with the disk system, and the supplier of the disk would then be fully responsible for the design and implementation of the file system. It should also be mandatory to provide a disk pack standard for interchange and for the diagnostics to be used interchangeably. These aren't part of the standard.

l. Much "make-work" will delay any true technology and cost gains. Any slight delay in computer evolution will easily produce a net loss in performance benefit which would more than offset any savings!

5. The current defacto standards are adequate to motivate competition.

a. For the IBM

add-on, there are vendors. Each device has a source of alternative suppliers that are appropriate to the device.

b. The minicomputer suppliers have adequately defined interfaces (e.g., the Unibus) with lots of competitive suppliers. For organizations who want to use the IBM standard, there are alternative supply sources who meet the standard (e.g., System's Concept and who supply to our PDP-10 and PDP-11 computers).

6. The computer industry is a complex one and this clear, direct form of Government regulation will quite likely affect the performance adversely. This standard totally constrains a design (if it is to be as effective as desired by its supporters...even though it is not adequately specified to accomplish this goal now.)

The computer industry has evolved rapidly over its short 30 year life providing an increase in performance (memory-size x data-rate) of over 10 billion. This has been accomplished, in part, because the Government has nurtured it by being an extraordinarily wise user and funder of R and D.

With this standard, the ANSI Committee is taking over a key portion of the design of systems of computers and it's unclear it has the experience and understanding of computers or the computer industry to do so. The industry taken as a whole seems quite complex to me, and it's doubtful there is a good econometric model of it. Even if there were a model, the prospect that the ANSI Committee would be using it in this instance to predict future development trends and then, advisedly, choosing a standard interface technology, would be of concern.

7. <u>Although the proposed standard has been in the computing environment for some time, it's underlying goals have not been adequately stated and analyzed</u>. For example, we have never seen a document stating: (a) the goals, (b) the underlying assumptions (e.g., more competition, save $100 million), (c) how to accomplish the goals, and (d) answers to some of the basic questions (e.g., semantics versus syntax, technology, cost, effect on non-IBM mainframe suppliers).

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:ljp

Attachments (3)

cc: Bob Brown
CBEMA/Standards
1828 L Street, N.W.
Washington D. C. 20036

May 29, 1979

Mr. Jescke
PSI
Gesellschaft fur ProzeBsteuerungs-und Informationssystemme
mbH
Katharinenstr 19/20
1000 Berlin 31
Germany

Dear Mr. Jescke:

Thank you for allowing me to address your users in Berlin on 17 May. It was an honor to help you celebrate the Tenth Anniversary of PSI.

Under separate cover, I'm sending you a copy of the book, Computer Engineering which three of us at Digital compiled to commemorate our Twentieth Anniversary.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:swh
GB0003/34

July 24, 1979

Dr. Jaeschke
Gesellschaft fur ProzeBsteuerungs - und Informationssysteme

mbH
PSI
Katharinenstr 19/20
1000 Berlin 31
Berlin, GERMANY

Dear Dr. Jaeschke:

The stein is a lovely reminder of our stay in Berlin.

May your next ten years be as successful and rewarding as the first.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:swh
GB0004/19

Updated:
4/6/77

File: PUBLICATION
INDEX

File No. Publication

0-1961 Bell, C.G. & R.C. Brigham, "A Translation Routine for the DEUCE Computer", British Society Computer Journal, Vol.2, #2, July 1959

1-1961 Bell, C.G.; H. Fujisaki; J.M. Heinz; K.N. Stevens, and A.S. House; "Reduction Of Speech Spectra By Analysis-by-synthesis Techniques", Journal of the Acoustical Society of America, Dec. 1961

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7-1971 Bell, C., W. Broadley, W. Wulf, A. Newell, C. Pierson, R. Reddy, S. Rege, "C.mmp: The CMU Multiminiprocessor Computer", preliminary draft for ARPA report, Aug. 1971

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<u>1972</u>

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2-1972 Bell, C., R. Chen, S. Rege, "The Effect Of Technology On Near Term Computer Structures", Computer 2 (5) pp29-38, March/April 1972

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9-1972 Bell, C., B. Bhandarkar, Feucht, S. Rege, D. Siewiorek, "Large Scale Integration--A Designers Viewpoint", NSF paper, CMU Nov. '72

10-1972 Bell, C., J. Grason, A. Newell, "Designing Computers And Digital Systems Using PDP-16 Register Transfer Modules", Digital Press, Sept. 1972

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<u>1973</u>

1-1973 Bell, C., Chen, S. Fuller, J. Grason, S. Rege, D. Siewiorek, "The Architecture And Applications Of Computer Modules: A Set Of Components For Digital Systems Design",

COMPCON '73, Feb.

2-1973 Barbacci, M., C. Bell, D. Siewiorek, "PMS: A Notation To Describe Computer Structures & ISP: A Notation To Describe A Computers Instruction Sets", Computer, Mar. 73

3-1973 Bell, C., "Computer Architecture, Comments On The State Of The Art", Hamburg, Oct. 1973, 3rd Annual Symposium of the "Gesellschaft fur Informatik"

4-1973 Bell, James; David Casasent, Gordon Bell, "AN Investigation Of Alternative CACHE Organizations", Transactions on Computers, Vol. C-23, #4, April 1974, pp346-351

5-1973 Bell, C.G., & C. Kaman, "The Effect Of Semiconductor Memory Technology On The Design Of ThE PDP-11 Series Minicomputers", NEC Conference, October 1973

6-1973 Grason, J., John Eggert, & C. Gordon Bell, "The Commercialization Of Register Transfer Modules (RTMS)", 10/73, Computer

1974

1-1974 Bell, C.G., & C. Kaman, "The Microprocessor--another Member Of The Mini(mal) Computer Family", IEEE Intercon '74, March 1974

2-1974 Bell, C.G., "The Computer Generation", Speech for Mellon Award

3-1974 Bell, C.G., "More Power By Networking", IEEE Spectrum, Feb. 1974

4-1974 Bell, C.G., "NSF Spending For Computer Science", letter sent to NSF, (Dr. Creutz), January 23, 1974

5-1974 Bell, C.G., "Computer Networks", March, 1974, unpublished. Published version--see 3-1974 above.

6-1974 Bell, C.G., C. Kaman, S. Fuller, V. Lesser, "Microprogramming And Its Relationship To Emulation And Technology", May 1974

7-1974 Bell, C.G., "The Interaction Of Technology With Computer Science", Submitted to American Scientist, 6/74

8-1974 Bell, C.G., "The Technology Of The Computer", NEREM 74

9-1974 Bell, C.G., S. Teicher, "Digital System Implementations", Wescon '74

10-1974 Bell, C.G., "A Need For Hardware Description

Languages?" (Sent to Chu, 10/14/74, unpublished)

1975

2-1975 Bell, C.G., "Technology Of Computing And Trends Toward Smaller, De-centralization", U. of Calif. at Irvine, 5/9/75

3-1975 Bell, C., "Computer Structures: What Have We Learned From The PDP-11, talk given at CMU, 9/75

4-1975 Bell, G., W. Strecker, "Computer Structures: What Have We Learned From The PDP-11", IEEE Computer Conference, Florida, 11/75

5-1975 Rossman, George E., Michael J. Flynn, Samuel H. Fuller, C. Gordon Bell, Frederick P. Brooks Jr., Herbert Hellerman, "A Course Of Study In Computer Hardware Architecture", COMPUTER, Dec. 1975, pp 44-63

6-1975 Bell, G., "Interaction Among Technology, Products And Users", Spring DECUS keynote address - 4/75

1976

1-1976 Bell, G., Andrew Knowles, "Standalone Computers And Their Interaction With Networks", COMPCON '76

2-1976 Bell, G., S.H. Fuller, C.H. Kaman, V.R. Lesser, "The Effects Of Emerging Technology And Emulation Requirements On Microprogramming," IEEE Transactions on Computers, Vol. C-25, No.10, Oct. 1976

Shelf Bell, C. G., J. Bell, "Minicomputer Software", Proceedings of the IFIP Conference on Software for Minicomputers, co-editors, North-Holland Publishing Company, 1976

1977

1-1977 Bell, G., A. Kotok, T. Hastings, R. Hill, "DECSYSTEM 10 (And 20): An Evolving Computer Structure," special CACM issue.

PATENTS - Gordon Bell

Multistable Circuit, #3,275,848, 9/27/66, C. G. Bell (PDP-4,5)

Digital Computing System, #3,376,554, 4/2/68, C.G. Bell, A. Kotok (PDP-6)

Apparatus for Performing character Operations, #3,401,375, 9/10/68, C.G. Bell, A. Kotok (PDP-6)

Multiple configuration Data Processing System, #141,282, 5/7/71, filed but not issued. C.G. Bell, John Eggert, Robert VanNaarden, Peter Williams (PDP-16)

Homogeneous Memory for Digital computer Systems, #188084, C.G. Bell, not assigned, filed 10/12/71 (for all machines)

Branching circuit for Microprogram Controlled Central Processor Unit; C. Gordon Bell, John E. Buzynski, Charles H. Kaman, James F. O'Loughlin; #3,900,835; Aug. 19, 1975

AWARDS

Fellow, IEEE

Carnegie-Mellon University's Mellon Institute Award, April, 1973, for Application of Science to Industry.

Eta Kappa Nu

American Men of Science

AAAS

Elected to Board of Directors of SIGARCH, IEEE Society, April, 1973.

1975 W. Wallace McDowell Award, at IEEE Fall COMPCON, September 9, 1975, for Contribution to Computing Art.

National Academy of Engineering (NAE), April 1977

AFFILIATIONS

Computer Science and Engineering Research Study (COSERS) of NSF, 1975

Co-editor Computer Systems Department of the ACM

Screening Committee for International Exchange of Scholars, Fulbright-Hays Awards, 1973-1976

NSF Advisory Panel, Office of Computing Activities

Three COSINE task forces of NAS defining Computer Engineering curricula.

IRCAM, 1976, BOD, Institute of Research and coordination Acoustic/Music

NIHF (National Inventors Hall of Fame)i3625,2

Editor of Computer Systems Department of COMMUNICATIONS OF THE ACM, Myrtle R. Kellington, Executive Editor, Sept. 1972

1976-1977 - IEEE Piore Award Subcommittee

1977, April 1 - Member of National Academy of Engineering

1977 IEEE Field Award Committee Subcommittee

Updated: 4/6/77

File: PUBLICATION INDEX

<u>File</u> <u>No.</u> <u>Publication</u>

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Apparatus for Performing character Operations, #3,401,375, 9/10/68, C.G. Bell, A. Kotok (PDP-6)

Multiple configuration Data Processing System, #141,282, 5/7/71, filed but not issued. C.G. Bell, John Eggert, Robert VanNaarden, Peter Williams (PDP-16)

Homogeneous Memory for Digital computer Systems, #188084, C.G. Bell, not assigned, filed 10/12/71 (for all machines)

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<u>AWARDS</u>

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Carnegie-Mellon University's Mellon Institute Award, April, 1973, for Application of Science to Industry.

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1975 W. Wallace McDowell Award, at IEEE Fall COMPCON, September 9, 1975, for Contribution to Computing Art.

National Academy of Engineering (NAE), April 1977

AFFILIATIONS

Computer Science and Engineering Research Study (COSERS) of NSF, 1975

Co-editor Computer Systems Department of the ACM

Screening Committee for International Exchange of Scholars, Fulbright-Hays Awards, 1973-1976

NSF Advisory Panel, Office of Computing Activities

Three COSINE task forces of NAS defining Computer Engineering curricula.

IRCAM, 1976, BOD, Institute of Research and coordination Acoustic/Music

NIHF (National Inventors Hall of Fame)i3625,2

Editor of Computer Systems Department of COMMUNICATIONS OF THE ACM, Myrtle R. Kellington, Executive Editor, Sept. 1972

1976-1977 - IEEE Piore Award Subcommittee

1977, April 1 - Member of National Academy of Engineering

1977 IEEE Field Award Committee Subcommittee

ID#0293

| **d** | **i** | **g** | **i** | **t** | **a** | **l** | **interoffice memorandum**

Subject: **Publication of Technical Aspects of Communication in Japanese**

To: Marcie Kenah, BY
Dennis Brown, BY
CC: Don Frost, PK3-2/S50
Carl Janzen, AK

Date: 10 OCT 78
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-

2236
    Andy Knowles, ML5-2/A52

I really question whether we want to assist the wide-scale education of the Japanese engineering community as TAC might do. This will ultimately come back to haunt us when their products are improved. They build nets and terminals, and further tune their notion of distributed processing as we know it. TAC tells "how to" and is therefore not germaine to selling.

Please don't even consider publishing <u>Computer Engineering</u> in Japanese, assuming there may be a demand. Also, I would minimize the distribution there.

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST: Dennis Brown BY Don Frost PK3-
2/S50
Carl Janzen AK Marcie Kenah BY
Andy Knowles ML5-2/A52

FROM: GORDON BELL DATE: SUN 13 JAN 1980 10:17
AM EST
DEPT: OOD
EXT: 223-2236
TO: JIM BELL
SAM FULLER
cc: LARRY PORTNER
ULF FAGERQUIST
STEVE TEICHER
JOHN HOLMAN
CRAIG MUDGE
JOHN MEYER
OOD:

SUBJECT: WE MUST GET A PUBLICATION POLICY

Craig and I had a good discussion last nite on this, but I am quite
confused as to what the policy is. Craig is operating under the policy
that all his CAD work is pretty open and can be discussed. I.e. he can
publish and lecture on the problems and techniques the group
have developed for coping with 80K transistors, etc. This is
not the policy that I outlined which restricts discussion of the
product (that's clear), design process , or manufacturing

process, or circuit technology until a product has been announced. Given that in VLSI, the major impediment to the design is the CAD tools, Craig's policy doesn't feel very good to me because it helps our competitors like Intel, and I'm not sure how they are helping us in our areas like better process technology.
Also, we have restricted Ivan Dobes from publishing about gate arrays, even
though the work is quite non-product specific because it applies to MCA and
we are so far away from FCS. Similarly we are not open on the analysis necessaryr
to parallel power supplies, which is the theoretical underpinning of Modular
Power supplies. Also, here I am reluctant to talk very much after publication
because Power Supplies represent an area where I believe we now have a
technology lead, and I don't want to help our competitors catch up. In the
Research group, there might be some issues, although I don't think they do
that much publishing.

One thing is becoming clear and clearer: we have a problem here because various
groups are operating according to different policies. Would you please arrange
a meeting with some of us to input to the policy and then get someone to write
a trial balloon one that can be reviewed? I would also like to inform the maMarket-
eting Committee too and get their input.

To refresh our memories, the 12/16/79 EMS message was: We are not going
to publish papers on product or process that are product related until the
product in question is announced. Note this really squelches just about
everything, including the VLSI VAX, assuming CAD is a process and related

or targeted at a product. I would like to get the right policy here ASAP,
and as I indicated before, I have no pre-disposition to it. If I don't get
a policy forming soon from you guys, I intend to move to further restrict p
publication and outflow of information. Your help is needed.

Command >

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*****************
* d i g i t a l *
*****************
```

```
TO: DICK CLAYTON                      DATE: TUE 12 AUG 1980
10:15 PM EDT
    MIKE TITELBAUM                    FROM: GORDON BELL
cc: JIM CUDMORE                       DEPT: OOD
    ROY MOFFA                         EXT:  223-2236
    JOE ZEH                           LOC/MAIL STOP: ML12-1/A51
```

SUBJECT: PERMISSION TO PUBLISH ON TINY

I think we should go ahead with it, provided that the announce
is somewhere around the time of Tiny. At any rate, I don't see
any harm of saying that we have it and it will be used for
internal products. We could almost say this now! (Who cares?)

Since there isn't a product surrounding it per se, and it as
an internal part, then can we just announce it in this rather
interesting way?

Dick, I'm for it, but if there's an issue that will upset the
marketing folks, I'd like you to get the clearance.

I'll give you strong support on this.

GB1.S6.18

d	**i**	**g**	**i**	**t**	**a**	**l**	**i n t e r o f f i c e m e m o r a n d u m**

Subject: **FY 80 Planning**

To: OOD

CC: Paul Bauer, ML3-3/B91 Operations
Mitch Kur, ML12-2/A16

Date: 22 NOV 78
From: Bob Puffer
Dept: Engineering
Loc: ML12-2/E38 Ext: 223-2863

Last week's OC Woods established a tentative NOR plan for FY '80. Overall, we can start planning based on an average central engineering growth (including contingency and reserve) of 25-28% over FY '79. This should translate into a 10-12% people growth.

The balance of FY '79 looks good and the corporation is planning on and committed to meet its BOD budget. Engineering is also expected to meet its original BOD budget. The bottom line is that the plan has not changed and still looks good.

Attached is a sheet qualitatively describing the budget growth by engineering area, which Gordon initiated and I edited. It is a talking point from which we will begin discussion of the budget for your areas. Obviously the goal is an allocation supportive of the engineering strategy statement. I would like to see us agree, up front, on this sheet (after appropriate ECO's) so that we don't get expectations and detailed planning out of touch with reality.

I will schedule this for discussion at our next OOD meeting.

RP:ljp

Attachment

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Gordon Bell ML12-1/A51 Dick Clayton ML12-2/E71
Jim Cudmore ML1-5/E30 Bill Demmer TW/D19
Ulf Fagerquist MR1-2/E78 Bill Johnson ML21-3/E87
John Kevill ML1-3/E58 John Meyer ML12-1/A11
Larry Portner ML12-3/A62

Paul Bauer ML3-3/B91 Mitch Kur ML12-2/A16

GB0004/54

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i n t e r o f f i c e   m e m o r a n d u m

Subject: **Purging/Using Our Capital Equipment**

To: OOD
Lu Abel, ML3-6/H27
Jim Bell, ML3-2/E41
John Clarke, ML1-2/E60
Don Crowther, ML5-5/E72
Bill Johnson, ML12-3/A62

Date: 9/18/79 Tue
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

follow up: 10/5/79

In walking through the mill, and other facilities, I think I see a couple of solutions to our space problems:

1. Clean out the unused equipment; especially VT05's, LA30's, and some VT52's.

2.give terminals (e.g. the public room 3-5 and R + D) to TPL to sell, or to individuals. I've yet to see anyone use this equipment.

This should get us space, cut the capital equipment, get some $'s back in and make the place much neater.

What do you say?

GB:swh

ID#402

| d | i | g | i | t | a | l | i n t e r o f f i c e m e m o r a n d u m

Subject: **What's the Status of PUSART?**

To: Joe Zeh, WZ2

CC: Bruce Delagi, MR2-1/M64
Sam Fuller, TW/A08
Bill Green, ML1-4/B34
Bill Johnson, ML21-3/E87
Roy Moffa, ML1-2/H26
Jim O'Loughlin, TW/E07
George Plowman, ML5-5/E97
Bob Savell, ML5-2/E50

Date: 4 JAN 79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

follow up 1/18/79

Do we need PUSART now that there are much better serial I/O chips?

Joe, what are the past and current business plan for PUSART with the number commitments?

Does anyone want to change their commitments?

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

```
DIST:           Bruce Delagi      MR2-1/M64   Sam Fuller
                TW/A08
                Bill Green        ML1-4/B34   Bill Johnson     ML21-
3/E87
                Roy Moffa         ML1-2/H26   Jim O'Loughlin
                TW/E07
                George Plowman    ML5-5/E97   Bob Savell       ML5-
2/E50
                Joe Zeh           WZ2
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+---------------------------+                        GB0004/48
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a n d u m
|   |   |   |   |   |   |   |
+---------------------------+
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Subject: **Pushing Basic + 2 (i.e. New VAX-11 Basic) at DECUS**

```
To: Kerbey Altmann, MK1-2/J05       Date:  9/13/79 Thu
    Joe Carchidi, TW/D08            From:  Gordon Bell
    Bob Daley, MK1-2/H03            Dept:  OOD
    Herb Jacobs, TW/D08             Loc:  ML12-1/A51  Ext: 223-2236
    Bernie Lacroute, TW/A08
    RoseAnn MacLean, MK1-2/D03
    Kathy Norris, TW/A08
    Dick Snyder, MR1-2/E37

CC: Bill Heffner, TW/E17            Follow Up:  9/28/79
    Si Lyle, MR1-1/M42
    Larry Portner, ML12-1/T32
```

Yes, I support a strong VAX-11 Basic (alas new Basic + 2) at DECUS. It has to include demos with full screen at the sessions.

A really good product is essential in order to get RSTS users to switch to VAX, because the AME approaches will never (can never) offer enough incentive.

The theme should stress:

1. Performance
2. Big address
3. Cleaner language + interfaces
4. Ability to mix languages (including) in a single program.
5. Ease of conversion from RSTS (talk about the conversion program).

We should have documents there too that show this, especially the conversion.

Also, we should have some demos that show conversions. Could we have a customer(s) give testimonials?

GB:swh

00 CORE DECGRAM ACCEPTED S 002552 O 540 16-OCT-82 17:29:37

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION DATE: SAT 16 OCT 1982 5:10 PM EDT

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION DEPT: ENG STAFF

EXT: 223-2236

LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5178835281

SUBJECT: THANKS FOR THE LONG AWAITED Q VS BI REPORT

Fantastic to finally get this information at last. We've been
speculating about BI and Q based systems for quite sometime with
no data! Although the distribution list was relatively long, it
didn't include several key people who are trying to sort out and
understand this space including: moffa, bj, kalb and teicher.
We lost valuable time in getting some understanding. I like
Ken's saying: Open distribution of information, formal decision
making.

It seems like all the data's there to make decisions on the
use of BI vs Q bus. A hasty reading says to me:

Get a semiconductor company to embrace the BI, get the cost
down and go for it as a high quality, competitive bus to
outdo VME and Mulitbus. We must have the chips to compete!

We want our first systems to use Qbus for cost reasons, but
a major factor (not mentioned) was the earlier time to market
of a system based on Qbus boards and boxes. I want a system
out based on uVAX ASAP... otherwise kiss the TVG business
goodbye.

Note, we now need some formal plans and this is possible now
that we have less noise about the goodness (versus time) of
the BI. My two observations above are just that, no commits.

Thanks
g

"TO" DISTRIBUTION:

BILL DEMMER PETER JESSEL BILL STRECKER

"CC" DISTRIBUTION:

MIKE GUTMAN BILL JOHNSON JEFF KALB
ROY MOFFA GRANT SAVIERS JACK SMITH
BOB SUPNIK STEVE TEICHER

GB3.S8.69
I'm happy to give this Q1 report after a 6 month lapse in the Yellow Book publication. Lot's of changes should be observed (see the contrasting product charts).

The big changes: the low end is moving in terms of computer and terminal systems (e.g., Krypton, the new CRT, and the printing terminals). The market thrust is increasing too with LSI-11 sales picking up at the board level where we have a unique, great product that has the highest performance of all the microcomputers. The DCG Engineering Group has been doing enhancements to provide significant market-oriented and mid-life kickers to these products. It's nice to get the various disk (especially RK06) shipping...it's clearly the largest most complex hardware system we've built. PDQ seems, at last, to be on a course to ship at a predictable time. It looks like quite an interesting machine although a year earlier ship would have been better.

Although we have been updating the development plan (the Red Book), there's been significant product development activity. (Our fear of planning is that it will consume us and no development will occur). Since there was a plan in place, this Red Book has been used extensively to:

1. Work on about 10 product problem issues...many of which have been solved, the rest will be reported on at PL Manager meetings until they are solved.

2. Start "systems planning" as viewed by customers...not a collection of memories, disks, power supplies, software as we've been doing. The Spring Red Book will be the first full-fledged plan this way.

We (about 100 mostly hardware-oriented engineers from Central and PL Engineering) attended a 2 day LSI seminar that really covered plans and activites in all hardware. It was the most intense, interactive, interesting meeting I've been to...and I look forward to next year's session. (We have to figure out how to include software, systems, and other engineering...200 people in a group probably isn't the answer.)

The M/E Committee is soul-searching its charter to move to a more policy- vs police- orientation. We need a similar (M/E+?) group oriented to service (FS/Software/Software Support/Development). Bob Swarz has been here for a few months as the Corporate Manager of the RAMP (Reliability Availability Maintainability Program). He reports both to Field Service and to OOD, and is beginning to work with our engineering groups to understand, educate, analyze, and make standards and policies in this area. We'll clarify this soon.

There's been a small group defining the Commercial Instruction Set architectural addition to our computers. The one we have defined is quite extensive, but I believe necessary if we're going to have a range (low to high) of high performance, competitive, commercial machines (which I feel we must). The process was somewhat frustrating, but we've learned quite a lot from it (which I've tried to state in a memo).

Various standards are beginning to consume more resources...the price of being in nearly every marketplace. The responsiveness is impressive as we often need quick commitments to make product/business decisions. A related activity, standard systems, or systems that can be configured is being attached by Jim Barclay. It looks as if it may someday be possible for nearly any of our customers to order predictable systems that are buyable, buildable, billable, and useable in a deterministic way.

Gordon Bell
10 NOV 76

STRATEGY Q & A

Q1 IS THERE "BUY IN"?

. THE OPERATIONS COMMITTEE, B.O.D. AND OOD HAVE APPROVED IT.

. NEARLY ALL PLM's SAY THEY SUPPORT IT.

. THERE ARE INTERACTIVE PRESENTATIONS PLANNED WITH P/L GROUPS.

Q2 DOES BUDGET SUPPORT THE STRATEGY?

. DON'T KNOW YET.

. AM USING STRATEGY FOR ALLOCATING RESOURCES...MUST REMIND OTHERS TOO

. THERE IS PROBABLY NOT ENOUGH MONEY TO SUPPORT <u>ALL</u> OF THE STRATEGY.

Q3 WHO'S MANAGING THE STRATEGY?

. ALL OF US. A FULL TIME PERSON IS NEEDED.

Q4 WHAT'S DIFFERENT FROM WHERE WE WERE HEADED?

. DECISION ON VAX MADE IN SPRING '75.

. MUCH EMPHASIS ON COMPATIBILITY...ESPECIALLY IN 11's.

Q5 WHAT ARE THE "HARD" PROBLEMS IN DOING IT?

. CONCENTRATION AND MANAGEMENT.

. IT HAS STRONGER STANDARDS AND MORE PRODUCT INTERACTION (THIS

COULD BE CHEAPER AND EASIER TO MANAGE THAN BEFORE).

. MUCH SOFTWARE.

. INTERCONNECT NEEDED QUICKLY TO "GLUE" IT TOGETHER.

. GETTING TERMINALS EXPERIENCE.

. GOING TO APPLICATIONS.

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* d i g i t a l *
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TO: see "TO" DISTRIBUTION DATE: SAT 3 OCT 1981 18:35 EST

FROM: GORDON BELL

cc: SAM FULLER DEPT: ENG STAFF

EXT: 223-2236

LOC/MAIL STOP: ML12-1/A51

SUBJECT: USING THE Q BUS FOR BUILDING COMM SYSTEMS

Sam informed me that we are about to get 12 Qbus Ethernet interfaced from Bob Metcalfe's company. Maybe we could license his design instead of building our own here.

I've asked Bernie and Dick Davies (who is doing comm hardware and software in the UK) to look at building our gateways out of lsi 11 based systems. We are not using our own 11's enough hopefully because we don't know about them. Is there a way you guys could get with Bernie so that we could start to build these systems this way?

What happened to the Shoebox? It is really important to have a cost-effective way to build these point products. The world is going to demand a plethora of them to convert among the various protocols, terminals, etc.

USING THE VT103 AS THE BASIS FOR BUILDING COMM SYSTEMS
What really looks good for the point products is the VT103 since it offers a box, power supply, crt console, and computer. With it, we would make special dual board options for interfacing to all the protocols. We and CSS could build these boards and systems very quickly. Also, it would make an ideal box for the concentrator, tcp, that the commercial group needs that is to concentrate 4 lines. In looking through the Yellow Book, I can't find the option I think we need, namely an 11/23 with 128Kbytes (using 64Kbyte chips), and 2 serial lines. Are we building such a board? (It would be the basis for the concentrator.) Where is the plans for all the Qbus options that

would be appropriate?

The kinds of products then that I see would be:
a 4 line concentrator - using the board + serial line board
a gateway - using the board and special boards for the
  various brands of X25 and SNA
a concentrator for Ethernet using the Metcalfe interface
  until we get ours
a front end for concetrating line printers on large
systems...
  in essence, the print server.

Note the cost per line has to be low cause the box won't cost over a 1000.

Can we look at this approach for really cost-effective systems?

"TO" DISTRIBUTION:

GERALD V BUTLER   BOB DALEY   BRIAN
FITZGERALD
MIKE GUTMAN   JIM KING   BERNIE
LACROUTE
BOB SAVELL   HERB SHANZER   JIM WADE

GB3.S1.38

00 BURT DECGRAM ACCEPTED S 8672 O 39 25-APR-81 15:31:56

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* d i g i t a l *
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TO: see "TO" DISTRIBUTION   DATE: SAT 25 APR 1981
15:28 EST
FROM: GORDON BELL
cc: ENG STAFF: DEPT: ENG STAFF
    WIN HINDLE   EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: QUALITY AND PRODUCTIVITY: WHAT'S THE ANSWER?

Let's talk a little about this issue. I want to learn what you know about quality and how to get it.

We (Engineering Staff) had a discussion at a recent Jungle Meeting on measuring these as they relate to Win's request. I
am still depressed from the discussion. BJ has operated a quality organization for three years and things are improving.
This is the only encouragement.

You guys apparently tried some sort of top down organization approach and gave up. I don't see how Engineering can hire the
same folks and have them do any better, as Dick Amann suggests.
Our product quality is really too low, and we engineers don't have the understanding of quality. Our productivity measures
are non-existent... and we are being asked to improve both parameters, neither of which we understand.

Let's discuss in one of our joint meetings, but in the context
of some teacher and readings.

It should be able to be proven that given our current understanding
and behavior about quality, we are clearly doomed.

What is the answer?

"TO" DISTRIBUTION:

BILL HANSON JACK SMITH PETER VAN ROEKENS

ATTACHED: MEMO;47

****

* d i g i t a l *
****

TO: GORDON BELL
11:33 EST

cc: see "CC" DISTRIBUTION
ASSURANCE

DATE: FRI 24 APR 1981

FROM: PAUL REY
DEPT: HDWR DESIGN

EXT: 223-2348
LOC/MAIL STOP: ML11-3/H19

SUBJECT: QUALITY, RELIABILITY

THIS EMS IS ACTUALLY FROM DICK AMANN

On a recent article you wrote "without some total (quality) program
across the company"..."we're (not) going to make it."

The possibilities of getting a total program going are diminishing.
The groups who have tried to provide cross company quality focuses
in specific areas are being decimated and decentralized.

Central Manufacturing's Corporate Q.A. group is being decentralized.

The Manufacturing Process Quality group is already gone.

Corporate Component Engineering, who help assure quality components,
will be next on Manufacturing's hit list for decentralization.

Corporate Product Safety, who look at the quality of our products'
safety design, is being decentralized.

My fear is that by the time this company's management wakes up to

the need for a cross company quality focus, the very people, operations
and groups who could have been a nucleus for this focus won't be
around.

If you feel strongly about this, why not stop all future decentralization
of quality oriented groups and, instead, look at transferring them
into engineering?

"CC" DISTRIBUTION:

CHRISTOPHER J BALL	BILL KELLY	DOM LACAVA
GENE MONDANI	BRUCE SMITH	PHIL TAYS

GB2.S6.13

00 CORE DECGRAM ACCEPTED S 000346 O 30 08-MAY-83 11:32:56

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TO: EMC: DATE: SUN 8 MAY 1983 11:03 AM DST

FROM: GORDON BELL

cc: DICK CLAYTON

DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5199269694

SUBJECT: DICK AS VP OF QUALITY

I think the effect of engineering is too low on quality and productivity. This includes presenting the product to the fields, so they can't possibly miss-order it. We must get them a tool so an order is checked at entry... this is the same reason why one has to simulate. The downstream costs are so incredibly high that the errors kill you.

ATTACHED: MEMO;51

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M e m o
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TO: DICK CLAYTON
10:59 AM DST

cc: EMC:

DATE: SUN 8 MAY 1983

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5199269688

SUBJECT: RE: QUALITY

Am strongly supportive of a central quality focus. Would even
go so far as a special appointment as suggested by Lou Cohen as a VP of Quality. Am happy to hear that for the time being until we improve, yo're the VP of Quality! Lou is a resource with in engineering who could help enormously in terms of spreading out into various hardware groups, based on his software work.

I have long felt we need strong guidance because I don't think
I see the talent, concern and understanding of the relationship
of engineering quality to product quality AND schedules. That's
why I'm ve tried to push the thingprogram called Quality Design
Methodolgy.

BJ's the only one pushing this inby an explicit porgram arogram and
assignment of people. He had a Process workshop a month ago and John Manzo's working it full-time. SEG's already been there and I don't workry about them either because you can't build chips without such a commitment to quality design.

Am concerned about mass storage and the low end where there's non-trivial engineering of connecting complex vlsi parts... a typical eco rate is one wire/ic! We should have some results soon too on Venus to see if all this pays off. So far, there were 300 wirewires on the one board that wasn't simulated, whereas
the first two boards that had extensive simulation had 5 wires.

We need a revolution in our design thinking in the short run. In the long run, I'm convinced that automatic design (i.e. compilation of hardware) is the right way and what we must target.

Get us quality.

Gordon

****
* d i g i t a l *
****

TO: WIN HINDLE DATE: MON 27 APR 1981
6:40 EST

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: A QUALITY PROGRAM

I'm pretty sure we (engineering) should propose that
we focus on quality as a sole goal, even though it is more difficult than productivity. This should also really get after the predictability issue as variance is a great indicator of poor quality. I still maintain that productivity
will be very much higher doing than this than if we
go for the two measures.

In your first memo, you said: "WE have chosen to not have a corporate czar...". When was this decision? Who made it? What
is the rationale?

The discussion with Engineering Staff was alarming. We don't understand either issue very well. We need teachers and a corporate wide program as a major theme.

I'd like us to reconsider a single, directed, company-wide quality program and include campaigns, prizes, school, and metrics. Suggest WE tune the program slightly as stated.

GB2.S6.16
****
* d i g i t a l *
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TO: BILL JOHNSON DATE: SUN 9 MAY 1982
6:32 PM EDT

FROM: GORDON BELL
cc: LOU COHEN DEPT: ENG STAFF
PEG: EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: QUALITY PROGRAM AND INSPECTORS VERSUS INSPECTIONS

Hopefully I've not set the quality program back by my apparent
misunderstanding of inspections versus inspectors.
What I objected to was having some full time people who do nothing but inspecting. This is similar to the design review process in hardware where people review how a design is done and try to verify whether it will work, NOT review the design in terms of whether there's a better way. My concern was that
full time inspectors would soon become obsolete and useless. It's necessary to have some formal walk-through and if you have to call it inspections, then fine.

Yes, I think code walk throughs are really necessary. This is sure a process I support. I also think it is vital that the process be started in hardware. There it should be easy because diagnostic engineers should be providing this function automatically. This would let us formalize the process. Software appears to be about 5 years ahead of hardware in terms of understanding quality. Can we get a similar program going in hardware?

As you know I strongly support the quality program including the teaching and believe we have to go significantly farther in understanding errors in the classical way that Demming has taught the Japanese. Here, we have no effort. If we take this
approach, then it's possible to build some tools that will assist in checking for the errors and eliminating them.

I really support the quality program and my only complaint is that it isn't quantative or widespread enough yet! Finally, it doesn't exist in hardware engineering, but it must!

GB3.S5.28
In the finale when you actually delivered a spec and commitment to a timely schedule, I hope it was clear that I was and am truely thankful. (Rejoicing with you may have been diminished since the same work is starting for printers and then communication servers.)

Although I started on the project to get a decent personal VAX in January, Ken urged me to work on it seriously while I was in the hospital. Now, I finally feel we have an approach to getting this first, and then I hope for the follow on products.

REDUCING THE PERFORMANCE RISK FOR 19" WITH MICROCODE, NOT HARDWARE
Although we're all confident the scheme is going to work, given LISA. There may be a problem in performance for the 19" monitor and the larger number of pixels. It's pretty clear what the bitblt (area move instruction) is, and if this can be kept as a macro in the software, then when we do

performance monitoring, we can see if it makes sense to make this a VAX instruction.

I now believe that ALL future micros that are microcoded, as opposed to RISC-type, should have some form of the bitblt operations when they are to be used in the PC market. This is akin to why we put decimal instructions in machines that process Cobol. With this capability, we get the necessary speed and direct control without the highly special, inflexible hardware that's hard to communicate with. Past micros have taken the approach of co-processors chips (a misnomer because there's not a seperate Instruction-set).

The microcode option should be kept in mind, although at this time we clearly can't undertake it because of the work for DECwest. We ought to think what the format would be (eg. several simple instructions versus one, general complex one).

MAKING IT A PRODUCT WITH SEAHORSE in Q384
We can get the product out very, very quickly by proceeding directly into the test process by coupling directly with Seahorse when it enters its test (DMT, etc.) In fact, we save enormous $ and time by not having to do two tests. Reid estimates that the market doubles for Seahorse, and I estimate that it goes up by a factor of 4.

The product should be co-ordinated with Dave Cutler and Reid Brown.
.
00 CORE DECGRAM ACCEPTED S 006420 O 391 13-JUN-83 18:44:36

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TO: see "TO" DISTRIBUTION   DATE: MON 13 JUN 1983 3:15 PM DST

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION   DEPT: ENG STAFF

EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

MESSAGE ID:
5202828427

SUBJECT: THANKS FOR GETTING THE QVSS GOING--NOW THE PRODUCT

GB6.4

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thankful. (Rejoicing with you may have been diminished since
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"TO" DISTRIBUTION:

BOB HUETTNER   DICK HUSTVEDT   CATHY

LEAROYD
REGINA/FORRESTER

"CC" DISTRIBUTION:

JIM CUDMORE DAVE CUTLER SAM FULLER
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M e m o
!___!___!___!___!___!___!___!
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TO: GEORGE CHAMBERLAIN DATE: TUE 25 JAN 1983
11:35 AM EST
FROM: GORDON BELL
cc: see "CC" DISTRIBUTION DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

MESSAGE ID:
5188994152

SUBJECT: RE: RE: COST-SHARING AND THE NEW RESEARCH TAX CREDIT
REGULATIONS -

GB4.S1.21

This R & D Tax stuff is absolute bull-shit and just what I
predicted
when I gave my very luke-warm support to NSF, DOD, etc. who
pushed to
get this as a means of increasing R & D spending to compete
with the
Japanese. I was skeptical because I felt U.S. managers would
merely
use this to save money so that they'd look better. Your memo

says we
save $75M/5 years --- confirm this !

I wanted (hoped for) an entirely different behavior that addressed the fundamental problem . . . we do no research. Your memo merely confirms my correct observation about human nature. I would like to meet with you folks about getting me the $15M back you think you saved so I can do the critical work needed to beat Japan.

"CC" DISTRIBUTION:

AL BERTOCCHI BRUCE RYAN @MP3E TAX DEPARTMENT
EMC: F/U 1/25 WIN HINDLE
BRUCE HOLBEIN ALBERT MULLIN OPERATIONS COMMITTEE:
LARRY RICCI MARK A. STEINKRAUSS BILL THOMPSON

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TO: TAX DEPARTMENT   DATE: FRI 21 JAN 1983
7:40 PM EST
                                            FROM: GEORGE
CHAMBERLAIN
cc: see "CC" DISTRIBUTION   DEPT: TREASURY ADMIN
                                            EXT: 288-6422
                                            LOC/MAIL STOP: AKO1-
3/C-9 - TREAS.

                                            MESSAGE ID:
5188589700

SUBJECT: RE: COST-SHARING AND THE NEW RESEARCH TAX CREDIT REGULATIONS -

Goood job by Bill Modahl and support!
(This will be worth some $75M over five years.)

"CC" DISTRIBUTION:

*GORDON BELL   AL BERTOCCHI   BRUCE RYAN
@MP3E
WIN HINDLE   BRUCE HOLBEIN   ALBERT
MULLIN
LARRY RICCI   MARK A. STEINKRAUSS   BILL
THOMPSON

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! d ! i ! g ! i ! t ! a ! l !          I n t e r o f f i c e
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TO: LARRY RICCI   DATE: FRI 21 JAN 1983
2:04 PM EST
                                            FROM: TAX DEPARTMENT

cc: see "CC" DISTRIBUTION

DEPT: CORPORATE TAX
EXT: 288-6301
LOC/MAIL STOP: AKO1-3/D14

MESSAGE ID: 5188589212

SUBJECT: COST-SHARING AND THE NEW RESEARCH TAX CREDIT REGULATIONS -

DIGITAL WINS A ROUND

The 25% tax credit for increased research spending is of considerable value to us. Under the law as adopted in 1981, it appeared that we could not claim credit on research spending reimbursed to us by our

foreign subsidiaries under our cost sharing agreement. (In a recent year, this amount was over half of total Digital research spending).

We thought this was inconsistent with the intent to create the incentive, and sought to resolve this in our favor during the 1981 legislative process. Treasury then opposed it, and we were un-successful.

Refusing to give up, we met several times last year with the Treasury officials drafting regulations for the new tax credit in an effort to get our point of view accepted. Few other companies in our industry have our sophisticated approach to sharing the costs of research, and we were alone in seeking this modification.

The new
regulations, as proposed in the Federal Registerfor January
21, 1983
allow the credit for all research spending regardless of cost
sharing
chargeouts.

The result will be to approximately double the effect of the
credit
on our reported earnings.

"CC" DISTRIBUTION:

*GORDON BELL @MP3E	AL BERTOCCHI	BRUCE RYAN
GEORGE CHAMBERLAIN	WIN HINDLE	BRUCE HOLBEIN
ALBERT MULLIN	MARK A. STEINKRAUSS	BILL THOMPSON

WPS USERS - Leave HP mode and type <CR>

Digital **Interoffice Memo**

Subject: **R and D Organizational Change/Charter**

To: Consulting Engineers
Engineering Committee
Engineering Managers
Operations Committee
Product Line Managers

Date: 8 DEC 76
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

Effective now, Jim Bell, head of the Research and Development Group, will report to me. This change recognizes the somewhat wider activity scope for the R and D Group.

It should be noted that much of DEC's R and (advanced) D will reside in development groups in central engineering, Product Lines, and outside of DEC.

CHARTER

The charter of the Research and Development Group is to provide Research, Advanced Development, Information Services, Consulting, Technical Education, and Technical Staff Services to the Corporation, with particular emphasis on meeting the needs of the Office of Development.

1. Research - To conduct an internal research program and to interface with external researchers.

2. Advanced Development - To turn ideas into working prototypes for further evaluation.

3. Information Services - To provide comprehensive library services to the Corporation's employees, regardless of where they are located.

4.   Consulting - To provide consulting, utilizing both internal and external resources.

5.   Technical Education - To supply, influence, and coordinate technical education activities.

6.   Technical Staff Services - To provide other technical staff functions as designated, with emphasis on those services which are future oriented, are leveraged by a broad payoff, or serve to bind together the activities of diverse groups.

GB:ljp

****
* d i g i t a l *
****

TO: WIN HINDLE   DATE: WED 30 JAN 1980
6:51 AM EST

FROM: GORDON BELL
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1
A51

SUBJECT: YOUR NOTE ON THE R80

All of us have been actively working on this. The cluprit in terms of stop was the head redesign. We had used Alum instead of steel, and it had an exceedingly high creep (hence got unspringy) after 3000 hours (still undetected in dmt). We have/had many project in parallel to clear this up. There were many other issues like bad boards and the clean room that heaved a sigh when the head problem came up cause everything had used up its slack. This will be cheaper and better in long run... given we get the capacity elsewhere.

ATTACHED: MEMO;63

****
* d i g i t a l *

****

TO: GORDON BELL*   DATE: TUE 29 JAN 1980
8:45 PM EST

FROM: DEMETRIOS

LIGNOS

cc: GRANT SAVIERS   DEPT: STORAGE SYSTEMS
EXT: 522-3242
LOC/MAIL STOP: CX

SUBJECT: R80/RM80 PROJECT STATUS

GORDON, PER YOUR REQUEST, I SENT YOU COPIES OF THE CX PROGRAM REVIEW PRESENTATION MATERIAL (GRANT SAVIERS IS BRINGING THE MATERIAL TO YOU).

THE R80/RM80 PROGRAM IS PROGRESSING IN PARALLEL WITH THE HEAD REDESIGN EFFORT IN MAYNARD. RIGHT NOW IN COLORADO WE ARE BEGINNING HDA PRODUCTION ONCE MORE, FOLLOWING THE CLEAN ROOM CONTAMINATION PROBLEMS. AS YOU PROBABLY HAVE HEARD, THE CLEAN ROOM WAS VERY POORLY CONSTRUCTED AND IT IS POSSIBLE THAT MOST OF THE HDA CONTAMINATION (ERASURE) PROBLEMS WERE CAUSED BY THE CLEAN ROOM LEAKAGE. THE REPAIR WILL TAKE SOME TIME, BUT WE CAN
WORK AROUND IT ON A LIMITED PRODUCTION BASIS.

THE MODULES ARE COMING ALONG VERY WELL. WE HAVE ALL NEW ETCH BOARDS BUILT AND WORKING ON DRIVES. AS A RESULT OF ETCH PROBLEMS, WE HAVE A TOTAL OF EIGHT WIRES ON ALL THE BOARDS INSTEAD OF 280 WIRES AND ETCH CUTS.

DIAGNOSTICS, MICROCODE, SOFTWARE, TECH PUBS, ALL IS PROCEEDING WELL IN PARALLEL. DMT IS DOING VERY WELL (THREE DRIVES) AND WE HAVE SURPASSED THE 30 PERCENT CONFIDENCE LEVEL ON THE RM80 MTBF. WE ARE USING, HOWEVER, THE EXISTING HEAD DESIGN AND THE 280 WIRE/ETCH CUT REV. CONSEQUENTLY, THE DMT RESULTS DON'T COUNT FOR PRODUCT SHIP, BUT GIVE US THE

CONFIDENCE WE NEED ON THIS PRODUCT.

MANUFACTURING IS PREPARING THE NECESSARY PLANS TO BE ABLE TO SHIP FIVE TO TEN UNITS A DAY WHICH IS THE VOLUME MATRIC THAT THE READINESS REVIEW TEAM SUGGESTED.

WE HAVE STILL A LOT OF WORK TO DO. THE PROGRAM IS, WE BELIEVE, UNDER CONTROL VIA THE PERT BUILDING PROCESS. THE R80 HEAD REDESIGN EFFORT IS GOING WELL SO FAR (A FEW ALTERNATIVES EXIST), BUT THERE IS STILL RISK IN TERMS OF TIMING. WE ARE WORKING VERY CLOSELY WITH MAYNARD (ROTTMAYER, RIGGLE) AND NATICK (B. PETRARCA) VIA TELECONFERENCES AND MEETINGS TO MONITOR THE DAY TO DAY ACTIVITIES IN THE HEAD AREA.

I HOPE I HAVE GIVEN YOU ENOUGH INFORMATION ON THE PROJECT AS WE STAND TODAY. WE ARE LOOKING FORWARD TO SEEING YOU SOON.

GB1.S2.23

+---------------+
! **d i g i t a l !   i n t e r o f f i c e   m e m o r a n d u m**
+---------------+

Subject: **R80 and RL02 at Breadboard Time**

To: Phil Arnold, Dave Brown,
Bob Browne, John Kevill,
Demetrios Lignos, Ken Olsen,
Grant Saviers

Date: 28 JUNE 78
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

CC: Marketing Committee
Mass Storage POTS
Lon Beaupre, Bill Hanson,

John Leng, Julius Marcus,
Mike Riggle, Jack Smith

Please convey my congratulations to the developers of the R80 and RL02.

I'm especially relieved in the case of the R80 -- to see a breadboard -- and I look forward to hearing about the engineering prototypes when they get up in mid July. The R80 is perhaps the single most important product we have under development.

It was especially gratifying to see the close co-operation and teamwork between manufacturing and engineering -- and I look forward to the R80 continuing on schedule. At one of the fall milestones I'd like to get Ken to visit Colorado Springs Engineering and Manufacturing.

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST:	Lon Beaupre	ML1-5/B94	Roger Cady	MK
	Steve Coleman	PK3-1/M28	Steve Davis	PK3-2/S53
	Si Lyle	MR1-1/M42	Art Massicott	MR2-2/A52
	Mike Marshall	ML5-2/M46	Pat Mullin	MK
	Bill Munson	ML5-5/E76	Bob Peyton	ML1-3/E63
	Grant Saviers	CX	Ken Sills	ML1-3/E58
	Win Hindle	ML5-2/A53	Ted Johnson	PK3-2/A55
	Andy Knowles	MR2-2/A52	Stan Olsen	MK
	Bill Thompson	ML12-1/F41		
	Phil Arnold	CX	Dave Brown	CX
	Bob Browne	CX	John Kevill	ML1-3/E58
	Demetrios Lignos	ML3-6/E94	Ken Olsen	ML12-1/A50
	Mike Riggle	ML4-1/B32		
	Bill Hanson	ML1-4/P11	John Leng	MR1-1/A65
	Julius Marcus	MK2/C37	Jack Smith	ML1-4/F31

SPECIFIC ACCOMPLISHMENTS:
Tony has been the key organizer of computer science information for scientists and engineers. This is evident in his Encylopedia and the Taxonomy effort resulting in the AFIPS Taxonomy. In addition to the work listed by Sammet, he compiled a two volume numerical analysis on the approximations of various functions for computers.

These are all massive efforts involving nearly 100 volunteers.

RELATIONSHIP TO RECOGNIZED LEADERS:
I believe he is number one in this effort of structuring knowledge.

IMPACTS OUTSIDE OF ENGINEERING:

TEAM EFFORT:
Fundamentally his work on the taxonomy and encylopedia is a team effort. His role was as the leader.

+---------------+
! **d i g i t a l !   i n t e r o f f i c e   m e m o r a n d u m**
+---------------+

Subject: **Goals and Constraints for RAME (RAM + Expandable) Non-Stop Computers**

To: Roger Cady, Bill Demmer, Pete vanRoekens

Date: 2 MAY 78
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

<u>Constraints</u>

1. Provide a system so that non-stop configurations can be built (non-stop requires no single hardware or software point of failure).

1A. A secondary goal would permit high availability, spatially independent systems to be built using the same components, tools and programming techniques.

2. Use the COMET modules.

3. Use the VMS program interface such that no change is required on languages, utilities and other non-operating system programs.

4. Use the same names, mnemonics, and general mechanisms, etc. for system primitives that do the same thing (e.g., pass messages) as DECnet and VMS.

5. VMS designers are tied up till August. Minimize consultation x hours/week of these resources.

6. Prototype will operate on 11/780 mP system.

7. Provide significant intelligence in all PMS level components of the system so that each can be independently self diagnosed, including: controllers (e.g., KMC-11 like), drives (RP06 and TS04), terminals (e.g., VT100), and bus interfaces interconnecting the computer. (We may assume that primary memory is checked using the Pc.) The Pc can be microdiagnosed.

8. Any component can be disconnected and taken out of the system using the proper powering procedures. Similarly, the system can be expanded or contacted without taking the system down. (A reboot might be allowed?)

Goals

1. Minimize time to market.

2. Design a structure that is at least as expandable as the Tandem, but without the Tandem limitations requiring both C's for inter-C data transmission.

3. Eventually make all our computers using the modular, expandable approach.

4. Cover Tandem in all dimensions of cost, performance, R, A, M, E while not increasing component count significantly. Add some functionality dimension to segment us in the marketplace.

5. Permit all three forms of: tightly coupled computers, duplexed network computers (i.e., Tandem) and physically separated computer networks to be built (at O/S build time and/or by the hardware configuration) by users:

a. the 2 or 4 Pc multiprocessor, in a single cabinet to form the basic computer module (a cluster); by sufficient private primary memory, and no shared memory the system can be alternatively configured as a multicomputer structure.

b. the mP, cabinet clusters used as either 2-4 Pc single C's or 2-4 separate C's will be interconnected to form the basic, tightly coupled C network; and

c. the same basic mC network can be distributed in a duplex or quadruplex fashion over long distances to get operational independence for very reliable operations.

GB:ljp

Middlesex County National Bank
25 Nason Street
Maynard, MA

Dear Sir:

Please withdraw $-- from my Account #-- (check enclosed) and deposit 380# to:

Account #:80-277-584
Peter Delehar
Midland Bank Limited
152 Port Obello Road
London W11

Sincerely,

Gordon Bell
Page Farm Road
Lincoln, MA 01773

TWX

Brian Randell
University of Newcastle Upon Tyne
Computing Laboratory

Tel: Newcastle (0632) 29233

Your Arithmometer will be shipped to you shortly. In case of a problem, contact:

Peter Delehar
Delehar Antiques
146 Portobello Road
London W11

TWX

Peter Delehar
Delehar Antiques
146 Portobello Road
London W11

380#'s (dollars from my bank deposited to your account) was sent to your bank December 31. Please let me know the additional cost for postage to ship the armithmometer to:

> Prof. Brian Randell
> The University of Newcastle Upon Tyne
> Computing Laboratory
> Claremont Tower, Claremont road
> Newcastle Upon Tyne NE1 7RU

I would appreciate your shipping the above as soon as possible.

RANKING OF U.S. AND WORLDWIDE SUPPLIERS OF LOGIC (1955-1979)

	1955 TUBES (U.S.)	1960 TRANSISTORS (U.S.)	1965 MSI (U.S.)	1975 LSI (U.S.)	1979 VLSI (U.S.)
1.	RCA	TI	TI	TI	TI
2.	SYLVANIA	TRANSITRON	MOTOROLA	FAIRCHILD	MOTOROLA
3.	GE	PHILCO	FAIRCHILD	NATIONAL SEMI	SIGNETICS
4.	Raytheon	GE	GENERAL INST	INTEL	FAIRCHILD
5.	Westinghouse	RCA	Ge	MOTOROLA	NATIONAL SEMI
6.	Amperex	MOTOROLA	RCA	Rockwell	NIPPON
7.	NT Video	Clevite	Srague	GENERAL INST	HITACHI
8.	Ranld	FAIRCHILD	Philco	RCA	SIEMENS
9.	Eimac	Hughes	Transitron	SIGNETICS	RCA
10.	Lansdale	Sylvania	Raytheon	Am Micro	TOSHIBA
FAILING		7	3	5	2

TRANSITION

	1972 (W.W.)	1975 LSI (W.W.)	1979 VLSI (W.W.)
1.	TI	TI	TI
2.	MOTOROLA	MOTOROLA	MOTOROLA
3.	FAIRCHILD	SIGNETICS	NATIONAL SEMI
4.	Matsushita	FAIRCHILD	NIPPON
5.	HITACHI	NATIONAL SEMI	SIGNETICS
6.	TOSHIBA	NIPPON	FAIRCHILD
7.	NIPPON	Hitachi	INTEL
8.	NATIONAL SEMI	SIEMENS	SIEMENS
9.	Mitsubishi	RCA	RCA
10.	SIGNETICS	Toshiba	SIGNETICS
FAILING TRANSITION	2	2	

GB2.S4.2
ID#332

<u>Why Change the Current Strategy</u>?

We have arrived at the current strategy by integrating our past customer needs, with the result that nearly every past system we have ever built is being evolved. This evolution creates too many systems with converging functionality. By prolonging the phaseover to VAX, we're unable to invest enough in VAX due to continuing and evolutionary support costs. Also, we're unable to provide applications, or have any slack resources to respond to competitive threats (eg. large micros or focused products such as the 8100).

We are just beginning to get a feel for the expense of putting new software systems in the field, and there are other systems still to come. Since we provide many choices, we find our sales and customers have difficulty deciding what to sell and buy. This makes us difficult to understand and to do business with. Lots of low volume products mean we don't have adequate volume to amortize the start-up manufacturing, sparing and training expenses.

Why Not Aggressively Evolve All Four Base Hardware Architectures?

In reality, our past strategy has been almost a divisional product structure. Customers can choose among the 4 basic hardware computer systems with 2+3+7+1 models and then select the appropriate software system, among 2+2+7+1 software systems for 8, 10/20, 11 and VAX respectively. This gives us several hundred systems. The number of alternatives is too large, resulting in small and decreasing volumes of each of the systems as all architectures are extended to cover a full range that we believe our customers require. We can not afford all the necessary enhancements to support four architectures over the range of size and use that our customers demand.

While any of the architectures can be implemented at any size down to and including LSI chips, there is no significant differential cost of the processor between the 10/20, VAX and an 11 with commercial and scientific instruction-sets. An evolved 8 to handle the strategic range would even be the same cost. The main differentials are: the cost of the memory to hold the tasks and the size of the operating system software. The 10/20 operating systems have been oriented to generality, and while VMS and TOPS 20 have roughly the same functionality, the 10/20 requires 512K bytes of resident memory, whereas VMS require 256K bytes. This occurs because TOPS 20 has evolved and because of the efficiency of VAX architecture. VMS also has real time capability. Similarly, it is now inappropriate to consider 10/20 based architecture for terminals and personal computers, when compared with VAX, because small problems cannot be encoded to be competitive with modern 8- and 16-bit microprocessors. Furtheremore, extensions to the 10/20 architecture would require basic work in the operating system and languages to build a VAX competitive product.

Why Not Segment Products By Market?

Since the 10/20 has significant commercial software and since it is believed that our customers are insensitive to architecture, we might simply have a market segmented approach and use 11's at the low end and 10/20's in the high end. Lower priced 10/20's would be implemented over time as appropriate.

Our technical users (EDU, ESG and even LDP) do not segment computer purchases into commercial vs scientific. A "control" customer such as DuPont doesn't segment its applications either. Even NASA wants COBOL to off-load their mainframe and to do administrative EDP. Universities likewise want a single machine, and hence the software will be "pulled" into existence. Version 4 of VAX COBOL executes faster than the 20's already.

Since there is basic incompatibility between the 11 and 10 architectures, the migration problem is enormous. Now our large commercial customer base is with 11's. Our users perceive VAX and 11 are of the same family.

The 10/20 still requires basic changes (CIS, 30-bit addressing) to bring it up to VAX performance and capability together with compilers and some basic software (eg. multi-keyed ISAM). TRAX-36 and RSTS 36 will also have to build off our 11 base. In short, while it might be feasible to build 10/20 software so that our 11 users could meet our strategic goals for distributed processing, we would still fall short of the distributed system one can build with a single architecture as described in a subsequent rationale.

How Do Customers Preceive The Situation?

In mid October, a group at Bell Laboratories, building PBX systems visited us and made the comments:

> "Only you have the basic architecture in VAX to cover the range of products we need for distributed processing. This includes: terminals, offices and large offices.

Give us a truly compatible range of VAX machines, starting with a VAX-on-a-chip and extending through the IBM 3033. (Don't corrupt VAX, since as in the 11, we must preserve our software base, given that the processor is only 4% of the cost.)

The machines must have a reliability and security orientation.

Why don't you do it?

We will help fund the development."

Recent discussions with Stanford, ITT, CERN, NASA (Ames) indicate concurrence even though they are large 10/20 and 360/370 users. MIT is proposing to build a homogeneous VAX-based network. DuPont wants a similar structure, but is less rigid on the need for a homogenous architecture even though they've standardized on the RSTS machine internally for many of their systems. (There's a videotape describing their needs and ideas.) CERN, and NASA (Ames), for example, feel that the large mainframe may be on the way out as we offer small group-level computing with VAX. There are probably 10/20 customers who feel strongly that we should base our future on 10/20's. The main reason to focus on the single architecture is that it is part of the 11 family.

Why Have A Single Architecture?

There are technical, marketing and economic reasons for choosing a single architecture at this time on which to base a major part of our future. However, this does not mean that we must neglect our 12- and 36-bit user base.

While computer networks can and have been built with heterogenous computers and IBM is betting that it can build distributed computing systems with only similar machines, a single architecture is the most effective for distributed computing systems. The homogeneous (identical) architecture approach insures that software will give the same results no matter where executed and therefore programs may be run anywhere in the network, data stored anywhere and programs moved about in their object form without the overhead of recompiling or translation as data is transferred. This also insures that the human interface to the system remains constant, because identical software is executed in different machines instead of relying on software that is specificed to have identical interfaces (e.g. languages, command languages, file systems, utilities).

From a user viewpoint, the homogeneity is ideal, and the success can be verified by reviewing the history of IBM's decision to build the 360 (and not continue with the 1401, 1410, 7070 and 7090 series machines), even though there was an incredible base of these machines. This was also the time that Honeywell established itself with the 200-series and RCA with the 301. The homogeneity provides a simpicity for the entire DEC organization and its customers, and lets us all focus on end use applications rather than choosing a particular operating system and language. Currently, we have too many low level, incomplete choices and the software efforts of us and our users are not focused. An applications base can only be built effectively on a good, stable architecture.

Economically, a homogeneous architecture is essential because it allows us to concentrate and become a focused, high volume manufacturer and take advantage of learning curves. While 10% learning curves mean a doubling of manufactured quantity causes a 10% decrease in cost, they also imply that having two very similar products at one-half volume causes 10% higher costs in each. There are similar effects of learning in hardware, software and sales training costs, although the learning costs are small in comparison with the logistics and start-up costs associated with our many, different though functionally equivalent, products. We become difficult to do business with in the process.

Why Base The Architecture on VAX?

Although we went through the arguments in the spring of 1975 when we decided to build VAX instead of building lower cost versions of the 36-bit architecture, we now have a real machine that met its development goals and has user acceptance on which to base future products in a natural, evolutionary fashion.

Mostly, the choice of VAX in 1975 was based on having a large, PDP-11 user base. Furthermore, the choice to stay with the 8-bit byte was of convenience because of the IBM and communications worlds.

The VAX architecture was designed to permit the building of a range of machines with sizes that are important to us. Our targeted range of implementation was 1000:1 and this is attainable with an LSI implementation for terminal applications in January 1982. This is why a small page size and simple paging system was chosen, versus a larger page size and more complex scheme that would have been particularly oriented at large systems. However, it would not be wise to build the machine 1000 times as large in 1982, because it would take the system size beyond the suggested $250 K selling price limit and into mainframe price and customer expectations territory. Thus, in January 1982 the LSI VAX could sell for several hundred dollars at a board level. An ECL technology machine might be configured to sell for $ 500 K, giving the 1000:1 in price and a range of 64 Kbytes of RAM and ROM for VMS in the terminal to as much as 32 Mbytes in the large configuration (4000 64 K chips, costing $60K and occupying 20 PC Boards).

VAX was also designed to address the high cost of programming. Already VAX has been acclaimed (by a customer in our ads) as the best machine for implementing software. The large address space eliminates the need for much of the effort we spend encoding large programs into overlays. The architecture has instructions for the important data-types, the addressing is independent of the data-types and the important language constants are built into the hardware. There is clear separation among program and data. The procedure call instruction allows more sub-program sharing than with architectures that are dependent on conventions (e.g. 360 and 10/20) and it eliminates a class of systems programming errors resulting from the multiple assignment of general registers among different programs.

The 32-bit address space of VAX appears adequate for the computing needs in the foreseeable future and there is extension capability given that any special needs arise. The address space and protection modes also give us a capability to run sub-programs written in different languages as a single program. This capability is unique and may turn out to be the single most important attribute of the machine. Since only one other computer has the capability, we don't understand it or how valuable it will be.

Another technical reason is based on the encoding efficiency of the VAX instruction-set. The VAX architecture can encode a Fortran program in about 1/2 to 2/3 the space of a comparable large computer such as a 360 or our 36-bit computer, while providing 32-bit addresses versus 24 or 20 bits of addressing for the 360 or 10/20. Benchmarks in BLISS and FORTRAN show this now, and the Common Family Architecture studies also indicate similar results. While memory cost is decreasing, memory is still a significant fraction of system cost. Three years of cost decline at the historical rate of 20%, is required to get factor of 2 the cost difference back. That is, from a memory cost viewpoint, we have a 3-year cost edge on the market. More importantly, there is a similar effect on performance. By having only 1/2 the bits to move between primary and secondary memories, the performance is higher due to disk-MOS memory swapping bottlenecks.

Finally, we have an 11 user base on which to build that is approximately 7 and 50 times as large as our 36-bit base in terms of installed equipment dollars and installed units.

<u>Why Not Use The 10/20 As The Base</u>?

The software and user base on the 10/20 is the major reason to not arbitrarily reject the architecture. On the other hand, since the 11 user base is larger and has grown more rapidly, its software base is larger and we have to protect and build on it as a higher priority.

Right now, the 10/20 requires incremental investment to make it competitive with VAX and the rest of the mainframe market. Extension to provide a large address space, to extend the floating point range to fulfil customer commitments, and to give a competitive commercial instruction set for COBOL are needed. Making these hardware investments requires comparable software investments and we must again wait to compete because there is a new machine and software to support.

Subsequent implementations for small systems will be expensive both in terms of new software and start-up because TOPS 20 has been oriented toward large mainframe generality.

Smaller systems will require contractions. Also it stands to only cloud the market more as alternatives for mid-range systems will include 2 VAX and 1 or 2 11-based systems. As small systems are implemented there is a need for compatibility with the even larger 11 base.

Why Distributed Computing?

Distributed computing keys off our strength in interactive computing through timesharing, small systems, real time computation, terminals, and networks. Furthermore, we believe this is what our customers want. The issue is not distributed computing, but solving the problems that it creates.

ID#383

| d | i | g | i | t | a | l | i n t e r o f f i c e   m e m o r a n d u m

Subject: **Your Recession**

To: Charlie Spector, ML5-2/M17

CC: OOD, Marketing Committee,
Sam Fuller, TW/A08
Irwin Jacobs, MK1-2/H32
Bill Keating, ML12-3/A62
Bill Kiesewetter, MR1-1/M81
George Plowman, ML5-5/E97
Bob Savell, ML5-2/E50

Date: 7 DEC 78
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

Now that I've seen the IBM 8100 (and System 38) I understand the recession in your marketplace! This may cause subsequent recessions in other marketplaces too. You might invite Don Alusic and Ted Webber to talk about these -- also the Marketing Committee might listen.

We have to get a market message to counteract and sell current products against these early paper announcements for August '79 - February '80 FCS's. We have products here, now.

<u>We</u> have to get (and plan to get) better applications terminals, and distributed processing links quick! We can now do all right, and must plan to be much better.

GB:ljp

D I G I T A L   INTEROFFICE MEMORANDUM

DIST:

Dick Clayton	ML12-2/E71	Jim Cudmore	ML1-5/E30
Bill Demmer	TW/D19	Ulf Fagerquist	MR1-2/E78
Win Hindle	ML10-2/A53	Bill Johnson	ML21-3/E87
Ted Johnson	PK3-2/A55	John Kevill	ML3-6/E94
Andy Knowles	ML10-2/A52	John Meyer	ML12-1/A11
Stan Olsen	MK1-2/A57	Larry Portner	ML12-3/A62
Bob Puffer	ML12-2/E38	Bill Thompson	ML12-1/F41
Sam Fuller	TW/A08	Irwin Jacobs	MK1-2/H32
Bill Keating	ML12-3/A62	Bill Kiesewetter	MR1-1/M81
George Plowman	ML5-5/E97	Bob Savell	ML5-2/E50
Charlie Spector	ML5-2/M17		

****
* d i g i t a l *
****

TO: BRUCE DELAGI

DATE: SAT 3 OCT 1981 11:44 EST

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

cc: ENG STAFF:
JOHN MEYER
LARRY PORTNER

SUBJECT: RE: TURNER'S ARTICLE ON IBM AWARDS PROGRAM

IBM seemed to put it together right. I had several students at CMU that swore by the company and the way they were treated... and who remain there. WE HAVE A STRONG COMPETITOR AND ROLE MODEL TO FOLLOW... THEREFORE, WE SHOULD BE ABLE TO DO BETTER WHEN WE PUT A PROGRAM TOGETHER.

John and Don.
Can you lead us to put together a really strong recognition program?

As Bruce indicated, the basic problem we have very often is simply neglect. Dave Cane may have not left if we had shown more concern about how important he was to building Digital and its computers. Therefore, I think it is important for each of us not to wait for a comprehensive, automatic program that makes up for direct attention and thanks.

As you do various recognition programs, can I urge you to share them with each of us. Also, maybe we ought to think of something special this year at the 10-20 year award dinner to brighten an otherwise sterile affair.

GB3.S1.40

GB0001/42

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Subject: **Red Book Data**

To: PMC (Mike Gutman, Per Hjerppe, Bernie Lacroute, Jack Mileski, Stan Pearson) OOD

Date: 3/12/79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-

With our going to a two-year plan this time (ie. 80-81) wouldn't it be worthwhile going all the way in providing financial data on the projects and programs? This would include: FY79 and/or Money spent up to and including FY79; Cost to complete; and Total cost of program outside of engineering. This would give us 3 or 4 extra columns, but much insight.

As indicated in a previous memo, we need to have uniform presentation of systems. Let's use the MSD format, which plots log price versus log mass memory size, arranged on paper that has some overlap among the ranges (1K-16K, 16K-250K, > 250K).

1. Here, though small is 1-16K, it might go up to 25K, as suggested at EBOD, and possibly to 40 K to show the overlap with the low MSD range. This would give a 40:1 range.

2. MSD is clearly from 16 to 250K, but perhaps needing the extra low High range (250K-625K) to cover the 11/70 multiprocessor. This would give a range of about 40 also.

3. The 36-bit systems presumably cover from the high part of low Medium (i.e., 25K) with Minnow, and go up to mid High (1.6M) with multiprocessors, for a range of 64, or if Minnow gets down to 16K, then a range 100.

In plotting the configurations, please show all the diskless and disk and tape offerings and how multiple disks of a given kind represent different points in this space. Here, the point (superficially hidden agenda item), is that we seem to be offering too many overlapping systems. E.g., Nebula is in Comet space, and Comet offers every disk and tape system (RL, RK, RM, 2-3 RP, RA and RM 80). Certainly multiple RK's equal an RM, or offer no RK. Nebula does about the same thing, even though there is little to be saved by its cheap processor/memory pair at the high end. (Did we screw up by not having Nebula be an 11/04-like relative to Comet (the 11/34 analogy), instead of a separate system? Other overlaps between MSD and T/SS should also be apparent.

Given these plots, we must <u>also</u> make the other plot of # of users versus system size (in $), plotted as areas (performance group calls them "plates"). Here, a plate border is outlined by a set of configurations and a range of users with varying use (arranged from light to heavy use). Note, a couple are attached, but let's show all the configurations using log price and log # of users.

In this pass we must add cost-of-ownership as a metric, versus just the purchase price we're used to.

GB:ljp
Attachments

D I G I T A L INTEROFFICE MEMORANDUM

DIST:	Mike Gutman	ML3-6/E94	Per Hjerppe	MR1-2/E78
	Bernie Lacroute	TW/A08	Jack Mileski	TW/E10
	Stan Pearson	ML12-2/E38		
	Dick Clayton	ML12-2/E71	Jim Cudmore	ML1-5/E30
	Bill Demmer	TW/D19	Ulf Fagerquist	MR1-2/E78
	Bill Johnson	ML3-5/H33	John Kevill	ML3-6/E94
	John Meyer	ML12-1/A11	Larry Portner	ML12-3/A62
	Bob Puffer	ML12-2/E38		

January 13, 1981

E.L. Ginzton
Varian Associates
Executive Offices
Palo Alto, CA 94303

Dear E.L. Ginzton:

I am writing to you in response to your letter of January 8, 1981, regarding Bill Miller. It looks like he's qualified and I'd be happy to be a reference. Please send me the forms.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:swh
GB2.S1.11
October 27, 1980

Carlo H. Sequin
Associate Chairperson
Computer Science Division
University of California, Berkeley
Dept. of Electrical Engineering and Computer Science
Berkeley, CA 94720

Dear Prof. Sequin:

David Patterson is personable, enjoyable, and verbal. He seems to interact well with his industrial peers. His papers are well written, contain insight and are generally useful. A recent paper for Computer Architecture News is one such paper, but contains only conjecture. Given that two very capable architects, Strecker and Clark, strongly disagree with the paper - based on data, then I'm somewhat concerned about his thoroughness.

Although I don't fully understand Berkeley's professorship requirements, I believe he would be just on the borderline of meeting tenure at Carnegie-Mellon.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:swh
GB1.S7.39
October 27, 1980

Peter J. Warter Jr.
University of Delaware
Department of Electrical Engineering
122 Du Pont Hall
Newark, DE 19711

Dear Pete:

I've known Professor David Robinson for about ten years. We served on a committee in the fall of 1971 and I recall him being an effective and creative contributor. He has also been active within the IEEE COMPCON group.

I also looked over the papers you sent and found them all interesting and useful. Over the years we have found his students to be well trained, although we do not actively recruit at Delaware.

I believe he should be promoted to professor.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:swh
GB1.S7.38
December 7, 1981

Dean Riordon
Carleton University
C.J. Mackenzie Building
Ottawa, Canada K1S 5B6

Dear Dean Riordon:

I've known Dr. Morris through the year he spent on sabbatical at Digital. During that year he was a mature, respected, effective and energetic contributer. He advised and made architectural proposals. He also made suggestions for improved performance in our scientific processing software that we used.

Since I have not been active in the signal processing area, I don't know where he ranks in this field.

I believe he meets the external criteria for promotion to full professor.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:mal
ID#GB3.S1.62
ORGANIZATION

Board of Directors: Meets once a year in May.

Executive Committee: Gwen Bell, 3 DEC people, 2 external people
Meets monthly to discuss policies, budget, money spent.

Director: Gwen Bell Fundraising, memberships, business

plan, Fiscal Year
(June)

Exhibits Coordinator: Jamie Parker
Collecting, archiving, displaying, letting, borrowing, in charge of audio-visual for talks in cafeteria. Need to know procedures for assigning numbers to artifacts, thanking people for gifts, what lists are used.

Librarian-Archivist: Gregor Trinkaus-Randall
Reports to Jamie, leaving Jan., been here 3 months, works in 4th floor storage area. Need to know what he has accomplished while here.

Program Coordinator: Chris Rudomin
Events, talks, Sunday afternoons, Bits and Bytes (5 or 6 times Spring and Fall), plays, tours, tour guides (DEC and elsewhere?) Need to know routine for events.

Office Manager: Geri Rogers
Responsible for David and Debbie. Goal is to send out 100 leters per month asking for money. Manager of Cost Center number which is 20E--from DEC-budget is $60,000 per year.

Secretary: Debbie Sterling
Reports to Geri?

Business Manager: David Bromfield
Accounting, money, leaving in August, MIT. Need total job description.

Store Manager: Carole Strecker
Buying inventory, shipping, mail order catalog. Hours are Sunday through Friday 1-6. Office is downstairs.

Store: Linda Davidson
Merle Insigna

Handyman: Bill Meany
Works part-time, reports to Jamie, leaves before dark

Other: Laurie Burroughs

Lives at Bells, transcribes notes of talks (?), works with Chris on special dinners, takes care of food for Sunday Bits and Bytes.

Meredith Stelling
Works for Chris and Jamie; also helps in store. Working on blurbs for tours. Other jobs?

a)
Dr. Reddy was the leader of a DARPA Speech Research Project for approximately 10 years that resulted in producing the highest performance speech recognizer. The Harpy System has been a model for subsequent commercial systems and for the training of researchers and engineers who have continued in speech research.

He has played a similar, but less dominating role in the understanding of vision.

Finally, he has been a key member in the Artificial Intelligence community.

Most recently, Raj has originated and headed the Robotics Laboratory at CMU. This effort has resulted in several practical results in robotics.

b)
I believe he is in the top 5 speech and top 20 Robotics researchers.

c)
The areas of Raj's interests are quite broad. Most recently, Raj has been a member of the Paris Group. This research group has a goal of providing significant computing to people in both underdeveloped and developed countries through various techniques.

d)
Dr. Reddy has lead the teams. His leadership has included direct work, indirect motivation and the supply of ideas.
7 April 1983

Moira Roth
Visual Arts Department
University of California, San Diego
La Jolla, California 92093

Dear Moira Roth:

From looking at Cohen's vita, it would seem he easily qualifies for someone who's attained national and international recognition. I'm not in the art world. I don't know how he's regarded except that he seems to have an excellent reputation.

As a computer scientist, I think he's built and continues to build pioneering, rule-based programs. His engineering ability is quite good too, as he's also built various drawing equipment.

From a personal standpoint, I've enjoyed the interaction with Harold since 1977. I've tried to be supportive of his work by sponsoring equipment grants through Digital Equipment Corporation and recently a VAX-11/750.

It would seem there's a strong case to be made for the promotion of Harold Cohen to Professor VI.

Sincerely,

Gordon Bell
Vice President, Engineering

GB5.3
1 June 1983

Ms. Linda Mihalko
Executive Assistant
Marconi International Fellowship
333 Jay Street
Brooklyn, New York 11201

Dear Ms. Mihalko:

I would like to recommend Dr. John McCarthy for the Tenth Marconi International Fellowship Award.

I have known and worked with Dr. McCarthy since the early 60's.

In 1961 while a consultant to Bolt, Beranek and Newman he was instrumental in defining and implementing the first timesharing on the PDP-1. Later, at Stanford, he built a timesharing, Zuse, on a much more advanced PDP-1. He was a consultant to me and Digital in defining the PDP-6 -- a machine which was designed for timesharing and to be able to execute the LISP Language effectively. His invention of LISP is well known, and for the last 25 years has been the basis for implementing Artificial Intelligence Programs. John continues to have innovative ideas in computing, including forming the LOTS (Low Overhead Timesharing) at Stanford so that students could have access to computing.

As head of the AI Lab at Stanford, John provided an environment where much of the early ideas in AI were formed, including: computer music and art, robotics, television based CRTs, computer aided design, etc. all of which are basically interfacing people with machines.

Sincerely,

C. Gordon Bell
Vice President, Engineering
Professor, on leave, CMU

GB5.46
May 4, 1981

Dean Louis Padulo
Boston University
School of Engineering
110 Cummington Street
Boston, MA 02215

Dear Louis:

One of our engineers, Thomas Stambaugh, has asked me to write you in regard to teaching at Boston University in an adjunct position. I believe his resume accurately reflects his work. As you observe, he is articulate, and as such could probably do a good job teaching an introductory course in computer systems design.

I'm sorry that we have not provided sufficient challenge for him here, such that he feels it is necessary to get gratification in this form. However, I'm delighted that he is remaining committed to engineering, and support this move.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:swh
GB2.S5.44

GB0002/40

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Subject: **REGARDING MCA'S, VENUS & 2080'S AND RELIABILITY**

To: Ron Bingham, MR1-2/E85
Bill Demmer, TW/D19
Per Hjerppe, MR1-2/E78
George Hoff, MR1-2/E47
Bill Johnson, ML12-1/T32
Andy Knowles, ML10-2/A52
Alan Kotok, ML3-5/H33
Jud Leonard, TW/C04
Dave Potter, TW/C04
Dave Rodgers, TW/C04
Bob Stewart, TW/C04
Bill Strecker, TW/A08

Date: May 1, 1979
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

Pat Sullivan put the priorities of Dolphin at RAMP, Performance, Cost while Venus was Cost, Performance, RAMP.

I just came from CMU and the perception is that VAX's are reliable and 10's are big and not so reliable. We must not/cannot change this with the new machines!

Let me suggest there are even other metrics: time to market, development cost, simplicity cost-includes monthly service cost. My priorities feel like:

1. Cost-including monthly service cost (that'll get the RAMP goal).

2. Time to market, development cost and simplicity (also address RAMP).

3. Performance -

MCA scares me because of the high development cost, the need to make an ECL breadboard for checkout and modifications and the long turn around time and high cost for modifications. Let's go for a really straight forward circuit family, simple packaging scheme and be satisfied (hopefully) with the resulting performance. If this is not the case, then get the power via vectors added to the ISP or by multiprocessors, or something that is very straight forward. Let's be creative with simplicity.

GB:swh

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Ron Bingham	MR1-2/E85	Bill Demmer	TW/D19
Per Hjerppe	MR1-2/E78	George Hoff	MR1-2/E47
Bill Johnson	ML12-1/T32	Andy Knowles	ML10-2/A52
Alan Kotok	ML3-5/H33	Jud Leonard	TW/C04
Dave Potter	TW/C04	Dave Rodgers	TW/C04
Bob Stewart	TW/C04	Bill Strecker	TW/A08

September 10, 1979

W. Randolph Franklin
Assistant Professor
Rensselaer Polytechnic Institute
Troy, New York 12181

Dear Randolph:

It was nice to finally meet you at the Brown Computer Science Inaugural Seminar.

Having looked at my schedule, this academic year, I must decline. Thanks for considering me.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:swh
GB0004/44

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GB3.S1.43

I N T E R O F F I C E
M E M O R A N D U M

TO: Company Car Department

Date: March 4, 1982
From: Gordon Bell
Dept: Engineering
MS: M112-1/A51

Ext: 3-2236

EMS: @CORE

SUBJ: COMPANY CAR AUTHORIZATION

This is to authorize the extension of an additional three (3) months of the use of a company car to Don Hooper, Badge: 97016.

The charges for this will be to Cost Center 383.

____

Gordon Bell
V.P. Engineering

No, No, No. Such a report by Larry and I flies in the face of our trying to build a set of responsible, independent engineering managers. If we want responsibility, we don't build a reporting/tracking system to watch 4000 people...requiring at least 10 people just to keep it up to date. We have two people just barely reporting on the projects! I don't want any more centralization. This might be part of project accounting, so we can get a report on projects and people on them. If we want to audit the groups this way, then let's put it in Win's Operations Review! I want more designers not people and thing counters!

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Subject: **Request for Data by February 1**

To: George Plowman, ML5-5/E97

Date: 10 JAN 79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

follow up 1/22/79

I'm giving a talk and need some standard data about your area that I presume you have.

If you don't have it or can't find it, let me know by January 22.

Generally, I've seen these curves somewhere.

Specifically, I need:

1. Cost of various kinds of phone lines and switching systems versus time.

2. Cost per bit/sec. of various lines and switching systems versus time.

3. Cable TV cost versus time.

4. a. modem speed, b. cost, c. cost/byte/sec., versus time.

GB:ljp

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Subject: **Request for Data by February 1**

To: Ralph Coffman, ML4-3/A20

Date: 10 JAN 79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-
2236

follow up 1/22/79

I'm giving a talk and need some standard data about your area that I presume you have.

If you don't have it or can't find it, let me know by January 22.

Generally, I've seen these curves somewhere.

Specifically, I need:

1. Cost/book versus time for various sizes.

2. Cost/byte of book versus time for various sizes.

3. Mail cost of a letter versus time.

4. Mailing cost/byte versus time.

Also, could you get me a few, quality articles on the UK television experiments for 2-way cable TV? AT and T's ACS?

GB:ljp

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Subject: **Request for Data by February 1**

To: Mike Gutman, ML3-6/E94

Date: 10 JAN 79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

follow up 1/22/79

I'm giving a talk and need some standard data about your area that I presume you have.

If you don't have it or can't find it, let me know by January 22.

Generally, I've seen these curves somewhere.

Specifically, I need:

1. CCD and Bubbles cost/byte (for various sized memories) versus time.

2. Tape cost/byte/sec. of drive and media cost/byte versus time.

3. Same for disks.

GB:ljp

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Subject: **Request for Data by February 1**

To: Joe Zeh, WZ2

Date: 10 JAN 79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

follow up 1/22/79

I'm giving a talk and need some standard data about your area that I presume you have.

If you don't have it or can't find it, let me know by January 22.

Generally, I've seen these curves somewhere.

Specifically, I need:

1. Design time for various past memory, processor, peripheral chip design densities. Can we put Fonz and our parts on this? (Here, I want to see the effect of complexity on design time. -- There's some standard curves here which I don't have.)

2. The cost/bit for MOS and bipolar ROM, relative to RAM versus time.

GB:ljp

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Subject: **Request for Data by February 1**

To: Stan Pearson, ML12-2/E38

Date: 10 JAN 79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

follow up 1/22/79

I'm giving a talk and need some standard data about your area that I presume you have.

If you don't have it or can't find it, let me know by January 22.

Generally, I've seen these curves somewhere.

Specifically, I need:

1. CRT cost versus time for various levels of intelligence.

2. Printing terminals versus time for various speeds.

3. Cost/char./sec. of printing terminals versus time.

4. Same as 2 and 3 except for line printers.

5. Cost of paper/page for various times.

GB:ljp

August 30, 1979

Gordon
14533 Kazan Street
Irvine, California 92714

Dear Sir:

Please send me information on your Mnemodex System.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:swh
GB0004/42

+---------------------------+ ID#0286

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Subject: **Resale of Modems and Installing Interactive Computers**

To: Vince Bastiani, Bruno Durr,
Ted Johnson, George Plowman,
Jack Shields, Chuck Stein

Date: 10 OCT 78
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

CC: Marketing Committee,
Roger Cady, Dick Pascal

follow up 10/24/78

Should we OEM modems?

It seems to me our customers really have a painful time installing total systems as there's a free-for-all with many services and options available from the operating companies. Smart users buy their own modems. Furthermore, we could provide a better, more cost-effective solution, get more system control, ease the cabling problems and minimize space, if we sold a complete system with modems.

We get the pain, why not get the profit?

Does anyone in sales have an opinion (or understanding) here?

I still see the communication area (P/L? Product? Field Skills? CSS?) as a major strength/thrust that marketing and sales should deal with. Can we get it on the agenda for resolution?

Vince, have you ever heard of Gandoff Modems? Dave Lilie of NOAA (303-499-1000, ext. 4171) has the poop.

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Win Hindle	ML5-2/A53	Ted Johnson	PK3-2/A55
Andy Knowles	ML5-2/A53	Stan Olsen	MK1-2/A57
Bill Thompson	ML12-1/F41		
Vince Bastiani	MK1-1/M37	Roger Cady	MK1-1
Bruno Durr	PK3-2/S56	Dick Pascal	PK3-2/A66
George Plowman	ML5-5/E97	Jack Shields	PK3-2/A58
Chuck Stein	ML5-5/E97		

GB3.S10.33

00 CORE DECGRAM ACCEPTED S 004118 O 348 06-DEC-82 17:14:46

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TO: SAM FULLER

DATE: MON 6 DEC 1982 2:09 PM

FROM: GORDON BELL

cc: JACK SMITH

DEPT: ENG STAFF

EXT: 223-2236

LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5183917643

SUBJECT: BUILDING A FIRST CLASS RESEARCH GROUP

The WCRL really looks good. What concerns me now is overall research at DEC, and what your role is in it. The group here looks a lot weaker and even more decoupled to the rest of the company. Eg., we want Forest to be involved in the product review, but no one knows who is doing what here. I've tried to get a rise from them, but got none.

You could get someone overall, or you could strengthen this part... because you are fragmented, as technical director, into a strongly co-ordinating role in architecture. Also, there's all the needs we have to do external research (eg. CMU). There's also an opportunity to assist in this external research by building experimental machines for universities... like I believe IBM has decided to do. This would help us intellectually and with research, as well as the universities.

As part of the research charter, I would like you to take on the CFM program, or get rid of it. Alpha Omega is really flourishing, and needs a leader too to co-ordinate the flow of ideas from it into DEC.
Again, I see this as your responsiblility.

We have Ken's encouragement to go out and get funds for research. I think we need to do this! We haven't moved, and I am going to continue to push you to do it. Right now, I'm frustrated

because we
can't get the Dataflow compiler work done, along with the GaAs work.
ARPA should fund them. Nothing's moving!

There's a lot to do!

<name>
<address>
<city,state>
<tel#>
<as of>
<>

<name>BOCHAGE
<address>
<city,state>WATERTOWN
<tel#>
<as of>11/78
<>

<name>LA PETIT FERME
<address>
<city,state>NY
<tel#>
<as of>11/78
<>

<name>LOCKE OBER'S
<address>
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<tel#>
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<>

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<tel#>
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Joe Carchidi	no guest
Charles Denny	no guest
Andy Goldstein	no guest
Judy Jurgens	no guest
Don Monroe	no guest
Kathy Morse	no guest
Kathy Norris	no guest

FALL 79	NAVAL RESEARCH LABORATORY TITLE:	WASHINGTON DC
2/28/80	ACM - Distributed Processing TITLE:	ADL?
	<u>VISIT</u>	
3/20/80	Case Western TITLE:	
?	TI, Mostek, Intel, Motorola, Harris TITLE:	
80-81 Series	CMU Distinguished Lecture Series TITLE:	
?	Syracuse U (Prof. Oldfield) TITLE:	

ENGINEERING

Vax & I/C Program Manager	GB?	V 0
Interconnect	Demmer/Rodgers/Plowman	V 0
High End Vax, 10/20 migration	Ulf	V 0
Hydra	PVR	V 0
WPS plan		V 0
Graphics Display Definition		V 1
Electronic Mail	Alusic	V 1
LSI-VAX Definition	Clayton	V 2
CAD Review	BJ/Kusik	V 5
LSI Status Review	Cudmore/Green	V 5
Importing TEX	Glorioso,Lane,Gilmore	I 1
Performance Understanding--VMS	Potter	I 5

ENGINEERING ADMINISTRATION

Low End Conflict	Stan/GB/Dick/Bruce	GB
4		
Organization Study (Hendrick's)	?	GB
10		
Getting good Q/M Reports	?	V 5

CORPORATE

Org.Comp.Status/Plans Library	Knowles	GB
10		
Cost of Ownership		

CUSTOMER

PERSONNEL

Engineering Morale	GB	GB
3		
Hiring		
HRP		

HOBBY

Japan Paper		GB
10		
SW Engineering Book Outline	SUPNICK	I
10		
Museum Opening	May 1, 1980	H
1		

MEMOS/PAPERS TO WRITE/WORK TO DO

Personal VAX		GB
0		
Definitions and Systems		GB
6		
R&D Strat.Impact Paper +85 +90	Jim/Ulf	GB
9		
Application Taxonomy		GB
10		
Trees of SW		GB

10
Phil. of budget,org.,mgmt LP/GB ?
10
Cookbook for Reliability
Cookbook for "ease of use"
Why EE vs MBA
J's (UVLSI-VAX) vs MCA

TALK LISTING 9/14/78

FILE #

5-YEAR AWARD TALK
AMERICAN CAN TALK (TEXT FROM NSF)
BASIC LANGUAGE TALK
CAD SYMPOSIUM
COMPCON
COMPUTATIONAL SALES MGR. MEETING--MONTREAL
COMPUTER ORGANIZATION & ARCHITECTURE--COURSE
COMPUTERS IN EDUCATION--CHALLENGE
EDUCATION LECTURE--MANAGEMENT OF TECHNOLOGY
ESG TALK
IBM LECTURES - COMPUTER ARCHITECTURE
INTERACTION AMONG TECHNOLOGY, PRODUCTS AND USERS
IRVINE--THE 2ND DECADE
MCDOWELL AWARD
MELLON AWARD SPEECH
MINI TALK-1
MINI TALK-2
MINI + EFFECT OF SEMIS ON -11 DESIGN
MUSEUM SLIDE TALK--COMPUTER GENERATIONS
NAVAL UNDERWATER SYSTEM
NAVY TALK ANAPOLIS
N.E. TALK
NEREM
NET TALK
OBJECTIVES--HOW TO SET UP
PDP-10 MARKETING
PDP-11 TALK FILE
QUANTUM SCIENCE TALK
RTM'S
STANDARDS & PORTABILITY FOR SOFTWARE PROBLEM
TECHNOLOGY--3 YEARS
VAX-11 TALK OUTLINE

Clayton, Dick Nancy
Dobes, Ivan Ivana

Kusik, Bob	Bonnie	
Moffa, Roy	Nanette	
Sherwood, Will		Cheri Fletcher
Sutherland, Ivan		
Titelbaum, Mike	Barbara	

Total: 7 + 5 + 1 + 2 Bells = 15

Clayton, Dick	Nancy	
Dobes, Ivan	Ivana	
Kusik, Bob	Bonnie	
Moffa, Roy	Nanette	
Sherwood, Will		Cheri Fletcher
Sutherland, Ivan		
Titelbaum, Mike	Barbara	

Total: 7 + 5 + 1 + 2 Bells = 15

GB0003/72

Note some criticisms got answered later on. I've left the comments as I read the paper in order to see when I thought of it.

1. Definitely want it de-thesized w/photos, figures added. Remove parenthetical footnotes. The work should maybe use or at least reference the difference in the invention paradigm presented by Eric von Hippel of the Sloan School. There are other people there that might be interesting to reference - Ed Roberts,? Paradigm of person-type: scientist entrepeneur, manager, gate keeper, mentor, etc. as it relates to motivation of each worker! This

characterization of roles is really important and missing!

2.Referees: von Hippel, Brian Randal, Willis Ware (Rand)?, Harry Huskey, Fred Gruenberger, Phister (good reference) - also would be a great co-author to redo this if possible.

3.There's probably some ties that he may not know about that I wrote in Bell + Newell. Eg. Wilkes at Penn, Huskey at NPL, that made for information exchange. B+N time line has many of ideas leading up to C. Also the COSERS report has (will have if it ever comes out) the key hardware ideas in machines. I'll have to re-arrange them.

4.Lack of understanding of evolution see COSERS + (B+N), learing curves, limits of technology, especially scientists vs. mathematicians vs. engineers.

5.Need the paradigm of individual motivation versus team work and funding. Calculators were done by individuals. Babbage got funds, advanced test but failed on a C. There seemed to be minimal awareness of others work.

6.He must have a paradigm of innovation consistent with other work...see! Also a taxonomy of paradigms would help in a separate chapter.

7.Observe that all calculators were individual efforts and the C was a group effort. The people who might have built the calculator would have had to get together. The time to do this is approximately 10 - 15 years!

. Should really mention Ludgate too. Bletchley's work is too light.
. Defense is underplayed as a market-motivation - source of funds. Note on cost - benefit, annihilation allows for high costs.
. Would like to identify + label forever generations. Try:

5 VLSI
4 LSI

3   MSI
2   Transistor

A.P.C. 1 "Reliable" Vacuum Tubes <-----> coincident with <---- Information
the computer strange is electronic

B.C. or B.P.C. (Before Programmable Computers)

1 Relays (Electro-Mechanical)
-- <Begin use of electron-flow to control
information processing

2 Motor driven mechanisms (important)

3 Mechanical (gears, levers, etc.)
<Begin possibility for Automaton

4 Manual movement of beads, rods,

5 Stones, tables, paper.

p2 - It is clear that the C is an epochal invention.

Time is wrong measure! It's technical time (in units) see measures by Fusfeld. Fusfeld is right, this work using time feels wrong!

C is significant because it is embodiment of "process". It supplements or supplants other information processors (eg. humans, special control mechanims, systems of flow) by its ability to process (compute), store, switch, transmit, transform/transduce information!! (This is very pervasire and includes telephony for example.)

The computer is as significant as the idea of mechanical mechanisms (wheels, motion conversion,...)

The key inventions are probably only four so far:

1. Mechanisms - formation of matter to permit organized motion of mass.
2.Mechanisms to make other mechanisms.
3. Energy and chemical conversion -
3A. Possibly there is electronic mechanisms - where matter is formed to permit motion of electrons!
4. Computers -

Interviews: Forrester? Wilkes? Kilburn? <---- no references!

5. B.S. a computer is well-defined mechanism! Poorly written - needs algorithm and leave of interpreters. The discussion with computer scientists doesn't help.

p12 - no choice. Look at speed, reliability, and size (also design technology)

Shannon's thesis was important here...he references it, but used later.

p19-20 - why sci/dp distinction under Babbage? earlier or late in writing?

The argument here on sci may say that it pushed harder than business for the stored program computer.

Note age of people, eg. Babbage is interesting (important?) - should there be a table with significant factors (characteristics) of people involved.

p28 - Note Buyer-Seller paradigm |
| in Hollerth Story vs. Nasa, TVA,
| NSF paradigms
Note Breakaway paradigm |

p30 - Eccles Jordan flip flop was essential.

Requirement for a C.
- gates +
- memories for processor and program
- I/O - Teletype?

von Neuman ----> blind alley by long word

Note Aiken's failures: Little effort to "engineer" and understand technology. Non-engineering environment!

He was always sub state-of-the-art, machine weren't interesting. and 1 generation behind:

MK I Mechanical (motor driven) - the best; IBM built it (could have been relays ----> see Stibitz Bell Labs)

MK II Relay 48 ----> should have been v. tubes

MK III Electronic 51 -----> ok, but not a decent<?> memory! (You should look at crude engineering.)

MK IV Drum 52 ----> vs. Whirlwind

Bush treatment is neat (should cite SNOW's book on the two cultures and Lindaman - Tizzard Feud.

Interesting role: there are organization + people who become inhibitors -

e.g. <u>Bush</u> who was pushing DDA's + Analog
e.g. Government by standards. Note also a concept of negative work to   inhibit.

Whirlwind - Number of tubes, -- reliability
- Real Time really important (read Redmond + Smith manuscript)
- Scopes
- Parallel
- Core greatly under estimated

(Note importance of Gov't Buying of working machines.

p81 transistors weren't incremental & were significant (probably pivotal) to evolution as we now know it. See the figure.

Performance levels approximately Machines Ability approximately TECHNOLOGY

. simple 4 functions
. complex pre-programmed functions
1st generation ----> . universability
. real time
. higher level languages (compilers)
How are we now ---->
. interpretted lanuages such that non machine language interface is possible.
Machine understanding
-----
to C . human speech input-output

Chapter 3

No. WW II created a whole theory of reliability analysis that did NOT exist in 25-30! The early radios in WWII didn't work. Do the research on this important theoretic underpinning. A C was out of the question. Agree C would have been invented without a war Here Shannon's work ('38) was important - should do research to see what understanding was in automatic switching which Bell had.

I still see no memory available. Thus how a C?...
Teletype ASR was important - necessary for memory. Note the concepts (Architecture) have always just barely streched reality. Beyond this is called Science Fiction.

Supply Constraints = conventionally call Technical Push

conceptual (Architecture)	physical technical
. Turing paper	. Memory technology
. Boolean algebra applied no design	. Tube reliability
	. Relay

p85 - I don't believe it's fair to say Babbage did all those things - We've "read into" history more than is there.

Alternatively once a basic idea is given, just like a theorem in mathematics, it's easy and straightforward to invent the rest (i.e. come up with all the useful corollaries)! Then a technology which determines what to do:

for mechanical - Base 10 is natural because large #'s can be
represented for electronic, it's harder (un-economical to
represent >2, hence base 2.

p89 - Am unconvinced about statement that I could have been built in late 20's (versus mid - late 40's)!! There's work to do to prove it. I'd read the MIT R + D Lab work for state-of-the-art Radar did much to make pulses & counters. See also above. Is there an issue of management of projects? (This was a very large one) (I'd certainly list project scale of management as a supply limiter.

p89 - Demand

Didn't it simply take the war to get a fundor that would put up enough $'s? Read Whirlwind article and book by Redmond and Smith. I claim Whirlwind was the first, properly funded C proejct - look at it vs IAS (look at results too). IAS was a junky non-functional machine. The great thing about the mathematicians (e.g. vonNeumann) is that they wouldn't help the gov't bureaucrats kill Whirlwind.

Talking about firms is so limiting. Most early invention of C and calculators were by individuals, not firms. Occasionally, the individuals had to form a firm to build it. Some wanted to for the wrong reason ($).

Revolutioning invention are not firm based
Evolution invention are not firm based in neo-classical way. This has been proved many times.

Read the von Hippel stuff. Later C-based inventions come from user or University - based machine. Unlike many inventions, the user -- designer and hence, the more than rapid evolution. Note try these extensions:

Floating point
Compilers

Time-Sharing
Interactive computing
One-level store + memory segmentation
Data bases -
ALL the applications languages
Real time computing

Neo-classic vs. behaviorist theory is not true. The computer has been largely outside the classical firm. Use this model to show why firms like GE, RCA, etc. were unsuccessful. I submit that for a variety of reasons (double learning curves occur for transistors in both computer and consumer industry, user pull, new developments) C's evolved much more rapidly than anything else and those who operated firms as neo-classical to maximum profit got creamed because the time constants were different. The model has to reflect the incredible evolutioning time constants and the constant implied obsolescence.

p112 - Be careful. The Hollerith work is probably based on something mechanically fundamental (eg. 4-bar linkage), or 7ms. electromagnetic or a magnetic material. Note Babbage failed due to Manufacturing technology in about the same way you predicate a more complex device at about the same time.

p114 - Note the irony of all the adding machines Company's that weren't out of business where electronics came in. This should be included (Friden, Monroe, Marchant). Rarely does a company who has no research ever do it. Rarely does a company switch base technologies.

p114 - Ugh. The groupings are poor and probably wrong.

Might read Turing's Biography (by his mother)

p124 - Also physicists usually aren't concerned with reliability...hence, ENIAC has built because they didn't know better. Contrast with MIT (who did pre-product breadboards) and IAS or IAS ala ILLIAC I (and copies).

I see Aiken operating exactly like the Moore School except 1 generation delayed. Most likely because he operated with a more closed mind. (The others were experimental physicists?) He <u>eventually</u> got there. Was he too head strong to listen to anyone else? to conservative?) <u>Ultimately</u> there was competition when MIT went after the Moore School (but by there E-M left for their own business).

p134 - I have trouble with economic view as stimulating invention in machines. To market them ultimately yes. Mostly CS is in search of the ultimate - building a machine that rivals man. This has been true for a 1000? years... and probably shickard too. Certainly Babbage and the other machines; market is incidental.

A machine is an embodiment of scientific knowledge - unlike pure science of mathematics which is just the finding of it without application. Hence, CS is both engineering and science the way it's played. Read Perlis, Newell, + Simon "on CS" in <u>Science</u>.

<u>Chapter 4</u>

Is too in. Can it be re-written, because the triva-like talk are not apparent to non-economist.

Labor saving isn't necessarily where it's at. We do things that weren't ever possible - eg. no organization could be built so large without C's, e.g. Airline scheduling, space shuttle.

Chapter 5

Note NO PATENTS spur invention. What about Los Almos + Livermore<?> effort.

Move Chapter 5 back and cut B.S. Stuff needed for Ph D that has no imperial data for backup, and is typical of the verbage needed by Yale and symbolic of Yale's graduates. The sophomric diagrams here about economics is really in bad taste! Nothing backs up this B.S. This is a non-analytic, B.S. thesis, but possibly an interesting story when made complete. Don't clutter it with the social non-science (a paradox) needed to get a degree.

Chapter 6

Too much B.S. why not put specific stuff on Chapter 5 there too. Show % of government C buying vs. time. Can it be argued that government was the only buyer, hence, it evolved C's rapidly (i.e. clear market target). This certainly holds for super computer development (i.e. CDC 1604, 6600, 7600, STAR, Cray 1).

Note single buyer-seller paradigm...plus Cray!

Chapter 7

There is more than one way to do a task. Programs or algorithms aren't patented (and that's what C's are). Also rapid evolution is to side-step patent. Many significant works e.g. COBOL is works of the standards group.

p234 - Sorry MIT + Forrestor got $13M or core patent.

I like time line diagrams.

April 13, 1981

Robert J. Robinson
22 Locust Lane
Clifton Park, NY 12065

Dear Robert Robinson:

The draft report looks fine. I concur with the theme of the

80s: Transitions.

If you're in the area and want to chat, fine. Alternatively, why don't you give me a call some evening and we'll do it by phone?

Since you might be interested in industry, I'm taking the liberty of sending your vitae to several people here.

Glad to hear from you.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:swh
GB2.S5.13

00 BURT DECGRAM ACCEPTED S 11799 O 32 06-DEC-81 19:20:36
****
* d i g i t a l *
****

TO: KEN OLSEN DATE: SUN 6 DEC 1981
7:19 PM EST
FROM: GORDON BELL
cc: WIN HINDLE DEPT: ENG STAFF
LARRY PORTNER EXT: 223-2236
JACK SMITH LOC/MAIL STOP: ML12-1/A51

SUBJECT: RE: MARCH ENGINEERING REVIEW. LET'S REVIEW THOSE WHO NEED IT!

Basically I agree, but we have to be able to have a review of the critical product piece of engineering that is not working on the low end. This critical part produces products that pays for the low end hobbies.

Since nearly every group has its own processes for designing and introducing products, we MUST review them. THIS IS NOT THE CENTRAL GROUPS... WHICH WE DON'T HAVE. This would take away from development time, but since these areas are generally poor and have relatively poor interfaces with manufacturing, a review here might make sense. The money is spent within the development group and is the other 50%!

Some of the products that you (as low end engineer) might be interested in are: distributed systems which is building the Ethernet (and we don't have the low end connected to it yet), modems, the File/Print/Computation Server for Personal Computers that we need to make that will run on all our systems (especially the 23 for the stores), what we should do with UNIX (that's being proposed now and we want to get the decision made soon), what software is going to be available to use the VT200 (do you understand that the MAJOR contribution of the 200 is to have a computer in it that has to work with the operating systems and we don't yet have these functions defined yet, and probably the biggest one of them all is whether we can get a DECENT engine for the Personal Computers/Terminals you want in may. I'm skeptical that the world is going to be very happy very long with the 11.

The products you might want to know about as a low end engineer, because the rest of the company is paying for the sand in your sandbox are: chips that will let us have competitive chip and board products (which we don't now have), getting competitive

low end systems (a pricing, manufacturing and disk problem!), asking whether our VAX products are competitive in the next few years (I'm worried and would have used the March meeting to make sure that this gets fixed!!!!), reviewing the comm plan
(which seems to be coming around nicely because they have had to do their homework and because they have to SHIP Ethernet for the 36-bit folks, how to have a compatible and competitive
36/32 bit product set that will get us the most business with Jupiter.

There's a real biggie that could save about $100 Million in development by NOT introducing the BI. I want to get this settled by then and use that date to make the decision.

In short, I applaud having a whole bunch of people go ahead and work on products for May. Let's excuse them from the meetings. Let's decide who we are going to excuse, then let's demand that these other loose ends get tied up. We can not flounder on these critical issues.

I think it's possible to have one group walking and another group chewing gum at the same time. Are we capable of watching the walkers and listening to the gum chewers concurrently?

Basically, there are many areas that have to shape up. They all need the rigor of a review to clear their heads.

HOW CAN WE GET THIS REVIEW AND CHANGE OF DIRECTION?

GB3.S2.48
00 BURT DECGRAM ACCEPTED S 33892 O 309 24-JAN-82 19:27:37
****
* d i g i t a l *
****

TO: ENG STAFF: DATE: SUN 24 JAN 1982 6:36 PM EST
JACK SMITH FROM: GORDON BELL

DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: REAL REVIEW OF NON-PRODUCT ENGINEERING GROUPS

I think we got a basic understanding of what a real review might look like. What youse think of the following?

Our review meeting was productive in that it showed we had several project areas which have just evolved to be there, and
there's an inadequate feedback mechanism for control of the direction and output of work. This situation has evolved because
we all direct our management in engineering at the product output, and the project part that feeds this output is left up to
the manager. I see these mechanisms:

1. givem the money, trust em
2. givem a base budget, trust em, and then let them sell services

   This is where we are in many of the areas. Given that the customers need some specific work, there's always adequate $'s
   to match the growth and aspiration of the manager cause he can
   always "hold-up" his customers for the real work, while he does what he wants.
3. givem a base budget, review the base work by the customers and let them sell the rest.
4. put all the budget in the systems' groups.
5. have me or some other autocrat review and decide their budget
   according to what I think are the needs, in conjunction with
   any kind of input.

NOW
We have operated at 2 for some years, continuing to squeeze the

base budget. The resulting growth while sometimes less than the
product groups, appears to be significant. At our next review,
this total growth has to be reviewed, INDEPENDENT OF THE FUNDING
SOURCE! (DEC is an ideal environment for both the entrepeneurial
and ransom-type manager). The sources of funds abound: product
lines, many manufacturing plants, manufacturing overhead and
flow, various seed money, etc. All in all, I think we may manage
this better informally than say TI which has an incredibly
complex system and the decisions seem to be made at a very high
level (expensive and unimformed folks).

WHAT WE SHOULD DO TO REVIEW THE NON-PRODUCT GROUPS
There appears to be no alternative than to have an extensive
review of the projects by the customers in order to set the
priorities and budget. Rather than involving all the Engineering
Staff or even all the Product Engineering Managers, I believe we
must have small reviews, chaired by the lead customer of an area.
The review includes BOTH the part that's allocated and the part
they sell to various customers. Here's a starting point:
Physical Interconnect/Packaging Power-Thompson
Technology aimed at high end and mid range and fast turn-aroung.
Fagerquist (chairman), Demmer (or surrogate), Saviers, and Avery
(here, I'd like to get Gonzales to be the representative, plus
someone to represnt the manufacturing sites. (5 persons)

Components-Metzger
Same group

Semiconductors-Teicher
Gutman (chairman), Demmer, Fagerquist, Saviers, plus someone from
mfg.

TOPS-Holman
Could be either group or whole hardware PEG group

Fuller, and Bell Portner/Staff
BJ (chairman), Demmer, Saviers, ?

If such a review could be successful, then we might ask that a similar technique be used for the non-product part of each of the engineering groups... together with some outside audit.
For now, I hope we are all committed to a thorough review of what we do.

GB3.S2.59
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* d i g i t a l *
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TO: RICK CORBEN DATE: MON 31 MAY 1982 10:05 PM EDT
EMC: FROM: GORDON BELL
JOE REILLY DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: MORE ON WHAT NOT TO DO

I believe the terminals area is ripe to cut.

There's also a printer that we are cycling up to do that is budgeted at 4M that could be done in 1/2 the time and less than 1/2 the budget in Japan. The parts are all there. Why cart them over here?

Of course there's the whole monitor, video, workstations morass with long projects requiring much money.

Note Walt's suggestions for some places to look.

I see several big areas for projects to cut in software:

1. The whole Office effort, given that we're evolving to a reasonable set of software based on buyouts and make dos. This is especially necessary in light of the lack of output there.

2. There are many 4th generation languages that we ran across in the A/D review. These would all kill us if they came in.

3. Based on my interaction with the group that's bringing us DECalc, I would like to see that whole group abolished. They almost copied Visicalc. This is basically immoral and I would believe we should be sued over this sort of behavior! No way do I consider this the mark of an ethical company to do this kind of software plagurizing!!

ATTACHED: MEMO;43

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* d i g i t a l *
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TO: GORDON BELL

DATE: MON 31 MAY 1982 9:40 PM EDT

FROM: WALT TETSCHNER
DEPT: TERMINALS ENG
EXT: 223-6788
LOC/MAIL STOP: ML5-3/E12

SUBJECT: PROJECTS/PROGRAMS WE SHOULDN'T BE DOING

Some projects/programs that I view as questionable are:

1. Marlboro & Tewksbury are purchasing CAD systems from two(2) different vendors. The groups are in agreement that only

one(1)
of these vendors will win. This redundant approach has been
justified on a "cover your bets" basis. My feeling is that we
can't really afford the luxury of multiple approaches except
in rare cases. I believe that these efforts are costing in the
area of $.5M each.

2. The Marlboro & Hudson chip CAD projects seem to be on a collision
course. The fact that these groups can't even get together & have
a rational meeting on the two(2) approaches speaks for itself.

3. We've got lots of human factors efforts that seem to be totally
decoupled from any real product development(CRG, Industrial De-
sign, Small Systems Software,...) These effort should be merged
totally into the product groups & I'm sure that we'ed save a lot
of redundant effort.

4. We're spending close to $1M to have a group hype the Unigraphics
CAD/CAM system. The basic function is needed & useful but should
be done for a small fraction of what we're spending.

5. The External Commercial Development has seemed to be totally in-
effective as a catalyst for external buyouts. I don't know of a
single significant product buyout that has been sparked by this
group & we seem to be spending a lot of $s to do it.

GB3.S5.58

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+----------------------------+                                  ID#374
|   |   |   |   |   |   |   |   |
| d | i | g | i | t | a | l |  i n t e r o f f i c e   m e m o r
a n d u m
|   |   |   |   |   |   |   |   |
+----------------------------+
```

Subject: **Review of All Future Terminals**

To: Dick Clayton, ML12-2/E71
Bruce Delagi, MR2-1/M64
Roy Moffa, ML5-2/E93
Stan Pearson, ML12-2/E71
Dick Schneider, ML11-4/E53
Art Williams, ML1-3/E62

Date: 5 DEC 78
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

I would like to review and sign off (by using a breadboard) all future terminals at a point where they can still be modified beginning now.

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST: Dick Clayton ML12-2/E71 Bruce Delagi MR2-
1/M64
Roy Moffa ML5-2/E93 Stan Pearson ML12-
2/E71
Dick Schneider ML11-4/E53 Art Williams ML1-
3/E62

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION DATE: WED 26 MAY 1982
7:41 AM EDT

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: REVIEW OF PRODUCTS AND PROJECTS WE SHOULDN'T BE DOING

EMC is going to do a full scale review of the projects we are doing and have to do a forced ranking of the projects in order
to reduce the engineering budget.

I'd like to solicit a listing of the non-critical things from within engineering, especially our senior consulting engineers
who know about both the quality and timeliness of them.

Some of the things that come to mind to be reviewed critically
in the area of software revolve around make versus buy. Here,
I am tremendously impressed with the CT program to get software
such as NPL running on CT. Also, Personal Software is going to put their software on CT. These are major efforts and we need them, yet could not possibly have staffed up to get them done.

Some of the programs that I definitely do not think we should be doing are: DECSET (buy both TEX and SCRIBE); ANY manufacturing
programs... we should buy all them ala ESG and test them; ADE (NPL and Visicalc are alternatives); DAWN; VISICALC (buy it!);
PASCAL (we have one and ours is late and doesn't use the common
compiler). APL... is it going to come out? I hesitate to mention it, but then there are the 4000 incompatible mail systems... any idea of how to deal with this one?

Conversely, there are languages such as RPG that should have been finished when we have the alternative to do it based on COBOL. I want to understand the function of the Commercial Systems Hardware group too.

Ken has raised concern about the plethora of experts running around, with tin cups that every group feels obliged to have. Of particular concern to me in this regard is ID and human factors and performance folks. The experts seem to take the need to design away from the designers who don't have to worry now about estetics, form or its usability.

These were just a few things that came to mind in the middle of the nite. Could I get a list of the projects and efforts that you think are unnecessary, redundant, going nowhere and that could be eliminated?

"TO" DISTRIBUTION:

RON BRENDER DAVE CUTLER DICK
HUSTVEDT
PETER JESSEL JESSE LIPCON ROBERT
MCKENZIE
AVRAM MILLER PEG: JACK SMITH
BILL STRECKER STEVE TEICHER WALT
TETSCHNER

GB3.S5.52
April 13, 1981

David A. Patterson
University of California, Berkeley
College of Engineering
Department of Electrical Engineering and Computer Sciences
Computer Science Division
Berkeley, CA 94720

Dear Dave:

It was nice to get the paper on RISC. I passed a copy along to several people here who might have a better feel as to what's novel.

The architecture looks clean, and resembles a NOVA or a 6600 at first glance; the register idea is novel. At first glance it seems like the BTL machine architecture. It's unclear there is anything that's counter-intuitive; at least I don't see it.

It's awfully hard to comment on the next logical step since I don't know what the project goals are. It sounds like building the chip is next, which would give some insight into building chips and their use.

Thanks for the paper. Please keep me informed on the progress and give my regards to Lloyd Dickman.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:swh
GB2.S5.14
00 BURT DECGRAM ACCEPTED S 23445 O 36 30-MAY-81 13:27:07

****
* d i g i t a l *
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TO: BRIAN CROXON DATE: SAT 30 MAY 1981
13:22 EST
BILL DEMMER FROM: GORDON BELL
cc: see "CC" DISTRIBUTION DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: REWARD/PENALTY SYSTEM IN ENGINEERING/MANUFACTURING

I think you have a responsiblity to make it visible that you took a risk in putting the 780 out without the usual testing and that this saved a year on the schedule. Furthermore, this
risk wouldn't have been possible without your counterparts in manufacturing.

You state that the people who took this risk have been penalized
within manufacturing, yet we (engineering) have tried to reward the persons who were part of the 780 team. Clearly the 1
year bought us the market!!! It clearly shows up as an anomonly
because it got on the market quicker than any other product.

Recently, we have had longer product gestation times,

resulting
in less than competitive products, and part of these are probably this added time. Others, I might argue, are just a result of problems in engineering, manufacturing or the coupling.

Let's get this understanding out in the open, and also, let's get these manufacturing folks out of the penalty boxes, if they are still around. We need careful, risk takers
like your 780 manufacturing counterparts. I, for one, believe
they are the key to our future... not the paint by the numbers
folks.

"CC" DISTRIBUTION:

BILL HANSON	WIN HINDLE	KEN OLSEN
LARRY PORTNER	JACK SMITH	DAVE THORPE

GB2.S6.56

ID#0297

| d | i | g | i | t | a | l | i n t e r o f f i c e   m e m o r a n d u m

Subject: **Richard Watson, LLL Visit on November 13 and 14**

To: Rich Peebles, ML3-2/E41
George Plowman, ML5-5/E97

Date: 16 OCT 78
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

follow up 10/30/78

Will you please contact Richard (formerly of SRI) and get him to give a seminar on the network research and the computing environment at Lawrence Livermore Laboratory (phone 415-422-1100). He's putting an operating system on the Cray 1 that sounds just like our research.

How can we/should we collaborate with him?

GB:ljp

****
* d i g i t a l *
****

TO: MAURICE WILKES
DATE: WED 12 MAY 1982 7:58 PM EDT

FROM: GORDON BELL
cc: see "CC" DISTRIBUTION
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: RE: RISC

We are all vitally interested in RISC and have been following it with great interest. The code density is more of a problem than people think because our programs have been growing so much, especially programs that are written in LISP which are a lot more like data structures than programs. VAX gets a major boost over the 370 because the code density is about 2 x better and there are fewer tables and data to swap. Programs have gotten bigger at a faster rate than disks have increased in speed.

I don't think RISC will be understood very well for awhile until it gets in a real work versus simple benchmark environment. Somehow having all the registers will mean they have to be loaded and stored during context switching and in certain cases of procedure calls and clearly when there's calls between programs written in different languages where the single compiler is really several compilers and several conventions (unless one thinks they can live with a single language at a time environment).

The other part of RISC that's really not understood is the need for special data types, especially floating point to speed things up. Clearly the RISC chip isn't made for that, but requires support there.

Forrest, Jud, Bill, Sam, Doug and I are all vitally interested and want to understand, particularly in light of the fact that making VAX's is a tough design job with lots of Fortran, Pascal, and Cobol and the operating system built into the architecture. The alternative of a faster but dumb cpu (with no microcode) and a big cache is a different approach using about the same amount of hardware.

The code density and protection in procedure calls from mixed languges etc was a major goal of VAX... so we all want to understand.

"CC" DISTRIBUTION:

FOREST BASKETT SAM FULLER JUD LEONARD
BILL STRECKER

GB3.S5.29

GB0004/20

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i n t e r o f f i c e   m e m o r a n d u m

Subject: **RM80, RA80, RA81, and UDA**

To: Bill Demmer, TW/D19
Bernie Lacroute, TW/A08

CC: Mike Gutman, ML3-6/E94
John Holman, ML12-2/T36
Demetrios Lignos, CX
Bob Puffer, ML1-5/B94

Date: 7/26/79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

Joe Smith, ML8-3/T13
Grant Saviers, ML3-6/E94

I made the decision to stop the work on putting th R80 in the corporate cabinet versus having cabinet compatibility with the RM03. We don't currently manufacture the cabinet in CX. There's much work to do to it and it increases risk in the schedule. There's real progress on the R80 and now's not the time to open this or divert manufacturing and engineering resources for what only gets us increased cost! The empty corporate cabinet was broken on arrival.

We have a real winner in the RA80 and the UDA attachment if we can get people in CX interested in doing it. It gets rid of the MASSBUS baggage. Furthermore, getting volume is essential to getting us the RA81...where we can have the leadership we all want at all parts of the system. Let's get the UDA for the RA80 and the software for RSX, RSTS, and VMS so it can quickly get on the 11/44, and COMET, 11/780. This also gets us the RA81 when it's ready.

GB:swh

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Bill Demmer	TW/D19	Bernie Lacroute	TW/A08
Mike Gutman	ML3-6/E94	John Holman	ML12-2/T36
Demetrios Lignos	CX	Bob Puffer	ML1-5/B94
Joe Smith	ML8-3/T13	Grant Saviers	ML3-6/E94

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+--------------------------+                               ID#0185
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Subject: **AUSTRALIA -- RMS Feedback**

To: Bruno Durr, Ed Fauvre,
Bill Heffner, Larry Portner

Date: 78 AUG 14
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

follow up 8/28/78

I got a fair amount of feedback here that RMS is too slow. Is it? What are we doing on it? Are we putting a cache structure into it for speed?

I got comments from a very bright programmer in Melbourne on Datatrieve. He'll send critiques. Somehow we need to get people like this to review products before they are implemented, not after they're distributed!

GB:ljp

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+---------------------------+                              ID#0276
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Subject: **Review of BASIC, COBOL, FORTRAN, RMS and DCL Compatibility**

To: Bill Johnson

CC: Ed Fauvre, Bill Heffner,
Win Hindle, Bill Keating,
George Plowman, Larry Portner,
Pat White

Date: 18 SEP 78
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

follow up 10/02/78

Win has asked that this subject be brought on Marketing Committee.

Will you put together a way of looking at this? RSTS (BASIC) compatibility on future VAX systems seems to be a possibility, but can we do it?

GB:ljp

FROM: GORDON BELL
DATE: TUE 8 JAN 1980 4:01 PM EST
DEPT: OOD
EXT: 223-2236
TO: PAT BUFFET
cc: JOE ZEH @CLEM
OOD:
OOD: @CLEM

SUBJECT: ROADRUNNER FOLLOW UP: 1/25/80

GB1.S1/7/EMS

Roadrunner looks great, even though I had to read a 100+ pages to get what could have been in a two page project summary, with perhaps 30 pages of appendix. It did prompt some questions:

Why aren't the CPU groups signing up?

Why don't they use it for their interface chips?

Who intends to use it and for what specifically?

Where is the go/no go decision scheduled?

What is the decision process?

Could you get some user to use it concurrent with the design?

Why don't we build the T interface chip this way?

GB:swh
00 BURT DECGRAM ACCEPTED S 37466 O 336 08-SEP-81
17:29:34

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* d i g i t a l *
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TO: BARRY JAMES FOLSOM DATE: MON 7 SEP 1981
21:50 EST
BOB GLORIOSO FROM: GORDON BELL
cc: BILL AVERY DEPT: ENG STAFF
DON GAUBATZ EXT: 223-2236
KEN OLSEN LOC/MAIL STOP: ML12-1/A51

SUBJECT: RE: RE: 3 WEEK CAT SCHEDULE IS GREAT, BUT LET'S FINISH ROBIN FIRST

Please re-read the title: Get Robin First!

I think we need to close on a plan to get the TRIAD built. I thought, apparently erroneously (cause I just got through talking to Ken) that Cat=Triad. If Cat is just a cost reduced Robin, then who cares. We've lost a bundle in all the corporation's cost reduction efforts.

I say the 6 months is too long, by 5 months to get 2 processors
added to the existing Robin structure. Why can't we get the work done by no latter than Nov. 1?

For starters, let's get our product definitions down in writing, with no more than one page. If you note the orginal worry about Robin that started this dialog, it was
What is the software that is going to run on Robin?

If I look at the continuous, unbroken string of about 30 products in this space that have lost the corporation money, it is that the hardware has no software or software support. Now is the time to get this settled on Robin before we add another loser! Also, let's talk about Cat only in terms
of what is from Hw/Sw ... starting now!

First, get Robin straightened out, then CAT!
(Or fly before we walk).

GB2.S8.27

00 BURT DECGRAM ACCEPTED S 35128 O 178 08-SEP-81
12:59:10

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* d i g i t a l *
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TO: BARRY JAMES FOLSOM DATE: SUN 6 SEP 1981
11:12 EST

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION DEPT: ENG STAFF

EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: 3 WEEK CAT SCHEDULE IS GREAT, BUT LET'S FINISH ROBIN FIRST

Right now I hope there is NO effort going into CAT except some
A/D somewhere as to how you get the extra processors into the system. Aaron Boxer was doing this and I hope he and Bob and Don are moving ahead on it.

Mostly I'm worried about the software now on Robin. I have yet to see any sort of plan as to what it is and who's doing it.
To make the market believe we have a serious personal computer
(it's unclear that Xerox did with their small computer), the components appear to be:
.A decent word processor ... apparently this is the Wordstar
.VISICALC
.some sort of Operating System with file system
.BASIC and preferrably in addition,
.Pascal
.Terminal emulation and file transfers to a host... in this case
this is essential cause we are billing it as a part of a DEC system cause our users have VT100's already.

Where are we on these? Could I see the manuals?
When can I spend an hour or so at a system and test it?
(In addition to having Mary Jane and I test the product, I hope
there is some formal testing taking place too.)

It is truly wonderful to see the speed at which this product hardware is being done. Let's make sure it is a Quick and Quality
product and not a Quick and Dirty product.

"CC" DISTRIBUTION:

BILL AVERY DON GAUBATZ BOB
GLORIOSO
KEN OLSEN

GB2.S8.28

00 BURT DECGRAM ACCEPTED S 4317 O 91 21-SEP-81 09:06:55

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* d i g i t a l *
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TO: see "TO" DISTRIBUTION DATE: MON 21 SEP 1981
8:39 EST

FROM: GORDON BELL
cc: ENG STAFF: DEPT: ENG STAFF
BILL STRECKER EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: COMPUTER SCIENCE BOARD REVIEW OF US ROBOTICS

The Computer Science Research Board of the Nat. Res. Council
reviewed the situation in Robotics on Friday. Pat Winston,
MIT
AI Lab. and someone from the Schlumberger Robotics lab
(formerly
of IBM Research) gave position papers. I was impressed with
the
work and the level of Robotics. The direct use and indirect
effects to real time control, vision, image processing,
languages, inspection, and various transducers may be more
important than the products built in the short term. (For
example, much of the processing is on arrays and they need
both
special purpose and general purpose instructions. Most
likely
lots of the functions will be built into special chips such
as a
vision chip that does a 2 dimensional cross correlation with
a

filter to do blurring so as to find surface lines on an image.)

Pat Winston presented a depressing picture regarding Japan. They are absolutely committed and are working very hard. They are building a really advanced LISP machine, are assimilating our most advanced language (Stanford's AIL), and they are structured to form an engineering discipline based on software. In the past they have systematically seeded every US research lab to train their PhD's, while using their own universities to train Master's students. The PhD's then head the teams that do the work. (I've observed this too!) Hitachi has a machine for wire coating inspection and lead bonding control. They are about to release a machine to work in their factories for solder blob and PWB inspection (something we've been after for years!). In general, their work follows an engineering, versus science approach. They do little to advance the overall state of knowledge, but they take the current ideas and apply them in a systematic fashion. (Sort of like DEC in this regard.) I enjoyed the discussion with Pat and got an invitation to spend a day there... despite the fact he complained about the number of visitors in their labs.

The Board's position was:
We believe that Robotics Research is a vital part of computer science and we are particularly concerned about recent advances of Japanese robotics research and products. Furthermore, we would like to sponsor a review to assess the state of the art here versus Japan at the National Academy of Engineering meeting

next October. It appears that there is better coupling between
American robotics research laboratories and Japanese companies
than to American companies. The level of American products
versus the Japanese is lagging and we believe that both research
and coupling to research is the key to competitive robots.

The work going on at the universities and our work is important
in order to ultimately develop and apply robotics. The direct-
and side-effects will be quite large.

"TO" DISTRIBUTION:

ROGER CADY   DICK CLAYTON   BOB GLORIOSO
KEN OLSEN   TOM WILLIAMS   MAURICE WILKES

GB2.S8.22

+---------------+
! **d i g i t a l !   i n t e r o f f i c e   m e m o r a n d u m**
+---------------+

Subject: **Rockwell Communications Study**

To: Al Crawford   Date: 28 APRIL 78
From: Gordon Bell
CC: Al Bertocchi   Dept: OOD
Loc.: ML12-1 Ext.: 2236

I heard a presentation of the above. They are getting out of the AT&T system and building their own. Rockwell has about 100K people, 80K phones, 400 locations and several hundred teleprinters. They spend about $40M and project going to $55-80M. Their traffic is 85% voice, 6% data, 9% teletype and FAX.

Overall their productivity has improved greatly over the last 3 years.

For a communications company their thinking is as backward as ours, although they don't have a centrex to write off.

GB:ljp

December 19, 1978

Mr. William A. Rodgers, Executive
Director of University Computing
Eastern Michigan University
Ypsilanti, Michigan 48197

Dear Dr. Rodgers:

Thank you for the proposal. I've sent it to Jerry Witmore, the Product Line Manager for our Educational Product Group. Since I'm just an engineer, I often don't see the value (market) for ideas, but nevertheless, I'll comment.

We have some microprocessor development systems, and may not be interested. At any rate, the large expense of the package is their support. The mobile computer is interesting, but I don't see why one wants it. The Scope Edit/Sort program didn't come through in the directions you sent. It clearly must be good since your users give it such high marks.

Since Jerry will have a better feel and is responsible for marketing I hope you can work something out with him.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:ljp

CC: Vernon Alden
Jerry Witmore

****
* d i g i t a l *
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TO: SI LYLE
DATE: SAT 23 AUG 1980
12:27 PM EDT

FROM: GORDON BELL
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: MORE ON THE ROI ISSUE. I'M CONCERNED TOO.

What I think we might do is to take the vt100 study and show how by our conventional measures it is great and that it has been shown to be profitable. Then we pose the question do you want to continue our simplistic pc measures or do you want to consider roi? I haven't read the memos on the woods that ko is proposing where he has invited his group vp's to expound in lectures, but believe we have more insight to this mathematical function via burp.

I'd like one of us to give the lecture.

Meanwhile go ahead and get someone to make a memo that shows the vt100 is great as viewed via our simplistic pl measures.

Gary Cole wrote a memo like this on how well the wps 78 did versus the plan (as measured simplistically). Let's take his simplistic memo and give it the treatment ala vt100 for our lecture. Also, I believe you are doing the 780 as a study too.
g

ATTACHED: MEMO;70

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* d i g i t a l *
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TO: STEVE COLEMAN   DATE: SUN 27 JUL 1980
11:48 AM EDT

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION

DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: JAPANESE DISCUSSION AND MORE THOUGHTS ON UNDERSTANDING WHAT TO BUILD

Can you write up your version of this and possibly send it to me by Friday by EMS? Want to try to get the problem formulated and segmented as I raft down the Snake River on 8/5.

Also, appreciate any notes on the OC Woods on organization. Hope you build your version of a product/organizational model.

Am enormously frustrated by not having a good feeling about where we are investing big $'s in plants (and inventory) versus
where the revenue is. For example, we are going balls out to build MOS capacity and design capability. Our management

heads, talent and thoughts are all there. The revenue is all coming from Comet and Venus I believe. We are violating the principle that if we don't sell it, then we should buy it (Have you read the policies on Make/Buy that I try to use in our M/E decison making?). Am really scared when you factor in Intel (who'll clobber us in MOS because they sell it) and Japanese who have key hi end bipolar, magnetic storage
and video and speech processing technologies.

Can I get one of your people to help us address this issue across M/E about segmenting and trying to understand TOTAL investment picture?

Similarly, I think we probably should look at selling disks simply to get the cost and volume and quality... but need a way to look at it. It may/may not make sense, but need to understand!

Note that Ken's model of Briggs and Stratton or Tecumseh as being competitive is probably falactious. Both are probably low growth, but both, no doubt are really backward integrated and automated to the foundry and would believe they are highly automated. Both supply a component to a relatively difuse, market (lawn mowers, garden tractors; air conditioners
dehumidifiers, refrigerators) hence they can dominate. The specials like Harley Davidson or Japanese make their own no doubt. In our case, we are not like Briggs and Stratton because we have only a small foundry (Hudson) which supplies most of the work. Silicon Valley has always been our foundry and we have been an assebly shop supplying to our OEMs in iron and base software. Note that the % labor is significantly
decreasing as we buy more and more out (like the expensive 16K rams). With bigger parts and more performance in the micros cpus, our oems are going to Si valley for boards or chips. Alternatively, the cost is going into the magnetics and if we have volume there and are good, it may be our salvation. It feels like we are merely an assembler and when you consider we are 80% materials and 1/2 our added on manufacture is FAT that shouldn't be there in the first

place, we may be heading toward big trouble in the mid-80's.

"CC" DISTRIBUTION:

SHEL DAVIS WIN HINDLE LARRY PORTNER
JACK SMITH

GB1.S6.43

+---------------+
! d i g i t a l ! i n t e r o f f i c e m e m o r a n d u m
+---------------+

Subject: **Use of ROM**

To: Mike Gutman

CC: OOD, Len Halio,
Oleh Kostetsky, Jim Marshall,
Roy Moffa, Rich Olsen,
Mike Titelbaum, Ed Wright

Date: 19 JUNE 78
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

follow up 7/3/78

The use of ROM for software distribution and/or protection has been studiously avoided by the SDC, Software Groups and Basic Systems Group. A recent article in Computer by Shepard of TI states that this is clearly the way to distribute much software. Can you examine how we can get there?

Can we use the TI calculator form factor?

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Jim Bell	ML3-2/E41	Dick Clayton	ML12-2/E71
Jim Cudmore	ML1-5/E30	Bill Demmer	TW/D19
Ulf Fagerquist	MR1-2/E78	John Kevill	ML1-3/E58
John Meyer	ML12-1/A11	Larry Portner	ML12-3/A62
Bob Puffer	ML12-2/E38		
Mike Gutman	ML21-2	Len Halio	ML5-2/E93
Oleh Kostetsky	ML5-5/E39	Jim Marshall	TW/A03
Roy Moffa	MR2-1/M64	Rich Olsen	ML1-2/E65
Mike Titelbaum	ML1-2/E65	Ed Wright	ML12-B/B75

FROM: GORDON BELL DATE: TUE 12 FEB 1980
4:03 PM EST
DEPT: OOD
EXT: 223-2236
TO: GARY COLE
cc: DICK CLAYTON
BRUCE DELAGI
HERB SHANZER
DICK GONZALES
DON WHITE
PAUL GARDNER

SUBJECT: A BIG ROM FOR 1 FLOPPY? (<1 PAGE) FOLLOW UP: 2/29/80

Why can't we substitute a big rom for 1 floppy? (Does it do much, given that the expense is in the controller?)

What about a big rom, extra ram, and TU58? (This takes extra software in WPS. What would be the cost - especially if we can cram it in the VT100?

We need someway to get the cost down...the packaging and the RX is clearly the culprit. Could we let Dick Gonzales loose for a week on the problem (show him the IBM 5120)? I'm not proposing to hold up the intro into manufacturing, but I'd sure like a less homely, cheaper product.

I am delighted we agreed to only have RL02's as an option to a 278 versus the RLX78 shared disk, much software, long cables, etc.

Overall the plan and spec looks impressive and aggressive. Let's make it happen.

GB:swh
GB1.S1.60

****
* d i g i t a l *
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TO: LARRY PORTNER   DATE: MON 13 OCT 1980
2:25 PM EDT
                                                     FROM: KEN OLSEN
cc: *GORDON BELL   DEPT: ADMINISTRATION
    JOHN HOLMAN   EXT: 223-2301
    EDWARD A. SCHWARTZ   LOC/MAIL STOP: ML10-
2/A50

SUBJECT: BOD PRESENTATION OF ENGINEERING FACILITIES PLANS

At our next Board of Directors meeting, which is right after the Annual Meeting, we will have no presentations except the normal red tape. However, I would like to have you make a short presentation showing where you think we will have engineering facilities in the next twenty years.

Can you make a chart that lists for 1980, 1985, 1990, 1995 and 2000, the percentage of space that today we guess will be in each of the following locations: Northeast, Southeast, North Midwest, South Midwest, Northwest, Southwest, England, France, Germany, Italy, other European countries, Canada, Australia, Japan and other countries.

I know we have not thought much beyond the next five years, but I think it would be very worthwhile for the Board, and for us, to present your thoughts as they are today, so that we have something upon which we can work and for which they can make a contribution.

****
* d i g i t a l *
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TO: DICK CLAYTON DATE: TUE 14 OCT 1980
4:58 PM EDT
BILL DEMMER FROM: GORDON BELL
SI LYLE DEPT: OOD
OPERATIONS COMMITTEE: EXT: 223-2236
LARRY PORTNER LOC/MAIL STOP: ML12-1/A51

SUBJECT: WHY ROSING WENT TO APPLE ... AND US

In debriefing:

1. Challenge of job: build the best, total office computing environment including computer (with no restriction as to what microprocessor to use (I suspect it will be the 68000), copier, Network Interconnect (his preference and belief is to use Ethernet...but this may change), a File Server and a Printer Server. The group is a newly formed division headed by John Couch, former head of software. He has responsibility for the engineering of this, including the introduction into manufacturing. All their software is in Pascal and this is quite significant. Ironically, Apple has a prototype 1 megabit Ethernet running which they could probably get to market quickly. Hopefully, they won't cause it will wreck havoc in the standards world and put another incompatible thing for us all to interface to ultimately.

2. Reward: 40K shares of stock over 4 years, enough to make him a millionare a couple of times over, given that Apple blossoms. Also, better salary with profit sharing and perks to get a better house.

3. He views the fact that he is entering a whole new start-up division as fun, aside from the potential reward. Is certainly looking forward to small company and small group within a small company. He came from DG and certainly has enjoyed and contributed to DEC. His concerns: we have the depth, but we aren't fundamentally preditory and mean like DG, because we are always growth limited and there are too many people with good ideas around. Somehow, he still believes we have too many products cause there is too much history in 11's. We should be supporting VAX more.

4. Is worried about our getting the Personal VAX (though not enough to stay and get it), especially given the rumblings that Andy wants to KILL Nebula. His view is that this would be a tragedy of short sightedness, given all the emerging personal computers and the disdain our customers are beginning to show for the 11's especially in the low end. [Here, we must protect the people we have from migrating to him at APPLE,

cause they have the knowledge to build high resolution scopes.
There are other people he feels are not being rewarded adequately and he, no doubt, will somehow go after them.]

5. Generally, he believes that Apple has and will have no trouble in staying the leader because they are not vertically integrated and because of their organzational philosophies. They only do a task if they can be the best at it (hence, no PCB work or module assembly). Their recent addition of peripherals seems to violate this, but then they may either mean to dominate this area, or are scared by the lack of quality suppliers. They have a very small, very high quality organization and they revel in hiring the fewest number of people they can, and this is reinforced with profit sharing. Hence the more persons, the less profit per person. The stock and rewards are distributed widely in order to motivate, versus the large company where the rewards are mostly to the top few persons who have tenure. DG wasn't especially oriented to motivate the doers, versus the managers of the doers.

Frankly, I think we have a serious competitor on our hands. He has all the technology we have, and very few constraints. The people are both good and extremely motivated.

GB1.S7.34

ID#417

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Subject: **Proposal for Royalties to DEC Authors of Digital Press Books**

To: Del Lippert, BU

CC: Heidi Baldus, BY
Shel Davis, PK3-1/C21
Marcie Kenah, BY
John Meyer, ML12-1/A11
Jack Shields, PK3-2/A58

Date: 1/16/79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

I quite agree to sponsor the royalties for Digital Press at the Operations Committee. Could you get the package together so that it could be there for the January 29 meeting? I'm sorry for this urgency, but since several people within engineering are working on books now, with no real plans in this area, I feel you must drive to get it resolved.

I've had a change in attitude toward a point of view that we have professionals that do not work all their hours for DEC, but merely put in a 40+ hour week, and they are going to write books on the side. The purpose of the plan should be to encourage them to write for us (versus others). Certainly, given that they are going to write, we should support and encourage them to do it for Digital Press.

It's your move, but I would like you to come with a plan in the next few days and I would like to have someone from personnel and legal there to get their respective blessings. Let's get this resolved since it has taken too long and there are implicit agreements being made.

GB:ljp

[Del, please contact Bill Long when your ready to schedule.]

D I G I T A L INTEROFFICE MEMORANDUM

DIST:	Heidi Baldus	BY	Shel Davis	PK3-
1/C21				
	Marcie Kenah	BY	Del Lippert	BU
	John Meyer	ML12-1/A11	Jack Shields	PK3-
2/A58				

October 5, 1981

Ms. Colleen O'Brien
McGraw-Hill Book Company
Hightstown, New Jersey 08520

Dear Ms. O'Brien:

Would you please transfer all my royalty payments to the Computer Science Department at Carnegie-Mellon University effective now.

If there are any problems, please let me know.

Thank you.

Sincerely yours,

Gordon Bell
Professor and Vice President,
Engineering

GB:mal
ID#GB3.S1.10

Account: 04466-062

Reference: 107-X

ID#0236

d i g i t a l **i n t e r o f f i c e m e m o r a n d u m**

Subject: **RSTS Upgrade with VAX**

To: Joe Carchidi, Ed Fauvre, Bill Heffner, Bill Johnson, Bernie Lacroute, John Leng, Julius Marcus, Larry Portner

Date: 78 AUG 15
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

CC: Marketing Committee

follow up 8/29/78

The message is very clear in Australia. The users who have RSTS would like some way of upgrading their current systems to VAX. This could be as weak as a link (DECnet) for current 11/40 - 11/70 systems, but there has to be a plausible, attractive product.

Could we explore what such a product might look like?

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Win Hindle	ML5-2/A53	Ted Johnson	PK3-2/A55
Andy Knowles	ML5-2/A53	Stan Olsen	MK1-2/A57
Bill Thompson	ML12-1/F41		
Joe Carchidi	ML3-4/E88	Ed Fauvre	MK-2/E6
Bill Heffner	TW/C10	Bill Johnson	ML21-3/E87
Bernie Lacroute	TW/A08	John Leng	MR1-1/A65
Julius Marcus	MK1-2/C37	Larry Portner	ML12-3/A62

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! **d i g i t a l** ! **i n t e r o f f i c e m e m o r a n d u m**
+---------------+

Subject: **Running 8s on 11s**

To: George Beason, John Clarke

CC: Dick Clayton, Bill Demmer

Date: 28 APRIL 78
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

follow up 5/5/78

What's the possibility of running 8 SW on microcoded 11s?

How fast will an 8 running on the LSI-11 run?

How about on the FONZ?

Isn't this the way to migrate 8 users and software?

GB:ljp
I thoroughly enjoyed your paper on MOS design styles. I think it should be extended to cover the issue of designing dense circuits and the time penalty they cause... the message, make it bigger and lay it out QUICK! Also something on the design time versus time for various size (# transistors) chips would be nice.

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+---------------------------+                              ID#397
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Subject: **RX02 on PDT**

To: Dick Clayton, ML12-2/E71
Bruce Delagi, MR2-1/M64

Date: 19 DEC 78
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

follow up 1/2/79

Julius mentioned he needs the RX02 on PDT.

Also, they're selling PDT's (well) and need products -- to avoid delivery stretch out.

Shouldn't DCG continue to design (the RX02) and support PDT's? Let's not move the engineering.

GB:ljp

GB3.S10.20

00 CORE DECGRAM ACCEPTED S 002637 O 486 16-NOV-82
12:47:40

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TO: see "TO" DISTRIBUTION   DATE: TUE 16 NOV 1982
12:46

FROM: GORDON BELL

cc: BRUCE DELAGI   DEPT: ENG STAFF
SHARON KEILLOR   EXT: 223-2236
DEL THORNDIKE   LOC/MAIL STOP: ML12-
1/A51

MESSAGE ID:
5181987885

SUBJECT: SABBATICALS -- SHOULD WE? WHERE? WHEN?

In talking with Bruce it's clear that we should have at least one person at all times in sabbatical residence at: Stanford, MIT, CMU, Berkley, Cal Tech, LLL, LASL, simply to interface and interact (especially in research/system building)--- but more important to get rejuvinated.

When can we start?

What you think?

"TO" DISTRIBUTION:

EMC: PEG: RAD:
TMC MEMBER DIST:
****
* d i g i t a l *
****

TO: KEN OLSEN DATE: SUN 23 MAY 1982
7:31 PM EDT

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: SACRED COWS AND GOLDEN CALVES

Aren't they the same, only just different religions?

We make strong statements from time to time about products and methodologies. Most of the time, I believe we're right. The problem is that if we ever give ambiguous or conflicting statements, the people believe they have to be scholars and interpret the statements. I stamp them out whenever I find them because the problem can be solved by asking or simply doing the right thing (if there's been strong statements to the contrary).
In no cases do we want these kind of scholar/politicians around.

TABOOS... Let's list these too
There is another category too, called taboos, which are things that people aren't supposed to do because we've told them they can't, like 10 commandments, serving liquor, having wife/girl friend work for you, etc. These include: programming in assembly language (came out of desire to get us to higher

level languages) such that now Bliss is all that's permitted
...
here, I wanted even higher level and more available
languages;
using 15 or 17 inch monitors; color; graphics; I'd like to
make
modem-less terminals and PC's a taboo (here I thought you had turned everyone around. but alas Kirk and Folsom produced products which don't deal with the modem problem). If any of
us
have these things that we don't want people to do then let's make sure they get listed too so as to save time.

Sacred Cows Within Engineering
Industrial Design got to this status and we can now change the situation with Schneider gone. (We have an identical view of what they should do I suspect. Clearly we needn't have so much work so early. This requires engineers to
take
the reponsiblity they now delegate, hoping that someone will create for them. A similar category of people are growing up within ID and elsewhere, Human Factors people. I've asked to review every additonal hire of these people. They are
priests.

Base technology people have been in this category because we obviously need them. Unfortunately they've been
decoupled.
I believe Metzger is going to solve this and get us
product programs.

Non-Research, mustn't be a cow
I don't think we encourage this enough. Both of us have made strong, non-supportive statements. Here, we need something very good and very directed to get the work in place to make competitive products. Over the last few years, I've
concentrated
on getting the various product groups to do their own A/D because I used to find managers all saying that the 20 guys
in
research were doing all the advanced work for the company.

Right now, the research group is doing work that we think must be done that the product groups don't yet recognize as being essential (eg. Security, robotics with MFG., helping build the inhouse Local Area Networks... really operational, Charle' Rupp on a Silicon Compiler is not recognized as vital).
Also, the myth that rewards only come from products doesn't encourage longer term basic thinking that will lead to a product. For example, there are several very good ideas about
pipeling that won't be in products until late 80's, but we have to have them NOW so as to be ready when the next design starts. They are getting into the Nautilus though.

GB3.S5.44

GB3.S10.14

00 CORE DECGRAM ACCEPTED S 001207 O 327 13-NOV-82 17:08:21

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TO: KEN OLSEN   DATE: SAT 13 NOV 1982 5:07

FROM: GORDON BELL

cc: EMC: DEPT: ENG STAFF

OPERATIONS COMMITTEE: EXT: 223-2236

LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5181684371

SUBJECT: RE: PRODUCT LINE SUPPORT OF SALES DEPARTMENT

Based on a very tiny sample, supporting our salespeople has to
be about the number one corporate product, and probably at

the
root of the lack of orders. As one sales veteran stated:

"We've had high backlogs (and high sales) and had to spend our time
chasing people internally about shipments.
We've had no backlogs (and low sales) and we had to spend our time
chasing orders.
But this is the first time when we've had no backlogs (and low
sales) and we have to spend our time chasing shipment problems.

We want to spend our time selling and not on internal shipment problems!""

The comment is that going back to training on products was great.

The field diagnosis, was lack of clear responsibility in TND. In TOD (The Old Digital), the system was crappy, but the P/L people made it work because it was the only way to make the P/L numbers. Now, it's difficult to find out if and when something has or will ship. They are having the most trouble with new products where there are allocation or engineering hold problems.

Also, compounding this problem is the new Point of Manufacture
system, which will save much when it's operating.

Bottom Line
TND is somewhat like Reagonomics. Some good ideas and much needed changes and belt tightening. The implementation puts the whole idea and system at risk. Many parts are working, but much is needed to make it work. Let's make TND work!

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+---------------+
! d i g i t a l !   i n t e r o f f i c e   m e m o r a n d u m
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Subject: **About a Score of Impressions and Recommendations from Visiting Three Sales Offices**

To: Marketing Committee

CC: Dick Clayton, Bruce Delagi,
Bruno Durr, John Leng,
Julius Marcus, Gerry Moore,
Larry Portner, Jack Shields

Date: 10 MAY 78
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

Introduction

I think we have a massive sales effectiveness problem. It starts with a complete inability to know anything about what we are going to sell, transcends into a labyrinth of finger pointing about products and sales support and goes finally into general office procedures. The most condemning aspect of the situation is that there is no visibility that we have a problem...in this case a hierarchy of problems, and then a setting out to solve the problems.

The purpose of this memo is not to define the problem (this can be done by McKenzie and Company) but to give symptoms based on my impression from recently visiting sales offices and talking to customers and salesmen -- and to urge us to get McKenzie in now! The impressions should not be taken to be universal about offices or salespeople. The salespersons are open about these problems and anxious to get the problems resolved; they are anxious to discuss them with other officers too -- the only hopeful sign.

Summary (* Action possible)

1* We have inward focus. No output is caused by intra-sales and sales-P/L talking.

2* DEC salespeople have no identity. We got them everywhere else, and with our unstructuredness they're ineffective. Also, we have no way to build DEC salespeople.

3. There is a dichotomy of product-oriented and customer-oriented sales. Can this be managed centrally?

4. There's little method of account control (selling, service, software versus time).

5. The three organizations are both ineffecient and cause less team behavior.

6* One office at least, looked amateurish and are there adequate office procedures, etc.?

7. The order processing system is pretty questionable, but then there was no plan with performance and costs.

8* The pink sheets are a joke and as officers, we may be liable for incompetence. Let's change sales measures to ships -- not books.

9* A complete sales plan for the product (e.g., VAX) is either nonexistent or incompetent. Sales should object. This has to be done at a group marketing level.

10* WP could be a calling card. All salesmen would like to use it -- since it's something everyone understands, can appreciate, and sell.

11* There is a complaint sales doesn't have time to plan or to report correct bookings. I don't think they know how anyway. These might go through a different organization (e.g., F/S or the Controller).

12. Sales has to be approached as a training and logistics problem, not the management of artists!

13. There are too many products for anyone to know, yet too few because every P/L Sales group needs more.

14* Left alone salespeople try to sell the largest systems. There is no focus, discipline, or goals (quotes) by size.

15* The DEC 100 doesn't recognize the team work necessary for account management or encourage a second salesperson. Segmentation is encouraged.

16* The P/L literature is a collection of garbage! I defy a customer to understand our products from what we distribute as literature. I propose every product line put together a single catalog that explains its products to a prospective marketplace/use. I'll help put the first one for ESG together.

17* There's lots of informative transmission within P/L -- sales by paper, word of mouth, and meetings and essentially no reception. Low quality information (by documents like Sales Update) requires continuous rebroadcasting, etc. We require every salesperson to be a file clerk.

18. We're totally naive that we can have lower costs and compete with the equally large mainframes (e.g., IBM) that force much service. Our manufacturing base isn't that big -- especially as we continue to cut orders back!

19. The VAX-2020 hassle is a field conjured situation by competition in the sales force. There is a relatively well segmented market.

20. The lack of sales is transient as we try to move from OEM to End User -- is a perception.

Details

1. We're fundamentally inwardly focused. I believe, based on sampling of calls to salespeople, that the sales organization spends too much of its time communicating with itself and with product lines. There is essentially no time or people left for customers. It recently took <u>2 salesmen</u> to call on me to tell me what they wanted me to say at a presentation to a customer seminar. (This could be a phone conversation, TWX or memo -- those 2 salesmen were not making their quotas this year!) In many cases there is emphasis on trips to Maynard or elsewhere and <u>meetings</u> to discuss the situation versus written statements and action-oriented conference calls.

2. There is no identity now as a DEC salesman. I personally identify with the older, technical salesperson who speaks bits, instructions/sec, operating systems capabilities and detailed applications...so I am significantly less critical of the technical salespeople. We now have a mix! We have the truly professional salesman, who, as all the salesbooks say must have first and foremost the ability to sell themselves. We hear all the time how professional (recall Kaufman's comments on the professional) they are, but they are simply not results-oriented. They all came from another company because we do not believe in training programs or growing them from the ground up. Since we are at a reasonable size, it is getting somewhat more difficult to get them and since Burroughs is the only company relatively screwed up and not growing, it's the only source of trained people. The sales associate program is a joke in the field...as one salesman said we are spending our time creating Rolls Royces and we need a factory to produce Chevrolets. Our fear to hire college graduates, for example, is typical of the problem. (Note, if Manufacturing had not put schools in PR to train

electronic people, we would not have been able to get the rapid growth...we couldn't steal these people from all the other companies.)

Since the newer less product oriented, less DEC oriented salespeople are better personal salespeople they may occupy the senior sales management staffs and cause a downward bootstrapping of product knowledge without the attendant improvements in sales performance.

3. There is a distinct dichotomy between the commercial and more scientific salespeople and I don't doubt if there is effective management because of this.

The problem of having no identity as DEC salespeople is that older more established companies totally run by procedures and when we have such a lax procedural base, a lot is left to the individual initiative; structured people will blame the company for every thing (e.g., yield setting, literature, sales training, product segmentation, no time to plan, no team selling, OEM versus end user, selling by size, etc. etc.)

4. There is not a very good concept of an account that lasts over time. With a high growth and lots of people movement even before they are ever tested or qualified, this tends to get in the way of a stable relationship with a customer or with a team of people in an account. There is a muddy pecking order within sales, software support and field service; the notion of a team really doesn't pervade the group in most cases.

5. The three organizations require independent top-down structure which seems redundant and probably enforce segmentation.

6. My impression of the NY office was that it looked amateurish and a place I wouldn't want to take a customer. Their computer room had cables laying about and skins off the equipment which was in a state of repair and upgrade (do the repair off hours). Only 50% of the proposals were done on word processing systems and it is unclear for such a large office why there were only two WP terminals (in a very large disorganized looking room). One of the midwestern offices had only 10% utilization and knowledge of WP. In talking with the head of the office I couldn't get sales bookings and sales costs figures for the last two and projected years.

Although there was a literature room, and area of the office held an assorted overflow. Surely there was no one responsible for literature.

The very pleasant work area was where the top level management had their offices, walled off from the troops.

7. The salespeople wonder about the effectiveness of the order processing system. It seems like we have decentralized one small part of the

operation, while leaving the rest in tact, and now we have a more cumbersome operation with only additive costs and delays. There is no measurement of this performance or its costs, nor did it have a plan!

8. The system of measuring and reporting backlogs, especially in the OEM marketplace is at best incompetent and it may even be illegal. As an officer I would like to know the extent of our collective liability in this area (Al Bertocchi, I believe you should formally access this). There is no way that the backlog and order rate we have had has any basis on reality. Supposedly the sales offices fingers, memos and meetings point back to the product lines to make them aware of the situation. There is nothing written on the subject. The pink sheets, which we watch religiously are clearly only random data and I submit that taking some appropriate temperatures in .01 degree increments of every salesman at 2:30 every Friday would yield better data about our backlog. For starters, the backlogs are cumulative numbers and can not be represented or even approximated with the single number we

use. Secondly there is no way that the companies who order from us can go through the growths that are attendant with the backlogs we project.

I would like to propose we throw out the pink sheets and go to the measurement of ships in the OEM area as an aside, each sales office has a Field Service planner who must plan spares and the training of field service people...they know what the order rate really is and don't go through the euphoric ritual that we do to get the high backlogs. We continue to joke about the oscillations superimposed on our exponential growth, but in this case it may just be the last time we oscillate.

9. There is little or no training and/or focus on new product programs (e.g., VAX) together with a sales strategy as to how to go about selling it. Each of the product lines are doing different things and there is not strategy or deep understanding across the groups. The selling is essentially contained within Win's product lines, and there should be sales, promotion, customer identification, sales support program at this level. In this way, the training can take place across ESP, EPG, LDP, OEM for real time users, IPG plus the few in GIS. A central support group would get the training fast, get the advertising co-ordinated, provide a backup sales group, give field seminars which at this time have to be on a product basis (note Brookhaven has not had a presentation yet on VAX). The manager of the NY office, a commercial type, hasn't the foggiest notion of what the machine is or how to prospect for it. The salespeople don't either! (They only know that it is a hot machine.) We must get organized on VAX!

10. With the big inventory of VT78s and the universal interest in Word Processing, I believe we get these systems into the offices for quick delivery. These also provide a good calling card for all customers. Salespeople agree but don't know how. Also, there is the usual reluctance to sell anything they don't get credit for.

11. Sales managers believe they are flat out working on today's problems and don't have any time for planning or for account management because they are driven to get orders (which they are clearly not getting). I don't think it is in the nature of salespeople to plan, and I would propose that this aspect of understanding go through field service or financial organizations on a separated reporting basis. I believe the controllers organization should be solely responsible for the assessment of order rate and the recording of shipped nor, etc.

12. In a quick perusal of our sales training, I don't see how the training is set up to take people who have fundamentally been salesmen working on short term goals and turn them into people capable of managing offices. The logistics, planning and field service management has better training for managing sales offices where the goal is to get, and equip trained salespeople, plus interface with the suppliers (i.e., P/Ls) to insure there is a message. In this regard the concept of sales being anything more

than a congeries of artists seems foreign to sales management. The problem is that the company is locked into the output of water and oil color painters, house painters (with a few barn painters thrown in) together with a collection of musicians and finger painters all trying to get us some sort of artistic extravaganza.

It seems like we need effective co-ordinated, plans on how we are going to get the orders in the various products/marketplaces. I have never seen a single sales plan, for example, giving: the number of salesmen, the areas, how they are to be trained, how the training fits in with promotions and how prospects are gotten, what the gestation period of a sale should look like, what the competitive posture is, how the P/L supports the field, etc. etc. Such a plan would be the basis for effective product line support and the management of sales. From the plan, we can assess deviations and measure results. Alas -- nothing but the artists.

13. Although we have too many products for the multi-priced, multiapplications markets based on our ability to mobilize salespeople effectively, we are still in a runaway situation requiring more products because there are still lost sales in every possible area because we go after orders anywhere we can instead of having a targeted, organized measured and controlled approach.

Business products is the best example of this now, where when it was successful, had only a limited set of products and a targeted approach to selling.

14. Business products used to be segmented by size and hence had a clear product focus, and with reorganization into end user and OEM, lost this and lost control so that all groups went for the biggest ticket items, and ignored the small products we were initially successful with and where we had a clear niche. Now we compete with every competitor and our OEMs compete with us in the small, medium and high end marketplaces.

15. The DEC 100 somehow destroys any notion of team work that is necessary for account management and selling the right product.

I would propose there is no credit for bookings, but only ships and that reference account selling where a second salesperson is brought in be accounted credit toward quotas in some sort of shared fashion that could even be negotiated by the two salespeople. I believe we would rather lose an order to a competitor than to give the business to a fellow DED salesperson.

16. The plethora of product line products and collection of what we kindly call promotional literature and can be more accurately called garbage is disheartening to customers and to salespeople too. I believe that each product line must build a product catalog of what they're selling including hardware, software, services for their particular marketplace. This, relatively large catalog, would be aimed at the customer (and we wouldn't have to produce some of the horrendous marketing guides that I doubt our sales

people read (nor are many of them capable of reading). The catalog would establish who the customers are and what the products are for the particular customer base. Let the customers decide our sales costs are out of sight because no one knows about a product. (I will personally volunteer to help with the catalog for ESG in order to get this focus. Here, we want something like the Tektronix or HP catalog!)

17. The P/L - Sales; and Sales-Customer interface is an inefficient, mouth-mouth resuscitation process. (Note, no ears are involved.) The transmission process needs to be clarified, and our messages simplified and cut down with less irretrievable (i.e., unless we want every salesperson to be a file clerk) garbage in Sales Update and flash TWXs!

18. Our marketing vis a vis large competitors (IBM) is naive. A salesperson will, within seconds state we sell because we have lower prices and better products, yet we aren't selling because we need much more sales support and service that cause higher prices. I can't identify any uniqueness now in the commercial market (a few years ago we had OEMs and low prices). The EDP Manager/IBM salesman controls what the Fortune 1000 computes on! There is perhaps a strategy to get a foothold, but we have to only sell completely unique products (i.e., VAX to scientific, TRAX, 2020, DECnet, WP, RT Factory Data, or unique small systems). Forget all else!

19. See summary.

20. There are probably more but this is all I could recall from a few days in the field and a feeble memory.

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Win Hindle	ML5-2/A53	Ted Johnson	PK3-2/A55
Andy Knowles	MR2-2/A52	Stan Olsen	MK
Bill Thompson	ML12-1/F41		
Dick Clayton	ML12-2/E71	Bruce Delagi	ML12-1/F41
Bruno Durr	PK3-2/S56	John Leng	MR1-1/A65
Julius Marcus	MK2/C37	Gerry Moore	PK3-2/A66
Larry Portner	ML12-3/A62	Jack Shields	PK3-2/A58

+---------------+
! d i g i t a l ! i n t e r o f f i c e m e m o r a n d u m
+---------------+

Subject: **Sales Support**

To: Jim Bell

CC: OOD, Ted Johnson,
Tom Schendorf

Date: 15 MAY 78
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

follow up 5/29/78

Ted has complemented you as a clear product/technology presentor. He asks for more of your time for field presentation. Let's decide how much.

Ted would also like to get a list of presentors that could make these presentations. Could you collect such a list from the rest of OOD and within R&D together with their presentation titles?

As an immediate problem, could you figure out how we can pull together a "canned" presentation that attends to the following (attached) problem?

GB:ljp

Attachment

D I G I T A L   INTEROFFICE MEMORANDUM

DIST:

Jim Bell	ML3-2/E41	Dick Clayton	ML12-2/E71
Jim Cudmore	ML1-4/E30	Bill Demmer	TW/D19
Ulf Fagerquist	MR1-2/E78	John Kevill	ML1-3/E58
Julius Marcus	MK2/C37	John Meyer	ML12-1/A11
Larry Portner	ML12-3/A62	Bob Puffer	ML12-2/E38
Ted Johnson	PK3-2/A55	Tom Schendorf	BY

00 BURT DECGRAM ACCEPTED S 29472 O 567 11-NOV-81 17:50:58

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION   DATE: WED 11 NOV 1981 2:24 PM EST

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION   DEPT: ENG STAFF

EXT: 223-2236

LOC/MAIL STOP: ML12-1/A51

SUBJECT: SANDIA AND LASL: VAX, LAN, OFFICE AND VT18X

Some comments regarding a recent visit:

Environments (VAX... and 2080 support).

They each have about 25 780's and really love VMS. The only complaint
was a need for a larger exponent. LASL has four Crays and a

large
network of supercomputers. VAX is used for: switching, processing
for print service, CAD, Central computing and distributed computing to
a small collection of users. They compute, do pre- and post-
processing and check out for the super computers. A 780 supports
about 18 users. Sandi's going out for a replacement for a 6600 which
supports about 60 users. THEY NEED A MORE POWERFUL VAX!!!

We must provide a really clean way to make the 2080 an upgrade from a
VAX. Given their FORTRAN orientation, this should be relatively easy.

Their supercomputers have dial in and fixed terminals, file server
(>1000 gigabytes in a disk form, 3850 and automatic tape library),
LANS a print/COM server, concentrators, authentication/securing
servers. They're both building LAN's over their large areas. LASL is
using and going to wideband for remote connection. Sandia has a
Hyperbus in their center with gateway machines for 9 VAX's and fiber
optic links to the remote VAX's.

Their fiber optic back bone is built with Western Electric, 144
strand cables, $20/ft. A receiver or transmitter costs $100., and
operates at 32 Mb/s, but could run at 90 Mbs.

Neither intend to use Ethernet as their primary LAN, but each would
use EN within a building. (The geographical areas and security issues
preclude this use... although the main part of Sandia is only

1.5 km.)
They are worried about security on EN.

Sandia envisions both a single EN across buildings, interconnected via
fiber optic repeaters AND separate EN's for various buildings that go
through gateways to other ENs.

Thus, there are three options needed for their EN:

a. Repeaters using fiber optics as an intermediate link.
b. Gateways using fiber optics among EN's.
c. Gateways using CATV among EN's.

It would be nice to map EN into several channels of wideband.

I think we want to sponsor and encourage the development of these
gateways and repeaters to be done by the 3rd party LAN Industry!
Liddle is going to discuss with us at the DEC-Intel-Xerox PR seminar.
The technical user communicates and publishes.

There was a problem of not being able to sell word processors
directly, but requiring a commercial salesperson. I don't understand
why?

We just have to start to attend to our technical users! Their
requirements for office processing:

1. Run with dumb terminal VAX or

2. Run standalone to off load the VAX on a WPS

3. Scientific character set.

4. Mail

5. Typesetting, (with typesetter support). They want us to offer the typesetter. They use TEX. Should we support it too?

6. One terminal for: dumb terminal, including graphics, and upgradeable as standalone.

Where are we on being able to do this on the 278? On the CT?

GETTNG MORE PERFORMANCE FROM VAX

1. They need Venus.

2. We must have a really clean connection between the 780 and the 2080. Given the VAX installed base, a cluster upgrade using the 2080 looks like a much better market than just upgrading the current 10/20 base.

3. Atlas is expected and being discussed.

4. Is there any way to get a 4 processor Atlas? Los Alamos is building a 9 processor 8086 to study single task, multi processing. Good Luck.

5. Better communications hardware would get some cpu cycles? What is the effect of combo? What else is needed?

6. Personal computers for word processing and intelligent terminal functions for editing would also get may machine cycles. Here an electronic 278 provides the best performance.

7. Can HSC and clusters help? Can the clusters be used

to get
more users on a single system because of separation between
control files and processing?

VT18X

Basically confusion. Can they buy it? Can they get a demo? How does
it work with VAX? How do they get their hands on all the third party
SW? How much will we offer?

GENERAL

Interface to Product Lines is tough LDP, GSG, TPG, ESG, (and commercial for WPS).

"TO" DISTRIBUTION:

BILL AVERY	JOE CARCHIDI	BILL DEMMER
DICK HUSTVEDT	ROSE ANN GIORDANO	BERNIE LACROUTE
BILL MCBRIDE	BRUCE STEWART	

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JOHN O'KEEFE	DAVE RODGERS	JOEL SCHWARTZ
HARVEY WEISS		

GB3.S2.37

Two Lieutenants: A Parable on A Parable

In the early days of the year 1979 there was a famous parable
about two lieutenants who came back from a meeting with their

commanding generals. One transmitted the message to attack a particular hill at 0700. Two got the message that there was dissension among the generals and that there was likely to be bloodshed if said hill were attacked. Two met with his group to plan a way to convince the generals not to attack the hill. The alternative plan would be delivered at 0700.

Here, endeth the first parable

Like any good parable, it is simple and has a message. The following tactical probabilities make other, interesting parables:

1. taking more than one hill, given both groups;
2. taking the hill, given both groups;
3. taking the hill or hills with only one group;
4. annihilation of the groups for the given attack forces;
5. annihilation of the generals' camp.

Furthermore, there are various situational rewards:

1. medals;
2. promotion for results at the hill or hills;
3. getting killed.

And one might believe that Two's troops included sergeants, and possibly women, who would:

1. actually go for the hill, as apparently directed;
2. go back to the generals at 0700;
3. retreat.

The final result of the attack turned out to be:

Lieutenant One's Group was annihilated and he was given a post humous dishonorable discharge.

Lieutenant Two's Group scattered. Some of the professional soldiers sold out as mercenaries, two sergeants were killed (possibly by their own troops) and got big medals, and the rest were captured, soon traded back and went home.

The camp containing the generals was captured while the generals were discussing Number One's bad luck. The general with the most stars escaped and went back from the fighting as chief of staff, bringing with him his promoted assistant, Two.

Moral, aside from being careful about getting involved with people who fight and about knowing when to run, because parables are as complex as taking hills:
  Given a few people and a simple situation, things never turn out to be as simple as one would think beforehand... or, complexity sure can kill a lot of people.

GB0001/11/HOLD

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a n d u m
|   |   |   |   |   |   |   |
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```

Subject: **Pascal (e.g. UC/SD Type)**

To: Bruce Delagi, MR2-1/M64

CC: Dick Clayton, ML12-2/E71
    Bill Johnson, ML12-3/A62
    Bill Segal, ML3-5/E82

Date: 7/18/79 Wed
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

follow up 7/27/79

Given our interest and affinity to want Pascal, I fail to see why we're not using one of the many versions for the LA124. It's available on the 8080 and 11, and permits movement of programs (eg. LA124) to Tiny.

Why aren't we using it?

GB:swh

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Bruce Delagi MR2-1/M64

Dick Clayton ML12-2/E71 Bill Johnson ML12-3/A62

Bill Segal ML3-5/E82

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+----------------------------+                       GB0004/50
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```

Subject: **Pascal Strategy**

To: Ron Brender, ML3-5/E82
Dick Clayton, ML12-2/E71
Bruce Delagi, MR2-1/M64
Don Infante, ML1-4/P14
Bill Johnson, ML12-3/A62
Bill Keating, ML12-3/A62
Si Lyle, MR1-1/M42
Stan Pearson, ML12-2/E71
Gil Steil, ML5-5/E76
Pat White, ML12-3/E51

Susan Azibert, TW/C10
Lois Frampton, ML5-5/E76
Steve Hobbs, TW/C10
Janice Kelso, ML5-5/E76
Leslie Klein, TW/C10

Date: 9/13/79 Thu
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

Follow Up: 9/28/79

Steve Lionel, TW/D08
George Poonen, ML3-2/E41

The strategy looks good, but:

1. Why don't we buy the new OMSI-11 Pascal instead of doing Micro Pascal?

2. Why staff so much on Pascal+ on VAX?

3. How are we going to keep compatibility among the products?

4. How's # 3 doing so far?

5. Will we be able to have Pascal+ be the base for the ADA run time system?

6. Why can't we bring in the current Pascal 11 now from OMSI for use internally (e.g. special LA's, new terminals)?

GB:swh

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+---------------------------+
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|   |   |   |   |   |   |   |
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```

Subject: **Pascal/VAX**

To: Bill Demmer, TW/D19
Larry Portner, ML12-3/A62

CC: Bernie Lacroute, TW/A08
Jerry Witmore, PK3-1/M40

Date: 18 OCT 78
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

follow up 11/1/78

Who's responsible for watching/co-ordinating Pascal on VAX?

How's the project coming?

Can we get them here for a design review?

GB:ljp

October 10, 1978

Mr. Stuart Patterson
National Center for Atmospheric Research
Atmospheric Technology Division
P.O. Box 3000
Boulder, Colorado 80307

Dear Mr. Patterson:

Let me take this opportunity to thank you and your staff at NCAR for the fine hospitality and interaction on the 3rd. It was truly an honor to talk about VAX with such an outstanding group. The trip through the computation center and seeing the Cray 1 was a high point.

It was intriguing to speculate how we might use smaller computers (such as VAX), located within an individual scientific group, to provide similar levels of service (for over 90% of the users) to that obtained with the Cray 1. I hope Dawn can get some benchmarks and understanding of the NCAR user profile from you. Such a system will, of course, exacerbate the need for networking. Here, I hope you might avail yourself of some of the understanding we have of networking within the Denver office and also visit our network group.

In order to really get a better understanding of your future needs, I'd like to get you to write down and present us with various scenarios of how you see the NCAR computation needs developing with time. We could then understand and respond to your needs. Could I ask you to come and present this view some time when you're in the area? This would also be the basis of seeing whether we could help in the network area.

Again, thanks for the hospitality.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:ljp
ID#0290

CC: Bob Anundson
Dawn Boyd
John Mucci

November 26, 1984

Mr. John Payne
National Semiconductor Corporation
2900 Semiconductor Drive
Santa Clara, CA 95051

Dear John:

I'm glad that there is increasing concern about National's future microprocessors. I'll be in the Valley during the week of the 10th of December and hope we can discuss the progress and direction then. I see three critical issues:

1. Get the 332 done and out by May
2. Establish the overall goals and constraints for the 532 project now. Follow this up within a month with a review of the functional specification and high level design. My target, is described below, but may not be aggressive enough.
3. Deciding on a longer term, hardwired architecture, which has 32000 data-type, operating system and language compatiblity to compete with the so called, reduced instruction sets, including MIPS Co.

The 532 described below is needed within two years, in order to be only a year late!

Here's some background data that we might start from:

Machine	Implm.	Clock (ns.)	(Mhz)	Ticks/ instr.	Speed*	Mips
VAX						
750	u	250	4	11	.75	.375
780	up	200	5	10	1.0	.5
8600	u4p	80	12.5	6**	4.2	2.1
32000						
32032	userial	100?	10	27	.75	.375
32332					1.9	
32532	u	30	33	15	4.4	2.2
Risc II	hardwire		83	12	8	2.0 1.0
(1.5)						
MIPS Co."	250	4	4	2.0	1.0 (1.5)	

* Note the 780 is commonly rated at 1 Mips, but actually runs less than 0.5 Mip when averaged over a long period. The rating comes from doubling the number which roughly corresponds to the number of 370 instructions which would have to be executed to do the same work.

** The 8600 (Venus) has a multiple stage pipeline, each of which is very complex to fetch (Ibox), Execute and do floating point. In addition, there's a special interface (Mbox) to interface the cache and memory.

Note the large number of ticks required to interpret the average instructions in the 032. Some recent benchmarks show that the 032 is probably able to keep up to a VAX 750 if you ignore the slow floating point in the 032 and use the same, poor UNIX compilers. I'd like to see the Whetstone numbers you have here.

The 532 above would use a package that would let you get all the 32 bit or possibly 64 bit data and 32 bit addresse lines in and out rapidly. The design should be incredibly simple and brute forced, not piplelined. Note most of the performance comes from the technology (3.3), the other performance gain should come from a 32-bit organization (2) and a wider microprogram control. The MMU should be on chip, like the Microvax chip, in order to avoid the package and handshake delays. I assume this can be done with double level metal, 2 micron CMOS, and most certainly 1.25 micron CMOS. I think it is also crucial to utilize Weitek in your planning to reduce the internal work.

I believe it is possible to build an ECL Risc that's 10-20 times faster than a 780 for programs (but may require 1.5 times the number of instructions) using a 25 mhz clock. This would have about 3-4 ticks per instruction, and could be implemented in CMOS. An article by Jean Yates is enclosed which describes the opportunity of Riscs.

While it is crucial to persue all three paths in parallel I would like to concentrate mostly on the first two on this visit to insure they are on the right track. Then we should explore ways to get a faster architecture.

Sincerely,

Gordon Bell
Chief Technical Officer

CC: Ken Fisher
Randy Parker
Dick Sanguini
Charles Sporck

Enclosure

G BELL SYSTEM PRICE MODEL (3/75)

SYSTEM PRICE ($) PER BYTE OF MAIN MEMORY

$= 3 \times 5 \times 8 \times .005 \times .79^{t-1972} \times$ NO. OF BYTES

$= .6 \times .79^{t-1972} \times$ NO. OF BYTES

<u>WHERE</u>

3 IS MARKUP (ROUGHLY)

5 IS FRACTION OF SYSTEM IN PRIMARY MEMORY

(TENDING TO BE INAPPROPRIATE BASE VARIABLE)

8 BITS/BYTE

.005 IS COST OF A BIT IN 1972

.79 IS 21% PRICE DECLINE PER YEAR

1972 IS BASE YEAR

SOME SYSTEM PRICES AT VARIOUS TIMES USING THE GB 3/75 MODEL:

BYTES	1978	1980	1982
1	0.146	0.091	0.057
8K	1.2K	745.0	467.0
65K (QBUS LIMIT)	9.6K	5.9K	3.7K
256K (UBUS LIMIT)	28.3K	23.9K	14.9K
1M	153.0K	95.4K	59.8K
2M (11/74 BUS LIMIT)	306.0K	190.8K	119.5K
8M	1,225.0K	763.0K	478.0K

FUTURE DIRECTION IN 1985'S COMPUTING

J BELL MODEL 17 OCT. 1979 [GB]

I. FUNCTIONAL AND PERFORMANCE

SEMICONDUCTOR DENSITY DOUBLES EVERY YEAR.
FUNCTION PROPORTIONAL TO MEMORY SIZE
TERMINAL CAPABILITIES WILL IMPROVE COLOR GRAPHICS, HARDCOPY
VOICE I/O COMMON
PERFORMANCE X3 /5 YEARS [24% YEAR]

II. EASE OF USE

PROGRAMING ENVIRONMENTS WILL GET BETTER (VIA LARGE ADDRESS SPACE)

DIFFERENT TECHNIQUES TO PROGRAM (LESS PROCEDURES)

PROGRAM GENERATIONS

ENGLISH LANGUAGE PROGRAMMING

TEACH BY SHOWING ALA ROBOTS

[NO PROGRAMMING: USE PACKAGES]

III. ACQUISITION COST

. FACTOR OF 3 EVERY 5 YEARS - [20%/YEAR]
. Mp FACTOR OF 10 EVERY 5 YEARS - [37%/YEAR]
. DISKS DECLINE AT SAME RATE AS ?
. MOVE ATTENTION TO PACKAGING AND POWER

IV. OPERATING COSTS

. ATTEND TO POWER AND SERVICING
. HIGHER PAPER COSTS MAY DRIVE TO ONLINE AND VIDEO STORE

V. RELIABILITY (YES - THERE ARE TECHNIQUES)

VI. SERVICEABILITY (REMOTE DIAGNOSIS)

VII. COMPATIBILITY (YES AND FAMILINESS TOO)

<u>THREE RIVERS PERQ</u>

C:=(

Pc (WCS:$3K/4K BYTE; ADDRESS SIZE: 32 BITS; ISP:P-CODE);

Mp (256 KBYTE);

Ms (12 MBYTE);

T (RS232, IEEE 488; SPEECH OUT);

T CRT (8 1/2" X 11", 768 X 1024);

$19,500 DISCOUNT: 30%/100;

OPTIONS:

(Ms(FLOPPY); Ms (24M BYTE)

T(PACKET SWITCH; 10 MB/SEC; $2K)

T(UNIBUS)))

CMU CSD SPICE (PERSONAL SCIENTIFIC COMPUTER) ENVIRONMENT

. SET OF 200 PERSONAL COMPUTERS,

C PERSONAL: = (

(Pc APPROXIMATELY 1 MIP; MICROPROGAM: >16KW;

ADDRESS-SIZE: 30 TO 32 BITS)

Mp (>1 MBYTE)

Ms (100 MBYTE)

T.DISPLAY (RESOLUTION: 1K X 1K; COLOR)

T.CAMERA; T.AUDIO;

PRICE: $\$10K_{1985}$)

. NETWORK: 1 TO 10 MB/SEC

. SHARED FILE SYSTEM INCLUDING VIDEO DISK

. HARD COPY SYSTEM

. SPICE ENVIRONMENT

CMU SPICE ADVANTAGES

1. LARGE, CYCLE-INTENSIVE PROGRAMS CAN BE RUN EFFICIENTLY (NO SWAPPING OF N USERS)

2. MICROCODE TO EACH TASK

3. HIGH RESOLUTION GRAPHICS (PERMITS WORK ON VLSI LAYOUT)

4. NATURAL COMMUNICATION

VOICE AND VIDEO

5. EACH USER HAS A BIG COMPUTER TO SELF

6. RELIABILITY

7. EXTENDABILITY IS REALLY MODULAR

<u>CMU ASSUMES</u>

TIMESHARING IS ENDING

SMALL, HIGH VOLUME SYSTEMS WILL EVOLVE TO BE EMBEDDED IN TERMINAL

NO EVOLUTION OF CENTRAL SYSTEMS TO

SOLVE RESPONSE TIME; PROVIDE MORE; BEST SHARING

PROVIDE DIGITIZED AND RECOGNIZED AUDIO (AT + T FUNCTION?) -

STORE, TRANSMIT AND PROCESS VIDEO

(BECAUSE LOCAL TRANSDUCTION/PROCESSING IS NECESSARY)

CMU SPICE SCENARIOS

1. DOCUMENTATION PRODUCTION INCLUDING ALL FIGURES COMPLETE PAGE LAYOUT

2. PROGRAM DEVELOPMENT USING COLOR, EMACS-LIKE, CO-ORDINATION WITH TEAM/MANAGEMENT

3. PROGRAM DEBUGGING

4. VLSI DESIGN

5. MULTI-MEDIA COMMUNICATION (TEXT, FIGURES, SPEECH)

6. NON-INTRUSIVE COMMUNICATION

7. TELEPHONE ANSWERING SYSTEM

8. INFORMATION DISTRIBUTION

WHAT IS CMU CSD SAYING?

WANT / NEED? MANY MORE CYCLES/SEC; Mp; Ms (CURRENTLY 200 USERS SHARE
2 KA, KL, 3-780'S) TO:

DRIVE MUCH BETTER SCOPES AT FULL DATA RATE (Pc)

EMACS TYPE EDITING (Pc, Mp, Ms)

ABILITY TO MANAGE A TELEPHONE AND VOICE (Pc)

PICTURES (AND GRAPH) STORAGE, TRANSMISSION AND PROCESSING.
(Pc, Mp, Ms)

WANT A CENTRAL FACILITY FOR FILES, PRINTING

DON'T SEE A NEED FOR A HIERARCHY OF CAPABILITIES OF PROCESSING

HOW DOES A PERSONAL SYSTEM DIFFER FROM A SHARED ONE?

. TO A USER, NO DIFFERENCE EXCEPT:
CONSTANT RESPONSE TIME
LOTS OF RESOURCES (Pc, Mp, AND Ms) TO THROW AT TERMINAL,
SPEECH, VIDEO

. IS ECONOMY OF SCALE OF WHAT MATTERS DISAPPEARING?
Pc -> 0
Mp -> 0
Ms = CONSTANT; SIZE INCREASES
.ECONOMY OF SCALE
.PERFORMANCE LIMITED BY MECHANISM
T.CRT -> 0
= CONSTANT; SIZE INCREASES
T.COMM = CONSTANT;
= INCREASING; UNAVAILIBILITY
T.LOCAL AREA NETS = ?

. LOTS OF RESEARCH QUESTIONS
MAKES EXPLICIT PROBLEM OF MULTIPLE, NEED TO CO-OPERATE/INTER-COMMUNICATE
DIST. DATA BASES
DIST. PROGRAMS AND PROGRAMMING
INTERFACING OTHER SYSTEMS

. IN SUMMARY
WE ARE TAKING LARGE SYSTEMS PROGRAMS THAT WERE EXECUTABLE ON CENTRAL SYSTEM AND BRINGING THEM DOWN TO OPERATE ON THE MANY INDIVIDUAL- AND GROUP-LEVEL COMPUTERS.

THE DEDICATED PROCESSING WILL PERMIT SYSTEMS TO BE BUILT WE NOW DON'T UNDERSTAND.

MUCH GREATER FOCUS ON:
EASE OF USE

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! d ! i ! g ! i ! t ! a ! l !         I n t e r o f f i c e
M e m o
!___!___!___!___!___!___!___!
```

TO: see "TO" DISTRIBUTION DATE: FRI 18 FEB 1983
1:19 PM EST

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

MESSAGE ID: 5191336734

SUBJECT: FOCUS ON A MICROVAX PC

GB4.S1.42

We're driving like crazy to get 1 or 2 significant PC's based on
MicroVAX and the Qbus. The first implementation is with Cutler's
2-board MicroVAX.

The options are:

. the disks, including floppy (for loading)

. the connection to an Ethernet and some other net (if necessary)

. Cutler's MicroVAX, followed by MicroVAX chip & board

. Two or Three Crt options:

  . low resolution - probably 15" monitor or CT-compatible screen
  . hi resolution - 19" monitor

. color (simple)

. Board to interface a laser printer to make a print server

We need to go back and address our technical market who are buying HP,
Apollo, the IBM 9000, Sunworkstation, and are looking forward to the
Apple Lisa.

Will you provide the box?

At this time we're trying to get 3 MicroVAX-based PC's.

1. Rainbow III - Barry will get CP/M to be transportable and move to
   a 32-bit micro. They'll probably do this for a 68020, which will
   be in the same time frame. This will be a portable operating
   system.

2. Pro 750 -

3. The Qbus-based PC's using your box.

If we play our cards right, the situation will be:

1. CP/M - It will evolve to be multi-user, and ultimately
   transportable to 68K - and MicroVAX.

2. UNIX - on 68K, Intel, 11's, VAX, IBM 370.

3. Vanity systems (eg. Apple, Atari)

4. One language, no O/S (eg. TRS).

5. DEC-VMS compatible - permitting dynamic movement of files and programs. Let's continue this and keep our compatibility, quality and coherence.

"TO" DISTRIBUTION:

JIM CUDMORE	WIN HINDLE	BILL JOHNSON
ED KRAMER	KEN OLSEN	JACK SHIELDS
JACK SMITH		

WPS USERS - Leave HP mode and type <CR>

These 5 slides (definitions) may be of interest to you. They try to segment what and how computing is (and may be) done.

A TIMESHARING COMPUTER consists of:
.processor and primary memory,
.secondary memory for programs and data,
.communications links to other computers and to
.human interface terminals (eg. CRT and keyboard).

A timesharing computer is used interactively by several persons in a shared fashion. The computer belongs to a group, while the terminal ususally belongs to an individual.

A PERSONAL COMPUTER consists of:
.processor and primary memory,
.secondary memory for programs and data,
.communications link to other computers, and
.human interface components (eg. CRT and keyboard).

A personal computer is used interactively by one person at a time. The computer usually belongs to an individual. (LINC is the first to satisfy this defintion, if you ignore the addtional constraint that says a PC must be portable!)

A CENTRAL FACILITY (mainframe) provides:
.network communications among computing nodes, with conventions for exchanging data,
.archival storage for group and personal facilities,
.large, shared, central data bases,
.large, special facilities beyond group or person (eg. printing, plotting, high performance processing, electronic mail),
.general computation on a service bureau basis.

A GROUP LEVEL FACILITY (timeshared minicomputer) provides:
.ability to be part of communicating network,
.intra-group communications via the facility,
.shared programs and data for a single group,
.special facilities for the group (eg. microprocessor debug, simulation, printing, plotting, processing),
.shared, general computation for members of the group.

A PERSONAL FACILITY (personal computer) provides:
.ability to be part of communicating network,
.private programs and data for an individual,
.fast response for simple human interactive (eg. editing) tasks.

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION DATE: SUN 23 MAY 1982 4:22 PM EDT

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION DEPT: ENG STAFF

EXT: 223-2236

LOC/MAIL STOP: ML12-1/A51

SUBJECT: MAKING COST-EFFECTIVE PC'S. LIKE SONY?

The SEG proposal to get a chip of the month out is vital to our success. The recent Sony announcement very likely is a result of intensive custom LSI. Note that they use VAX's and 4 years ago when I visited were already doing much custom work for consumer electronics. Their president, Iwama, was proud of the fact he had worked with Leo Esaki and that Sony was the first to pick up the Western Electric patents.

If you look at their recent, portable stuff, it is really VLSI intensive and probably CMOS to boot. It would not be a surprise if this is what it's all about.

Recently Avram showed that we have 2 x the chips as the IBM PC. We do more, but the issue may come to cost, reliablity and uniqueness or not. In this case, IBM probably had no customs. Clearly guys like Apple don't use customs, or if they do it's joint with another vendor.

Right now we are in an abyss that the chip a month program has to get us out of:

1. We believe we can do our own chips, yet we don't
2. We've cut ourselves off with working with the outside to any great degree

3. We don't use standard chips because of our uniqueness needs
4. We've stopped outside customs that gave us uniquenss in the vt100 and la120

SEG is going to need help and every product group is resposnible
for its own competitive destiny, without having the right skills, attitudes and sufficent targets.

Now that we have the PWB and cabinet turnaround times down, using the QTA, we have to have a CQTA!

Avram, What's your guess here vis a vis looking at their Typecorder and Word Processor? Is the Sony PC another breakthrough in cost and functionality?

"TO" DISTRIBUTION:

JEFF KALB   AVRAM MILLER   STEVE TEICHER

"CC" DISTRIBUTION:
BILL AVERY   KEN OLSEN   PEG: JACK SMITH

GB3.S5.43
****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION   DATE: MON 29 SEP 1980 10:18 AM EDT
                                             FROM: GORDON BELL
cc: see "CC" DISTRIBUTION   DEPT: OOD
                                             EXT: 223-2236
                                             LOC/MAIL STOP: ML12-1/A51

SUBJECT: PDP-11 PROGRAM ENVIRONMENT ON VMS

Several events have prompted the following proposal:

1. Wondering what a 370 in a terminal would be and do, vis a vis use with a large 370 mainframe.

2. Speculating significantly better software support systems for our microprocessor systems. (Also noting that Intel is supporting their 8086's on VMS...smart people.)

3. Terrified at building the KO Jr. (65Kbyte + 2 - 200 Kbyte disks) and KO Sr. (256Kbyte + disks + 5 Mbyte disks) software on them.

4. Thinking about how we might get rid of 7000 PDT 150's.

5. Wondering how to build and debug software for intelligent terminals (especially the new ones for the commercial group).

6. Thinking how vax on a chip and in a terminal would work with a centrally supported type vax. Wishing that 11's were vax's, but remembering that vax does execute 11 programs damn fast.

Fundamentally, I'm proposing a bare, full function, virtual 11 environment for building 11 programs on vms. In addition, it might be sufficiently good so as to be useful for executing particular programs in production mode...though not a goal.

It would look like a simulator that was used at one time on the 10 to do 11 development before there was 11 software, and have:

1. The mass storage, terminals, and communications to vax with processor, including interrupts. It would run at faster than 11 speed for the small processors. Most likely it would have a terminal to control it and a terminal simulating the real one.

2. Software environment to load, run and debug programs in the simulated environment. It would allow monitoring of the whole state including the files and comm lines.

3. Ability to load and monitor a real 11 when ready.

4. Fallback of a really good monitoring and support capability enabling control of a real, local 11 such as the KO or PDT or computer on a board (a harder case). This is double, but still tricky cause it requires vms to have a monitor to access all the state of the system and to be able to have breakpoints, etc.

It would be aimed at applications 2-5 above, especially 3 & 5.

What's the chance of getting something like this together out of the SSC effort in order to support the effort on getting lots of software quickly for the PDT 150, and the KO?

What would it have precisely?

Would it really make things a lot more productive...not

waiting for
disks, assemblies, etc. or having to have the software development
environment anywhere near the thing being developed?

What youse think?

GB1.S6.59

"TO" DISTRIBUTION:

ANTON CHERNOFF	BOB DALEY	GIL STEIL
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JACK MACKEEN	JACK MILESKI	AVRAM MILLER
LARRY PORTNER	HERB SHANZER	

GB0001/29

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| d | i | g | i | t | a | l |
|   |   |   |   |   |   |   |
+---------------------------+
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i n t e r o f f i c e   m e m o r a n d u m

Subject: **11/23 Fonz Announcement**

To: Dick Clayton, ML12-2/E71
Bill Green, ML1-4/E34
Bernie Lacroute, TW/A08
Roy Moffa, ML1-2/H26

Date: 28 FEB 79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

Jack Smith, ML1-4/A54
Mike Titelbaum, ML1-2/E65

follow up 3/9/79

I hear that we have all but announced this. What's the story? Why was this announced without Marketing Committee approval?

What are our options now?

Can we delay announcement and get the PAX in it (especially since there's a problem in semiconductor capacity)?

Certainly we don't need the 11/24 early...and, can we save some engineering money? We do need Fonz to be built in to other products. Could we give them high priority?

GB:ljp
00 BURT DECGRAM ACCEPTED S 17829 O 25 10-MAY-81 16:48:32

****
* d i g i t a l *
****

TO: HERB SHANZER
DATE: SUN 10 MAY 1981 16:45 EST

FROM: GORDON BELL
cc: see "CC" DISTRIBUTION
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: KEN'S COMMERCIAL 11/23 PACKAGE

I hope you'll keep abreast of this. It looks interesting (provided we can remove the contact paper). If we do it, it should offer a significant payoff in terms of cost. The big saving I see is making the long box in a high volume plant
and then shipping the manuals, software (on disks) and frame from FAT. The disk drives would come directly from high volume.

The site merge of the parts would cut the inventory and wip down considerably. (It's too bad we simply don't simply assign an inventory carrying charge to PL's to encourage them to do the right thing.)

The package should be able to handle a 23B 9 slot backplane. We also might consider taking the DF03 modems out of their boxes and use a single PS (if the 23 one will do it), to further clean up and cost reduce the whole system.

Am anxious to see what the costs and a working system would look like.
gordon

"CC" DISTRIBUTION:

BRIAN FITZGERALD RICHARD GONZALES IRWIN JACOBS
SI LYLE KEN OLSEN

GB2.S6.39

GB0001/43

| d | i | g | i | t | a | l | i n t e r o f f i c e m e m o r a n d u m

Subject: **Post Mortem on 11/70 CIS**

To: Bill Demmer, TW/D19 Date: 3/12/79

Dave Rodgers, TW/C04 From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

I hope in putting the 11/70 with CIS away, you will write-up a history as you understand it. As I go back many years on this project, I find us always pushing against doing the extensions. This is understandable. However, some of the marketing people occasionally say this has been the problem on the project. My analysis is somewhat different, I believe any machine or architecture can be extended once. In this case, the extension was the second/third one beyond the original 11/45 and well beyond the range of the design options due to nature of the two extensions. Alternatively, was it because of two design options for mP and CIS?

We (I especially) learn from history. Is it too painful or too useless to try to make an internal history of the project that we can all learn from in the future?

GB:ljp

GB0002/3

d i g i t a l **interoffice memorandum**

Subject: **Why We Probably Have to Do the 11/70 On a Chip**

To: Marketing Committee
OOD
Bruce Delagi, MR2-1/M64
Sam Fuller, TW/A08
Bernie Lacroute, TW/A08

Date: 4/3/79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

Jack MacKeen, MR2-2/M65
Jim Marshall, TW/A03
Roy Moffa, ML1-2/H26
Stan Pearson, ML12-2/E38
Bill Strecker, TW/A08
Mike Titelbaum, ML1-2/E65
Roy Moffa, ML1-2/H26

Although there are many arguments why we have to carry out this expensive chip development effort, the following summarizes my thoughts:

1. It's a classic follow-on, constant cost product for our module (DCG) business. Here, we have a large base built on the 03 ('75), and 23/24 ('79). Jaws (the proposed 11/70 on a chip), available in '82 would support this large, user base.

2. It would be used in many places as a major cost reduction. As an 11/70, the cost reduction at just the box (no memory) would be in the order of 9K! No other cost reduction project could get anywhere near this leverage.

3. There will be some obvious uses for it as it becomes available, based on the fact that the Fonz chips will create markets internally. These include use in the mass storage controllers, Hydra front end (Mercury), as special speech and signal processors, and the terminals (e.g., graphics) evolve to need this kind of power by then.

4. There will be many uses for standard 11 systems at the lower cost put in highly integrated systems. These would run RSTS, SCS, RSX, and TRAX.

5. It is the way to build our systems in this time frame using one engine. In retrospect, we could have probably avoided the 11/44 and covered the space with an 11/24 if the memory

space were extended to >128KW. The speed of the Fonz is adequate, but the memory space is not. A similar situation will no doubt exist as the need for the 11/44 follow-on (called 11/XX) is identified. This is the way to do it.

6. Just as the 8 is the really low end now, so too will be the 11 until we get the price of VAX systems down. I don't see this happening until '85 or so.

7. By identifying it, hopefully we can avoid doing enhancements to the Fonz.

8. It is getting to be clear that we can't get a VLSI-VAX in this time frame. The specific details will be forthcoming on VAX as we learn how difficult the project is. This is both a hardware and a software base maturity issue.

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Dick Clayton ML12-2/E71 Jim Cudmore ML1-
5/E30
Bill Demmer TW/D19 Ulf Fagerquist MR1-
2/E78
Bill Hanson ML1-4/P11 Win Hindle ML10-
2/A53
Bill Johnson ML3-5/H33 Ted Johnson PK3-
2/A55
John Kevill ML3-6/E94 Andy Knowles ML10-
2/A52
John Leng MR1-1/F35 Bill Long ML10-
2/A57
Julius Marcus MK2/C37 John Meyer ML12-
1/A11
Ken Olsen ML10-2/A50 Stan Olsen MK1-
2/A57
Larry Portner ML12-3/A62 Bob Puffer ML12-
2/E38
Jack Shields PK3-2/A58 Bill Thompson PK3-
2/C12

Bruce Delagi MR2-1/M64 Sam Fuller
TW/A08
Bernie Lacroute TW/A08 Jack MacKeen MR2-
2/M65
Jim Marshall TW/A03 Roy Moffa ML1-
2/H26
Stan Pearson ML12-2/E71 Bill Strecker
TW/A08
Mike Titelbaum ML1-2/E65 Roy Moffa ML1-
2/H26

****
* d i g i t a l *
****

TO: BILL DEMMER DATE: MON 25 MAY 1981
23:53 EST
ULF FAGERQUIST FROM: GORDON BELL
PAULINE NIST DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: WHAT IF THE 780 WERE REALIZED USING MCA'S OR NEW TTL/FAST LOGIC?

Let's talk tomorrow. Bob has been off doing a quick study as to how fast an MCA translitteration of the 780 would run. His rough answer: 2.5 x a 780. If we had done this, it would have shipped 2 years before venus, at a small fraction of the development and start-up costs. I am concerned that we don't understand how to compute time/cost/performance (that's why I wrote the little essay in Computer Engineering whichh apparently no one read). Anyway, the bottom line is that a 780/mca would have roughly a price/performance ratio of 250K/2.5 or 100K, where the 780 is the standard base. Venus will have price/perf. of 320K/4 or 80K. Since this ratio should get better at .8 per year, then a 2 year delay should be .8 x .8 or .64 either lower cost or higher performance.

The point of this is: We seemed to have screwed up in not making this product. Now, with some faster TTL coming out, maybe we could do a direct substitution of FAST ttl and get a speedup of say 2, with virtually no redesign, but by using the new parts.

Could you look at this one?

I think we ought to spend a little more time on the mca version too and see if the Stewart numbers can be improved any. I think these should be kept alive until there is some better feeling about Venus.

GB2.S6.50

Mr. Alec Peltier 15 August 1980
Special Assistant to Counsel General
Operations Branch
American Embassy
London
England

Dear Mr. Peltier:

Reference your conversation with Richard Goldstein on August 15 regarding Dr. Maurice Wilkes. I wish to extend my personal appreciation for your efforts on this matter.

I am writing to explain our situation regarding Professor Maurice V. Wilkes with whom we have made arrangements to join the staff of our Corporate Research Group.

Professor Wilkes has been a towering figure in computer engineering and computer science from the invention of computers until the present day. He is one of the small handful of men who originated the modern computer; he was personally responsible for the construction of EDSAC 1 which was working in May 1949. Some of the concepts first proposed by him, such as "microprogramming," have continued to grow in importance until today virtually all computers manufactured in the world are designed using this technique which he created.

For the last decade Professor Wilkes has been Head of the Computer Laboratory at the University of Cambridge (England), where he was previously Director of the Mathematical Laboratory for a quarter of a century. I will not attempt to list all of the honors and awards which he has received over the years; this information is available from standard reference works such as <u>Who's Who</u>. Suffice it to say that he has been one of the intellectual leaders and respected senior statesman in computing for the last three decades. He is a Fellow of the Royal Society, a Fellow of the Institute of

Electrical and Electronics Engineers, a Fellow of the British Computer Society, of which he was the first President, and a foreign associate of the U.S. National Academy of Engineering. He received the Turing Award and the Harry Goode Memorial Award, two of the highest honors in American computing. He has received honorary Doctorates from five universities in three countries, together with other honors from around the world, including recently being named as a foreign associate of the U. S. Academy of Sciences. In summary, he is a distinguished scientist and engineer of world reputation, possessing unique background and qualifications not available elsewhere.

Dr. Wilkes is urgently needed to run our research program on techniques for making computer systems more secure. This program is not only important for us as a major computer manufacturer, but also may have a significant impact on U.S. leadership in computer technology throughout the world. Dr. Wilkes' presence is necessary to move this work forward. Also, we need his interaction and leadership across all our research.

Dr. Wilkes is scheduled to leave England the last week of August and will start to work here September 2. He has made all personal arrangements including letting his house in London and renting a house here in Massachusetts. We were lead to believe several months ago that his visa was in order but he was told by your office a few days ago that it would be 1 to 3 months before he could get his permanent visa. This is totally unacceptable. Please check into this urgent matter, expedite, and return TWX the status of this situation. Your help is most urgently requested in this matter.

I have known and interacted with Dr. Wilkes for many years. We need him here. Won't you please, please help us? What other information do you need? I will be calling you and Dr. Brewster after you have received this.

Sincerely,

Gordon Bell
Vice President, Engineering
DIGITAL EQUIPMENT CORPORATION
Maynard, Mass. 01460
Telex No: 948457

cc: Richard Goldstein
Attorney at Law
Suite 606
335 Broadway
New York, New York 10013

GB1.S5.69

REFERENCE:

Peltier & Brewster: Telex code: FORN 266777
Brester Tel #: 499-9000 London

Richard Goldstein: Telex code: FORN 620292

+--------------+ ID#0161
| **d i g i t a l** | **I N T E R O F F I C E   M E M O**
+--------------

SUBJ: People to Place

TO: John Meyer Date: 7/10/78
From: Gordon Bell
CC: OOD Dept: Office of Development
MS: ML12/A51 Ext: 2236

There are a number of people casting about for jobs either within OOD or in other parts of the organization. These are the ones I'm aware of:

1. Bruce--try Stan or Larry's (commercial organization). We discussed a job with systems (hardware and software responsibility). Also a job with customer/end use would be preferable. He needs to know how to motivate a set of unrelated projects...as distinct from a highly focused program which I believe he could successfully manage.

2. Stan Pearson--I don't know. Somehow we aren't giving him the strokes here. I've been awfully impressed with what he is doing in the RAD committee for example, but we've signalled that he has to go to line management. I believe we desperately need him in the planning role and we have to make this rewarding.

3. Peter Jessel--I can't tell what he wants to do. I believe he is good in focussed Advanced Development and might be good in R and D. Ulf should talk to him, as Jim has been unable to do anything. Whatever Dick is going to do the small systems areas might create a need. I said talk to both Dick and Bill regarding the systems job. (Here my reasoning is that if Dick's only customer is Bill,

maybe he should turn the function over to Bill.) Also, Peter might like to get more involved in end use (DCG, Stan, Commercial) as he believes the realignment will be more useful to product definition. He is also talking to Telco.

There are undoubtedly more. Please make a list of other people...the unhappy or the groping. Assign them to various people. I am tired of losing people who get in this mode and that we make find themselves. I expect them to be settled in or out of their current jobs by the first of September.

gb

D I G I T A L   INTEROFFICE MEMORANDUM

DIST:

Dick Clayton	ML12-2/E71	Jim Cudmore	ML1-5/E30
Bill Demmer	TW/D19	Ulf Fagerquist	MR1-2/E78
Bill Johnson	ML21-3/E87	John Kevill	ML1-3/E58
John Meyer	ML12-1/A11	Larry Portner	ML12-3/A62
Bob Puffer	ML12-2/E38		

ID#434

d i g i t a l   i n t e r o f f i c e   m e m o r a n d u m

Subject: **Doing Business With The People's Republic of China**

To: Carl Janzen, AK
Ted Johnson, PK3-2/A55

Date: 26 JAN 79
From: Jean Bow
Loc: PK1/E33

As a DEC employee, I would like to support DEC and help you in deciding about, and hopefully doing business in China. I'm going to China April 11 for one month and could present DEC products and meet people.

I understand from Gordon Bell that you are formulating our trade policy and that you will meet with me in regard to a possible assignment.

Should DEC Try to do Business with China?

Yes. China's desire to modernize her industry, agriculture, science and medicine via western technology has opened up a vast potential market for DEC. I believe DEC has the unique know-how and adaptability in building special systems (hardware and software) to solve difficult problems. Indeed, China has many difficult problems at present that could be solved by the innovative use of computers. Therefore, China should be given a chance to listen to what DEC has to offer prior to her commitment to our competitors, both U.S. and Japanese.

Making Contact

The purpose of my forthcoming trip to China is to visit my family, whom I have not seen for 30 years. I also intend to visit government research centers, universities, laboratories, hospitals and manufacturers. I am prepared to take courses here, if necessary, and give informal lectures on the practical aspects of our computers and how to use them. I do have a technical background as you can see (attached). For example, how to organize and manage computer data centers, how to teach practical mini courses on using computer software, and the difference between university and business data centers, etc. I will have opportunities to establish contacts and personal rapport with various key Chinese personnel. In addition, I will be able to plan and establish contacts in advance from Boston as soon as you can give me some guidance. Please take advantage of my enthusiasm. I want to help.

JB:ljp

Attachment

DOCNO8/21

Digital **Interoffice Memo**

Subject: **Peripheral Buy Out/Getting Co-operative Vendors:Versetec Case Study**

To: Distribution

Date: 20 SEP 76
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

F/U 9/28

Given our limited resources, particularly in PL Engineering, F.S. and Software Support, I'd like to suggest we limit our product offering higher volume, supported products. This would have precluded our offering the Versetec printer, for example.

0. We don't make much on it, and it adversely affects PLC.
1. It's expensive for the graphics user.
2. Customers don't buy it because it's too expensive.
3. We don't support it well because we don't have good margins (i.e., both poor hardware and software).
4. Versetec has a good product with hardware and software support.
5. We offer the obsolete (100 pt) version.

Therefore:

LET'S NOT DISTRIBUTE THE VERSETEC PRINTER BUT LET'S HELP THEM SUPPLY PRINTERS TO OUR COMPUTERS!

Everybody wins! Also we could offer Calcomp plotters in this same way.

Instead of adding a new printer to the VS60, let's co-operate to get a good product that we do not make. What other

products should be bought/attached out?
Why not just offer this and not process it through our books?

GB:ljp

Distribution

OOD
Ed Corell
John Hall
Ed Kramer
Bill McBride
Bob Peyton
Bill Thompson
Sam Bosch
Jack Gilmore
Win Hindle
Jesse Lipcon
Ken Olsen
Grant Saviers
Allan Wallack

FROM: GORDON BELL DATE: SAT 9 FEB 1980 9:34 AM EST
DEPT: OOD
EXT: 223-2236
TO: GEORGE THISSELL
JIM BELL
BERNIE LACROUTE
JACK MILESKI
STAN PEARSON
DICK SNYDER
BILL HEFFNER
BILL KEATING
OOD:
PEEBLES VIA J BELL

SUBJECT: GEORGE IS PROBABLY RIGHT

Somehow we have to get the personal VAX project going quickly in order to deal with this problem of one-ness and the built-in complexity that it might imply. The intent of the single VMS is to be able to run a program at any level so as to preserve programs, and more importantly data across the various systems. The thing that can vary is the user interface and the packaging of the system and the documentation to reflect the specific uses of the variations.

George is absolutely right on the evolution of a complex system.
It implies tons of manuals, and expensive system programmer experts, high support and massive overheads that only the CS depts can afford because the people are free and can deal with the complexity. Also, large organizations want them
to keep their staffs challenged.

Personally, I have had waged and lost all the battles in this regard by trying to get a manual written for a user (here, I have wanted to try the simple experiment of putting all you need to know if all you know is APL, BASIC, PASCAL, or Fortan,
and simply want to login, create, run (with a library), and debug your program in a single manual). This would have made VAX simple for all who touch it in 95% of the cases. Alas, it
doesn't cover all the intricies of the file system, loader, debugging, writing macro programs, user defined commands, and administering the system. Not only have I lost the battle, but
I found out that we can't even get manuals like this written because the typesetting system and writers are not enough in control of their words that it is a 2+ year project...instead of simply moving a few files from previous manuals around. We
are somewhere in the early 1970's in our manual writing and typesetting capability it feels like.

Yes...we need some work here, and a plan. The systems organizations
as we have them now will never deal with this cause there are hundreds of other issues like Dock Merge that have to be dealt
with. Somehow it is in the domain of the Technical Director of
SW, and we need real leadership here to keep us from going down the current path that will inevitably mean a set of new systems to cope with the complexity.

PS
The IBM approach ain't right...cause it means no movement of computing styles, files, programs, and a mess in the complexity due to the fact that SNA won't be that good in solving the Interconnect problem. I still believe in the concept of where we could go, but it takes a belief and design to do it. The personal VAX is a start.
... assuming it starts someday. (The test is how big the manuals
are.)

George, I'm delighted you have bought some programs from the outside and potentially have saved us t to mkt and precious development resources. Given that we share a common problem/
vision here, how can you in addition help guide us?

Anybody worried about this besides George and I?

ATTACHED: MEMO;76

TO: ROGER CADY DATE: FRI 8 FEB 1980
1:11 PM EST

FROM: GEORGE THISSELL
cc: see "CC" DISTRIBUTION DEPT: SOFTWARE
ENGINEERING

EXT: 223-7698
LOC/MAIL STOP: ML12-3
A62

SUBJECT: RE. DEC UNIQUENESS

Read your note and will throw out a couple of comments-

Think we're striving for ease of use for our large customers by
expanding on the generality of the Operating System so as to minimize their training,networking, interchange, etc, problems.
Unfortunately a by-product of generality is to give up some

of
the "approachable,friendly, and easy to use" characteristics
that the single function user can have in 11 Land (single
user
is RT-11, T/S is RSTS, multi programmed real time is RSX...)I
suspect that a large part of this ease of use is in the
manuals
which are describing a smaller functionality and are therefor
easier to read....

It's worrisome in terms of the single function prospect that
we're putting so many eggs into the one Operating System
approach
which by definition is more complex than a system dedicated
to a
subset of the universe. The system your data base prospect
gets
will not only be able to run DBMS-32 but also Transaction
Processing, Real Time, Time Sharing, etc which is great for
the
General Motors Programming Shop but complicates life for the
single function guy. Maybe what's needed most is really good
Tech
Writers who produce sets of single function system manuals?

It's even more worrisome that IBM seems to be trying to get
where
we came from: the image of the S38 is Data Base; the 8100 is
Real
Time; the 4300 is GP; etc. And they seem to feel that SNA
will solve
all their compatibility problems? At any rate it seems
intuitively
clear to me that whatever DB system you may develop on VMS
just
has to be more complicated than say the S38 with its more
narrow focus.Better manuals and prebuilt systems can help,
but....

Maybe you've guessed by now that I question the one Operating
System approach; you're right I do! On the other hand I don't
advocate the chaos of the 11 Land where Operating Systems

continue to proliferate, but rather a rigidly planned set of compatible, functional subsets of VMS. I would think this would
return "ease of use" to the single function user while VMS would
continue to be the GP system needed by the GM's of the world.

I'll also question the notion that 1 OS is easier to maintain than
several(when blaspheming why not go all the way). I'll argue that
there's a powerful synergism of complexity that more than makes up
for the extra drivers and manuals. In five years we're going to
need some pretty smart people to maintain VMS (Remember when OS370
went critical; ie fixing 1 bug was introducing 1.x bugs? or when
the TOPS-10 solution was to throw away 1000 SPR reports?)

In sum then I'm suggesting that the multi function capability required by the one Operating System approach promotes ease of
use for our large customers at the corporate levels but has to
cost the single function user in terms of complexity. We can mitigate this to an extent with prebuilding systems and more precisely focusing our manuals but nothing's free;controlled additions to the O/S lineup could help on the ease of use axis.

Regards

"CC" DISTRIBUTION:

GORDON BELL* BILL JOHNSON JACK MILESKI
RON HAM

GB1.S1.69

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+----------------------------+          COMPANY CONFIDENTIAL
           GB3.S2.25
|   |   |   |   |   |   |   |
| d | i | g | i | t | a | l |                i n t e r o f f i c e
|   |   |   |   |   |   |   |                  m e m o r a n d u m
+----------------------------+
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SUBJ: NOMINATION: BILL JOHNSON, VICE PRESIDENT OF SOFTWARE ENGINEERING

TO: OPERATIONS COMMITTEE

Date: 2/16/82 Tue 9:46
From: Gordon Bell & Jack Smith
MS: ML12-1/A51 Ext: 223-2236

We would like to recommend that Bill Johnson be appointed Vice President of Software Engineering. BJ fulfils the agreed upon criteria*.

BJ has the largest engineering group, and due to the complexity of the interconnection of the components has the most difficult management job. In this regard, we are known for quality and creatively compatible systems. He is an excellent manager, managing by inspection, and knows what goes on in the products and within the projects.

The recent announcements of the 782, VAX Information Architecture, and Office are indicative of the performance of our creative and productive software engineering group.

BJ is pivotal to our product future.

Due to BJ's wide experience in both hardware and software engineering, he is a widely sought after person. He can handle a wide variety of future assignments.

*   "<u>Officer Criteria</u>

Past (a) sustained, excellent performance in key positions

(b) major contributions to DEC

Future

(c) <u>strong belief that person will make contributions in future</u>

<u>Future factor is the most critical</u>."

CANDIDATE: Bill (B.J.) Johnson Sponsor: Gordon Bell

Jack Smith

CURRENT POSITION: Manager of Software Engineering

ACCOMPLISHMENTS: B.J. has been our fast track performer; in rapid succession he has been Manager of Diagnostic Programming, Technology Director for Central Engineering, and Manager of software Engineering. In all of these roles he has demonstrated leadership and strong technical and organizational skills. His role in software is to manage the largest, most complex (organizationally) Engineering group. He has increased focus in quality and advanced development, and software methodology.

He has put into effective operation Reading and DECwest. We believe that all groups are operating very effectively.

FUTURE: B.J. will continue to be a fast track performer. He is rapidly acquiring a broad perspective of DEC's business which when allied with his hardware and software technical skills makes him extremely valuable.

FAGERQUIST

5/510

Hooper, Don	2080 + Itel
Kotok, Alan	KA,KI,KL, Venus
Melanson, Ron	
McClure, David	DECnet
Elkind, Bob	
Fossum	780,Venus

DEMMER

8/462

Stewart, Bob	45,70,780	
McInnis, Don	750, Nautilus	*
Titelbaum, Mike	05,03,23	*
Lim, Arthur		
Jenkins, Steve	45,70,780,BI,Nautilus	
	*/2	
Li	750	
Meinerth,		
Steely		

AVERY

	6/464	
Miller, Avram	CT,+	*
Forrester, Ned	VT100,VT200 video,	
Gonzles, Dick	Minc, CT, VT,	*
Lomicka, Roy	LA36,120,LA100+,VT micro	
Rudy, Jeff	Editors,	
Folsom, Barry	VT18X	

LACROUTE

	5/189	
Rodgers, Dave	780,I/C program, NI, pluto	*
Lauck, Tony	DECnet arch	
Ermolovitch	NI construction	
Wilson, Andy	IAS,	
Schzecjeim, J		

GUTMAN

	3/100
Lipcon, Jesse	
Gaubatz, Don	
White, Don	

FULLER

Strecker, Bill	70 cache, VAX arch, DEC arch
Glorioso, Bob	Venus,
Dileep	

SAVIERS

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* d i g i t a l *
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TO: LARRY BORNSTEIN
6:43 PM EST
PEG:
JACK SMITH

DATE: SAT 17 APR 1982
FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: HIRING FROM WITHIN AND WITHOUT, AND OUT-PLACEMENT

Bill Thompson really probed at me on the issue of approving many hires. I've been doing it, assuming that you folks are doing this within budget! At the same time, I know that we are going to have to let some people go, if things continue to deteriorate bookings-wise. Jack is dealing with his group and I'm approving the Nautilus expansion. I also approved a very strong technical person (and manager) for Sam, along with the 6 people for the California startup.

I had a request for a former general manager and VP which I think both Jack and I should look at, cause it looks like there will be good managers available with similar experience within DEC. It's unclear as to the quality because the person had been running their videodisc effort and hence I'd question his technical judgement and esthetics. The OC is asking members to identify high quality people for reassignment. They are also asking for the budget to be made 2 ways for FY83: one as is; one if some of the marginal people can be identified and put in a holding place for reassignment. This should also be done for engineering too.

In short, we gotta really put on the brakes. There are many people that are going to be identified for reassignment that we might have and that we want transferred. We do have to keep our commitment to the colleges and strong technical contributors because they are what really make the products.

Any managers are going to have to be screened thoroughly, and unless they possess very strong technical skills, I don't intend to approve them.

GB3.S4.31

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* d i g i t a l *

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TO: OPERATIONS COMMITTEE: DATE: TUE 19 MAY 1981 8:22 EST

LARRY PORTNER

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: A PROPOSAL FOR EVALUATION OF DIRECT REPORTS IN JUNE

We recently evaluated the direct reports within engineering using the salary, proposed salary, and proposed stock. In addition, Don Ames provided the stock value available in 1982 on an if sold basis, treating all past stock grants as compensation. The data was suprising and useful! In addition, I believe we should have the total value of all remaining stock to be used as a guide.

We asked each person to rank order their candidates together with the justification of the stock shares. The criteria used were:

1 exceptional performance
2 criticality to continued success and who were not proportionally compensated or recognized
3 position in the organization and who might receive stock assuming they were doing an adequate job

The method we used for the evaluation was to:

1 have each person present their candidates in order of importance (what amounts to the LAST person that one would throw out of a lifeboat)
2 have the whole group comment on the candidates and collectively decide on the shares for the candidate. This of course required additional stock shares.
3 these new requirements were then merged back into the initial list so that we could compare across organizations, and
4 finally we made a single pass of the complete list from the largest number to the smallest number. At this time, the total number was reduced, as we found there were persons within each group that were reduced (this amounts to finding persons we didn't need in the boat at all).

We found that the past data was useful in a several cases: there were critical persons we always want in the boat with us and who are neither compensated very well nor who have many shares. Also, there were a bunch of harmless folks with us who are doing little to move the boat, and who would probably not be missed if they fell overboard. In fact, we found that we were paying some riders $120K, while our key people were only getting $60K. Since the initial recommendations were to add some more to the riders, in proportion to their position in the organization, the final recommendations came out nothing like this.

Therefore, I propose that in the June meeting, we come with the

personnel list which includes: name, salary, proposed salary, percent increase, rating, stock compensation this coming year,
remaining stock compensation for all following years, and the proposed stock grants, together with the justification as to why
each person occupies the critical position in the boat.

I recommend that we use a similar procedure in June.

Gordon

In addition, we observed that stock value to a person varies by a
factor of 20 to 40. If a person is really committed to DEC, then
the value is at least the spread x 10 x (2 - 4), or 15K to 30K
per 100 shares! If the person isn't committed, the value is only
the spread he can sell next year, or about $750. When we
ultimately grant the stock, we should accompany it with a sales
pitch!

GB2.S5.57
Engineering Review
Gordon Bell/Larry Portner
4/21/81 Tue

```
                                                  |JC  |RC  |BD  |WD
                                                  |WF  |UF  |JH  |RH
                                                  |WJ  |BL  |SL  |JM
                                                  |JR  |GS  |ST  |WT
                                                  |PVR      :
```
<u>Products produced by their org</u>
```
                                       Quality    |    |    |    |
                                              |   |    |    |    |
                                              |   |    |    |    |
                                              |   |    |    |
                  Functionality,competitiveness   |    |    |    |
                                              |   |    |    |    |
```

Mkt. Positioning Knowledge & Strategy

Cost

Uniqueness

Develop Process within their org

Eng. Support (CAD, etc.)processes

Cost control

Schedule control

Quality/utility of A/D

Productivity of group

Organization/people within their org

General health (doesn't feel good?)

Personnel processes (hrp,idp,etc.)

Successor/depth

Education/skill mix/up-to-dateness

Person development

Interface of org to others

Customer services

Manufacturing

Marketing

Other eng (con)

To bosses

The person

Leadership to troops

Mkt understanding					
Prob.solving/ideas/innovativeness					
Corp.understanding & view					
Personal development					

FROM: GORDON BELL DATE: FRI 26 OCT 1979
1:24 PM EST
DEPT: OOD
EXT: 223-2236
TO: JOHN MEYER
SHEL DAVIS
cc: OOD:
OOD: @CLEM

SUBJECT: KEEPING VERSUS RECRUITING -- FOLLOW-UP 11/2/79

GB0005/33/EMS

We suggested that someone be assigned, effective immediately, to the problem of understanding why (all the ways) we lose people through attrition and then educate our managers. Keeping the people we have is cheaper than recruiting. Should this person be part of the recruiting group?

GB:swh

FROM: GORDON BELL DATE: TUE 16 OCT 1979 2:29 PM EST
DEPT: OOD
EXT: 223-2236
TO: LARRY PORTNER
BILL JOHNSON
cc: BOB DALEY
JOHN MEYER
TERRY POTTER
SAM FULLER

SUBJECT: BRUCE HURWITZ'S RESIGNATION

GB0005/12/EMS

I just got a call from Al Saloky on Brice Hurwitz's resignation to go to Wang at a big increase. The concern is: Bruce will take people, the group needs a manager, the friction among performance group is high and other groups depend on them. What's being done to address these issues? Let's BE QUICK! and RIGHT!

GB:swh

WPS USERS - Enter HP mode and then type <CR> 00 BURT
DECGRAM ACCEPTED S 22785 O 417 05-JUN-81 15:18:02

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* d i g i t a l *
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TO: ENG STAFF & DIRRPT: DATE: FRI 5 JUN 1981 12:54 EST
ENGRG. USERS: FROM: GORDON BELL
OPERATIONS COMMITTEE: DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: 16-BIT PROGRAM OFFICE MANAGER

We are very pleased to announce the appointment of Mike Gutman as
Manager of the PDP-11 Program Office reporting directly to Gordon
Bell and Larry Portner.

The Program Office covers the development of all PDP-11 based products from microprocessors to large systems for technical, real time and commercial systems.

The PDP-11 Program Office will be responsible for determining the
strategies for PDP-11 products, the line management of QBus and
Ubus hardware development and support, and the resource allocation of all hardware and software projects.

There will be a transition period as Mike works out of his current job in Storage Systems and he will take over the Program
Office on a full-time basis by the start of the 1982 fiscal year.
Mike will be announcing the PDP-11 Program Office organization at
a later date.

Mike came to Digital 7 years ago to help found the Components Group. For 3 years, he was Product Manager and then Engineering
Manager of the Memory Systems Group. For the last 3 years, he
has been Storage Group Product Manager.

He received both his Bachelors and Masters degrees in Electrical
Engineering from Worcester Poly Tech. He and his wife Lois have
4 daughters and reside in Framingham.

We look forward to seeing Mike in this challenging and demanding role and hope he can count on your support.

GB2.S6.66

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* d i g i t a l *
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TO: KEN OLSEN DATE: THU 9 APR 1981
20:57 EST

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: SOME FOLKS WE MIGHT GET TO WORK HERE

I'd like you to call Erich Bloch (home 914-763-5969, or work 696-1900 x 3401)... and ask him to come for lunch, etc. or visit our semi place, or something. I'll do the hosting...
in detail. I have great expectations that he can easily do my job, and that we should get him here. He has considerable
experience and intellect. Also, he's a recent (1 year) club (NAE) membrer.

Intend to invite Corell in to chat with us: Jack, Grant (for Colorado
job), Larray, Esten, and I and Si. John Piepietro is handling.
Possibilities include having him run and eng/mfg group for all
of printing terminals... or an eng. only role.

We are pushing to get Jeff Kalb here, former DG VP of Eng. Jack and Jim (Cudmore) are leading.

GB2.S5.61
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* d i g i t a l *

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TO: STEVE TEICHER
9:36 PM EDT

DATE: WED 13 AUG 1980

FROM: GORDON BELL
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

cc: CHAD CUTLER
ALAN KOTOK
BILL STRECKER

SUBJECT: RE: PROMOTING CRAIG MUDGE TO SENIOR CONSULTANT

The criteria in my head is two, significant technical accomplishments. Strecker (11/70, memory hierarchies modelling
general case, and vax architecture), Kotok(10 architecture guidance, our telephone system, many 10 implementations, and the ecl gate array push), Cutler (11/M, VMS and now a new compiler technology that promises to be backbone of much of future compilers). I would like to meet with the senior consultants on this and maybe go over names of all the people we have that fit this highest category. Believe he has done very solid work on the 60 FP and WCS, and Nebula advanced development, and in Managing the cal tech inteface including the idea of formal ports. Although I don't believe we have to wait for Scorpio, I do believe the transfer of the MOS work into production this year could constitute a second major accomplishment. Certainly the book was useful too.

This issue is so hot that I want you to keep pushing but I think it is essential to get with the Senior Consulting Engineers to get a bit more formality. I'll get this set up quick!

Senior Consultants how do you feel on this?
Who are we missing?
What do you think the criteria should be?
(Note, I'm putting some pretty strenuous criteria that goes beyond promotion of full professor with tenure in the academic
world.)

I also consider both Riggle and Fred Hertrich to be fitting of the title, although Mike has a manager's title and Fred isn't in the company.

PLEASE LET'S JUST KEEP THESE MEMOS VERY, VERY CLOSE TO OUR BODIES AND POSSIBLY NOT MAKE COPIES OF THEM!

Can we try exploring this a bit more this way and then get together? Also, how about a telephone conference tomorrow?

GB1.S6.19
February 19, 1980

Minna Post Peyser
Minna Post Peyser and Associates
Northview Estates - Lake Oscawana
Putnam Valley, New York 10579

Dear Ms. Peyser:

Thanks for sending the information on your citizenship EDUCATION FOR PARTICIPATION IN THE COMMUNICATION AGE Seminar.

You certainly have identified a possible future issue. The panelists have interesting backgrounds and will clearly help put on a provocative seminar.

Since I'm already over committed to building computers I can't attend.

Good luck in identifying the issues and trying to get the various disciplines to somehow communicate with one another...no doubt a first step.

Sincerely yours,

Gordon Bell
Vice President,

Engineering

GB:swh
GB1.S2.11

THE BASIS OF SUPERCOMPUTERS:
SEMICONDUCTOR AND PACKAGING TECHNOLOGY

RELATIONSHIP OF SEMICONDUCTOR AND PACKAGING TECHNOLOGY TO PERFORMANCE

Semiconductor logic circuits and memory chips and the ability to interconnect them densely is the basis for today's pipelined supercomputers. For the last 20 years, Cray has taken "off the shelf" transistors and integrated circuits and packaged them creatively, forming a very dense structure to achieve the fastest speed clocks and therefore, the fastest computers. In addition, Cray has also organized his computers from a number of computers, processors and functional units to operate in parallel, giving greater performance.

For machines just being characterized, the Cray X-MP (a quad, multiprocessor) and the Fujitsu V-200, the clocks are 9.5 ns. and 7.5 ns respectively. The peak performance of the V-200 is about twice the Cray uniprocessor for the Livermore loops. The speed difference is probably attributable to a better vectorizing compiler for the V-200. The clock difference is due to Fujitsu's impressive semiconductor technology and the packaging capablity evolved from Amdahl. The X-MP is simply an evolution of the low density semiconductors used in the Cray 1. Virtually all computers today use Japanese high speed MOS and CMOS memories.

A Cray 2 uniprocessor, appears to be a breadboard for the Cray 3, and will be delivered soon to Livermore. It uses the fluorocarbon cooling bath and has a 4 ns. clock. The commercial version, the Cray 3 might be ready by '86. NEC's machine which will be introduced next year has a 6 ns. clock. Cray is currently exploring GaAs for increased speed and lower power.

Since the V-200 is IBM compatible, with a large virtual memory, Fujitsu is likely to create a new market, and begin a major erosion of the U.S. dominated supercomputer market unless the X-MP can be parallel processed, or new, faster models introduced quickly. Because the V-200 and corresponding Hitachi machines are IBM compatible, they will make an impact on supercomputers as we have known them.

THE JAPANESE POSITION IN SEMICONDUCTORS

Japan's semiconductor technology lead is increasing. All major manufacturers have operated submicron facilities for up to three years. Since these facilities represent a discontinuity in equipment for cleanliness, lithography, handling, etc., semiconductors are likely to be our technological blindside unless a major discontinuity is introduced to offset their effort. Today, the Japanese have closed the gap in manufacturing equipment by introducing their own, non-exportable equipment. The tight coupling between producer and consumer of semiconductors within a single company in Japan is also another interesting facet.

Note the situation in these directly critical semiconductor areas:

1. CMOS for RAM and gate arrays; Japan is several years ahead because U. S. suppliers were slow to make the transition from NMOS to CMOS. The best U. S. gate array supplier, LSI Logic, uses Toshiba chips. Toshiba has the most advanced CMOS facilities today in both manufacturing and research.

   While today's supercomputers are not CMOS based, one company, ETL is basing its future on a large, CMOS gate array.

2. evolution of ECL; Current and projected ECL gate arrays have continued to outperform U.S. produced devices. While efforts in this area are decreasing, evolutionary devices could enable the current Japanese supercomputers to be "evolved" again with relative ease.

3. revolutionary HEMT and revolutionary GaAs devices; The Japanese continue to build and describe high speed circuits at various conferences. Cray is working with GaAs; however, chip manufacturers are required to make the technology viable.

4. packaging; Trilogy's ECL circuits and packaging represented the most advanced design, but is currently "on hold" because of the company developed a design

that went beyond their ability to manage and process the complex design. Only a few efforts exist outside of IBM and are aimed at the necessary interconnect and packaging densities.

While not directly relevant, these areas are of similar importance:

5. <u>conventional microprocessors;</u> These are dominated by U. S. "Semicomputer" manufacturers quite likely because the Japanese are unwilling to make the architectural and software investments when the return is so low. It is much easier to copy the architectures and produce compatible chips.

<u>Microprocessor Opportunity and Potential Blindside</u>

Because of the low cost, reasonable speed (compared with minis and mainframes) and rapid rate of progress compared to conventional computers, the microprocessor represents two technological opportunities that could impact supercomputers and represents a unique opportunity for the U.S.:

5a. The PC provides about the same number of floating point operations per dollar as a Cray for a number of scientific problems, whereas a mainframe is an order of magnitude more expensive. High performance, scientifically oriented micros, would provide cost-effective computation for a much wider class of users, and it could reduce the dependence of some supercomputer users by offering an order of magnitude better performance/price.

5b. A substantial number of multiprocessors have been built which provide substantially better performance/price than large computers. Also, several multiprocessor computers have been built which provide performance that deliver power in the same range as supercomputers, but at substantially lower prices.

6. <u>microprocessor peripherals;</u> While not directly relevant to supercomputers, peripherals indicate the state of the art in design complexity. Many of the

major chips are designed in Japan such as the NEC graphics and disk controllers for the IBM PC.

7. Computer Aided Design: CAD has been developed by U. S. Universities. The programs move almost instantaneously across all borders, creating an even more powerful industry in Japan.

Today's CAD systems are aimed at chips or small, board-level systems. CAD for large systems appear to grow exponentially in complexity and size. An opportunity exists in this area, if simpler methods can be found to deal with the large system size without increasing the CAD or designer complexity. In this way a larger number of ideas could be explored without requiring the massive engineering resources of the large, Japanese companies.

8. electro-optical technology; Some effort should be made to access the likelihood that this technology offers for both computation and for interconnections.

RECOMMENDATIONS TO MOVE TO TECHNOLOGICAL PARITY

Several alternatives have been suggested to establish submicron facilities, beyond those at AT&T and IBM. The Semiconductor Industry Association, SIA, has recently focused on long term research through its research company, SRC which is supporting basic research in universities (and supplying additional engineers).

If the technology for future supercomputers will come from the SIA member companies following an evolutionary path based on CMOS, then the current direction must be acclerated. If the technology requires evolutionary materials and circuits, then an additional effort is required because of the commodity focus of the semiconductor industry.

We recommend following as many of the following alternatives as possible:

1. Startups. An entrepreneurial energy driven, industrial/venture capital financed company, such as Picotech, proposed by Integrated Circuit Engineering Corp., ICE, a market research firm in Phoenix. This would be located in the New Jersey and New York area and presumbably "pull" technical people from AT&T, IBM, RCA Labs, etc. to produced 0.5 and 0.25 micron chips. With the right leaders, this would could be the "best" solution. A facility in Silicon Valley would lack people with submicron experience.

1a.Picotech, Japan would be an interesting alternative. A company would be formed in Japan which would draw on the experienced semiconductor leaders and utilize Japanese process equipment.

2. An SRC or national effort.

a. Form an effort as part of, but in addition to, Microelectronics Center of North Carolina, MCNC done in conjunction with Semiconductor Research Company, SRC.

b. Some other SRC initiative directed at an aggressive submicron chip facility.

c. A National Laboratory for Submicron Device Circuits.

3. Synergy with VHSIC Phase 2. Use VHSIC's second stage results which are targetted at producing the first 0.5 micron chips beginning in two years. The first VHSIC phase obtained 1.25 micron chips within a 3 year timeframe because this was simply a transfer of technology from commercial advanced development to an expensive military line where the government can pay an order of magnitude more for chips. Since current facilities are not in place for submicron fabrication, the effort is unlikely to be successful in time for making competitive supercomputers.

4. Industry. An incentive program which would establish submicron facilities in ALL current semiconductor vendors who are working on high speed circuitry. A special effort should be directed at sorting out the viability and timing of GaAs. If VHSIC is involved in GaAs, the experience gained in this effort should be made available to the commercial industry in order to have cost-effective chips.

5. CAD aimed at small systems could be extended for sets of chips which are necessary for supercomputers.

6. Revolutionary, But Trivial Microprocessors for PCs and Multis. Providing substantially better microprocessors than currently exist or are likely to evolve. The evolution of microprocessors from Intel, Motorola and National has been slow. The key parameters for building effective computers are address size and floating point performance have improved much slower than the semiconductor parameters would predict. The architecture for micros has followed the time worn evolutionary paths of minis and mainframes, and this is not appropriate now because the memory speed and internal clock times for micros are almost identical, given a poor mismatch between processor and memory.

Today's micros need to be abandoned and a simpler load/store architecture that is characteristic of the Cray designs is needed, but with floating point arithmetic and large virtual address. Both Stanford and Berkeley have built the MIPS and RISC chi

June 29, 1978

Ms. Judith Pickett
Counsel
Conservation Law Foundation
of New England, Inc.
3 Joy Street
Boston, MA 02108

Dear Ms. Pickett:

Ken handed me your letter. Bob Puffer, of our organization, has responsibility for the mill and I'm sure would be delighted to walk around the mill pond and mill with you. In particular, to see the restoration we've done. It's been the subject of several architectural studies.

We're delighted that you're interested in solving our parking problem and want to get your ideas.

You may be interested in the history. Enclosed are two pamphlets our project printed.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:ljp
ID#0148

Enclosures (2)

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+---------------------------+                                  GB0003/60
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| d | i | g | i | t | a | l |   i n t e r o f f i c e   m e m o r
a n d u m
|   |   |   |   |   |   |   |
+---------------------------+
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Subject: **Picturephone Meeting Service and Our Video Conferencing**

To: O/C
OOD
Jim Bell, ML3-2/E41
Murray Copp, PK1/A10
Al Crawford, PK3-2/F34
Ralph Dement, PK1/A10
Jack Gilmore, MK1-1/J14
Dave Hunt, ML1-4/A97
Dick Kalin, MK1-2/L02
Ken King, ML3-2/E41
Alan Kotok, ML3-5/H33

Date: 6/24/79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext:223-2236

Follow-Up: 7/9/79

Several of us visited ATT's Picturephone Meeting room in Boston. It is one of a dozen (Atl, Bos, Chi, Det, La, Ny, Phl, Pgh, Sf, Wdc) or so linked together by full duplex color video channels. Apparently up to 4 of the rooms can be connected for an even larger conference. The cost per hour varies from about $150 to $390 (NY to LA).

The rooms hold 6 at a table, plus about 10 in a row behind, and another row of chairs can be installed. Apparently 24 have made it in a room, assuming the air conditioning is on better than when we visited. It has the following:

. 3 cameras that are voice actuated that cover pairs of the 6 at the table
. 1 camera to give a panorama of the room, when no one is speaking
. 1 camera with tilt and zoom to cover a presentor at a

whiteboard area
. 1 camera with zoom to cover back or top lighted viewgraphs or opaque stuff
. 1 camera on a slide projector
. 1 camera can be brought into the room for special use
. a tv videorecorder for input or recording the proceedings of a channel
. a Tektronix hardcopy output of the incoming channel
. several consoles where the camera channels can be selected
. 2 tv screens for viewing incoming and outgoing video

Each of the participants wears a neck mike, hence there is great audio. The numerous cameras make for lots of action to hold attention of the conferees. The person who manages a transmission has little to do, and in fact can do nothing and the voice actuation and presentor can do it all. This means there's not another person in the room to manage the conferencing.

I talked to people at BTL Friday and discussed the changes to subsequent rooms. Hitachi is building a digital encoder to get the color tv down to 5 MBS so it can use the regular network. There was some notion of a large (60") screen, which seems essential because the 2 TV screens were only 25" or so. Also, it would be worthwhile having some automatic or easy to use videomixing so that static material such as slides or viewgraphs can be mixed with the conferees.

What I would like to see:

. Let's make a concerted attempt to use the existing videoconference facility of AT&T's...and log our reactions, find out its use and limitations.

. Put in place these rooms as per what BTL will provide and a network among the NE sites assuming it pays on the basis of transportation costs (the worst case).

. Work with BTL to see just whether we can get down to a cheap, 50 bps link so that it can also be used among widely separated domestic facilities (eg. ML-CX).

AT&T hypes it for: product introduction and sales, especially to multiple sites; personnel interviews...it looks very good for this in certain cases where the interviewee has a hard time coming to visit; design reviews and technical problem solving between two groups; staff meetings such as regional sales or service (note with 4 sites, the travel time could be significantly reduced in our case). It has even been used for depositions.

GB:swh

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Al Bertocchi PK3-2/A56 Shel Davis PK3-

1/C21

Win Hindle ML10-2/A53 Ted Johnson PK3-

2/A55

Andy Knowles ML10-2/A52 John Leng MR1-

1/A65

Bill Long ML10-2/A57 Julius Marcus MK1-

2/C37

Ken Olsen ML10-2/A50 Stan Olsen MK1-

2/C36

Jack Shields PK3-2/A58 Jack Smith ML1-

4/A54

Bill Thompson MS/C12

Dick Clayton ML12-2/E71 Jim Cudmore ML1-

5/E30

Bill Demmer TW/D19 Ulf Fagerquist MR1-

2/E78

Sam Fuller TW/A08 John Holman PK3-

1/P84

Bill Johnson ML12-3/A62 Mitch Kur ML12-

2/A16

John Meyer ML12-1/A11 Larry Pornter ML12-

3/A62

Bob Puffer ML12-2/E38 Grant Saviers ML3-

6/E94

Jim Bell ML3-2/E41 Murray Copp
PK1/A10
Al Crawford PK3-2/F34 Ralph Dement
PK1/A10
Jack Gilmore MK1-1/J14 Dave Hunt ML1-

4/A97

Dick Kalin MK1-2/L02 Ken King ML3-

2/E41
Alan Kotok ML3-5/H33
Why can't these be identical in terms of power supply, electronics, and overall package? I assume they differ by a rom for the different positioners. I don't see why the form factors aren't identical such that either could be put in a cabinet slot.

What you say?
ROM: GORDON BELL DATE: WED 31 OCT 1979 11:33 AM EST
DEPT: OOD
EXT: 223-2236
TO: DAVE CUTLER
cc: LARRY PORTNER
ANDY KNOWLES
BILL JOHNSON
SI LYLE
BILL PICOTT @MR16

SUBJECT: PL/1 AT DECUS

GB0005/44/EMS

Certainly we must abide with PPC decision to not announce PL/1 or make a product commitment at DECUS.

Since we often describe R+D efforts, it seems totally appropriate to discuss your work as such and get feedback you might want.

I believe a talk on "The Structure of a PL/1 Compiler for VAX" or "PL/1 Code Generators for VAX" or "An Experimental PL/1 for VAX" would be good and should get on the program. Let's describe the work.

GB:swh
FROM: GORDON BELL DATE: WED 31 OCT 1979 9:00 AM EST
DEPT: OOD
EXT: 223-2236
TO: LARRY PORTNER

BILL JOHNSON
SI LYLE

SUBJECT: PL/1 FOLLOW UP: 11/9/79

GB0005/43/EMS

What's the story on VAX-Basic? I've been pushing to get a presentation there. We have a good product and must start to describe it. Let's go.

GB:swh
00 BURT DECGRAM ACCEPTED S 29041 O 30 29-AUG-81 17:03:40

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* d i g i t a l *
****

TO: BILL DEMMER DATE: SAT 29 AUG 1981
17:00 EST

FROM: GORDON BELL
cc: see "CC" DISTRIBUTION DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: HOW CAN WE GET A REALISTIC GEMINI/SCORPIO/NAUTILUS PLAN?

Having just looked at the potential competitors, it's clear that
they are based on the emerging 32-bit micros (Motorola and its
Japanes licensees, Intel, Zilog and its partner) which will
permit the construction of systems that are competitive with all
systems we build up to and including the 780 and multi-780's!
Also, these machines will be available BEFORE Gemini, Scorpio and
Nautiuls!

I'm not confident that we're going to get the competitive

machines of Gemini/Scorpio/Nautilus, even within the normal 6 quarter slip times. Is there a meaningful basis for producing
schedules since there are many undefined and very high risk parts? Is the management overcommitted too? We ought to not overlook these signs:

HUDSON

1. Tiny has had 5 passes and will require a complete redesign... it is also several years late.
2. J is behind schedule.
3. We were just surprised to have to design our own very complex rom/ram for the microcode. This a very advanced design.
4. BI looks like an even more risky and complex chip than the now 3 chips of Scorpio.
5. DECSIM has slipped and parts are one year late. It's needed.
6. We are behind in hiring and we are constantly adding people to maintain the schedule. A/D resources have to be used.
7. Plans and commitments are made independent of the doer because hiring is behind the commits (I.e. he who plans does not do).
8. A complex organization with lack of project role clarity.
9. All effort is on MOS, little involvement in the gate array.
10. Scorpio is the FIRST state of the art design we've tried.

PACKAGING, POWER AND PHYSICAL INTERCONNECT

1. Management is only by level of effort with no measureable programs.
2. No reporting of direction or progress outside the organization
3. No evidence as to doability of technology cause there's no communication or project.

MID RANGE SYSTEMS

1. Large FCC workload

2. A non-zero work backlog for CI, the 750 and other projects.
3. Lack of systems manufacturing interface and rapport (not critical until there is something to build)
4. Lack of recognition of the incredible work load ahead implied by the Gemini/Scorpio/Nautilus Program (too many CPU designers and no systems, and option module designers)
5. A PP/PI plan (wish) without a manufacturing engineer
6. A requirement for a sophisticated engineering process and no CAD gurus or managers
7. A basically arcane engineering process with process responsiblity buried 2-3 levels below Demmer
8. Lengthening project gestation times, giving less competitive products without the accompanying understanding
9. A Nautilus plan requiring the use of chips at the limit of their capability AND well beyond the needs that all other users will put them to. This was same problem with the MCA!
10.A Nautilus plan requiring a sophisticated CAD CHAS-like system for: drawing, communication, much checking (due to chip use), q/c, project scheduling, testing, etc.
11.A Nautilus plan of sufficient length to burn out people

WE HAVE MANY POSITIVES
The Hudson folks are working hard and are very good. Also, CHAS was just released on schedule and may be a breakthrough in tools that even MOS designers may use.

We have very talented designers, and they can do very good work if we don't overcommit and frustrate them. They can be frustrated by:
1. changes, false starts and lack of resources at the beginning,

2. a long project caused by poor planning and poor processes,
3. a long project because we can't get it manufactured.

The managers are very good with fine records of accomplishment both on technology and to schedule.

The architecture and the software are ready, and we have: VAX, VMS, BI, CI, NI and SI products. We have a SUVAX prototype. It is clear what components we must have. These are our real aces!

The system possiblities are quite clear, even though our planning is yet to catch up with this. (I don't advocate building a planning staff as it's too late.)

Bill,
I do not have an answer, but certainly have a concern about the enormous work load ahead and the underlap and overlap of organizations, products and projects... amounting to lack of clarity. None of the negatives taken alone are a problem, but the collection of them is frightening.

The project set is larger than the original VAX Project!!

We need to be calm. We need to understand. And, we need a believable plan!

"CC" DISTRIBUTION:

BRIAN CROXON	JIM CUDMORE	JEFF KALB
DEMETRIOS LIGNOS	JIM MARSHALL	DON MCINNIS
JOHN MEYER	JOHN O'KEEFE	LARRY PORTNER
STEVE TEICHER	WILL THOMPSON	

GB2.S8.32

John Alexanderson
MK

Bill Chalmers
MR2-2/M67

Bruno Durr
PK3-2/S56

Jack Gilmore
MK

John Holman
PK3-1/P84

Irwin Jacobs
MK

Ed Kramer
MR2-4/M16

Bob Lane
HD

John Leng
MR1-1/F35

Bill Long
PK3-1/A60

Jack MacKeen
MR2-2/M65

Julius Marcus
MK2/C37

Stan Olsen
MK1-2/A57

Jack Shields
PK3-2/A58

Charlie Spector
ML5-2/M40

Bill Thompson
ML12-1/F41

Gerry Witmore
ML5-2/M40

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

John Alexanderson	MK	Bill Chalmers	MR2-2/M67
Bruno Durr	PK3-2/S56	Jack Gilmore	MK
John Holman	PK3-1/P84	Irwin Jacobs	MK
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John Leng	MR1-1/F35	Bill Long	ML10-2/A57
Jack MacKeen	MR2-2/M65	Julius Marcus	MK2/C37
Stan Olsen	MK1-2/A57	Jack Shields	PK3-2/A58
Charlie Spector	ML5-2/M40	Bill Thompson	ML12-1/F41
Gerry Witmore	ML5-2/M40		

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Subject: **Your August SW Report**

To: George Plowman, ML5-5/E97 Date: 10 OCT 78
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-
2236

1. Get with Ted re
SWS/Sales Support findings.

2. Get PPG's help.

GB:ljp
****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION DATE: WED 7 APR 1982
8:51 AM EST
FROM: GORDON BELL
cc: see "CC" DISTRIBUTION DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: PLUTO'S GREAT. LET'S SELL IT WIDELY AS THE COMM.
COMPUTER!

It was great to see Pluto in operation yesterday. It looks
like
we finally have a Corporate communications server product
after
10 years of trying to get one. The mechanics too are a
landmark
and the ability to stack and have 96 lines in a small space
is
really great. We have a basis for future communications
system
products using the packaging to eliminate the intermediate
cables.

It's the first unpack and stack system.

It's clear to me we ought to consider selling it as a communications
computer in other than NI contexts without the UNA. In this regard
we'll clearly want the J in there as line speeds increase.
Also there'll be a demand for higher speed lines and doing
interfaces to high speed common carriers to couple LANs.
Similarly, you're planning the multidrop hdlc to get the cost
per terminal interfaced down even further.

I think it's time to take the cover off it and start talking to
people like the phone company and OEMs who need good communications
hardware. Clearly we ought to be able to clobber the 8100 and
the other IBM kludges that do comm! Let's do it. There clearly
has to be a market for it as our customers have been building
communications systems for years with our relatively crude
hardware. Now they ought to be able to do much better! Let's
figure out how we can sell it. Clearly there'll be a demand for
other components that can stack on it like a disk. It's by far
the neatest package I've seen from Digital. Congratulations.

"TO" DISTRIBUTION:

JOHN ADAMS   JOHN GILBERT   RICHARD GONZALES
MIKE GUTMAN   JIM O'LAUGHLIN   BERNIE LACROUTE
JOHN MCNAMARA   DAVE RODGERS

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MACKENZIE
JACK SMITH BILL STRECKER

GB3.S4.39
****
* d i g i t a l *
****

TO: BERNIE LACROUTE DATE: TUE 6 OCT 1981
15:34 EST
DAVE RODGERS FROM: GORDON BELL
cc: LARRY PORTNER DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: GETTING A REAL START ON PLUTO, GATEWAYS, ETC.

Pluto scares me. I see lots of paper and little real content on its
REAL (future vs. past) competitiveness, or what it is, or most
importantly, how it's going to be built. Now I see a second Product
Manager: US Paper!

For starters, I'd approach it as an evolutionary design by building it
now using current hardware (DMC lar serial line interfaces),
then evolve to support UNA and the Protocol Assist Module/line units.
In this way, you have an automatic backup to a standard 11 with a UNA,
cause all that PAM, etc. hardware will demand very large diagnostics
and a big handler change.

Also, the folks building the CATS and the old 10/20 DN may know
something that could be used to design this.

The sequence:

1. Get a host (10/20/VAX or whatever)/Pluto environment using today's hardware that supports PLUTO SW development, down line loading and debugging. (Decide on how to handle the multiple host development/down line loading and debugging environment).

2. Get a PLUTO environment that works with 1.

2A. Buld a PAM SW interface

3. Develop and TEST as concentrator while

3A. developing and testing a separate, parallel RJE (line printer part).

4. Replace the standard D(L,H,...Z) with the PAM.

5. Replace the DMR with UNA

We're doing the review soon. At that time, please give me a demo of 1 and 2. Note that this base software 1 and 2 has to be done and has to be completely general before you can build any gateways, servers, repeaters, etc.

GB3.S1.32

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```

Subject: **VAX PMS Structure**

To: Bill Demmer, TW/D19
    Sam Fuller, TW/A08

Date: 6 DEC 78
From: Gordon Bell

Bernie Lacroute, TW/A08 Dept: OOD
Wayne Rosing, TW/C03 Loc: ML12-1/A51 Ext: 223-2236

CC: Ulf Fagerquist, MR1-2/E78
Mike Gutman, ML3-6/E94
Bill Johnson, ML21-3/E87
John Kevill, ML3-6/E94
Pat White, ML12-3/E51

I'm appalled at the lack of any PMS Architecture of VAX. (I saw Bernie's input to Mass Store.)

Surely there are more ways than SBI, CMI, ICCS (only 1 version?), Unibus, and New I/O Bus to interconnect the range of VAX systems to disks? What about Massbus and the inevitable Nebula Backplane?

This will be a good lesson (case study) in losing money. There are now no standards!

Ulf and Bill, please get together to help, not sink, John (and Bill).

As an aside, Bernie suggests no CCD in HSC or no optimization. This, I believe is only because there is no performance data on VAX, our customers are in honeymoon period and not yet complaining.

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST: Bill Demmer TW/D19 Ulf Fagerquist MR1-
2/E78
Sam Fuller TW/A08 Mike Gutman ML3-
6/E94
Bill Johnson ML21-3/E87 John Kevill ML3-
6/E94
Bernie Lacroute TW/A08 Wayne Rosing
TW/C03
Pat White ML12-3/E51
6B

Founder and VP of R&D, Prime Computer 1972-1979
Under Bill's technical leadership, a significant minicomputer company was formed that grew from 0 to about one-half billon dollars revenue. The Prime minicomputer had the FIRST computer implementation of a 32-bit, virtual address with Multics style computing at a fraction of the cost. The entire product line which Bill managed, before leaving consisted of wide range of compatible minicomputers which were used for a wide range of applications (general purpose to office automation).

In 1978, VAX was introduced as a 32-bit minicomputer; today all minis and micros have been extended to 32-bits, but Prime was the first to extend the addressing of small computers and provide a virtual memory program environment.

Commercial development, in 1975, of first token-passing, local area network. (The first implementation of IEEE 802.5 will occur in 1984.)

Citation

For technical vision and leadership in computing that established the first minicomputers with large virtual addresses and the first company of a new industry of distributed, co-operating workstations.

6a

Founder, Chairman and CEO, Apollo Computer, 1980 - present

Under Bill's entrepreneurial and technical leadership, a new industry has been formed based on powerful, fully distributed workstations. The Apollo environment typifies distributed computing of the future.

The Apollo Domain environment provides computing directly at the user's Workstation, thus avoiding the response-time bottleneck of timesharing for what is highly interactive work. In addition to the workstation, the environment consists of a token passing ring (similar to IEEE 802.5, but at least 4 years earlier) to interconnect the stations. A 48-bit name space permits all workstations to communicate and share resources (especially files) with one another.

Apollo was the FIRST company to provide this environment. Now 150 new workstation companies have been formed to compete with some segment of Apollo. In addition, traditional companies such as IBM and DEC are attempting to provide similar products. Apollo still maintains the leadership position.

6 explanation

The Apollo environment is the FIRST commercial implementation of the fully distributed cluster outside of a laboratory environment (Xerox Palo Alto Reseach Center; Ethernet interconnecting Alto workstations). This kind of environment will be the main style of computing of the 90's. Only two companies appear to be providing products which are similar, but less extensive than the Apollo environment (eg. SUN Microsystems, Silicon Graphics). A proposal in 1979, at Carnegie Mellon University, SPICE, offered such an environment, but only now is it partially operational. The Apollo product(s) constitute a system formed from hardware (various workstations), a local area network, and distributed operating system-- any one of which are a significant.

The above examples illustrate the engineering difficulty necessary to make the Apollo Domain Environment and set of products, i.e. the work is well beyond what can be done by 100's of startups or capable research groups. Bill lead this effort!

Apollo started in '80, and introduced their first product within the first year. The company has just reached $100M annual sales, and should reach the billion dollar level by 1988.

7

1980-Apollo Domain, Distributed Computing Workstation Environment

Demonstrated vision and technical leadership to found a company to develop a computer system that is generally viewed as the successor to time sharing. See "Architecture of Apollo Domain."

1975-Prime Token-passing local area network

Delivered first, commercial high speed, token passing ring local area network. See Reference Manual for Primos.

1974-Prime Virtual Memory Minicomputer

Delivered first implementation of large, virtual memory on a minicomputer. One of first companies to do systems programming in a high level language (subset of PL/1). See Reference Manual for Prime 400.

7 additonal

1973-Prime
First product with demand paging on a 16-bit minicomputer. See Reference Manual for Prime 300.

1968-Honeywell
Consulted on the 16-bit computer that ultimately became the Series 16 minicomputer.

1968-NASA
Demonstrated demand paging on a minicomputer.

1968-NASA
Pioneered in the use of higher level languages for implementing operating systems by using Fortran as the implementation language for a NASA system.

1966-MIT
Pioneered a first course in systems programming with text.

7 next page

Bill has demonstrated exceptional technical vision, followed by leadership to implement the vision resulting in two key 'firsts" in computing which others have followed.

In the case of Prime, a recent study (which will be published shortly by me in Computer), showed that of 100 companies that began making minicomputers in the early 70's, only the startups Prime and DG remained autonomous. 75% of the companies failed. Only 8 companies succeed to any degree: Prime, DG, DEC, IBM, HP, Interdata, Harris, and SEL.

In the case of Apollo, they were clearly first and everyone is following. In this case, I expect a much more brutal fallout of companies. Of the 150, I expect only Apollo and perhaps 2 others will win. I expect DEC, IBM and perhaps 2 of today's computer companies to produce products that will compete with Apollo.

Bill's leadership as an engeering entrpreneur should weigh heavily in favor of his becoming and IEEE Fellow, because I believe this combination of superb engineer/leader/entrpreneur is who we want as leaders and role fellows in engineering.

Enclosed is a set of notes I took from a lecture Bill gave to the IEEE Engineering Management Chapter (12/83). It shows why Apollo is no. 1, and why Bill would be an asset as a Fellow of the IEEE.

Bill Poduska: On Apollo
Lecture to IEEE Eng. Mgmt. Chapter, 12/13/83
slides, (comments), [GB comments]

THE APOLLO BUSINESS PLAN

Business Plan
$100M by 1985. (Will achieve 4 Q run rate by early '84. Poised to be running at $1B by 1988.)
Marketplace
Computing Professionals, especially engineers. Productivity based, and the natural successor to timesharing. (3.5M engineers who potentially could be

twice as productive is the market goal. This amounts to 100B market. Trick is to convince public to part with money. This was easy because the buying decision is initially under 100K and is incremental. Model was positied by various universities including CMU. Take advantage of micro and evolving, poor performance of timesharing.)

Product

Network of dedicated Computers. The technology of the '80's. (MIT taxonomy: It's a NEW product to an OLD marketplace. It's a Workstation with 16 Mby VA, 4 Mby Mp, 154 Mby Ms, 1000x1000 x 1 to 8 planes x 2 for image backup. Operating system allows paging over a 12 Mbit/s LAN with 48-bit address in full transparent mode. pages: 1 Kby, average of 4 pages transferred. Apollo's own LAN has 280 nodes. Is busy 10%. Price: $40K monochrome.)

(Product strategy: [straight from computer engineering. Introduce a product, go up in performance, go down in price and form a wedge of **compatible, LAN'd** products.] '81 monochrome 40K; '82, color, flt pt, 100K; '83 desktop mainfram at 10K to 20K; Oct 83 fully compatible TTL version of 68K giving more Whetstones than a VAX 780. Soon a 100-150K product. Easy to add a node. They are predicated on NO BACKWARD INTEGRATION. THEY ARE A SYSTEMS COMPANY...). [RECALL WE MAKE WHAT WE SELL, NOT WHAT WE CAN BUY.]

[They simply exploit mini lethurgy and inability to move on micros. Apollo is clearly working on an ECL version!]

People

Used seasoned Professionals and entrepreneurs. Now 1.3Kp. (Company started in 5/80 with FCS 3/81 to Harvard. The Operating Committee has 8p with 3 Prime, 2 DG, 2 DEC, 1 outside Computer industry. Six had been founders before. The average age at startup time was 42! The average age for all startups is 32! Bill is now 45. Apollo ONLY hired quality people... most of whom had done it before.)

[Apollo is simply going to pick off the cream from DEC, Prime, etc. (I believe DG has its act together and is not vulnerable now.) in much the same way that the mini folks (DEC, DG, Prime) used Honeywell as the basis to start to build their companies. The issue of the average age of a company, particularly the top management is quite interesting.]

Money

Venture financing to be a public, profitable company. (The company is now selling at $32 with 22 Msh, giving a 700M market value. 80% of the people in the company are shareholders. 60 are Millionaires via the stock.)

MANAGEMENT PRINCIPLES

Risk

Use time line management; have plan A, B and A+. (Tradeoff cost, functionality NOT schedule. Be able to work with a slower part, but if a faster one comes along, also be able to exploit it. Not all breaks are bad. Whenever people work hard, they end up getting lots of good breaks too.)

Organizational focus

Functional based

Products look like organizations [Conway's famous law.] (Take lots of time for organizational design.)

Management is a contact sport (Air hostilities, but get the hate out in 24 hours.)

People Principles

Justice and share the rewards

Fun (Don't think that it's the end goal that's it. Achieving the goal is ALL the fun.)

Excellence!

TOOLS AND MEASURES (PREDICTION VS FACT... have a plan)

Money

P&L and Balance Sheets (are your friends. Understand and use them.)

People

Oranization Chart with names and dates (Put responsiblities here.)

Time

Schedule (has names and resources on it)

Time Line Management for resources
Bad Tools
Marathon Staff meetings that are problem solving sessions. (Charlie Spector taught them to have short, 2 hour, meetings that have problem identification and reporting. No problem solving on line. People are to do this.)
Committee design reviews

THE ENTREPRENEURIAL STEP

New ideas
Market driven, technology driven, Opportunity (exploit some pathological phenomena such as lack of parts, or high prices)
The Business Plan (note the first slide)
Business
Marketplace
Product
People
$
(Poduska as VC: business plans must be less than 10 pages. Have never read or known anyone who has read a business plan over 10 pages long. Go for Grade A people only. Grade B people with a grade A plan loses. Grade A people have fire in the belly and steel in the eyes.)
Selling the Plan
Value of the investor. (The VC system works!)
Seperate investors and management. (Keep the investors independent of the management! VCs know nothing about management. A business without management is useless, and VCs are now beginning to realize this more and more.)
Everyone must win
Pace and timing (Be in it for the long race.)

RISK AND REWARDS

Rewards
Ego- achievement
$- capital gains (Watch for $'s not for the % of the company. Control always rests with the management, NOT with votes.)

Risks
Ego- failure
$- no way (People may be out of a job 3 months.)

ELEMENTS OF SUCCESS AND FAILURE

Success
Ego drive
Faith in the idea
Trust in the people
Humility and humanity

Failure
Misjudgement (technical and people)
Mismangement
Unrecognized success (giving up too soon
Lack of courage

People
More important than the idea
More interesting than bits, bytes, nanos

Q&A
lots, eg.
Q: How will you keep Apollo from becoming large and lithurgic?
A: The key is to use some form of entrepreneurism. People like the personal challenge of proposing something and the freedom to carry it out with the corresponding risks and rewards.

Other thoughts (by GB)
My simple model of computer generations has to be extended to include people (leadership) and new organizations as I see incredible new highs and lows of performance.

Apollo is an archetype of the phenomenon that creates a new generation and industry... even though it is simply a replacement (New product to old market) designed to eat a large segment of the mini market. It is clear that old organizations rarely make it from generation to generation (eg. BUNCH to build minis). This can be seen by looking at every level of integration and systems including: logic technology, computer, software and various peripheral vendors. The notable exception is IBM who has moved out by significantly stronger leadership at the top.

Gordon Bell, Decmember 17, 1983

June 1, 1978

Mr. Bill Pohlman
INTEL
3065 Bowers Avenue
Santa Clara, California 95051

Dear Bill:

It was good to talk with you again on Tuesday regarding your kind offer to write a chapter for the update of Computer Structures by Professor Dan Siewiorek. You will of course be free to publish the chapter elsewhere and to get any other co-authors involved in the writing. We would encourage and urge the publication in the regular technical literature. I'm enclosing a copy of Computer Structures and a copy of the recent PDP-10 paper which may be useful as models.

I believe the article should cover the interaction of technology, architecture and use surrounding Intel's 8008...8086. The peripherals chips and bus are of interest too. I don't believe the 8086 should be more than 1/2 the chapter and the article should cover all the Intel machines back to the 8008 and any other machines that are relevant to the evolution of the microprocessor. The 8080 should be emphasized, particularly because it became a standard.

We need a first draft by September 1. Although the size is up to you, I believe that it would take 10-15 book pages or up to 45 typewritten pages to do justice to the subject.

If there are any questions, please contact me or Dan Siewiorek.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:ljp

CC: Bill Davidow, Intel
Dan Siewiorek

Enclosures (2)

GB0001/12

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Subject: **Policy on 10's, 20's and VAX's Within Engineering**

To: Bob Puffer

CC: OOD,
Al Crawford, PK3-2/F34
Rattan Dhar, MR1-1/M42
Bob Grimes, ML1-5/B90
Bill Keating, ML12-3/A62

Date: 2/14/79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

follow up 3/8/79 (OOD Mtg.)

Given the strategy, we need the above. Can you get someone to deal with this and give us a report at OOD in early March. Both Al Crawford and Bob Grimes have made commitments and have policies with respect to VAX (see the attached). I think we need a similar set of statements and we need to know who should make them...and implement them.

I don't have any detailed thoughts, but would like to get a general direction such as:

0. Probably plan to minimize the buying of more 10's. Buy VAX's instead.

1. Let's look at applications which we say will always run on 10's unchanged! Let's not rewrite them, but use them till we don't need them or they're obsolete (e.g., PC Layout).

2. Establish a network so that as work builds up on a given 10, we can off load it on VAXs and place new work there rather than having any kind of massive migration program. For example, the new PC Layout program should be moved to VAX because we're out of 10 address space. This will free up a lot of 10 capacity.

3. No programming anywhere in anything other than VAX languages (common Bliss, Fortran, Cobol, APL--betting on the cum of a good, compatible APL, etc.)...but specify!

Whoever is going to manage this would have the whole thing planned, and all I want you to do is to identify the person or persons within engineering.

GB:ljp

Attachment

D I G I T A L INTEROFFICE MEMORANDUM

DIST:	Al Crawford	PK3-2/F34	Rattan Dhar	MR1-1/M42
	Bob Grimes	ML1-5/B90	Bill Keating	ML12-3/A62
	Dick Clayton	ML12-2/E71	Jim Cudmore	ML1-5/E30
	Bill Demmer	TW/D19	Ulf Fagerquist	MR1-2/E78
	Bill Johnson	ML3-5/H33	John Kevill	ML3-6/E94
	John Meyer	ML12-1/A11	Larry Portner	ML12-3/A62
	Bob Puffer	ML12-2/E38		

GORDON BELL
Vice President, Engineering
Digital Equipment Corporation

OBSERVATIONS ON GENERATING COMPUTER GENERATIONS

ABSTRACT

We've implemented thousands of species of the computer in a few, basically evolutionary technologies. These technologies mark the generations. The evolutionary process is cyclic and includes the technology, the architecture and implementation of species, followed by use which in turn generates increased demand for better technology, permitting evolutionary new computer structures.

Since new generations spring from new technologies and often different people, a new generation most likely follows the time-worn path of early pioneers. New generation builders tend to relearn the same lessons about technology limits,

architecture, its evolution including the "wheel of reincarnation" for specialized functions, multiprocessors, etc.

GB5.33

CENTRAL ENGINEERING MASSACHUSETTS POPULATION PROJECT ON FY80 THRU FY84

SITE	CURRENT POPULATION	FY80	FY81	FY82	FY83	FY84
MARLBORO	412	453	450	450	450	450
MILL	1777	1600	1840	2116	2000	2000
TEWKSBURY	606	650	550	610	680	700
MISC.	40	40	40	40	40	40
HUDSON (FY82)		350	420	504	604	725
SITE Y (FY83)					432	700
?MARLBORO EXPANSION			50	100	155	215
TEWKSBURY OVER FLOW						61
TOTAL	2838	3093	3350	3820	4361	4891
SITE B (OUT OF STATE) (?)					291	
TOTAL						4600

NUMBER GIVEN TO FP&E WAS 4800

+---------------+
! **d i g i t a l ! i n t e r o f f i c e m e m o r a n d u m**
+---------------+

Subject: **Portability and Waterloo's Widget, Watfor, Watfiv and Watbal on Series 1**

To: Bell Heffner, Bill Keating, John Leng, Jerry Witmore

Date: 31 MAY 78
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

CC: OOD, Gus Ashton, Denny Doyle, Ed Fauvre, Win Hindle, Ted Johnson, Andy Knowles, Gordon McConnell, George Plowman, Ron Smart, Bob Trocchi,

follow up 6/14/78

I just talked with Professor Wes Graham at the University of Waterloo. He believes we're not too responsive in selling these products when compared to the system he put on (ported over to) the Series 1. Still, he wants this software on VAX.

His people have made 4 trips to IBM to train 100+ salesmen/trip and IBM has sold 100 Series 1 systems as a result of his products (we've sold less than 100). He would like us to get interested in pushing the products on 11's. (He'll also send us data as to the number of systems that run his software--even though he believes three times this number should with some reasonable selling and promotion!) Is there any way we could do this and at least give the customer the option of an 11 over IBM? IBM is also mounting a major sales effort to push this product.

As an aside, he said there is a faction within IBM that was pushing a 32-bit architecture for Series 1 that is now saying "I told you so" when we announced VAX! We apparently sucked IBM into a small, low end, 16-bit architecture -- when others within IBM think its too little, too late.

Portability and DEC

These systems were written in a portable way and moved over to Series 1 in a rather straight-forward fashion! Portability is being used more and more (e.g., UC/San Diego with PASCAL, Bell Labs with Unix and C). (Note much 10 and 11 software has been "ported" from other machines too!) Somehow, not only are we not developing portable software internally, but we often have multiple redundant efforts for software (e.g., many 11 Cobols and a new non-ported Cobols on VAX+ 10). Although Cobol may be the wrong example, there have to be good examples (e.g., the new Editor).

This year (FY79) I, again, want from Software Engineering:

1. Clear statement on where we (numerically) are vis a vis the language used to implement systems together with a policy!

2. Portability considered on each piece of software (i.e., what systems it is for and when will it move.

3. In DECnet, especially, there could be a complete overhaul of software, tools and policies considering high level languages and testing.

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST:				
	Bill Heffner	TW/C10	Bill Keating	ML12-3/A62
	John Leng	MR1-1/A65	Jerry Witmore	PK3-1/M40
	Jim Bell	ML3-2/E41	Dick Clayton	ML12-2/E71
	Jim Cudmore	ML1-5/E30	Bill Demmer	TW/D19
	Ulf Fagerquist	MR1-2/E78	John Kevill	ML1-3/E58
	John Meyer	ML12-1/A11	Larry Portner	ML12-3/A62
	Bob Puffer	ML12-2/E38		
	Gus Ashton	ML5-2/M40	Denny Doyle	KA
	Ed Fauvre	MK-2/C36	Win Hindle	ML5-2/A53
	Ted Johnson	PK3-2/A55	Andy Knowles	MR2-2/A52
	Gordon McConnell	KA	George Plowman	ML5-5/E97
	Ron Smart	AK	Bob Trocchi	PK3-1/M40
	Jerry Witmore	PK3-1/M40		

GB0001/20

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SUBJ: POST OFFICE AND MAIL COLLECTOR

Date: 2/28/79 Wed
From: Gordon Bell
Dept: Office of Development

TO: Don Alusic

Al Crawford MS: ML12-1/a51 ext: 223-2236

George Plowman

Follow up: 3/16/79

I hope that your Post Office program will deal with the problem that is now bugging me: I have two places to look for mail since the ARPAnet isn't connected to our systems.

Is it possible to have some background jobs in Post Office that will go out to specific computers like CMU10A and pick up my mail on a periodic basis?

Also, I would like mail delivered to the user community there, but the Post Office does that, I gather.

GB:mjf

Post v N Computing: A 10 YEAR, DIRECTED RESEARCH PROGRAM AND NATIONAL FACILITIES AIMED AT PARALLEL PROCESSING

A Draft Outline*

Proposal(s)**

Gordon Bell, DEC

George Clark, Harris

Bruce Delagi, DEC

Sid Fernbach, Consultant to CDC

Bob Lillestrand, CDC

Red Phillips, Univac

13 August 1982

ntive references to previous and ongoing work and bibliographic references have been omitted. While we believe the general is correct, specific tactics such as the applications to focus on, will be subject to change with the final proposal(s). We now th conceptual and detailed critiques.

The final proposal must come from the program group dedicated to produce the results. Thus we solicit:

- sites
- individual researchers and a program director
- applications and other research projects

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Hierarchies of local area networks of all types

VLSIzation Support

CDC's AFP

Experimental Multiprocessors

Location

Application Centers

ples

ng Summary

x

1. Some Critical Global Questions
2. Why use CDC's Advanced Flexible Processor?
3. Rough Budget

OVERVIEW

egan as an exercise by positing a computing environment we believe is attainable in 10 years based on parallelism c of the single, von Neumann machine and then asking ourselves:

Are we doing anything significant to understand and build this environment?

overwhelming:

most industrial research appears to be aimed at incrementally improving today's products and processes; while

academic research is aimed at basic research and the mechanism of getting grants, producing papers and Ph.D's.

f this program is to develop the technology and build next generation computers by establishing several National Laboratories cience and engineering research within the U.S. military, academic and industrial community. This technology is essential:

1. for defense;

to improve the declining computer and semicomputer part of the U.S. Information Processing Industry which now constitutes d supports much of our economy directly and via exports; and

3. as a basis for uch of the 21st Century Industries.

echnology position in the computers and semicomputer industry is a national crisis. As such, this necessitates these unique program:

1. collaboration nong national science, defense, university and industrial applied research, often called technology, in a fashion not unlike the ISIC program;

2. National

oratories so that limited machine and people resources can be shared, unlike the VHSIC program;

3. a large, fast

twork including access both for experimentation and to extend the program to other research sites;

4. construction of

ototypes by industry for evaluation within the research community;

5. technology

nsfer by industrial residents at the laboratories;

6. tighter

upling of application (need), architecture, construction and use by co-location in order to rapidly engineer, build and test ideas. is speeds up migration of ideas to use by applying engineering resources earlier.

will be the hub of a goal directed research program aimed at new VLSI-based, highly parallel computing structures. Parallel ems, including: specialized processors and hardware algorithms, multiprocessors, multicomputers, dataflow and high speed ork based meshes will be built and evaluated. Evolutionary projections show a performance increase in processing of only a 1) to 11 (Fig. 2) over the next 10 years. In contrast, the Japanese Fifth Generation Research Project, is aimed at producing high llel computers with a factor of 100 to 1000 more computing power for conventional and Knowledge Based computing systems .

goal of the program is VLSIzation, the ability to transfer an algorithm, simulated within the computing environment, to VLSI the foundry time in much the way programs are currently compiled. By it's nature, this structure adds inherent parallelism to e national facilities would also support the goal that computers would do a substantial part of the VLSI design. Research in the ting structures we target will rely on accomplishment of these goals.

er generation is marked by concurrence of technology and needs causing a new computing structure and resulting in new use. driving need is for the ability to transmit, store, and process (understand) the same information as people, including voice, es and images. Images are a major data type of this research program because of the links with people. The research need is hardware and technology and by the potential of Knowledge Based Systems requiring much higher performance. These must be gnal processing to assimilate voice and images.

ould be organized in 3 phases, covering roughly a decade, in order to focus the work in a timely fashion. Generations have en 7-10 years and consist of two periods: specification and construction; followed by use and evaluation. The immediate he most powerful, high speed network of general purpose computers would start the program in the use and evaluation phase. n application of this facility would then be applied to produce new VLSIzed computing structures by the end of this first phase. se would apply these newer structures, forming the basis for new designs in the final program phase.

MOTIVATION FOR THE PROGRAM

the combined Information Processing Industries is now declining relative to Japan. While there are many reasons for the re noteworthy and represent the motivation for this program:

1. The U.S. (and rld) funding for basic and applied research is large. This mechanism produces far more results than can be applied.

2. There is NO S. effort or policy aimed at systematically examining the basic research results and refining them so they can be applied to oducts. The cost to do applied research on even a small fraction of the basic research is usually far greater than the original work d is well beyond the scope of a single company or a laboratory. Furthermore, most laboratories doing research can only carry eas to the paper stage because of the engineering nature of the final stages to build and test the idea. Thus, overfunding search relative to applied research means a "spilling" of knowledge that forms the basis of a significant industry.

3. U.S. companies ve not worked collaboratively to develop these technologies because of legal and cultural reasons.

4. U.S. industry s been especially short sighted in its funding of this phase of research. Now, many short term, mundane product opportunities g. another Z80 + CP/M based personal computer) exist to attract resources resulting in further decline. This is further fueled by e venture capital market and increased R&D tax credits which in turn produce even more mundane products.

5. An inadequate pply of people and equipment exist to carry out the work in industry and the research organizations.

6. A research ogram aimed at parallelism requires interaction and co-location with a user community.

e effectiveness of the Japanese collaborative research programs and believe we must emulate them. Both France and the U.K. d programs aimed at the next computer generation. Note the past and present programs in the Information Processing area:

1. Pattern ormation Processing- voice and vision

2. VLSI- improved
ocessing characteristics (eg. 64K and 256K rams resulted in a 2 year lead over U.S. industry)

3. Supercomputers- high speed technology

4. Optoelectronics- just established

5. Standard
nicomputer for NTT- Fujitsu, NEC and Hitachi

6. Fifth

eneration Computer- Fujitsu, NEC, Hitachi, Mitsubishi, Matsushita, Oki, Sharp. ICOT Lab and 10 year program were established.
e first phase builds Relational Database and Prolog machines.

7. Local Area

etwork standards as part of the Fifth Generation.

8. Next

neration research and technology program.

THE RESEARCH PROGRAM CONTENT

ECTIVES

dertaken with the expectation that the confluence of the disciplines of parallel processing applied to image processing, and ineering, and implemented using VLSI will prove fertile. It, and the resulting VLSIzation process, that of first understanding am and tasks and then VLSI'ing them, may well be a major characteristic of the next generation computing systems, which the e Fifth Computer Generation.* The establishment of a quasi-competitive, but coordinated program of research using common es is intended to stimulate a national understanding of such systems and their potential application.

ed at a fundamental understanding of parallelism and its application to a class of problems critical both to the growth of the stry in this country and to the maintenance of a preeminant US position in intelligence based military systems.

AND USING THE FACILITIES: PHASE ONE

focus will be on installing and applying parallel approaches to image procesing and logic/circuit/process simulation problems, flow. We think it is vital to understand the range of dataflow from theory to practice across a wide range of applications. In its dataflow can be viewed as a formalized, generalization of pipelining that is conventionally used for graphics and image process. eral form, dataflow looks appealing for logic simulation, signal routing, and conventional array processing type tasks where a rallelism exists, but cannot be exploited due to the difficulty of expressing algorithms in conventional languages. It is indeed ataflow-specific machines <u>will not</u> exist, instead dataflow languages will enable programs to be written for large, multiprocessors. l be based on a high performance local area network to interconnect the central machines, including:

. supercomputers,

. experimental achines (dataflow and conventional multiprocessors and multicomputers), and

. the CDC AFP.*

erate with <u>fixed microprograms</u> to simulate several computer structures including dataflow computers. This will enable begin now and to understand the limits and use of dataflow architecture, for example. These efforts must be put to the test of applications in order that the tradeoffs discovered be relevant to solve.

), believes that the current generation, number 5, is based on powerful personal computers interconnected via local area
Japanese are working on the sixth generation, beginning in the late '80's.

have real applications on which to "benchmark" various designs. The following applications cover some of the possible ary and industrial problems: scanning electron microscopic image enhancement, automated assembly inspection, target ligital system design and construction (eg. logic simulation, routing and IC signature analysis). The actual applications should be final proposal.

l results have focused on using a dataflow architecture to examine its limits, the network and facilities we envision are much and will be used as alternative ways of computing.

ELOPMENT OF THE CENTRAL FACILITIES

hat the central research facilities will be enriched further over time by including, as additional research tools, the fruits of the program particularly focussed on realizing more powerful forms of processor interconnect and process (or operator based) ation. It is expectd, further, that several realizations of parallel solutions to specific application image processing problems will d (in VLSI) and included in the central research environment.

NG PARALLELISM: PHASE TWO

hase of the program here proposed, the principle results will include a deep understanding of the dimensions and metrics that ace of parallel computing - costs, performance, programming expense, and reliability. The proposed facilities provide a rich set ealizations for parallel computing - ranging from tightly coupled multiprocessors to conventional Local Area Networks. We do t the kind of interconnect for switching is a particularly fruitful area of study because it is really an economic issue that shifts with ulation, market demand, and supply. Thus, the goal is to provide various structures for evaluation and use very rapidly, but not interconnect possibilities!

and knowledge engineering efforts are expected to yield their most important results in the last phase of the program. stones are established throughout the research effort: discerning the computational (and data management) primitives rrent rules-based expert systems languages, establishing an effective integration of image and symbolic information into a e (consistent with the data management primitives noted above), realizing a VLSI implementation of a highly parallel, post von uter structure for expert systems, trying it out on (say) a SEM analysis problem, a fully automated VLSI design, and finally on an or (semiconductor) process/crisis management (or threat evaluation and reconnaissance mission). These will, in turn, provide ing needed for a second VLSI implementation of the expert system engine above.

ingredient of effective VLSI implementations supporting the research goals of this program we need the 1990's VLSI equivalent he Guttenberg Press but of the linotype machine and the automatic typesetter. The process would be completely controlled by small group. The most important element of this program then is the development of the capability for (fully) automated VLSI om representations of parallel algorithms simulated on the parallel computing facilities proposed. At first, this will likely be by conventional supercomputers and the dataflow machine simulators running at the central facility.

design capabilities will be made to stand the test of real use in VLSI implementatins of (at least one) dataflow machine. The achine will be based on the measurement and analysis of simulated dataflow machines running applications as noted earlier. pabilities will be also tested in VLSI realizations of IC signature analysis dataflow algorithms and the mobile object identification ojects implemented previously. The culmination of efforts in image encoding and compressions will be a special purpose VLSI that provides full motion video-conferencing within the bounds of a 56 Kbps phone line, for example.

A FACILITY TO UNDERSTAND AND EXPLOIT PARALLELISM

applications usually result from having new, higher performance computers allowing solution of problems that previously were y intractable. Performance increases in computing come from two sources: technology improvements and increased is program is aimed at understanding and exploiting parallelism to gain performance.

s to parallelism in two ways.

nmodity processors allow the low cost construction of the most cost effective systems. That is the Mips/chip of microprocessors rips the densest, high performance ECL gate arrays.

Second, VLSIzation is an inherently parallel process - standard algorithms are off loaded.

ots to improve performance through highly parallel structures has been relatively disappointing. We believe the major reason progress is the high real and personal cost to build and evaluate parallel structures. This program supports systematic research nt on the following alternatives. In this regard, we posit this fundamental hypothesis: <u>in order for a new computer structure to a user, and hence ultimately developed and exist, it must offer an order of magnitude improvent in performance over his l of computation.</u>

OCESSING (AND VLSIZATION)

order of magnitude or more speed improvement has resulted from looking at the execution times of particular work and then are to carry out the function. VLSIzation is a realization that this evolutionary process exists and is an attempt to formalize the

s of "off-loading" using special function hardware:

1. Floating point rdware versus a software interpreter

2. Channels, I/O ocessors and I/O Computers versus interrupt and hardwired I/O

3. Display

ocessors

4. Array Signal

ocessors

5. Front end

ommunications) and back end (disk, file and database) computers

g from a computation on a particular kind of data occurs.

n a requirement for a new computing structure. The function is then "off-loaded" in specialized hardware that operates in
e general purpose computer.

eral purpose, very high speed system, the resulting, specialized structures can be totally simulated before they are committed to
n this way the designer can interact with the structure in a quickly iteractive fashion instead of waiting at each iteration for
system (re) integration.

ORS

w computer class is formed, there are strong arguments to build multiprocessors for performance reasons. Invariably, others
rformance Uniprocessors at the same time and deliver more power via the strictly sequential approach. Multiprocessors were
e early 60's, with Burroughs probably delivering the first one (B5000). By the early 70's Burrough's, CDC, DEC, GE, IBM and
uilt 2 - 4 processor multiprocessors. Unfortunately, these were either used in an asymmetrical fashion, or at most they were
nary multiprogramming environment. In no cases was parallel processing of a single task provided.

n investigated parallel processing of a single task with a 16 procesor multiprocessor and showed that for various tasks speed-ups
By 1975 two 16 processor systems were built by BTL and at CMU. The CMU system was predicted on the 11/40 minicomputer,
ord the construction, and speed-ups of up to 10 were observed in various algorithms.

d Flexible Processor is an ideal machine to investigate the use of multiprocessors and multicomputers since the interconnection puters is via very high speed local links (ultra LAN) and shared memory. It can be used in many ways, including:

1. a 16 computer ultiprocessor;

2. a 16 processor ultiprocessor;

3. a fixed, rpreter for particular structures (eg. dataflow); or

4. a particular, dicated pipeline processing configuration (eg. image processing).

ories are building systems with up to several hundred microprocessors.

multiprocessor, the successor to the S1, with 16 supercomputer class processors. As soon as the processor's available, it should the multiprocessor case for evaluation, since the processors are both tightly coupled and have very fast inter processor mechanisms. This should be within the next three years.

ffering a 64 processor multiprocessor which requires investigation. We strongly recommend the installation of this machine in rder to work on the multiprocessor problem.

artz, et al at NYU has proposed the Ultra-Computer, a multiprocessor with up to 16,000 VLSI microprocessors. Just as soon as we easonable number of processors together, construction should begin on this very large multiprocessor.

hat one can produce conventional parallel processors which should be able to deliver up to a factor of four, for specially coded ctor of 10 is possible, but there has to be a significant amount of research to make this automatically possible. Studies continue amounts of parallelism in algorithms that we have no way of exploiting.

t the optimistic (Fifth Generation) projection for computing power speed-up over the next decade could be accomplished simply parallel processing using multiprocessors and not by semiconductor and packaging technology if a significant effort were ubtedly the dataflow language is an important part of this effort to represent, control and thereby exploit this form of

TERS

een done formally with arrays of tightly coupled multicomputers where independent computers (Pc-Mp pairs) operate and communicate with one another by sending messages. By 1980, CM*, a multicomputer system based on the LSI-11 with 5 clusters of 10 computers was constructed, and speedups of up to 30 were observed for particular problems, including tion. Because there is less interconnection among the computers, it is more difficult to predict the performance: the algorithm ully partitioned across computers rather than distributed in memory.

FP, we believe that other multicomputers should be constructed and used, particularly those with several hundred computers. l support the construction of several, (say 6) different multicomputer alternatives.

CHITECTURES

dataflow computers have been proposed, only a half dozen computers have been built. The performance of dataflow ot understood, although the use of dataflow graphs and languages to express parallelism is promising. In particular, dataflow most useful in expressing signal processing operations. For example, the AFP is programmed using a dataflow-like representation essing tasks. Individual computer modules can be assigned to various processing stages of say a digital filtering task. The AFP also deal to simulate static dataflow architectures and their application. It would be microprogrammed to be a general purpose ne using separate computer modules in a functional fashion: matching store, switching, processing, and i/o.

AND CONVENTIONAL LOCAL AREA NETWORKS

works, LANs, are systems which normally allow the physical distribution of functional, server components to cover a local ea (eg. a building, or campus). The functional servers roughly correspond to various parts of a shared system: person servers rkstations/terminals), file servers, print servers, and communicatins servers. The communications is via message passing le the curent 10 Mbit/sec LANs are relatively slow, they are well matched to today's, slow terminals, personal computers and for networking.

ve also posited that LANs can be used to provide high performance, parallel processing. We too believe higher speed LANs are nterconect architecture for new computer structures. The higher speed, 100 Mbit/s LANs will be the basis for interconnecting puters in a hierarchy as shown in the facilities section (Fig. 3).

tra-LAN as a major architectural component and standard for truly fast, highly parallel structures of this next generation. Note at interconnects the AFP provides transmission at about 2 Gbits/sec for each computer node connected for the tightly connected us, the AFP would be used for some studies of this type of LAN-based architecture.

the hierarchy of three LANs is summarized:

AFP's processor intercommunication; as first basis for an ultra-LAN architecture	Ultra-LAN	2 Gbits x p
Facility computer intercommunication and center to remote sites, forming a single cluster	Fast-LAN	100 Mbits
Individual workstations to form centers	LAN	10 Mbits

CESSING FOR KNOWLEDGE BASED SYSTEMS

widely agreed that Knowledge based Systems can exploit parallelism. For Rule Based Systems, it is believed that many rules can parallel. The research will be aimed at first answering the question, and then simulating and evaluating the resulting structure. sed to simulate such a structure, provided this approach looks worthwhile.

THE RESEARCH PROGRAM FORM

, DIRECTION AND RELATIONSHIP TO ONGOING RESEARCH

e, together with a board of directors would contract the research in a fairly structured fashion. While research of this type is not e today in computer science, we believe it can and must be done effectively by a joint industry and computer science research t. Industry can be effective at providing facilities and systems that have been traditionally absent from the research laboratories. the major motivation for the proposal.

the research project is to provide a large infusion of computing systems to support existing, more basic and unstructured work, ics.

ould not be to change the nature of the existing unstructured research to be highly focused and goal directd, but rather to nal resources so that both the structured project and unstructued work could co-exist and complement one another.

uld be aimed at very similar research targets in order to get the benefit of "friendly competition". Similarly, several approaches ined within a center. This approach was successful in the mid-70's in speech research and should be the "model" direction. peech research resulted in few, commercialized industrial or military applications, because the research coupling between ndustrial research was poor. Unfortunately, the final transfer phase of research was terminated before the program ended.* It een basic research and applications research that the program is fundamentally addressing. It is interesting to note that NEC ed development operating separately, but concurrently with the ARPA program. The result is that NEC provides recognition

e that a better model to follow is VHSIC. It is crucial that the participants be able to exploit the technology for commercial and tions propitiously. Unlike VHSIC, we believe that the work should be done at a few sites with movement of personnel.

OFFICE

is research is a fairly close weave. The environments are, indeed, established anticipating that unexpected leverage and will yeild significant results not included in the program plan. However, it is precisely the existance of a structured program and n of its several work flows that will enable this to occur. The program office is responsible for the successive development of the ources as it can find them and coordinating efforts so work can easily build upon what came before.

munication with Allen Newell and Raj Reddy at CMM.

ffice will set adequate standards so that ideas meet no unnecessary boundaries between the workers and the worksites in this , stable agreement on the common rules, language, workstation, the network and the general computational support structure he most important contributions of the program office, the goal is to use this commonality of interface to allow pyramiding of reful not to pyramid risk.

ses applications to test ideas, and uses realizations of those ideas to build the next generation applications. It even uses these emselves to acomplish future generation realizations fueling the next cycle. The central facilities are the place that application ng ideas, the realizations themselves, and the applications for testing ideas all come together. This must all flow forward rather k into a deadlocking interdependencies. The opportunity and expectation for people to build on each others work as it becomes key. In the natural uncertainties inherent in this ambitious program of research, there must be enough alternative paths so an use their wits to find a critically helpful piece of another's work or another's facility wherever it may turn up.

ffice must have the ability to facilitate the construction of important engineering breadboards so that systems can be rapidly built We envision utilizing the industrial sponsors for this breadboarding.

ffice is deliberately kept small to force most standards to be developed collaboratively with the groups doing the work. The g for the parallel computing facilities is very light in the expectation that site personnel will be provided by the host institution. le, Appendix 3, provides a more detailed breakdown.

EFICIARIES

as conceived in order to improve this flow of basic and applied research into industrial research and eventually into products. ficiaries are those who use these ideas to <u>eventually</u> build products. Products will not come directly from this program.

and, virtually everyone will benefit by the program:

1. the U.S.

chnology will be drastically improved - thereby improving defense and the economy;

2. the

searchers will be more effective and productive by having more meaningful work;

3. certain

search will be published; and

4. researchers

ll still migrate from the coupled programs, being attracted by venture capital, and build higher technology products.

ANSFERING THE TECHNOLOGY

tive means of technology transfer is through the transfer of people. Program sponsors will each have the right to place people in the program. It is expected that assignments be for a three year interval and that the assigned person return to the sponsoring epared to produce the competitive products of the late 80's.

operative working environment among the members of a project team, intellectual property rights for the work done as a team ies of the host institution will be controlled by the policies of the host institution. However, each program sponsor will have the xclusive license at reasonable terms.

the transfer will occur when the sites and industry collaborate on fabricating a design that a site has specified.

, chips produced as part of a research project would be licensed to the sponsors. The "rights" to chips and software produced as ch program are indeed not clear at this time and vary among the institutions. This area would have to be worked out between and the program.

sms for technology transfer include sponsor access to prototypes, distribution of published technical reports and invitations to ars.

e held quarterly for program sponsors with invited speakers from universities, government and industry.

kers the organizers of the seminars will have the freedom to draw on the wide range of topics encompassed by the program,

. Pattern and

age processing applications

. A. I. algorithm

search

. Multi-

ocessor architectural developments

. CAD/CAM

ftware systems

. VLSI design

ocess advancements

FACILITIES

ERARCHIES OF AREA NETWORKS

ould be organized around at least central research computation centers containing a variety of production and experimental ems (nodes) interconnected via 100 Mb/s links and forming the central facility for a hierarchical set of closely coupled, high ocal area networks. The centers will be linked to several campuses via the highest available links so that they could be used in a on "as if local" computation centers.

contain supercomputers, AFP's and experimental computers.

proposing ARPA-net II. This must come into operation relatively soon, to be used to interconnect the more remote research to gh bandwidth, such as several video channels would be needed to avoid limiting the interaction between sites. Here, the goal ovide only millisecond delays between processes operating on separated machines.

CILITY

cts would be designing many VLSI chips, the facility would need a way to build state of the art VLSI chips from mask design. this plished by a multi-year committment of appropriate existing capacity to the needs of the program.

ould start immediately and be coupled to existing computer science and computer engineering research facilities and programs. n is strictly on the basis of the intensity and quality of work in VLSI, image processing, parallel computing and AI. Either more or Berkeley Laboratories would be ideal sites for the computation center which would link to Stanford, SRI, and MIT, MITRE or Lincoln Laboratory could be the basis of an East Coast facility. Los Alamos has the largest network of s and support computers including storage and image production. If a central site were Los Alamos, this would force the nd installation of high speed links to other sites.

ENTERS

ery imcomplete list of application centers is included as an example of how work would be contracted by the program office to rs throughout the country.

r Performance Interprocessor Or Communications Structure

, Univ. Illinois)

low Simulation And Parallel Algorithm Compilers

ence, MIT, Berkeley)

Design Automation For Parallel Computation

Lincoln Laboratory, Berkeley)

----

e Enhance/Map/Encode/Compress

lard, Univ. Maryland, LASL, Lawrence)

re Extract/Target ID/Automated Inspection

GE, SRI, Univ. Texas)

e And Symbol Knowledge Representation/Expert System

ford, MIT)

DELIVERABLES

mpassed is broken into three classes shown in the Deliverables Table. Within each class there are families of projects and finally emselves. The program runs about ten years broken into rough phase transitions at the end of 1985 and 1989. The work in the the research environment and work standards in place and develops the first generation tools and applications. The second several machine realizations that use the tools and runs the test bed applications. In this phase, the research facilities are he machines realized by program efforts. These are in turn, the base of the second generation tools and applications. Finally, provides refinements and solves the hard problems that depended on the new understandings generated in the first two phases .

DELIVERABLES TABLE

A

P

P '82 '83 '84 '85 '86 '87 '88 '89 '90 '91 '92

L

I

C reconfigurable 100 MBy/s LAN 256cpu @ 100 MBy/s LAN

A 256 cpu @ 10 MBy/s LAN

T 1000 cpu @ 100MBy/s LAN

I

O simulator ok hotspot analysis

N VLSI dataflow machine

S dataflow compiler

|

E parallel logic simulator running on Dataflow simulator

N VLSI parallel compiler expert system for VLSI design

V

I

R pick 1 rules language next generation rules language

O common workstation (LISP?)

N 1,10,100 MBy/s LAN's parallel rules VLSI 2nd implementation

M

E 1 MBy/s NAN & gate

N AFP AI-VLSI support facilities VLSI dataflow on 100 MBy/s

T I II III IC signature analysis array

|

D 256 cpu node on 10 MBy 4096 cpu node on 100

E SEM enhancement dataflow

V

E Full motion video-conferencing in 56Kb/s

L ($500)

O IC signature analysis dataflow

M SEM scan analysis expert system

E

N

T parallel rules language primatives expert systems for

process/crisis mgt.

T image/info=knowledge

O

O

L

MOTIVATING SUMMARY

e motivation for this approach is timeliness and effectiveness:

1. THE RESEARCH
OGRAM SHOULD START NOW

2. WE NEED
OUPLING OF INDUSTRIAL R&D AND APPLICATIONS WITH COMPUTER SCIENCE RESEARCH

3. WE CAN BUILD
N EXISTING RESEARCH PROGRAMS AND COMPUTERS

at we start now on the research program, as our computer science research has been drifting these last few years as both mputer science research have both gotten large, diffused, and independent of one another. Significant industrial research Bell Labs and Japanese companies is non-existent and there is no coupling of basic and industrial research. For example, we better coupling of Bell Labs work to the Japanese computer industry via NTT's, ECL, than between Bell Labs and the U.S. dustry. Furthermore, both the academic and industrial research communities are now poorly coupled to real applications. We ogram focus of some of the existing research efforts into a goal directed system will enhance their productivity and enable the a vital Information Industry for the 21st Century.

APPENDIX 1

SOME CRITICAL GLOBAL QUESTIONS (AND ANASWERS)

1. Why is the tablishment of national facilities the correct way to attach the parallel problem?

. No single lab now has critical mass or focus in anyone area - currently all resources are difused.

. The lab(s) and programs operate together to do the work.

. Users, architects, and builders must couple.

2. What impact ll this proposed program have on existing research facilities? Programs?

. The intent is to build on, and extend current facilities by additionla resouces. We believe that this program is close enough to some of the existing.

2a. What about the extra space required for these facilities?

. We don't ow.

3. How will this effort help the basic problem of a shortage of qualified researchers?

. It is hoped that a "program" will stimulate the demand to produce more researches over the long term.

. Short term, the focus should increase everyone's effectiveness.

. We hope to apply industrial researchers to the problem that are now difused and often operate as a sub-critical mass.

4. Who is supposed to benefit from this proposal and in what specific ways?

(See Section on Program Beneficiaries)

5. Is there a nationla crisis and exactly what is it?

(See section on Motivation for the Program)

6.What evidence do you have to support the level of funding which is projected as being adequate to achieve the goals?

This is really a draft outline for concrete proposals. From this we expect specific sites to be established and operated in very rgetted areas: such as parallel knowledge based systems, high performance parallel processing and parallel image processing.

7. What, exactly is the overall objection of the program?

(See the first sentence of this document)

APPENDIX 2

WHY USE CDC'S ADVANCED FLEXIBLE PROCESSOR?

e AFP has demonstrated high performance in digital image and signal -

s. For example, a processor system can transform the every co-ordinate of a million point picture in 1/30 second. Several
operation today. It includes various support software including simulators.

e design, build and then use. A machine as fast and general as AFP would require at least 5 years to build. By using the current
l purpose research tool, we can gain at least 5 years on starting such a program from scratch. To illustrate, consider the several
cts that could use AFP today to simulate architectures. Since we need to evaluate these architectures by using them, we could
benefits and drawbacks of these machines five years (or so) sooner by adopting the AFP as a hardware simulation base.

ovides a very fast, flexible, microprogrammed set of up to 16 computer modules for experimenting in various parallel computing
rious type. A single, AFP microprogrammed processor provides the following capability:

. 20 to 800
ops in 16 parallel, 16-bit arithmetic and logic units

. Microprogrammed control

. Access to 32
egaword (256 Megabyte block oriented memory)

. 2 X 1 Gbits/sec
mmunication with neighbors in ring

processor and multicomputer structure are both provided since, the sixteen processors can be interconnected both to a common
emory and to adjacent processors.

us be used as a tool to study several different computer structures that we believe are much of the basis of the next generation.

so highly parallel, including having functional units with side effects, we believe it will not be imcroporgrammed to any great nvision is that it would operate in several configurations, with fixed microprograms to behave as:

1. Set of

croprogrammed pipelined, functional units within each processor. Four units can be initiated every 20 nanoseconds, although average of seven units operate in parallel for most problems. Because of the difficulty of programming this highly parallel ucture, the most important benefit, or side-effect will be understanding in how to do it effectively. Because the croprogramming so heavily pipelined, we believe a better understanding of dataflow techniques for expressing algorithms will sult from the use. Nearly all high performance machines are pipelined; hence, we believe AFP is a good vehicle to get a better derstanding of pipelining.

2. 16 processor

ultiprocessor with shared memory and very fast interprocessor intercommunication. Here, the processors will be programmed be particular ISP, such C. If C could become the basis of the machine, then UNIX could be run.

3. Set of 16

mputer Modules microprogrammed for particular functions. AFP was designed to be operated in this mode for image ocessing.

4. A dataflow

mputer. This is a special case of item 3 whereby particular computers are programmed to behave as the various functionla units a dataflow computer.

5. A set of

ecial, parallel processing architectures using individual, microprogrammed processors as the functional units of the particular uctures. In this mode, AFP turns out to be a very good emulator of relatively complex VLSI chips.

6. An

perimental Ultra-LAN based architecture. To examine how computers can be coupled effectively and work together on a task, e AFP looks like an ideal for study.

APENDIX 3

ROUGH BUDGET

xpenses are estimated at approximately $18M/year running from 1982 through 1989. Equipment is expensed as delivered. In three "competitive but collaborative" groups are charged with each project family.

	#	Heads	Total	Expenses	($M)
	Sites	(ea.site)	Heads	Manpower	Equip
ns/Structures	2	5	10	1	-
allel Computation	1	1	1	.1	-
sign Automation	1	3	3	.3	-
ting Environment	1	2	2	.2	15
Knowledge/	1	3	3	.3	-
	6		19	1.9	15

	# Sites	Heads (ea. site)	Total Heads	Expenses ($M) Manpower	Equip.
ns/Structures	2	5	10	1	5
allel Computation	3	3	9	.9	-
sign Automation	2	5	10	1	-
ting Environment	2	2	4	.4	10
Knowledge	3	5	15	1.5	-
ment Studies	1	3	3	.3	-
ion Studies	1	5	5	.5	-
	14		56	5.6	15

	#	Heads	Total	Expenses ($M)	
	Sites	(ea. site)	Heads	Manpower	Equip.
ns/Structures	2	6	12	1.2	5
allel Computation	3	3	9	.9	-
sign Automation	2	5	10	1.0	-
ting Environment	3	2	6	.6	8
Knowledge	3	5	15	1.5	-
ment Studies	2	5	10	1.0	-
ion Studies	3	5	15	1.5	-
	18		77	7.7	13

#	Heads	Total	Expenses	($M)
Sites	(ea. site)	Heads	Manpower	Equip.

ns/Structures	2	6	12	1.2	5
llel Computation	3	3	9	.9	-
sign Automation	2	5	10	1.0	-
ting Environment	3	2	6	.6	5
Knowledge	3	5	10	1.0	-
ment Studies	2	5	10	1.0	-
ion Studies	3	5	15	1.5	-
	18		77	7.7	10

	# Sites	Heads (ea. site)	Total Heads	Expenses ($M) Manpower	Equip.
ns/Structures	2	6	12	1.2	5
allel Computation	3	3	9	.9	1
sign Automation	2	5	10	1.0	0
ting Environment	2	2	6	.6	5
Knowledge	3	5	15	1.5	-
ment Studies	2	5	10	1.0	1
ion Studies	3	5	15	1.5	-
	18		77	7.7	12

	# Sites	Heads (ea. site)	Total Heads	Expenses ($M) Manpower	Equip.
ns/Structures	2	6	12	1.2	5

allel Computation	3	3	9	.9	-
sign Automation	2	5	10	1.0	-
ting Environment	2	2	6	.6	5
Knowledge	3	5	15	1.5	-
ment Studies	2	5	15	1.5	-
ion Studies	3	5	15	1.5	-
	--				
	18		77	7.7	10

	#	Heads	Total	Expenses	($M)
	Sites	(ea. site)	Heads	Manpower	Equip.
ns/Structures	2	5	10	1	4
allel Computation	2	3	6	.6	-
sign Automation	2	5	10	1	-
ting Environment	3	2	6	.6	5
Knowledge	3	5	15	1.5	-
ment Studies	1	5	5	.5	-
ion Studies	3	5	15	1.5	-
	16		67	6.7	9

#	Heads	Total	Expenses	($M)

	Sites	(ea. site)	Heads	Manpower	Equip.
ns/Structures	2	5	10	1	1
allel Computation	1	2	2	.2	-
sign Automation	1	5	5	.5	-
ting Environment	3	2	6	.6	5
Knowledge	1	5	5	.5	-
ment Studies	1	1	1	.1	-
ion Studies	1	5	5	.5	-
	--				
	10		34	3.4	6

	#	Heads	Total	Expenses	($M)
	Sites	(ea. site)	Heads	Manpower	Equip.
ns/Structures	2	5	10	1	-
allel Computation	-	-	-	-	-
sign Automation	1	2	2	.2	-
ting Environment	2	2	4	.4	3
Knowledge	-	-	-	-	-
ment Studies	-	-	-	-	-
ion Studies	1	2	2	.2	-
	6		18	1.8	3

	#	Heads	Total	Expenses	($M)
	Sites	(ea. site)	Heads	Manpower	Equip.
ns/Structures	1	5	5	.5	-
allel Computation	-	-	-	-	-
sign Automation	1	1	1	.1	-
ting Environment	1	2	2	.2	1.8
Knowledge	-	-	-	-	-
ment Studies	-	-	-	-	-
ion Studies	-	-	-	-	-

	3		8	.8	1.8

GB3.S7.3

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! d ! i ! g ! i ! t ! a ! l !          I n t e r o f f i c e
M e m o
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```

TO: see "TO" DISTRIBUTION   DATE: WED 1 JUN 1983
1:38 PM DST

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

cc: BILL DEMMER
BILL JOHNSON
TOM EGGERS @LTNX

MESSAGE ID: 5201608918

SUBJECT: 784/PPA AT STANFORD

GB5.48

I think we made some progress getting Stanford to get their act together so it can be used. It's clear to me that CMU is 10 years
ahead in thinking about parallelism, especially applied to multiprocessors (ala C.mmp and Cm*).

The vision is pretty much along the strategy (dream) I outlined for
PPA: get a 784 in now so that the ultimate software writing and
testing can be started instead of waiting two years till PPA arrives.
The 784 should "simulate" the ultimate machine with n processors and
be able to output what the actual running time would be.

The users there would include:

1. Heuristic Program Project's Machine Architecture Research. This 3 year program, with Bruce as one of the team members, is aimed at examining the performance and parallelism of AI applications as the basis of the next generation architectures. This work is badly needed because I view we have NO understanding about LISP performance, the desireability of special P's for LISP, whether or how LISP can be extended for mP's, etc. This work would also include running on PPA to verify conjectures.

2. John Hennesy's Single Assignment Language for Multiprocessors.

   VAX is currently the host; having PPA would let them accelerate their research by several years. I believe this will turn out to be the way to get performance from mP's. This is also probably the path to build a "parallel LISP" -- not by starting from each of the baroque dialects.

3. Dave Cheriton's distributed processing is quite different, but PPA could be the best vehicle for experimentation because it can provide the most rapid communication.

4. Many applications: Tom Binford - Pixel and image processing; Hennesy - circuit and logic simulation; plus many others in computer science, electrical engineering and the center for integrated systems.

5. Jeff Ullman - experimentations in parallel algorithms.

Bruce is coordinating the 784/PPA procurement and our part of the
program both within Stanford and DEC.

"TO" DISTRIBUTION:

FOREST BASKETT	BRUCE DELAGI	SAM FULLER
TOM GANNON	BILL STRECKER	

WPS USERS - Leave HP mode and type <CR>

00 CORE DECGRAM ACCEPTED S 003812 O 404 27-APR-83
15:21:13

```
.___.___.___.___.___.___.___.
!   !   !   !   !   !   !   !
! d ! i ! g ! i ! t ! a ! l !        I n t e r o f f i c e
M e m o
!___!___!___!___!___!___!___!
```

TO: BILL DEMMER   DATE: WED 27 APR 1983
1:34 PM DST
    PRODUCT STRAT COMM: FROM: GORDON BELL
cc: see "CC" DISTRIBUTION   DEPT: ENG STAFF
                                                  EXT: 223-2236
                                                  LOC/MAIL STOP: ML12-
1/A51

                                                  MESSAGE ID:
5198151615

SUBJECT: STRATEGY (OR BETTER CALL IT DREAM) FOR A HOT MACHINE

We appear to be making excellent progress in the design of
PPA (the 32
processor MicroVAX) which would have the power of roughly a
CRAY 1.
The performance picture doesn't appear to be appreciably
different
than what is given in the attached EMS.

It is becoming increasingly clear that the real limit to PPA
is the
problem of either modifying existing programs or re-
programming to
take advantage of parallelism. Therefore, we must have a
strong
program which puts 4 processor machines in the hands of users
so that
the programming can start. Otherwise, the acceptance in the

market
will be delayed two years until the real machine is in the market.

THE DREAM FOR PPA
Would like to see the following timetable:
Q184 Ship several 784 (quad mP's) to the test sites so they can be used for parallel program development during the next 1.5 years:
CMU-Joint development. CMU to use in their Supercomputer workbench, and to test the parallel processor AI machine.
LLL-Debug phyics programs for the Cray mP, and the S1 (16Pc).
LASL-Physics applications.
LBL-Physics applications, but move the techniques they've learned on their Midas system over to VAX/VMS... help us.
Illinois-Get them started on our system versus doing their own. Kuck knows more about compiling for these machines than anyone around.
NYU-Some bright folks. Save them from trying to build their ultracomputer and get them to work on the hard problem of software. Currently they plan an 8 Pc in 3 years on their way to 16000 Pc's.
Cornell-Ken Wilson, Nobel Prize winner, has been advocating.
Stanford-Might get them to want one for AI.

MIT-Might get them to want one for AI, etc. We really need
someone to work on parallel processing for AI languages.
Concurrent Prolog and Scheme (a LISP) dialect are candidate
languages which permit expressing parallelism.
PURDUE, YALE-Has work in this area.
Q384 Ship really good software so that applications can be
developed on PPA. This would include the ability to "simulate"
PPA such that a user can run at 4 x 780 speed and measure the
performance as if it were on an n processor machine.
Q185 Ship first MicroVAX PPA to a test site.
Q385 Ship PPAs to test sites. Verify that PPA matches the results
that were obtained by the 784 and that their software really
runs as predicted.
Q186 Begin shipping PPAs at a volume (eg. 780) rate, thus creating
a new level of price/performance, and performance (for this
price band) that has been heretofore unattainable.

What you think?
Are there other places? (eg. Schlumberger)

"CC" DISTRIBUTION:

CFM/TAB:	TOM GANNON	ED KRAMER
BILL LONG	BILL STRECKER	TOM EGGERS
@LTNX		

ATTACHED: MEMO;104

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!   !   !   !   !   !   !   !
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M e m o
!___!___!___!___!___!___!___!
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TO: see "TO" DISTRIBUTION   DATE: WED 16 FEB 1983
8:56 AM EST
O   FROM: GORDON BELL
Pcc: ROSE ANN GIORDANO   DEPT: ENG STAFF
    ED KRAMER   EXT: 223-2236
    BILL LONG   LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5191131339

SUBJECT: BETTER COST, PERFORMANCE AND PERFORMANCE/$

GB4.S1.24

Cycles for the Masses is beginning to look up. The following table indicates we have some very interesting possibilities for competitive machines everywhere. It also shows we are in a new computer generation, the Fifth, as the cost decreases by a factor of 10 or performance increases by a factor of 10. This gives a factor of 5-50 in performance/cost over where we are today. Note the following table of machines.

	Time	Price($M)	Perf.	Mflops	flops/$	# Users
Microvax W/S	85	0.01	0.9	0.45	45.0	1

Scorpio	85	.04	0.9	.45	11.0	5- 500
780	78	0.4	1.0	0.5	1.25	5- 500
790	6/84	0.5	5.0	2.5	5.0	5- 500
Nautilus	4/85	0.25	4.0	2.0	8.0	5- 500
dual proc.		0.4	8.0	4.0	10.0	
PPA	6/85	0.25	40.0	20.0	80.0	5- 500
Titan (proto)	12/83	0.1	10.0	5.0	50.0	1- ?
KL	74	0.75	1.3	0.66	0.9	10- 500
Jupiter	+30(mos)	0.75	6.0	3.0	4.0	10- 500
Cray 1	76	10.0	40.0	20.0	2.0	50-1000
with vectors			100.0	200.0	10.0	
Cray 2/XMP	85	10.0	120.0	60.0	6.0	
with vectors			300.0	600.0	30.0	

Notice there are several ways to get a performance:

1. Supercomputers (eg. Cray) operate in batch mode. At LLNL, a large user gets a maximum of 1 hr/day. Therefore, if one of our systems can deliver only 1/8 to 1/24 the performance, the price performance is likely to be better with a Supermini depending on the problem. In a real environment, most users would rather have something else so they can escape from the center.

2. Supermini, operated as a personal or with a small number of users.

3. The new, powerful microprocessor based personal computer with 750-780 performance. This gives a user the most power. I believe our technical marketplace wants this.

4. The new, shared, Supermicro such as Scorpio - These computers have the best cost/user, but will the added sharing be worth it versus the low cost PC's? This is quite attractive.

5. New, specialized facilities such as PPA, a 32 processor based on MicroVAX, FPS-164, XYCAD for high performance batch. All are quite interesting.

Performance/price depends on the fraction of a system that can be dedicated to a user. With MicroVAX PC - the price may be in the don't care range 10K-20K (or 10% of a professional's salary) but the performance is at 780 level. Therefore, work will migrate both from supers and superminis.

We have some incredible opportunities. It would seem desireable that
we first simply consider Titan and PPA as purely computational
processors, although Titan would eventually be a PC when it has
software. They would be operated as servers running, say Fortran, to
off-load KL's or VAXen via CI.

This VLSI generation is going to generate many more kinds of computers
than ever. Supers, Mainframes, and Superminis are all going to feel
the impact of Supermicros, PC's and interesting specials.

Bottom Line

We've entered an era (the Fifth Generation) driven by the powerful
microprocessor and this drastically changes the price,
price/performance and maximum performance of the systems we can build.

The numbers should reinforce the gut feel that the Fifth Generation is
going to be exciting.

"TO" DISTRIBUTION:

BILL AVERY   CFM TASK FORCE: BILL DEMMER
ULF FAGERQUIST   BARRY JAMES FOLSOM   BILL JOHNSON
DEMETRIOS LIGNOS   AVRAM MILLER   OPERATIONS COMMITTEE:

00 CORE DECGRAM ACCEPTED S 000860 O 106 02-APR-83 18:12:21

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.___.___.___.___.___.___.___.
!   !   !   !   !   !   !   !
! d ! i ! g ! i ! t ! a ! l !          I n t e r o f f i c e
M e m o
!___!___!___!___!___!___!___!
```

TO: SAM FULLER   DATE: SAT 2 APR 1983
6:06 PM EST
    TOM GANNON   FROM: GORDON BELL
    BILL STRECKER   DEPT: ENG STAFF
                                                  EXT: 223-2236
                                                  LOC/MAIL STOP: ML12-
1/A51

                                                  MESSAGE ID:
5195610346

SUBJECT: DISCUSSION WITH RAJ RE PPA AND DEC/CMU RELATIONSHIP

GB5.26

Just talked with Raj an hour or so He says that Kahn and Adams
say the money's in the bank and they are going ahead with CMU part.

I had pushed Allen re the notion that they would go someplace
else with our ideas. Raj said no. They only discussions they
are having are with Fairchild building a proprietary chip with
th new Fairchild 1 micron CMOS technolgy. CMU would do the
architecture and Fairchild the implementation. It would be
based around the Forgie/Newell ideas.

He also talked about Intel's interest in supplying a 432
redesign which Intel ispnding a 100M on, courtesy of Siemens.
apparently it has caches everywhere to make it perform.

He discussed the PPA concerns:
want more bus bandwidth so that on next go around 256 Pc's

are
possible.
Want to have a 10-100 x Cray on the 3rd version, by 1992. He wants us to think about evolving the design several times and to try and plan for it.
Wants 1 Gigabyte or so.
Worried about cache size too small

He needs a letter from one of us (It should be from BJ/Demmer/Strecker)
describing our intent and how we want to work with CMU. Raj will
send a template via Siewiorek this week.

He now buys into the 784, provided we can get a big, shared memory. I concur. We somehow have to get a memory of reasonable
size. Is there any work here? What's the limiting factor? Here, they would take it with the small one, provided we can get
an upgrade soon Tom, can you help here? This has to be a problem
that can be solved, and really must be solved to have a good running system (suitable for either production or simulation of PPA).

PRE-COMPUTER EXHIBIT OF ANALOG, DIGITAL AND TABULAR ARITHMETIC UNITS

Napier's Bones
Tables of Products, etc.
Burringhton's Book
Handbook of Chemistry and Physics
Book on Instruments
Rule
Slide Rule
Sector
Planometer (Platometer)
2 Fuller Slide Rules
Modem 20", 10", 6" Slide Rules
Circular Slide Rules (to buy)
Desk Slide Rule for Conversions

Digital
3 (Abacus and Soroban)
Anthometer
Millionaire
Australian Hand-Held Calculator
Pascal-Type Adder
Comptometer
Burroughs Comptometer
2 Adding Machines
2 Mechanical Scientific Calculators

First Electronic Calculator (Friden)
First HP Calculator (HP35)

C O M P A N Y   C O N F I D E N T I A L

Preliminary Draft for Commment by Digital Engineering Community

HEURISTICS AND COMMENTS FOR BUILDING GREAT PRODUCTS

Gordon Bell, Vice President, Engineering

Product goodness is somewhat like pornography, it can't fully be described, but we're told people know it when they see it. If we can agree on heuristics about product goodness and how to achieve it - then we're clearly ahead. Five sets of dimensions for building great products need be attended to (roughly in order of importance):

. a responsible, productive and creative engineering group;
. product and design metrics (competitiveness);
. design goals and constraints;
. product evolution, revolution and death; and
. the ability to get the product built and sold.

ENGINEERING GROUP

As a company managed primarily by engineers, groups are encouraged to form and design products. With this right, are responsibilities.

The Team must have:

. a_chief_designer/chief_programmer_to_formulate_and_lead the resolution of the problems encountered in the design; No matter how large the project, it must be lead from a "single head". We often make two errors in leadership: having no clear technical leader/problem resolver, and abdicating to a committee.

Committees do not do design! They are never held responsible, nor are they rewarded or punished. Committees can review.

. management who understand_the_product_space_and_who_has engineered_successful_products; The two most important jobs are:
. making sure that everyone knows their job; and
. setting and reviewing work on a timely basis, ie. MBO.

. team skills and resources to implement the proposal so that we adhere to the cardinal rule of Digital, "He Who Proposes, Does"; A plan must include the chief designer, team, project organization and resources (eg. computers). Supporting skills and disciplines are essential in the respective product areas, eg. ergonometrics, acoustics, radiation, microprogramming, data bases, security, reliability.

. an_understanding_of_the_design,_design_production_(eg. CAD) processes,_and_manufacturing__processes; Learning curves apply to all processes! The organization must be staffed with people who understand the product, the design process (CAD and management discipline) and the production introduction process. One or two out of three isn't enough.

Behaviorally, the team must:

. do_it_right_the_first_time; Being correct has the highest payoff everywhere: timeliness, quality, lack of rework, and mfg. cost.

. execute_the_project_in_a_timely_fashion; Virtually ALL of our projects are late because we start too late, don't get it done on time because some critical invention is required, take too long to get it introduced, etc. For the very long, very late projects, the failure is lack of planning, tools and organization. Finally, people burn out. This suggests we:
. limit_projects_to_two_years_by_a_small_team. We often make an aggressive business plan, then hire the team. They then find out they have neither tools nor technology to do the project.
. not_predicate_a_project_on_scheduling_inventions_in_the_design, process_and_CAD_areas. If we can't see how to do the work in 2 years, then let's not start the project! This means the product must be cut down to fit the tools, people and process. Advanced developement is to insure that we can do development.

. have a_written_design_methodology that includes: all design processes in the form of manuals, design conventions, conflict resolution, criteria for task completion, PERT structure, etc.;

. be_open_and_have_external_reviews,_and_clearly_written_product descriptions_for_inspection; For new product areas, we require breadboards in addition to the above heuristics. When the product gestation time equals the generation time, a full advanced development effort is the only way to be successful.

- start_small,_be_reviewed_and_grow_on_its_demonstrated_success;
- learn, in order to handle the increase in complexity that comes with technology. Until there's a formal sabbatical program, individuals would do well to consider taking the equivalent of a semester of technical courses each 10 years.

PRODUCT METRICS KNOWLEDGE includes:

- products_for_which_there'll_be_no_competitor;
- all_product_cost_metrics (cost, cost of ownership, cost to operate and use);
- all_product_performance_and_cost/performance_metrics; These are the goodness measures of a product and tell how easily it will be to sell, and if we have improved. Cost and performance is measured against a state-of-the-art line represented by the first shipment of a more advanced product. Alternatively, when there's no direct comparison, the time goodness is determined from the day the product could have shipped. For example, because of parts availability, Nebula and CT could have shipped two and three years ago based on component availability.
- reasons_why_the_product_will_succeed against present and likely future competition; sure success in the market is to introduce a needed function (eg. 32-bit address) by which all other products have to be measured.
- major_competitor_products by cost, performance and functionality; This should cover the past and future five years.
- leading_edge, innovative, small_company_products;
- productivity, quality and design_process metrics for projects.

DESIGN GOALS AND CONSTRAINTS

Design constraints are generally set as various kinds of standards. These are useful because they limit the choice of often trivial design decisions, and let us deal with important free choices, the goals.

Goals are vitally important because they target our uniqueness.

Poor "mind-set" standards can create poor products, even though they may have made sense at one time. The historical English measures is a good case in point. Currently, the 19" rack and the metal boxes Digital makes to fit in them, and then ship on pallets to customers, act as constraints on building cost-effective PDP-11 Systems. This historical "mind set" standard often impedes the ability to produce products that meet the 20% per year cost decline curve.

- . Goals_and_constraints must be_written_down_and_updated_from_the day_the_project_starts. Virtually every product failure and period of product floundering is a result of no clear goals and constraints since everyone has a different idea of the product.
- . A_product_can_only_have_a_few_goals_and_constraints. The ranking is usually: it must work and have improved cost of ownership, be the shortest time to market, highest performance and lowest cost.

We must adhere to standards which we either follow or set!

- . If_a_standard_exists,_follow_it_or_change_it_for_all! We lost the IEEE Floating Point format. It is likely we will eventually have to support it.
- . If_a_standard_is_forming_go_all_out_to_set_it. When formed, then follow it. We didn't make DDCMP a standard. When HDLC came, we didn't use it. The result: expensive, low performance products.

Standards can be grouped into four distinct sets:

- . DEC Engineering Standards; These cover most physical structures and design practice for producibility, and assimilate critical external standards, such as UL, VDE, and FCC.
- . professional society, industry and area information processing standards, from EIA, CBEMA, ECMA, ANSI, ISO etc. such as Cobol '74, Codasyl, IEEE 488;
- . defacto industry wide information processing and communication standards such as IBM SNA, Visicalc;
- . standards implied by the architecture of existing DEC products to insure our customer software investments are preserved include:
    - . architecture of computers, terminals, mass store and communications links; Our current ISP's include 8, 11's, 10/20, VAX, 8048, 8080, 8086, 68000; VT52, VT100, keyboards, Regis; MCP; HDLC, CI, NI, SI.
    - . physical interconnect busses for computers and for interconnecting them CT, Q, U, NI, CI, etc. These insure that future system products can evolve from component and computer options between generations.
    - . operating system interface file commands, command language, human interface, calling sequence, screen/form management, keyboard, etc.

- . Products_must_be_designed_for_easy_translation_into_in_any natural_language_since_we_are_an_international_company.
- . All_products_must_have_be_customer_installable_and_maintainable.
- . Portability_is_an_important_goal. Personal computers must be portable! We must achieve this for all systems ASAP!

WHEN TO CREATE, WHEN TO EVOLVE AND WHEN TO STOP PRODUCTS
Engineering is responsible for designing evolutionary products in our markets AND for producing products that are natural to our tradition of supplying the most interactive, cost-effective computing. If a new product such as personal computing emerges and we do not have a product, engineering has failed, independent of being asked for it!

Given all the constraints, can we ever create a new product, or is everything just an evolutionary extension of the past? If revolutionary do we know or care where product ideas come from? The important aspect about product ideas is:

. Ideas_must_exist_to_have_products! If we don't have ideas to redefine or extend a market, then we should not build a product.

It is hard to determine whether something is an evolution or just an extension. The critically successful products are likely to occur the second time around. Some examples: PDP 6,KA10,KI10,KL10,2080; Tops 10,Tenex,TOPS20; PDP5,8,8S,8I/L,8E/F/M; OS8-RT11; 11/20,40,34,44; RSX-A... M, M+; TSS-8,RSTS; various versions of Fortran, Cobol and Basic follow this; LA30,36,120; VT05,50/52,100, 101 etc.; RK05,RL01/2.

. A_product_tree_MUST_be_maintained_by_each_engineering_group showing roots, gestation time and life.

Goodness_and_Greatness = NO CRAPPY PRODUCTS!
All products whether they be revolutionary, creating a new base, or evolutionary, should:

. be elegant and high quality; Russ Doane's working definition is: "every feature contributes two benefits", like a double pun. Quality means no excess. Elegant, high quality designs, do double duty with a minimum use of resources. Quality is also the absence of errors, by being right the first time so that it doesn't have to be inspected or redone.
. offer_at_least_a_factor_of_two_in_terms_of_cost-effectiveness over_a_current_product; We have classic failures because a CPU cost has been minimized, only to find the total system cost has barely changed 10% and the total cost to the customer is only 5% lower! If each product is unique then we will have funds to build good products.
. be_based_on_an_idea_which_will_offer_an_attribute_or_set_of attributes_that_no_existing_products_have; For example, the goals and constraints for VAX included factor of two algorithm encoding and also offering ability to write a single program in multiple languages. VT100 got distinction by offering 132 columns and smooth scrolling.
. build_in_generality,_and_extensibility; Historically we have not been sufficiently able to predict how applications will evolve, hence generality and extensibility allow us and our customers to deal with changing needs. Extendable products also permit mid-life kickers to products. We have built several dead end products with the intent of lower product cost, only to find that

no one wants the particular collection of options. In reality, even the $200 calculators offer a family of modular printer and mass storage options. For example, our 1-bit PDP-14 had no arithmetic ability, nor could it be a general purpose computer.

As customers used it, ad hoc extensions were needed to count, compare, etc. and it finally evolved into a really poor, general purpose digital computer.

. be_a_complete_system,_not_piece_parts; The total system is what the user sees. A word processing system for example includes: memory, keyboard, tube, modems, cpu, documentation including how to unpack it, the programs, table (if there is one, if not then the method of using at the customer table), and shipping boxes.

. be_a_great_system_because_the_components_are_great; We should not depend on system markups and software functionality to cover poor components and high overhead.

. if_we_don't_make_it,_buy_it; We must carefully decide what components to make versus buy. It is very hard for an organization to be competitive without competing in the marketplace, hence unless we sell it, we should buy it.

Product_Evolution

A product family evolution is described on page 10 of Computer Engineering along the paths of lower cost, and relatively constant performance; constant cost and higher performance; and higher cost and performance. In looking at our successful evolutions:

. lower_cost_products_require_additional functionality_too; A lower cost product, with constant performance or constant function is risky because a new customer base and new way of marketing may be required. Some other company may, however, be successful with the concept. The PDP-8, based on new technology, was radically more successful than its higher priced predecessor, the PDP-5, because it was 2/3 the price and 6 times more performance. The PDP-8/S was a failure at 2/3 the price and 15 less performance than the PDP-8. There are similar stories about the LA 34, VT50/52 and PDT as replacement products.

. constant_cost,_higher_performance_products_are_likely_to_be_the most_useful; Economics of use, the marketing channel and customer base are already established and a more powerful system such as the LA120 will allow higher productivity (see Computer Engineering for the understanding and economics). In the 11's there was a successful evolution: 20, 40, 34 anChied 44. Not the 60. The 11/70 was probably our greatest success; it was billed as a mid-life kicker to the 11/45-55.

Revolutionary_New_Product_Bases

. A new product base, such as a new ISP, physical interconnection, Operating System, approach to building Office Products, must start_a_family_tree_from_which_significant_evolution_can_occur. The investment for a point product is so high that the product is very likely not to payoff. In every case where we have successful evolutionary products, the successors are more successful than the first member of the family. Point products with no follow-on will probably fail all roi tests.

Product_Termination

. A_product_evolution_is_likely_to_need_termination_after successive_implementations,_because_new_concepts_in_use_have obsoleted_its_underlying_structure. All structures decay with

evolution, and the trick is to identify the last member of a family, such as the 132 column card, and then not build it. This holds for physical components, processors, terminals, mass storage, operating systems, languages and applications. Some of the signs of product obsolescence:

- . It has been extended at least once, and future extensions render it virtually unintelligible.
- . Better products using other bases are available.

SELLING AND BUILDING THE PRODUCT

"Buy in" of the product can come at any time. However, if all the other rules are adhered to, there is no guarantee that it will be promoted, or that customers will find out about it and buy it. Some rules about selling it:

. it_has_to_be_producible_and_work, AND be useful to software; This, although seemingly trivial rule, is often overlooked when explaining why a product is good or not. If it is a piece of hardware that requires software to support it, the hardware must be available to the programmers who must support it. Software engineers approach new hardware with much caution! The often ask: is it significant? is it needed? why isn't it compatible with the past? If a hardware is viewed with distrust by software engineers it may be met with the same distrust by customers!

. a_business_plan_with_orders_and_marketing_plans_from_several marketing_persons_and_groups_needs_to_be_in_place; Just as it is unwise to depend on a single opinion in engineering for design and review, it is even more important that several different groups are intending to sell the product. Individual marketers are just as fallible as unchecked engineers. This rule can and must be violated for revolutionary products!

- never_build_a_product_for_a_single_customer, although a particular customer may be used as an archetype user; predicating a product on one sale is the one sure way to fail! Paraphrasing a remark by former GM executive Charles Wilson: if it's good for General Motors, it may only be good for GM.
- it_must_be_done_in_a_timely_fashion according to the committed schedule, price and functions as previously described;
- it_must_be_understandable_and_easy_to_use. The small size, complete hardware books were the DEC trademark that established the minicomputer. We must revive these such that a particular user never need access more than one. Simplicity must be the rule for our documentation.

What heuristics are missing? What heuristics do you disagree with?

What heuristics could be removed? reordered?

Could I please have your feedback before this becomes a final draft?

3/13/82 Sat 19:47:01 GB3.S2.5

OTHER PREMISES AND CONSIDERATIONS

1. OUR BASE PRODUCTS ARE OK, EXCEPT THERE ARE TOO MANY. GO FOR BETTER

LONG TERM STRATEGY. SKIP HOLE FILLING WHICH INCREASES CLUTTER.

2. WE'RE SUPPORTING TOO MANY SYSTEMS.

3. NATURAL PRESSURE THROUGH SALES, DECUS, MARKETING AND DEVELOPERS

REQUIRES ALL SYSTEMS TO BE SUPPORTED AND ENHANCED FOREVER.

4. NATURAL MARKET PRESSURE FORCES MORE GENERALITY INTO EXISTING

PRODUCTS. THIS DETRACTS FROM MOVING TO APPLICATIONG.

5. A "GREAT SYSTEM" WILL ATTRACT LANGUAGES (COMMON, EXOTIC AND

SPECIAL APPLICATIONS) AND APPLICATIONS BY EXTERNAL USERS AND THIRD

PARTY COMPANIES. TOO MANY SYSTEMS BY A MANUFACTURER WILL DETRACT FROM

THIS NATURAL MAGNET.

6. ALTHOUGH WE DON'T HAVE A PRECISE UNDERSTANDING OF VAX ACCEPTANCE,

IT FEELS LIKE "A GREAT SYSTEM" (LOVED BY KNOWLEDGEABLE USERS,

INSTALLS EASILY, WORKS AND IS EASY TO USE). IT'S EXCITING

ARCHITECTURALLY AND FITS WITH 11'S. THERE'S PRESSURE TO EXTEND IT

WITH MORE PERFORMANCE AND AT LOWER (11/34) COST.

7. EVEN WITH TOPS 20, THE 2020 HASN'T FOUND ITS NICHE YET.

draft press release

DIGITAL ACCELLERATES 32-BIT STRATEGY

ST. LOUIS, MO -- 23 MAY 83 -- Digital Equipment Corporation announced today that it is accelerating its program for moving users of its 36-bit products over to its more broadly-based 32-bit architecture.

Speaking at the Spring symposium of DECUS (Digital Equipment Computer Users) held at the (name of hotel) here, Winston Hindle, Vice President Corporate Operations, told 00000 members of Digital's users group that the company has decided to" divert its development resourcEs away from a follow-on 36-bit machine and into accellerated development of hardware, software and communications capabilities to enhance our already-formidable offering of 32-bit products.

"It has taken longer than originally planned to develop a follow-on to our existing DECsystem 10/20 family and it looks like we're still three years away," Hindle told the users. "So, we have decided instead to shift some resources and speed up the development of software and communications tools that will allow DECsystem 10s and 20s to be more easily integrated into our corporate architecture.

"We think the needs of our customers would be better served by concentrating our high-end development efforts around our more broadly-based VAX architecture," Hindle said.

...hype VAX, clusters, LANs....
****
* d i g i t a l *
****

TO: DICK CLAYTON DATE: FRI 1 FEB 1980
9:17 AM ART CAMPBELL FROM: GORDON
BELL
cc: STAN PEARSON DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1
A51

SUBJECT: PRICE VS. FUNCTUALITY FACTS

We (you) could add much insight to BOD (us) by taking a number of the products which change in price or function (you have a metric) and plot log (price) vs. log (volume) for a given functionality (e.g. LA30, LA36, LA34), and (DS210, VT78, VT278 [projected]). This should begin to answer some arguments and might give us great business insight re predicting volumes in turn of coefficients of elasticity (e.g. 20% lower cost doubles volumes). Then, we might also use price not cost to set operating points for factories rather than redesigning every product for 20% lower cost. These kinds of things are probably only done in only in business schools, but since I'm only an engineer it probably doesn't have any application to us...or does it? At least the data shouldn't hurt anyone and would make me feel better about affects if price, functionality on volume.

GB:swh
GB1.S1.47

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TO: BILL AVERY   DATE: WED 16 FEB 1983
2:14 PM EST
    RON CRISS   FROM: GORDON BELL
    FRED ENGEL   DEPT: ENG STAFF
    JOHN RING   EXT: 223-2236
    JACK SMITH   LOC/MAIL STOP: ML12-
1/A51

MESSAGE ID:
5191132290

SUBJECT: WHEN DO WE MEET ON THIS?

I got the Celi/Lomicka report.

Please get us (and your users) together to settle on the goals.

My priority is: quality (i.e. works), time to market, performance, range (print-no buffering to graphics server)... cost. Please select type 3 using an F (J's an upgrade) for the base work, with the option to go to type 2 if a limited product is possible -- but wait till it runs to decide. We'll use the MicroVAX board when it arrives. I don't see why we have to use Seahorse I since the processor isn't doing anything except routing. I assume the main controller is a 68K.

We need a product . . . yesterday !.

ATTACHED: MEMO;28


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TO: GORDON BELL   DATE: FRI 11 FEB 1983
2:51 PM EST
    BILL JOHNSON   FROM: RON CRISS
    BERNIE LACROUTE   DEPT: 10/20 SWE
                                         EXT: 231-5243
                                         LOC/MAIL STOP: MR1-2/L8

                                         MESSAGE ID: 5190625107

SUBJECT: THE PRINT SERVER PROGRAM

I think the print server program needs alot of overall direction. As a part of my new job I intend to assume the role of program manager. I would like to know that I have your support before I stick my neck out too far. If I don't hear from you by the 15th of February, I'll assume you have no problems with this.

Thanks, Ron

11-FEB-83 21:17:40 S 04767 MLCG
MLCG MESSAGE ID: 5190662774

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M e m o
!___!___!___!___!___!___!___!
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TO: JIM CUDMORE DATE: THU 5 MAY 1983
9:52 AM DST
BILL JOHNSON FROM: GORDON BELL
cc: EMC: DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5198964599

SUBJECT: REDUNDANT PRINT SERVER EFFORTS FROM NOD

GB5.20

The only 4-8 laser print controllers / print servers I know of are:

1. Craig James, John Celi, Roy Lomicka, Mickey Smith -- Printer group

2. Baum, Conroy, Feinberg, Friday, Fultyn, Laurune, Lint, Samberg --
Consortia of people who have a working prototype .

3. Brian Reid, Forest Baskett - Western Research Lab A/D project

4. Ron Criss's Server Group under Bernie (wait>2 years!)

5. Barry Folsom -- Omninet Shared Printer (get it soon)

6. CT clusters -- has/had a print server project?

7. MicroVAX / Seahorse I -- Server

8. Office ? Old typesetting group on LN01

9. A VAX based print/plot server that Marlboro uses for its

computation network.

I really don't expect to ever see a modern DEC print server that can print graphics, multifont as a product given our perfect record of producing nothing in this area, (including the LN01) there are undoubtedly more internal efforts at each site to serve comp centers and CAD groups.

Is there anyway to get a product? Or more engineering budget to support these redundant, folks?

```
+---------------------------+                              GB5.65
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+---------------------------+
```

SUBJ: PRINT STATION WE MUST REDIRECT IT

TO: JIM CUDMORE
SAM FULLER
BILL JOHNSON
JACK SMITH

Date: 6/13/83 Mon
From: Gordon Bell
Dept: Eng. Staff
MS: ML12-1/A51 Ext: 223-2236
EMS: @CORE

The attached memo fairly accurately reflects our meeting.

At the meeting, I felt we should continue on our present course to build the current print server interface, while having a simpler controller built in parallel for software development.

Today, I feel we should DROP the design because the product and project are so far beyond our capabilities. We would go on some kind of buyout or to a much simpler plan. One of our software groups has an operational breadboard of a printer, and this might be the basis of a product, too.

A MUCH SIMPLER PRODUCT AND PLAN

We might change the project, reflecting a much simpler product structure on which the group has a chance, to implement. There is no way that the current group, with this set of specifications, abilities and processes could ever come close to building an operational design in anything under 3 years, not ONE. In general, the approach is similar to the recent redirection to get a Personal VAX based on the Qbus, and that approach we should have used for the PRO, Pluto and VS100... all of which are roughly 2-3 years late, and uncompetitive using better tools and a more experienced staff.

In making the change, we should in parallel train people in hierarchical design for complex systems, and provide them with the managment and process tools to be successful. I see a problem not unlike Jupiter. (I suspect this may be the reason why the LA200 has taken many years and will never ship.)

The approach:

. Clarify the distributed organization, and make sure there is adequate management to undertake this complex projectt.

. The print server should be renamed to be an Ethernet-based Print Station to more properly reflect its function and structure. The product functions have to be drastically cut.

. The server will NOT queue print jobs, but operates as a printer attached to Ethernet. It doesn't have a disk or console. Seasoftware permits very nice debugging from remote VAXen. Fonts, and station programs are nicely stored on a remote VAX.

. The station will be based on Seahorse I (followed automatically by II). Seahorse I operates in prototype mode TODAY with a VAX, Seasoftware, an NI, and a Unibus to Qbus adapter.

. The hardware for this first product should be greatly simplified so that we can get a completely debugged system up asap. This would correspond to the current products on the market. Fundamentally, the design approach is several stages:

1. get the product built as quickly as possible in software, while using rigorous design methods with

specs. We will ship this unless it's too slow. If it is too slow, then microcode Seahorse to have the bitblt function. This will get the text-only print mode to be clearly acceptable.
2. when we understand the functions well enough and the amount of processing they require, selectively move the functions into hardware.
3. replace Seahorse I with Seahorse II (for cost reasons). A bounded version with MicroVAX, NI, etc. may be considered when we understand the current design space AFTER building a product.
4. VLSIzation of a function such as line drawing or bitblt might be considered when we understand performance.

. acquire and use the Adobe system for graphics description and font generation. It may be run partially in the station.

TODAY, USING THE LN01

C-T.printer-

PROPOSED STRUCTURE

```
C...C
!___!__ (Ethernet)
 !
 T.print_station
```

Where T.print_station :=

```
------- (Ethernet)
!
K.qna Pc Mp K.laser-T.print_engine-    (Pc :=
Pc.Seahorse!Pc.Microvax)
!_____!__!__!___(Qbus)
```

and K.laser is a double buffer memory which alternates between printing and being loaded by the processor. Pc accesses the Mp.

The current design has two gp processors and their associated busses, neither of which do very much except talk to each other and prepare work for a third, microprogrammed processor, which also controls a complex chip for line drawing. This design is based on one MicroVAX, and no special hardware in the first, potentially slow implementation. There are several ways to speed the design up:

- doing more operations in the hosts in preparing documents
- microcoded pixel operations
- some form of the current microprogrammed machine, or one special hardware operator to do a time consuming operation

WHY I THINK THE PROJECT HAS TO BE REDIRECTED

The reasons for this are not whimsical, but based on several previous projects, including Venus, Jupiter, VS100, Pluto, HSC and PRO.

- There's no definition or spec on what the system is supposed to do. Likewise, functional specs are non-existent for each hardware and software sub-component.

  The sketchy hardware specs are non-hierarchical, incomplete (memory sizes or locations aren't given, busses and links to busses are missing, etc.), conflicting, informal, etc. There isn't a manual for the various microcode machines or the hardware. I've seen nothing on software!

- There's no analytic data backing up any of the design, nor is there any data showing how each of the subsystems must perform.

- The design I see is incomplete (as reflected by the lack of specs), even though there's hardware coming. Flaky, incomplete hardware is a giant millstone! As such, it is precisely in the state of Jupiter when it was cancelled, even though much hardware was built and some of it running for 2 years.

. The design is far too complex to ever operate with this level of rigor in the organization, specifications and tools to carry out the design.

. The printer group is evolving to take on this major software effort, while lacking software engineering personnel and practices.

. We should have done PRO this way. Put on the Qbus, get the software operating, ship, and then cost reduce if necessary with a new bus, accelerators, etc.

. The VS100 and Pluto have similar structures: seperate 68000's, accelerator hardware with microcode and specialized software. ALL have taken more than 3 years, NONE perform acceptably, nor do we know why. On VS100, two of the processors are now acknowledged to be redundant.

I'm not advocating a large organization. This one is already larger than DECwest, and the project is of similar size. The quality of the project is over an order of magnitude poorer in every respect. As such, it is unlikely to ever reach completion.

Jim,
I think you have to lead us through this one. We badly need this printer. If it's available outside, and the project can be entirely software, then that's the easiest way out. Alternatively, we can go the painful route of training the people rather than giving up on them and never being competitive or able to build complex systems. Frankly, I think there are enough bright engineers among the intellectually bankrupt management structure that it's worth what will be a very difficult project and process. Success is probably some combination of the two.

Since the distribution of function and the need to print what our workstations produce is such a key part of the product structure, I have no choice but to help. What do you want from me?

ATTACHMENT
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C-T.printer-

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 !
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Pc.Seahorse!Pc.Microvax)
!_____!__!__!___(Qbus)
```

and K.laser is a double buffer memory which alternates between printing and being loaded by the processor. Pc accesses the Mp.

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- doing more operations in the hosts in preparing documents
- microcoded pixel operations
- some form of the current microprogrammed machine, or one special hardware operator to do a time consuming operation

WHY I THINK THE PROJECT HAS TO BE REDIRECTED

The reasons for this are not whimsical, but based on several previous projects, including Venus, Jupiter, VS100, Pluto, HSC and PRO.

- There's no definition or spec on what the system is supposed to do. Likewise, functional specs are non-existent for each hardware and software sub-component.

  The sketchy hardware specs are non-hierarchical, incomplete (memory sizes or locations aren't given, busses and links to busses are missing, etc.), conflicting, informal, etc. There isn't a manual for the various microcode machines or the hardware. I've seen nothing on software!

.There's no analytic data backing up any of the design, nor is there any data showing how each of the subsystems must perform.

. The design I see is incomplete (as reflected by the lack of specs), even though there's hardware coming. Flaky, incomplete hardware is a giant millstone! As such, it is precisely in the state of Jupiter when it was cancelled, even though much hardware was built and some of it running for 2 years.

. The design is far too complex to ever operate with this level of rigor in the organization, specifications and tools to carry out the design.

. The printer group is evolving to take on this major software effort, while lacking software engineering personnel and practices.

. We should have done PRO this way. Put on the Qbus, get the software operating, ship, and then cost reduce if necessary with a new bus, accelerators, etc.

. The VS100 and Pluto have similar structures: seperate 68000's, accelerator hardware with microcode and specialized software. ALL have taken more than 3 years, NONE perform acceptably, nor do we know why. On VS100, two of the processors are now acknowledged to be redundant.

I'm not advocating a large organization. This one is already larger than DECwest, and the project is of similar size. The quality of the project is over an order of magnitude poorer in every respect. As such, it is unlikely to ever reach completion.

Jim,
I think you have to lead us through this one. We badly need this printer. If it's available outside, and the project can be entirely software, then that's the easiest way out. Alternatively, we can go the painful route of training the people rather than giving up on them and never being competitive or able to build complex systems. Frankly, I think there are enough bright engineers among the intellectually bankrupt management structure that it's worth what will be a very difficult project and process. Success is probably some combination of the two.

Since the distribution of function and the need to print what our workstations produce is such a key part of the product structure, I have no choice but to help. What do you want from me?

00 CORE DECGRAM ACCEPTED S 003759 O 639 12-JUL-82 22:07:48

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION DATE: MON 12 JUL 1982 10:06 PM EDT

FROM: GORDON BELL

cc: OPERATIONS COMMITTEE: DEPT: ENG STAFF

EXT: 223-2236

LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5169285011

SUBJECT: SOMEHOW FINDING $'S TO BREADBOARD THE LQP/SHEET FEEDER

I really liked what I saw. Somehow we have to move post haste
to get a breadboard to see if there are any flaws in it and

how hard it will be as a project. The intriguing thing is that
we could take the WHOLE Spinwriter lqp market away from Diabolo,
NEC, Qume and C Itoh. This ought to be a major incentive to go balls out and get it. Also the add on ribbon/belt market would be enormous.

Let's get to working breadboards immediately. What will we NOT
do in order to get this one?

"TO" DISTRIBUTION:

BILL AVERY   JOHN RING   JACK SMITH

WPS USERS - Leave HP mode and type <CR>

GB0004/39

d i g i t a l **i n t e r o f f i c e m e m o r a n d u m**

SUBJ: The Centronics Quietwriter--Is it for us?

Date: 8/21/79
From: Gordon Bell
MS: ML12-1/A51 Ext: 223-2236

TO: Jim Bell, Dick Clayton, Henry Crouse, Bob Glorioso, Gene Jones, Walt Tetschner, Art Williams, Bill Zimmer, OOD

Although I'm enthusiastic that the Quietwriter could be a major alternative to the Selectric or daisy wheel impact printers, it is important that we do a thorough evaluation. Right now it looks good, but then at this stage of engineering, many things always look good. It seems like the alternatives can be ranked:

	Selectric Dot Matrix	Daisy Wheel		Quietwriter
quality	1	2	1?,2?	3...but rapidly improving
noise	4	3	1	2
font variability	4	3	2	1
graphics ability	3	3	2?	1
reliability	3	4	1?	2
best cost	?	?	?	?

So the issues are: the cost differences may not be significant, the Quietwriter's quality is unknown, but unless it gets to Selectric level, it is probably not worth pursuing, and it feels like Dot Matrix will come up rapidly because everyone is working on it in one form or another. I resent the fact that we have to really evaluate the Quietwriter because life would have been soo simple proceeding along the matrix path.

I hope this adds some balance to my position. Let's go flat out to evaluate the Quietwriter, cause it could be significant for the short (5 years?) time frame. We do need the quality most likely for mail and for personal communications. In the long run I believe dot matrix will win.

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION DATE: TUE 6 JAN 1981 2:55 PM EST

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION DEPT: OOD

EXT: 223-2236

LOC/MAIL STOP: ML12-1/A51

SUBJECT: SHEET FEED VS. ROLL OR FOLDED FORM FEED: AN OPPORTUNITY!

If we could go to ALL sheet feed it seems it would offer incredible opportunity for us.

Having only sheets, permits:

0. Handling all kinds of paper including envelopes, thereby allowing us to get rid of the lingering typewriters in the office.

1. Any paper can be used.

2. It's right. It avoids the cruddy roll paper where it's impossible to get to be 11" long. It avoids the messy bursting and stripping required in the folded/form feed.

3. It's unique and represents a competition knock-off.

4. By using cartridges, paper types can be switched early.

5. Eliminates the "box" or "roll" and is easy to place anywhere.

6. A different style/shape of printer can be made!

What do you think?

GB:swh
GB2.S1.7

"TO" DISTRIBUTION:

SI LYLE BILL PICOTT ART WILLIAMS

"CC" DISTRIBUTION:

BUZZ BROOKS ART CAMPBELL BOB GRAY
KEN OLSEN STAN OLSEN

ps which are small in transistor count, but these need to be available for widescale use. A program to make this transition within 2-3 years, providing 10 - 20 million instructions per second would have far greater impact on supercomputers than any other factor as described above for use in PC's and multiprocessor structures.

It should be noted that these multiprocessor computers do not provide a lasting uniqueness, but rather, lower the barrier of building supercomputers. Furthermore, any country can make a substantially better micro than those on the market (and in development) today, and with known interconnection techniques achieve substantial parallelism. This represents another technological blindsiding giving a 2 - 3 year lead.

7. <u>Packaging.</u> This crucial area needs to be examined seperately and an action plan formulated.

GB15.7
October 5, 1981

Mr. K. Teer
Mr. H. Bosma
N.V. Philips
Natuurkundig Laboratorium
5621 CT Eindhoven
The Netherlands

Dear Mr. K. Teer and Mr. H. Bosma:

Let me take this opportunity to thank you and your colleagues for the hospitality extended to me last week in Eindhoven.

I enjoyed being able to present a view of computing to you and your colleagues last Monday. The Computer System and VLSI research was very impressive and the work seems to parallel our own.

Again, thanks for the hospitality.

Sincerely,

Gordon Bell
Vice President
Engineering

GB3.S1.8

CC: Dick Van der Wel

May 2, 1978

Montgomery Phister, Jr.
Systems Consulting
307 12th Street
Santa Monica, California 90402

Dear Monty:

I'm sorry I didn't thank you for critiquing the essays. I've been working on the Computer Engineering book, hence I haven't done anything else except try to keep DEC's engineering running. A draft copy of the book is being sent to you. Also, I'm sending the Direct Sales Catalog and the Hardware Accessories Catalog.

In the future, let me suggest you go directly to the local office (where I'll introduce you) and pick out the catalogs you need.

Sorry I can't help more at this time, but I hope things get better when we get the book out.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:ljp

CC: Bob Long

+---------------+
! d i g i t a l ! i n t e r o f f i c e m e m o r a n d u m
+---------------+

Subject: **About a Score of Impressions and Recommendations from Visiting Three Sales Offices**

To: Marketing Committee

CC: Dick Clayton, Bruce Delagi,
Bruno Durr, John Leng,
Julius Marcus, Gerry Moore,
Larry Portner, Jack Shields

Date: 10 MAY 78
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

Introduction

I think we have a massive sales effectiveness problem. It starts with a complete inability to know anything about what we are going to sell, transcends into a labyrinth of finger pointing about products and sales support and goes finally into general office procedures. The most condemning aspect of the situation is that there is no visibility that we have a problem...in this case a hierarchy of problems, and then a setting out to solve the problems.

The purpose of this memo is not to define the problem (this can be done by McKenzie and Company) but to give symptoms based on my impression from recently visiting sales offices and talking to customers and salesmen -- and to urge us to get McKenzie in now! The impressions should not be taken to be universal about offices or salespeople. The salespersons are open about these problems and anxious to get the problems resolved; they are anxious to discuss them with other officers too -- the only hopeful sign.

Summary (* Action possible)

1* We have inward focus. No output is caused by intra-sales and sales-P/L talking.

2* DEC salespeople have no identity. We got them everywhere else, and with our unstructuredness they're ineffective. Also, we have no way to build DEC salespeople.

3. There is a dichotomy of product-oriented and customer-oriented sales. Can this be managed centrally?

4. There's little method of account control (selling, service, software versus time).

5. The three organizations are both ineffecient and cause less team behavior.

6* One office at least, looked amateurish and are there adequate office procedures, etc.?

7. The order processing system is pretty questionable, but then there was no plan with performance and costs.

8* The pink sheets are a joke and as officers, we may be liable for incompetence. Let's change sales measures to ships -- not books.

9* A complete sales plan for the product (e.g., VAX) is either nonexistent or incompetent. Sales should object. This has to be done at a group marketing level.

10* WP could be a calling card. All salesmen would like to use it -- since it's something everyone understands, can appreciate, and sell.

11* There is a complaint sales doesn't have time to plan or to report correct bookings. I don't think they know how anyway. These might go through a different organization (e.g., F/S or the Controller).

12. Sales has to be approached as a training and logistics problem, not the management of artists!

13. There are too many products for anyone to know, yet too few because every P/L Sales group needs more.

14* Left alone salespeople try to sell the largest systems. There is no focus, discipline, or goals (quotes) by size.

15* The DEC 100 doesn't recognize the team work necessary for account management or encourage a second salesperson. Segmentation is encouraged.

16* The P/L literature is a collection of garbage! I defy a customer to understand our products from what we distribute as literature. I propose every product line put together a single catalog that explains its products to a prospective marketplace/use. I'll help put the first one for ESG together.

17* There's lots of informative transmission within P/L -- sales by paper, word of mouth, and meetings and essentially no reception. Low quality information (by documents like Sales Update) requires continuous rebroadcasting, etc. We require every salesperson to be a file clerk.

18. We're totally naive that we can have lower costs and compete with the equally large mainframes (e.g., IBM) that force much service. Our manufacturing base isn't that big -- especially as we continue to cut orders back!

19. The VAX-2020 hassle is a field conjured situation by competition in the sales force. There is a relatively well segmented market.

20. The lack of sales is transient as we try to move from OEM to End User -- is a perception.

Details

1. We're fundamentally inwardly focused. I believe, based on sampling of calls to salespeople, that the sales organization spends too much of its time communicating with itself and with product lines. There is essentially no time or people left for customers. It recently took 2 salesmen to call on me to tell me what they wanted me to say at a presentation to a customer seminar. (This could be a phone conversation, TWX or memo -- those 2 salesmen were not making their quotas this year!) In many cases there is emphasis on trips to Maynard or elsewhere and meetings to discuss the situation versus written statements and action-oriented conference calls.

2. There is no identity now as a DEC salesman. I personally identify with the older, technical salesperson who speaks bits, instructions/sec, operating systems capabilities and detailed applications...so I am significantly less critical of the technical salespeople. We now have a mix! We have the truly professional salesman, who, as all the salesbooks say must have first and foremost the ability to sell themselves. We hear all the time how professional (recall Kaufman's comments on the professional) they are, but they are simply not results-oriented. They all came from another company because we do not believe in training programs or growing them from the ground up. Since we are at a reasonable size, it is getting somewhat more difficult to get them and since Burroughs is the only company relatively screwed up and not growing, it's the only source of trained people. The sales associate program is a joke in the field...as one salesman said we are spending our time creating Rolls Royces and we need a factory to produce Chevrolets. Our fear to hire college graduates, for example, is typical of the problem. (Note, if Manufacturing had not put schools in PR to train

electronic people, we would not have been able to get the rapid growth...we couldn't steal these people from all the other companies.)

Since the newer less product oriented, less DEC oriented salespeople are better personal salespeople they may occupy the senior sales management staffs and cause a downward bootstrapping of product knowledge without the attendant improvements in sales performance.

3. There is a distinct dichotomy between the commercial and more scientific salespeople and I don't doubt if there is effective management because of this.

The problem of having no identity as DEC salespeople is that older more established companies totally run by procedures and when we have such a lax procedural base, a lot is left to the individual initiative; structured people will blame the company for every thing (e.g., yield setting, literature, sales training, product segmentation, no time to plan, no team selling, OEM versus end user, selling by size, etc. etc.)

4. There is not a very good concept of an account that lasts over time. With a high growth and lots of people movement even before they are ever tested or qualified, this tends to get in the way of a stable relationship with a customer or with a team of people in an account. There is a muddy pecking order within sales, software support and field service; the notion of a team really doesn't pervade the group in most cases.

5. The three organizations require independent top-down structure which seems redundant and probably enforce segmentation.

6. My impression of the NY office was that it looked amateurish and a place I wouldn't want to take a customer. Their computer room had cables laying about and skins off the equipment which was in a state of repair and upgrade (do the repair off hours). Only 50% of the proposals were done on word processing systems and it is unclear for such a large office why there were only two WP terminals (in a very large disorganized looking room). One of the midwestern offices had only 10% utilization and knowledge of WP. In talking with the head of the office I couldn't get sales bookings and sales costs figures for the last two and projected years.

Although there was a literature room, and area of the office held an assorted overflow. Surely there was no one responsible for literature.

The very pleasant work area was where the top level management had their offices, walled off from the troops.

7. The salespeople wonder about the effectiveness of the order processing system. It seems like we have decentralized one small part of the

operation, while leaving the rest in tact, and now we have a more cumbersome operation with only additive costs and delays. There is no measurement of this performance or its costs, nor did it have a plan!

8. The system of measuring and reporting backlogs, especially in the OEM marketplace is at best incompetent and it may even be illegal. As an officer I would like to know the extent of our collective liability in this area (Al Bertocchi, I believe you should formally access this). There is no way that the backlog and order rate we have had has any basis on reality. Supposedly the sales offices fingers, memos and meetings point back to the product lines to make them aware of the situation. There is nothing written on the subject. The pink sheets, which we watch religiously are clearly only random data and I submit that taking some appropriate temperatures in .01 degree increments of every salesman at 2:30 every Friday would yield better data about our backlog. For starters, the backlogs are cumulative numbers and can not be represented or even approximated with the single number we

use. Secondly there is no way that the companies who order from us can go through the growths that are attendant with the backlogs we project.

I would like to propose we throw out the pink sheets and go to the measurement of ships in the OEM area as an aside, each sales office has a Field Service planner who must plan spares and the training of field service people...they know what the order rate really is and don't go through the euphoric ritual that we do to get the high backlogs. We continue to joke about the oscillations superimposed on our exponential growth, but in this case it may just be the last time we oscillate.

9. There is little or no training and/or focus on new product programs (e.g., VAX) together with a sales strategy as to how to go about selling it. Each of the product lines are doing different things and there is not strategy or deep understanding across the groups. The selling is essentially contained within Win's product lines, and there should be sales, promotion, customer identification, sales support program at this level. In this way, the training can take place across ESP, EPG, LDP, OEM for real time users, IPG plus the few in GIS. A central support group would get the training fast, get the advertising co-ordinated, provide a backup sales group, give field seminars which at this time have to be on a product basis (note Brookhaven has not had a presentation yet on VAX). The manager of the NY office, a commercial type, hasn't the foggiest notion of what the machine is or how to prospect for it. The salespeople don't either! (They only know that it is a hot machine.) We must get organized on VAX!

10. With the big inventory of VT78s and the universal interest in Word Processing, I believe we get these systems into the offices for quick delivery. These also provide a good calling card for all customers. Salespeople agree but don't know how. Also, there is the usual reluctance to sell anything they don't get credit for.

11. Sales managers believe they are flat out working on today's problems and don't have any time for planning or for account management because they are driven to get orders (which they are clearly not getting). I don't think it is in the nature of salespeople to plan, and I would propose that this aspect of understanding go through field service or financial organizations on a separated reporting basis. I believe the controllers organization should be solely responsible for the assessment of order rate and the recording of shipped nor, etc.

12. In a quick perusal of our sales training, I don't see how the training is set up to take people who have fundamentally been salesmen working on short term goals and turn them into people capable of managing offices. The logistics, planning and field service management has better training for managing sales offices where the goal is to get, and equip trained salespeople, plus interface with the suppliers (i.e., P/Ls) to insure there is a message. In this regard the concept of sales being anything more

than a congeries of artists seems foreign to sales management. The problem is that the company is locked into the output of water and oil color painters, house painters (with a few barn painters thrown in) together with a collection of musicians and finger painters all trying to get us some sort of artistic extravaganza.

It seems like we need effective co-ordinated, plans on how we are going to get the orders in the various products/marketplaces. I have never seen a single sales plan, for example, giving: the number of salesmen, the areas, how they are to be trained, how the training fits in with promotions and how prospects are gotten, what the gestation period of a sale should look like, what the competitive posture is, how the P/L supports the field, etc. etc. Such a plan would be the basis for effective product line support and the management of sales. From the plan, we can assess deviations and measure results. Alas -- nothing but the artists.

13. Although we have too many products for the multi-priced, multiapplications markets based on our ability to mobilize salespeople effectively, we are still in a runaway situation requiring more products because there are still lost sales in every possible area because we go after orders anywhere we can instead of having a targeted, organized measured and controlled approach.

Business products is the best example of this now, where when it was successful, had only a limited set of products and a targeted approach to selling.

14. Business products used to be segmented by size and hence had a clear product focus, and with reorganization into end user and OEM, lost this and lost control so that all groups went for the biggest ticket items, and ignored the small products we were initially successful with and where we had a clear niche. Now we compete with every competitor and our OEMs compete with us in the small, medium and high end marketplaces.

15. The DEC 100 somehow destroys any notion of team work that is necessary for account management and selling the right product.

I would propose there is no credit for bookings, but only ships and that reference account selling where a second salesperson is brought in be accounted credit toward quotas in some sort of shared fashion that could even be negotiated by the two salespeople. I believe we would rather lose an order to a competitor than to give the business to a fellow DED salesperson.

16. The plethora of product line products and collection of what we kindly call promotional literature and can be more accurately called garbage is disheartening to customers and to salespeople too. I believe that each product line must build a product catalog of what they're selling including hardware, software, services for their particular marketplace. This, relatively large catalog, would be aimed at the customer (and we wouldn't have to produce some of the horrendous marketing guides that I doubt our sales

people read (nor are many of them capable of reading). The catalog would establish who the customers are and what the products are for the particular customer base. Let the customers decide our sales costs are out of sight because no one knows about a product. (I will personally volunteer to help with the catalog for ESG in order to get this focus. Here, we want something like the Tektronix or HP catalog!)

17. The P/L - Sales; and Sales-Customer interface is an inefficient, mouth-mouth resuscitation process. (Note, no ears are involved.) The transmission process needs to be clarified, and our messages simplified <u>and cut</u> down with less irretrievable (i.e., unless we want every salesperson to be a file clerk) garbage in Sales Update and flash TWXs!

18. Our marketing vis a vis large competitors (IBM) is naive. A salesperson will, within seconds state we sell because we have lower prices and better products, yet we aren't selling because we need much more sales support and service that cause higher prices. I can't identify any uniqueness now in the commercial market (a few years ago we had OEMs and low prices). The EDP Manager/IBM salesman controls what the Fortune 1000 computes on! There is perhaps a strategy to get a foothold, but we have to only sell completely unique products (i.e., VAX to scientific, TRAX, 2020, DECnet, WP, RT Factory Data, or unique small systems). Forget all else!

19. See summary.

20. There are probably more but this is all I could recall from a few days in the field and a feeble memory.

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Win Hindle	ML5-2/A53	Ted Johnson	PK3-2/A55
Andy Knowles	MR2-2/A52	Stan Olsen	MK
Bill Thompson	ML12-1/F41		
Dick Clayton	ML12-2/E71	Bruce Delagi	ML12-1/F41
Bruno Durr	PK3-2/S56	John Leng	MR1-1/A65
Julius Marcus	MK2/C37	Gerry Moore	PK3-2/A66
Larry Portner	ML12-3/A62	Jack Shields	PK3-2/A58

+---------------+
! d i g i t a l ! i n t e r o f f i c e m e m o r a n d u m
+---------------+

Subject: **Sales Support**

To: Jim Bell

CC: OOD, Ted Johnson,
Tom Schendorf

Date: 15 MAY 78
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

follow up 5/29/78

Ted has complemented you as a clear product/technology presentor. He asks for more of your time for field presentation. Let's decide how much.

Ted would also like to get a list of presentors that could make these presentations. Could you collect such a list from the rest of OOD and within R&D together with their presentation titles?

As an immediate problem, could you figure out how we can pull together a "canned" presentation that attends to the following (attached) problem?

GB:ljp

Attachment

D I G I T A L   INTEROFFICE MEMORANDUM

DIST:

Jim Bell	ML3-2/E41	Dick Clayton	ML12-2/E71
Jim Cudmore	ML1-4/E30	Bill Demmer	TW/D19
Ulf Fagerquist	MR1-2/E78	John Kevill	ML1-3/E58
Julius Marcus	MK2/C37	John Meyer	ML12-1/A11
Larry Portner	ML12-3/A62	Bob Puffer	ML12-2/E38
Ted Johnson	PK3-2/A55	Tom Schendorf	BY

00 BURT DECGRAM ACCEPTED S 29472 O 567 11-NOV-81 17:50:58

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* d i g i t a l *
****

TO: see "TO" DISTRIBUTION   DATE: WED 11 NOV 1981 2:24 PM EST

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION   DEPT: ENG STAFF

EXT: 223-2236

LOC/MAIL STOP: ML12-1/A51

SUBJECT: SANDIA AND LASL: VAX, LAN, OFFICE AND VT18X

Some comments regarding a recent visit:

Environments (VAX... and 2080 support).

They each have about 25 780's and really love VMS. The only complaint was a need for a larger exponent. LASL has four Crays and a

large
network of supercomputers. VAX is used for: switching, processing
for print service, CAD, Central computing and distributed computing to
a small collection of users. They compute, do pre- and post-
processing and check out for the super computers. A 780 supports
about 18 users. Sandi's going out for a replacement for a 6600 which
supports about 60 users. THEY NEED A MORE POWERFUL VAX!!!

We must provide a really clean way to make the 2080 an upgrade from a
VAX. Given their FORTRAN orientation, this should be relatively easy.

Their supercomputers have dial in and fixed terminals, file server
(>1000 gigabytes in a disk form, 3850 and automatic tape library),
LANS a print/COM server, concentrators, authentication/securing
servers. They're both building LAN's over their large areas. LASL is
using and going to wideband for remote connection. Sandia has a
Hyperbus in their center with gateway machines for 9 VAX's and fiber
optic links to the remote VAX's.

Their fiber optic back bone is built with Western Electric, 144
strand cables, $20/ft. A receiver or transmitter costs $100., and
operates at 32 Mb/s, but could run at 90 Mbs.

Neither intend to use Ethernet as their primary LAN, but each would
use EN within a building. (The geographical areas and security issues
preclude this use... although the main part of Sandia is only

1.5 km.)
They are worried about security on EN.

Sandia envisions both a single EN across buildings, interconnected via
fiber optic repeaters AND separate EN's for various buildings that go
through gateways to other ENs.

Thus, there are three options needed for their EN:

a. Repeaters using fiber optics as an intermediate link.
b. Gateways using fiber optics among EN's.
c. Gateways using CATV among EN's.

It would be nice to map EN into several channels of wideband.

I think we want to sponsor and encourage the development of these
gateways and repeaters to be done by the 3rd party LAN Industry!
Liddle is going to discuss with us at the DEC-Intel-Xerox PR seminar.
The technical user communicates and publishes.

There was a problem of not being able to sell word processors directly, but requiring a commercial salesperson. I don't understand
why?

We just have to start to attend to our technical users! Their
requirements for office processing:

1. Run with dumb terminal VAX or

2. Run standalone to off load the VAX on a WPS

3. Scientific character set.

4. Mail

5. Typesetting, (with typesetter support). They want us to offer the typesetter. They use TEX. Should we support it too?

6. One terminal for: dumb terminal, including graphics, and upgradeable as standalone.

Where are we on being able to do this on the 278? On the CT?

GETTNG MORE PERFORMANCE FROM VAX

1. They need Venus.

2. We must have a really clean connection between the 780 and the 2080. Given the VAX installed base, a cluster upgrade using the 2080 looks like a much better market than just upgrading the current 10/20 base.

3. Atlas is expected and being discussed.

4. Is there any way to get a 4 processor Atlas? Los Alamos is building a 9 processor 8086 to study single task, multi processing. Good Luck.

5. Better communications hardware would get some cpu cycles? What is the effect of combo? What else is needed?

6. Personal computers for word processing and intelligent terminal functions for editing would also get may machine cycles. Here an electronic 278 provides the best performance.

7. Can HSC and clusters help? Can the clusters be used

to get
more users on a single system because of separation between
control files and processing?

VT18X

Basically confusion. Can they buy it? Can they get a demo? How does it work with VAX? How do they get their hands on all the third party SW? How much will we offer?

GENERAL

Interface to Product Lines is tough LDP, GSG, TPG, ESG, (and commercial for WPS).

"TO" DISTRIBUTION:

BILL AVERY	JOE CARCHIDI	BILL DEMMER
DICK HUSTVEDT	ROSE ANN GIORDANO	BERNIE LACROUTE
BILL MCBRIDE	BRUCE STEWART	

"CC" DISTRIBUTION:

DAVE CUTLER	ULF FAGERQUIST	BARRY JAMES FOLSOM
SAM FULLER	JACK GILMORE	BILL HEFFNER
TED JOHNSON	ANDY KNOWLES	BOB KUSIK
JOHN O'KEEFE	DAVE RODGERS	JOEL SCHWARTZ
HARVEY WEISS		

GB3.S2.37

November 2, 1978

Mr. Raymond C. Sangster,
Senior Scientist, Workshop Organizer
U.S. Department of Commerce
National Bureau of Standards
Boulder, Colorado 80302

Dear Mr. Sangster:

Thanks for your pro forma letter of October 27, arriving October 31, inviting me to a workshop on November 8 and 9, 1978.

Of course, I can't come so why bother sending it. As usual this is another ineffective transaction by the Department of Commerce. The conference looks useless too.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:ljp
ID#326

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TO: SKIP GARVIN

DATE: THU 17 FEB 1983
FROM: GORDON BELL

cc: see "CC" DISTRIBUTION

DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5191233865

SUBJECT: RE: SCHLUMBERGER

I'm reluctant to let them have this.

They complained to me that they weren't tuned in enough. This will take engineering resources, and I'm reluctant to promise these unless we have a very firm understanding in writing. I'd let them have protocols but only on a very restrictive basis (eg. they cannot use them on non-DEC equipment).

Overall, I think they're crazy to be pushing so far beyond our releases. This will be both expensive and painful for both parties.

Why can't you produce a plan that is constrained so they operate as a test site?

If we want them to be a research group, then that's another story.
BJ + Heff, what you say? Your decision.

"CC" DISTRIBUTION:

KURT FRIEDRICH	BILL HEFFNER	BILL JOHNSON
TREVOR KEMPSELL	BERNIE LACROUTE	BILL LYNCH
MIKE THURK @TWSK		

WPS USERS - Leave HP mode and type <CR>

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TO: *GORDON BELL   DATE: MON 14 FEB 1983
11:27 AM EST

FROM: SKIP GARVIN

cc: see "CC" DISTRIBUTION

DEPT: INTERNATIONAL ACCTS
EXT: 336-2205
LOC/MAIL STOP: CH/CH

MESSAGE ID: 5190927581

SUBJECT: SCHLUMBERGER

Gordon,

The meeting with Schlumberger, Friday Feb. 4th was very good and I want to thank you for your help.

In summary we could supply them with what they need although we will not be ready to support it as a product for at least 18 months.

They need the cluster support we are developing for CI to be implemented on the N.I. We are not in a position to do this. We could give them the preliminary code developed by Kerby Altmann, but we would also have to give them some protocols that we might not want in the public domain. We could also open up our VMS development people to a level of support that could disrupt our cluster effort on the CI.

On the other hand we could gain some valuable information on how Kerby's cluster software works on Ethernet.

My personal opinion is that Schlumberger will not be successful if we do not give them the code. Schlumberger has told me they desperately need this draft to protect our protocols. They are also willing to take the code without any support. This however is unrealisitic. The best thing we accomplished out of this whole exercise was that we identified a group of people who could answer questions regarding our plans for networks. We need to develop this capability further because there will be more "system engineering questions" asked as our customers become more knowledgeable. Local software CANNOT answer these questions.

My recommendation is to supply the code to Schlumberger if we can protect the protocols and not disrupt current VMS development on CI clusters. I would be willing to take responsibility to coordinate all the necessary meetings and act as a buffer between Schlumberger and our development people.

I think the risk is high but I think it's worth it! Schlumberger will hack out a solution with or without our help. I would rather have them hacking wiuth out software. Also I can't think of a more technically competent client to gable with.

I look forward to your comments.

14-FEB-83 17:49:22 S 03271 CLEM
CLEM MESSAGE ID: 5190989055

"CC" DISTRIBUTION:

KURT FRIEDRICH	BILL HEFFNER	BILL JOHNSON
TREVOR KEMPSELL	BERNIE LACROUTE	BILL LYNCH
MIKE THURK @TWSK		

WPS USERS - Leave HP mode and type <CR>

November 7, 1979

Philip Abelson
Editor, Science
1515 Massachusetts Avenue NW
Washington, D.C. 20005

Dear Mr. Abelson:

When I met Arthur Robinson last year at the Submicron Research Conference and presented a statement of technology management in Japan, he noted an interest in my paper for Science. Since then, I presented the paper at a Conference on Innovation at Dartmouth, and as such it might constitute prior publication and not be appropriate for Science. If you are interested in reading it, because it has some views not yet published, I'd be delighted to send it.

Since that time I have used a similiar approach based on a recent trip to Brazil and deliberation on how the Chinese might start to produce computers. Also, virtually all countries have made erroneous policy decisions about establishing a computer industry because their experience doesn't fit and because their decision making cycle is too long. As a result I have put together a paper on "Establishing National High Technology Industries: The Computer, A Case Study" and am enclosing it for consideration for publication in Science.

At present, the material is in what I consider a "final draft" for review and being sent to several people for their comments. My plan is to pull together some appropriate references at the point that it is in an acceptable form for publication.

Cordially,

Gordon Bell
Vice President, Engineering
Professor, Computer Science and
Electrical Engineering
Carnegie-Mellon University, on
leave

GB:swh
GB0005/57
Attachment

GB3.S10.34

00 CORE DECGRAM ACCEPTED S 004159 O 358 06-DEC-82
17:19:20

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TO: see "TO" DISTRIBUTION   DATE: MON 6 DEC 1982
2:21 PM

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION   DEPT: ENG STAFF

EXT: 223-2236

LOC/MAIL STOP: ML12-
1/A51

MESSAGE ID:
5183917657

SUBJECT: SCORPIO: ORGANIZATION REVIEW AND INSTALLING TND/EQDM

At the recent Scorpio Design Review, several issues came up:
.Who's in charge of the system architecture and various
modules?
.Do you specify and characterize the components and
processes?
.What is the design methodology? Who's in charge of it

.Will you use quality walk-throughs? how much simulation?
.How are you doing the training? since engineers will run programs
.Do you have the machine resources?
.How do you manage across all the sites?

While I don't think you are near VENUS/Jupiter disease because I see much more involved and knowledgeable top managment, I would like to see how the detailed design is organized, managed and what the designers know regarding handling a design of this complexity. Also, we simply can not afford any slips in Scorpio or the BI options... and I would like to accelerate them, as well as get more modules for the same effort. Note that quality design increases productivity.

PROPOSAL: LET'S USE THE QUALITIY DESIGN METHODOLOGY...

While this has not been flushed out very well, I'd like to use Scorpio to define and use it. John Manzo and Sharon Keilor would come in and help in the definition, and then go on to work on training.

The following slides were given at the State of the Corporation last week, and what I think we need to have in order to get the job done.

THE NEW DIGITAL (TND): ENGINEERING

THE EDGE IS THE ENGINEERING ENVIRONMENT

where we use our Fifth Generation products based on a homogeneous VAX environment, to learn, bootstrap and build the Sixth Generation

WHERE ENGINEERS, ENGINEER!
products, tools and processes to build products, and
components for building products in ALL parts of the World

AND USE THE QUALITY DESIGN METHODOLGY
to drive and exploit engineering learning curves so that
as engineers, we do lots of designs in our lifetime!

(The ROI on designs that have a shorter gestation time will be very
high because the designs will be much more competitive...)

A PROJECT EXPERIENCE (in the old Digital)

Specify the scehdule: 9...27 months to FCS
Establish a program office to co-ordinate and trade-off:
Service, Manufacturing, Marketing, Design Processes, Scheduling,etc.
Establish a design group and leave them alone to oranize, argue and
try to write some sketchy specifications about the product
Occasionally review but concentrate on the periphery, not the product
Predicate design on QUICK DESIGN, BUILD, SEE IF IT WORKS METHODOLOGY
where a poor, half-done breadboard is somehow built to learn from,
followed by a redesign (or two) that will be manufactured,
Avoid: understanding, conflict that comes from design trade-offs,
timing analysis, formal (computer checkable) interfaces,
verification, design inspections, simulation, etc.
Manufacture and wait for the ECOs

VENUS EXPERIENCE
(an example, of the Quality Design Methodology)
Copy and install the ideas from complex VLSI design and software:
Organize in a hierarchy of chief designer, project leader and box
projects (each with chief designer and project leader)...

in a team!
Establish clear goals: eg. quality, shipment, performance and cost
Characterize the processes and components (eg. gate arrays, modules)
Be able to understand the "state of the design" automatically
Predicate the design based on the QUALITY DESIGN METHODOLOGY:
  where at each step, there are no errors...
  design it correctly, verify and model it, inspect it, test it via
  simulation, and then build it (and expect it to operate at power on)
Use the physical hierarchy as a "friend" to segment the design and
  establish formal contractual boundries among the team
Use the logical hierarchy as a "friend" to segment the design in time
  and make sure that there is always a "running" (simulated) design!
Repeat on the next design!

TND: ENGINEERING FOR THE FIFTH AND SIXTH GENERATIONS

Highly trained, engineers and managers who understand the competition
  by being with customers, at school and technical seminars,
  competing with the Japanese, IBM, AT&T (et al), and start-ups
Install and use much improved design tools based on our own
  Fifth Generation...the VAX, homogeneous computing environment
  (with direct links to all engineering and manufacturing sites)
Tools for technology scaling to allow re-use of designs at least once,
  and learned from. Also, tools for automatic, low level design which
  will allow creative, higher performance and higher reliable designs
Underlying semiconductor and interconnect technology for designing (by
  compiling) all kinds of computers and computer based systems

The Sixth Generation, based on known and evolving ideas about better
communication with humans, thereby creating more use

"TO" DISTRIBUTION:

BILL DEMMER BILL JOHNSON DEMETRIOS LIGNOS

"CC" DISTRIBUTION:

LARRY BORNSTEIN SHARON KEILLOR JOHN MANZO
JACK SMITH BILL STRECKER

SCORPIO GOALS AND CONSTRAINTS (ROUGH DRAFT...I mean rough)

Scorpio covers the products eminating from the Scorpio chip set. Products such as the Suvax workstation and database processor will be described elsewhere in detail, but they must be included within the Scorpio goals and constraints.

Because of the power and low cost of the processor, memory and emerging specialized processors, we must think radically about designing new systems! (Note, Amdahl's rules about computation in conventional environments imply that we have indeed reached the point of a ZERO cost Pc, when balanced with Mp and peripherals!) Others will be using Semicomputer Company processors and special chips to make a wide range of systems. This has to be our mindset.

Gemini, Scorpio and Nautilus are the first processors of the non-Unibus, BI form factor. The processors and combinations of mass storage and other peripherals permit a wider range of systems to be built than in the past. G&S also are sufficiently small, yet powerful to be the basis of a revolutionary way in which we must build this next generation. At the same time we can use G&S to build drastically lower cost per terminal shared systems, there is an identical need to provide ALL the power of a Scorpio (750 power) to a single user in order to make that user more effective by voice, image and other complex processing required of Fifth Generation Applications.

THE ZEROTH GOAL is to use a very small set of Scorpio (Gemini now) modules to build the widest possible range of current and future oriented computing environments, including:

- ONE module set for oems and building our systems!!
- Group Servers -conventional shared systems as cost-effective follow-on to current 730-780 systems and delivered in the Unpack & Stack form factor allowing customer installation in an office, laboratory, computer room or rack environment
- Group Servers built into Mass storage with NO customer integration except to PLUG (on the NI) and GO
- Clustered systems using the CI and Cluster technology to provide increased availability and power by replication
- Multiprocessor-based Group Servers as an alternative to somewhat larger uniprocessors
- a homogenous, clustered environment, with process location transparency, interconnected via NI, and containing:
    - Group Servers operating conventionally (as above)
    - Personal Workstations of CT150 class (Person Servers)
    - File and Database Servers, storing voice and pictures
    - Printing/Plotter/Picture Servers
    - Communication Servers to terminals and gateways to other computing environments
    - Real Time Servers to various external processes (eg. power plants, industrial processes)

PRODUCT UNIQUENESS GOALS
Understanding and maintaining, useful uniqueness is a goal. VAX has attained this by: the basic architecture, evolution from the 11, the high quality VMS environment including

coupling of multiple programs in various languages, datamanagement, and the applications that it has attracted.

Some possible uniqueness goals:

- . smallest number of components for maximum range of use
- . ability to incrementally upgrade without throwing out
- . ability to design and trade-off for high availability (We must take our CI based work and cost reduce it!)
- . ability to design and operate in a distributed system environment in a transparent fashion, i.e. interprocess communication is independent of physical locality of the process (We must take our NI based work as the base!)
- . having computers above Scorpio that can be used for computational and data base work
- . having PDP-11 computers below Scorpio that can operate in a compatible, upgradeable fashion
- . ability to start now in building Fifth Generation, Homogeneous Computer systems
- . the "best" real time design, build and run environment, including: simulation of both controller and controllee on the development system, remote checkout of controller with a simulated controllee, remote checkout of controller operating controllee, and monitoring via the development system of the total system via the controller
- . user microprogrammability to help us get out of the various competitive holes, and to work on the various image and vector ops for speech and pictures we'll be in

PMS STRUCTURES
The ideal set of hardware and software might let us build every type of multiprocessor or multicomputer network that's ever been invented. There is a need for both mP and nC structures.

Single BI Multiprocessors Are the Basis
Conventional multiprocessors are not yet effective for

greater than a few processors (about 4) when multiprogrammmed or on a single task. Multi-Pc's on a single BI is for incremental performance and to interface special processes. It is also desirable to support systems with computers on the BI, operating with its private Mp.pvt (Cs = Ps + Mp.pvt). For multiprocessor systems on a single bus (a single computer), we have these goals:

- . multiple Pc's on 1 BI up to BI bandwidth (C= constraint)
- . all processors, including special processors (Ps) and computers (Cs) which can (must??) access all memory on a BI system (C)
- . reduction of BI bandwidth and isolation of programs by private memories which are accessed by Pc's or Ps's, thus forming local Computers on a BI (This option could come later, as it is fundamentally a way to reduce bandwidth. Depending on the globality of the M's, this becomes a physical protection mechanism.) I think I favor having global accessing so that all M is in one address space.

Multiple BI Multiprocessor, Single Computers
Given that we have so many ways to address the issue of performance and reliability, these multiport memory structures will probably just cloud the issue and introduce more complexity into our software and testing. Furthermore, given the limits on the BI, and cabling in general, they are difficult to build.

Since we are building multiprocessor and multicomputer systems already, rather than proclude them, we should make sure they are possible to build, although it will not be our intent to build and offer them.

Special multiport memory systems are inevitable as we begin to process raw video. Access of a video channel will be direct to a memory card, and a memory may be accessed by several BI or other special busses for transmission to some other part of a system.

Multicomputers for RAMP Using the CI
We have two unique pieces of technology with the CI that

should be exploited as part of Scorpio: the basic fast, interprocess communication that will result in high performance; and RAMP! We must have a Goal to cost reduce and offer CI or CI-type communication.

Distributed Processing on the NI
We must tune the interface of NI such that the overhead to communicate among processes on seperate computers is NO higher than the communication of among processes on the same computer!

SOFTWARE ENVIRONMENT
rooted on vax dist. systems and PCC's
gets into PCC's
Note, the systems should be transparent to whether there's a disk

RAMP
every card is capable of self diagnosis and reporting, (If this is made as a constraint, then there is an implication about Mp partitioning

every card can diagnose the bus, and go a long way toward diagnosing co-residents of the BI

UNPACK AND STACK SYSTEMS (U&S); AND INTEGRATED SYSTEMS
Environments: office and lab, C room, oem equipment in a rack (we haven't addressed this yet)

With Unpack and Stack (U&S) systems all components are shippable in 50# increments via UPS and can be installed by the user! There is no rack. This is the goal of all G&S, U&S Systems. For Scorio in or with large peripherals, the user can do all but move the drives into place. He can still build his Rackless system and connect it.

MODULE SET
what they are (can we get a set of specs for each of them asap?):

Pc, includes the various serial line diagnostics, etc.

Mp (hopefully solving this ability to have either global or private access) for a given Pc,

C.comm boards such as the combo ... alternatively, a protocol assist module would be used to access the vast array of line cards,

C.voice ability to do voice i/o for both personal and shared use

C.display such as Suvax, would also drive an imager for printing and plotting

NI,

SI,

CI,

K.Aztec, or shouldn't it be C.Aztec to be SI compatible?

K.Wini or C.Wini for small systems

eurocard: cost and benefit and will we not have Amerocards?

backplane interconnect and standardization. Must be able to handle multi-module options and to get cables off. How's CT?

longevity vis a vis U and not Q (Let's get the poop on why the Q bus has been so poorly executed ... Q16quad, Q16double, Q18quad and double, and now Q22quad and double... with need for Q22mP

escape to other busses ... why?? Which ones??

video and video bandwidth is not quite 1 BI ??

CHIP SET
The biggest constraint here is that we must predicate our designs on using industry standard microperipherals and special microprocessors for cost (eg Wini) and possibly performance

How close is the Scorpio Chip set to the II?

Can we sell the chip set? ie. is it easy to apply?

FORCE '83; THE MODULE/SYSTEM BUILDING PROCESS
What if we really made a very effective design process such

that we could do high volume specials reliably and cheaply?

If you folks would have a look at this, send me comments and then I'll try to get it in a better format.

Hope this will give us a couple of things to talk about this week.

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TO: see "TO" DISTRIBUTION   DATE: MON 6 DEC 1982 2:21 PM

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION   DEPT: ENG STAFF

EXT: 223-2236

LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5183917657

PROPOSAL: LET'S USE THE QUALITIY DESIGN METHODOLOGY...

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WHERE ENGINEERS, ENGINEER!

products, tools and processes to build products, and components for building products in ALL parts of the World

AND USE THE QUALITY DESIGN METHODOLGY

to drive and exploit engineering learning curves so that as engineers, we do lots of designs in our lifetime!

(The ROI on designs that have a shorter gestation time will be very high because the designs will be much more competitive...)

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(an example, of the Quality Design Methodology)

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and learned from. Also, tools for automatic, low level design which
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Underlying semiconductor and interconnect technology for designing (by
compiling) all kinds of computers and computer based systems
The Sixth Generation, based on known and evolving ideas about better
communication with humans, thereby creating more use

00 BURT DECGRAM ACCEPTED S 8622 O 35 25-APR-81 14:59:11

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* d i g i t a l *
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TO: STEVE TEICHER   DATE: SAT 25 APR 1981 14:55 EST

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION   DEPT: ENG STAFF

EXT: 223-2236

LOC/MAIL STOP: ML12-1/A51

SUBJECT: SCORPIO REVIEW: IT AND TEAM LOOK VERY GOOD. THANKS.

In the April Engineering Review, Scorpio turned out to be the cornerstone of our future and of the greatest concern throughout
the company. Therefore, I wanted to look at it closely as we enter the May Woods.

I asked the Scorpio team to review Scorpio with me, Craig Mudge
and Bob Supnik this morning in order to get more understanding
about the status and the team. The issues of concern:

.how tight is the design in terms of density? (25% area margin... more than we have had in the past. The FP chip
is 90K sq mils)

.what issues are pending that could stop em? (DECsim)

.what about the system? (they're concerned... there are several possibilities. This has to be addressed.)

.when will we see chips? (Sept. 83 and variance -10% +20%)

.what is the time between passes? (8 wks.)

.what if we change to the IEEE floating point format? (3 qrts)... basically, we can not change to the format!

.what other standards could affect the design? (the new,
IEEE bus interface that though similar to BI is NOT BI!)
Architecure must get involved, we can not afford to have
another "IEEE floating point standard" that we will
ultimately have to comply with and that is different from
what we are doing!" HELP! (Fuller/Strecker)

.what other VAX architecture changes could alter the design?
(there are some)

.what is the regularity factor? (as much as it can be...
that's the basis of the design)

.will the speed be adequate, given it is only a 5 mhz clock
and others are at 10 and are going to 20? (the VAX

architecture is complex and won't fit on current chips, we
are using parallelism to get speed versus raw parallelism.
Nevertheless, there has to be work in determining the
competitiveness of the chip vis a vis architecture and
implementation. This is the domain of Fuller/Strecker and
Supnik; we need to hear from them.)

.who is taking their methodology and applying it elsewhere?
(up to Supnik and Williams)

.what is the design methodology and how is it managed? (This
is a major part of the project. It is formal and
documented. It is virtually under spec. control.)

I am very happy about the project at this stage, and the high likelihood that Scorpio can be produced as planned.

Thanks for the review. I look forward to the phase transition in September. My congratulations to the fine team.

Gordon

"CC" DISTRIBUTION:

JIM CUDMORE BILL DEMMER STEVE FULLER
OPERATIONS COMMITTEE: BILL STRECKER

GB2.S6.12
00 BURT DECGRAM ACCEPTED S 21544 O 445 21-NOV-81 19:10:56
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* d i g i t a l *
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TO: see "TO" DISTRIBUTION DATE: SAT 21 NOV 1981 7:10 PM EST

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION

DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: DISCUSSION OF SCORPIO AT GVPC MONDAY... URGENT!

I just received the following memo, entitled SCORPIO, from Andy:

"Already we are facing another monumental disaster in terms of this project, its goals its time frame, it management, its lack of market sensitivity, etc. etc. etc. Eight chips for greater than $1000 in 1986 ain't going to make it. Can we have a review of at least the goal set before we spend the 20 million plus in capital next year to put a technology process in place which runs counter to the industry.

Please help us. SUVAX, etc. is at stake here. Help - we'll miss the 32-bit window if we continue on the current plan."

I believe that Andy may be exactly 100% right here. Rather than wait around till after Thanksgiving to get this review, I would like it to receive top priority at the GVPC on Monday, where we ask Bill and Jim to give us an update, plus how we are going to set a full review in motion. The Zilog possibilities should also be presented.

This is a topic we do not want to muddle and wait to discuss. The project is at the heart of our 1980's business. We must

have
it very soon and it has to be good; otherwise, we might as well
stop making VAXes.

(Will be at MR and would attend via conference call if possible.)

"TO" DISTRIBUTION:

JIM CUDMORE BILL DEMMER TED JOHNSON

"CC" DISTRIBUTION:

SAM FULLER GVPC: DEMETRIOS LIGNOS
KEN OLSEN STEVE TEICHER

GB3.S2.43
00 BURT DECGRAM ACCEPTED S 13529 O 348 23-OCT-80 20:09:53

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION DATE: THU 23 OCT 1980 8:05 PM EDT

FROM: GORDON BELL
cc: see "CC" DISTRIBUTION DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: IS SCORPIO SOON ENOUGH TO COMPETE WITH NEW 32-BIT MICROS

Several machine announcements arrived in today's mail, they are:
1. Bell Lab's 3B-5 32-bit microprocessor board using a MAC80 chip

working fall 81, production fall 82 at about comet speed. A
3B-20
at greater than 780 speed. Apparently ATT is headed into
computer
business for their internal use.
2. Meanwhile BTL, Indian Hill is using the Intel 432 to build
an ADA compiler.
3. HP is announcing a 5 chip, 32 bit set at the International
Solid
State Circuits Conference (when we discuss Tiny). Each chip
has
about 100K transistors, our target for Scorpio. The CPU chip
contains 450K transistors! Clearly the record for a non-ram
chip.
The performance looks like possibly 780 speed, and it has a
29-bit address. Clearly an outgrowth of the HP3000. Given
that
the chip has to work before it can be described at the
conference,
then they could be awfully far along at a system product.
(I make it, that they are 5 years ahead of us, by
comparison.)

We should also recall that there exists many micros on the
market
today that have 20-22 bit virtual addresses, all of which
will
be adequate for market already, and all which beat the 11 in
cases where the address is a limit. Also, they are all
getting
UNIX.

I believe we have a significant technical threat here in
several
dimensions. Furthermore, I don't believe the plans we have
in
place are adequate to meet HP, assuming they just move their
3000 software over and they go out and aggressively market.
Worse yet, if they can do it, so will IBM, the Japanese, and
we know about the big micros.

We must get together a small task force and begin this

assessment
and ask various groups what they can do.
Can I ask for a leader for it?

"TO" DISTRIBUTION:

DICK CLAYTON   JIM CUDMORE   BILL DEMMER
ROY MOFFA   CRAIG MUDGE   STEVE
TEICHER
MIKE TITELBAUM   JOE ZEH

"CC" DISTRIBUTION:

PATRICK COURTIN   ULF FAGERQUIST   SAM FULLER
JACK MACKEEN   OPERATIONS COMMITTEE: LARRY WADE

GB1.S7.54
****
* d i g i t a l *
****

TO: STEVE TEICHER   DATE: SUN 14 JUN 1981
18:31 EST

FROM: GORDON BELL
cc: see "CC" DISTRIBUTION   DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: SCORPIO MANAGEMENT

I really believe that conventional engineering managment and promotion principles should not apply within semiconductors and Scorpio. We push really great project engineers into the next level where they oversee lots of projects. Some are effective at this level, but we end up losing some really talented persons because of this reward structure. My own personal frustration is that I don't know enough to be a great
project engineer. The engineers that I most admire here are those that build great products as chief designers.

It feels like Scorpio is being managed by a person who has not previously managed a product, furthermore, our most talented
leader, Duane Dickhut is being wasted on supervising multiple projects... among them Scorpio. Scorpio is our highest priority project, and I'd like to see the project leader(s) report directly to you. Here, I say possibly two leaders, cause I have as the model, something like the chief surgeon model for programming. His second, will handle a number of the tasks, or there may be an adminstrator who deals with all the outside environment (budget, resources, product managment,
users of the chip, etc.) and possibly some of the project administration in a two-in-the-box fashion... while the leader
really leads the design team.

Within semiconductors, it is important to not follow the regular
path of promotion, since each design is much greater than the previous one, and hence the task is expanding exponentially already.

Can I really implore you to restructure the Scorpio project so that it reports higher, and is lead by the best that you have? (I had this discussion with Roy. Why don't you guys kick it around and then let's talk about it?)

"CC" DISTRIBUTION:

JIM CUDMORE BILL DEMMER JEFF KALB
AND CUDMORE
ROY MOFFA

GB2.S6.69

****
* d i g i t a l *
****

TO: DAVE CUTLER DATE: SAT 20 JUN 1981
12:15 EST

FROM: GORDON BELL
cc: DEMETRIOS LIGNOS
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: PLANNING, ARCHITECTURE, IMPLEMENTER GROUP FOR SCORPIO

Demetrios, as Scorpio leader, has proposed that a very small task force plan what we are going to do with Scorpio chips and boards, as there is such wide useage. The opportunities are that it gets us in the high performance board business, as well as being the basis of the personal vax, as a file server, as a database accelerator when coupled to an HSC50, and then as a really red hot multi- terminal computer to replace comet, the 780 and nebula as it has equal performance to all these at essentially zero processor cost. Also, as a high performance board set, it would also be used to move to a really hot front end, real time machine for lab and industrial use. Therefore, the range of use is enormous. Also, I'm pushing having multiprocessor capabilities, as all the micro busses now have this.

The team Demetrios had in mind to outline the plan, and then to go off and implement the various parts (whether they be hardware or software) are You, Dave Rodgers, Bill Avery, and Duane Dickhut (the chip builder). He wanted me to be a part of the early definition task force.

The approach sounds right as it is based on the planners=doers.
He should get it going in the next week, or two at the latest.

GB2.S6.67

****
* d i g i t a l *
****

TO: STEVE TEICHER DATE: SAT 25 APR 1981
10:00 EST

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: RE: REVIEWS OF SCORPIO AND OF METHODOLOGY

I would like to get the understanding of when I am wrong. I want
to be told ... it bothers me that you either think my ego
is a problem or that I'm incapable of learning. It feels
like you are building an incredible defense mechanism here by
putting the blame back on me for something.

I have levelled several concerns at the semiconductor group recently:
1. I don't sense a good enough understanding of the
technology space. The gate array fiasco was an indicator where
I watched us listen to bean counters shoot beans at each other
and the war was totally in another contintent. I
didn't see the relevant metrics, competitive comparisons,
or understanding of the industry scenarios.
2. The products coming out don't look competitive. Supnik
was able to defend the FPA in terms of Intel. While
I bought this, I have a gut feel that someone else will
have something better (eg. note the 68000 in the EDN article).
3. Apparently you learned something about the process in
my queries. I still don't feel good enough about your
understanding of it.

Somehow, we are arguing that I am another dumb manager, like Ken that is harassing you. (By the way, I am making similar arguments to and about Ken.) Admittedly I do not understand the semiconductor space, but I haven't been given the education.

The point is: the enemy is not me. While you are succeeding in intimidating me and chasing me out of the space, I wonder if others like Fujitsu, etc. aren't the real invaders?

You might talk to Grant, we had similar discussions and you might ask him how he won? or who won? or what happened?

We do have to get together on this. Maybe it will take some personnel folks too.

I really am not the enemy, and I can learn and I am wrong... let's deal with all of these.
gordon

GB2.S6.10
January 9, 1981

Mr. Ed Niederhofer
Vice President, Marketing
Scott Instruments
815 North Elm
Denton, TX 76201

Dear Mr. Niederhofer:

Thank you for your proposal. We have reviewed your offer of R&D services to develop voice recognition technology and have decided not to accept at this time.

We are currently evaluating the role of voice recognition in our products. Until we have a clear picture of our requirements, we are disinclined to enter into cooperative development arrangements or to draw premature conclusions about appropriate technologies or implementation approaches.

Your proposal and the enclosures have been directed to the appropriate development engineering groups. At a later date, when needs are better defined, there may be an opportunity for further discussion.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:swh
GB2.S1.10

EMS 14-JUN-79
08:41:01 510 1
To: Julius Marcus, Roger Cady, Bill Johnson
CC: OOD, Jack Mileski, David N. Cutler
From: Gordon Bell
Date: THU 14-JUN-79 08:41:01 EDT
Subject: SCS-11

Please forward to Daley, Heffner, and Keating.

I am not very happy about the scs decision, because it runs counter to what I
think gives us the long term best software position. For some reasons it may
not be possible to get to where this can happen. Certainly the position that
SCS is a new operating system will probably get us one and get us going down
the wrong path. Hopefully it might be as simple as having the work for the

human interface done in the m group. In no way do I understand how doing the
same interface to both RSTS and RT is going to get us an overall lower
support unless we make the assumption that these users will demand the same
interface and hence we will have to do everything on all operating systems.

Although I thought all the avenues had been persued, I would like to have some
more time to explore this. Bill Johnson should drive how we might look at it,
but I want to get into some of the implementation questio s. Cutler should be
invaluable here because he has been doing some work on the small system for
the micros group.

Overall, I would like to get to a single system that is compatible with VAX at
the M level such that it would run down to and including a single user. This
is the only way we are gooing to get the growth and compatibility I think our
users need and that we must be able to sell. This will require a lot of
discipline in the marketing domain that I'm not sure we have because the
users will come after us on the transition and the pressure will be fierce to
do everything. On the other hand, it may be the only way to get the
capabilities that are inevitably required for communications, data management,
human interface, reliability, foreground/background that will continue to
plague us to be done on m, rsts, and rt. ... I wanna go to m and get it down
in size too and get everyone over to it.

Command:

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+---------------------------+
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| d | i | g | i | t | a | l |   i n t e r o f f i c e   m e m o r
a n d u m
|   |   |   |   |   |   |   |   |
+---------------------------+
```

Subject: **Fall DECUS**

To: Development Managers,
Product Managers

CC: Marketing Committee, OOD,
Ed Kramer, Bill Picott

Date: 11 DEC 78
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

Having attended Fall DECUS let me congratulate you and your co-workers on their performance. It was one of the most intensely technical user-developer conferences I've seen and it was impressive to see the respect our customers have for our products and people. (It was also much larger than the first FJCC I attended in 1960.) We want to keep up this communications channel.

The exhibits and talks were extremely professional and very stimulating. The VAX sessions, were crowded and the customers very happy.

I was truly proud to be an engineer at DEC.

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Hank Allard	ML5-2/E93	Al Avery	TW/A08
Rowland Brandwein	MK-2/D3	Alyce Branum	ML12-2/E71
Reid Brown	TW/C10	Van Chu	ML3-6/E94
Roy Clites	ML5-5/E97	Walter Colby	ML12-2/E71
Peter Conklin	TW/A08	Dave Cotton	ML5-3/E12
Dezi Dezzani	ML5-3/E12	Marcia Donaldson	MR1-1/M55
Paul Feresten	ML3-6/E94	Bryan Fifield	TW/C02
Bob Flynn	ML12-2/E71	Kurt Friedrich	TW/C10
Wayne Galusha	ML3-6/E94	Phil Goldman	ML3-6/E94
Roy Graham	ML5-5/E97	Ian Gunn	MD
Len Halio	ML1-2/H26	Judi Hall	ML5-5/E76
Jim Hamilton	TW/C02	Leslie Hruby	MR1-2/E78
Steve Johnson	ML5-5/E97	John Jorgensen	MR1-2/E78
Lynn King	ML5-2/E93	Ed Lazar	ML5-3/E12
Richard Loveland	ML5-5/E97	Peggy Maas	ML5-3/E12
Art McCray	TW/C10	Don McInnis	TW/A08
Jack Mileski	TW/C10	Wolfgang Muller	GE
Kathy Norris	TW/A08	Bob Nussbaum	TW/C10
Laura Persily	ML12-2/E71	Richard Pietravalle	MK-2/D3

Lloyd Powell	ML3-6/E94	Mike Powell	TW/C02
Horace Prindle	MR1-2/E78	Tom Rarich	TW/A08
Glenn Reyer	MK-2/D3	Oscar Rodriguez	ML12-2/E71
Mike Sadofsky	ML5-5/E97	Tom Sherman	TW/C02
Ken Sills	ML3-6/E94	Ed Slaughter	TW
Joe Smith	ML11-4/E53	Kevin Smith	ML3-6/E94
Ned Somerville	MR1-2/E78	Chuck Stein	ML5-5/E97
Dave Tolman	MR1-1/M49	Mike Tomasic	ML12-2/E71
Joe Viula	MR1-2/E78	Ted Webber	MK-2/D3
Mike Weinstein	ML5-5/E97		

The Secretary reports to the Coordinator of Administration and spends most of the time in tasks related to the calendar, telephone, memberships and correspondence.

Calendar

- o Daily updates the calendar which includes staff meetings, appointments, events, store personnel schedule, etc.

- o One copy is posted, one copy each to Director and Store, and one copy is kept by the Secretary.

- o Staff makes additions, deletions, corrections each day to posted calendar.

- o Current calendar is kept on floppy SUESYS, document 0.5 and archive is on 0.10.

Telephone

- o Museum's main numbers are

answered by the Secretary

o Most calls are requests for information, for literature, or to schedule tours.

o A listing of all literature sent out is kept.

o Tour Information Sheet is filled out for tours and this information is added to the calendar.

Memberships

o All memberships are processed by the Secretary.

o A monthly running total of members and money is kept. (See Secretary's Office Procedures Manual for details.)

o Floppy MBR001 contains information about memberships.

o Rolodex cards for all members contains work and home addresses, telephone numbers, and effective date of membership.

o Book called "Membership Lists" includes alphabetical and zip code lists, Founders and Corporate Founders.

Correspondence

o Processes most outgoing correspondence

o Kept on floppies CM001, CM002, CM003 in chronological order and a copy if also kept in correspondence file.

o See Secretary's Manual for

detailed procedures.

Secretary's Office Procedures Manual

o New Members Procedures

o How To run labels, Rolodex cards, pull a founders list, do a member list, and procedures for correspondence file headings.

o Disk Index of floppies used by Secretary

Floppies

o SUESYS -- DECMATE System disk

o DEBBIE

o SYSMBR -- System disk for memberships

o MBR001 -- Membership List

o C001, C002, C003 -- Chronological correspondence

00 BURT DECGRAM ACCEPTED S 1420 O 32 13-JUL-80 23:16:54

****
* d i g i t a l *
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TO: OOD:
DATE: SUN 13 JUL 1980 11:10 PM EDT
FROM: GORDON BELL
cc: PER HJERPPE
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: 4 SEGMENTATION DIMENSIONS FOR OUR PRODUCTS AND WORK

I spend a lot of time trying to structure what we do. For the
last few years, I've been using this 4 dimensional space of:
Level of integration (the what), the size (scale) of what we
build; where we are in the life of what it is we are building;
and the activity (or what it is we do).

SEGMENTATION DIMENSIONS
Note the 4 dimensions, which we need to continually refine and
hold as our segmentation for engineering and manufacturing
organizations:

Level of integration:
H/S-chips, chip carrier, module, backplane, box, cabinet, hardware system/ operating system (including files and communications), language, generic tools, application;

Hardware price of the things (components or systems) we sell:
(hand held .4-1, Terminal based 2.5-6.25, stackable 6.25-16, cabinet(s) 16-40, 40-100, interconnected cabinet 100-250-625, multiple computers using CI 250-625-1.6M);

Phase (life-time):
Basic research, Research, Advanced development, Development, Support, Enhance, and Obsolescence;

Activity:
.Component design, sometimes we call it the technology (the thing- whether it be a chip or a word processing system. We must stick with the notion that one person's system is another person's component... hence we only

make components.),
.Engineering Process (how can designers use it as a component in the next highest level a design),
.Manufacturing Process (how do you make it?),
.Manufacturing test process (how do you know it works?),
.Maintainence Process (How can it be made to work over its lifetimea?),
.Market process (How do we define it during its various phases and sell it?),
.Management processes (how do we organize, manage and interface to one another to get the work done?)

TOP-DOWN APPROACH (MFG./ENG./MKT. SEGMENTS)

The taxonomy is only useful if it allows us to segment our activities. We are extremely lucky in having growth, because it is comparatively trivial to manage charters. On the other hand, left alone, there will be overlaps and underlaps in an area where the new product opportunities abound (eg. WPS, voice on packet switching networks, small systems growing into terminals). I think we ought to use the remainder of the summer to sort this out. Let me suggest two approaches: top down- we look at a cleaner manufacturing/engineering divisional structure; bottom-up, we look at overlap, underlap, and new opportunities.

Significant manufacturing-engineering (and occasionally marketing coupling). I don't want to muck in the divisional space, all I want is to STREAMLINE each group's charter and to have a clear relationship with all other groups as a buyer or seller.

This is the background thinking that led to the organizational
proposal today.

What you think?

GB1.S5.52
process record

GB3.S1.?

We've made great progress in building an organization, but I'm really concerned with whether we're on a successful course. The dismantling of the Burroughs Semiconductor operation brings this home.

It seems that the part aimed at VLSI has this quad-whammy:

0. It's just plain expensive. Maybe there's better use for the $100 million/year.

1. Being cut off from the merchant market by not participating in their designs.

2. Late, hence obsolete, proprietary parts. Parts such as the video controller, and BI chip take so long that we don't have timely, hence competitive systems.

3. Our low factory loading means expensive parts, but this is a minor problem.

Furthermore, the semiconductor use based on gate arrays that brings in the revenue is outside the mainline VLSI support.

It's unclear what the answer is, but it might be helpful to look at various reasons:

1.

Our architectures simply can't be implemented in VLSI! It took too long to get the 11 on a chip, and VAX seems more difficult.

2.

We only do the very difficult designs, hence they're all long and expensive.

3.

At the one or two chips designed per year level, we have virtually no learning curve since the technology and people changes erode transfer of useful relevant skills and knowledge.

4.

We have an organization that's staffed by "old DEC", not semiconductor engineers. The top three levels haven't designed a chip or semiconductor process from scratch.

5.

The projects may be mismanaged with too much emphasis on circuits versus chips. There may be the wrong mix of chips.

6.

We may have too much money and also misallocating funds, given that we can afford to start our own unique CAD system and our own unique MOS process. These will both be expensive to maintain, while also robbing us of potential chip development. There are other signs of this too.

7.

The semiconductor organization mirrors the rest of DEC and has simply gotten fat, very wide and defocussed on its mission.

There appear to be two future scenarios for getting semi-conductors, with reality in between:

1.

Only a few makers of chips because they're so expensive.

2\.

Everyone designs chips, only a few make them on standard processes just like color photograpy/processing.

I don't see us getting closer to either scenario.

What are your thoughts? I think we really need to discuss, perhaps after the Scorpio review next monday.
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* d i g i t a l *
****

TO: TED JOHNSON   DATE: SAT 3 OCT 1981 19:24 EST

FROM: GORDON BELL
cc: see "CC" DISTRIBUTION   DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: YOUR (FAULTY) PERCEPTION ABOUT SELLING TINY

I believe you and Peter are all wet. Whoever thinks we can get
50-200 for Tiny chips doesn't know the market! The PDP-11 is becoming about as interesting to the informed engineer or TOEM as
a PDP-8 (6120 chip), where there were an unmeasureable quantity
sold.

There is no risk of the Tiny being especially useful to an OEM
just as there is little use of it for our own products. With the 64K RAM chip it is hard to build a system that uses less than 128K (64K more than the Tiny addresses). Nor is there system software.

I do agree with trying to make the Qbus a commodity bus and selling peripherals. We must go significantly farther:

1. Get a semicomputer company to license and build and sell ALL 11 Chips very aggressively! In this regard, I have asked Philips (and Signetics) to come here and discuss this with us.

2. Publish our internal interconnect specs so as to get the semicomputer folks building in a more organized way.

3. Publish how to build really cost effective board based systems built on the Tiny, Fonz and Jaws.

4. Keep a strong license position on our software! This is the control, not the hardware.

5. Forget about competition from anyone taking the chips and making systems that will compete with us! The micros business is selling boards and anyone who would want to do that is free to now. Selling chips versus boards only means a differential of a 100 or so dollars anyway.

6. Push to try to stave off the onslaught of the scenario we have been looking at within engineering we call Doomsday. (Doomsday, is that time when the processor is free and an established commodity standard. There are commodity peripherals, commodity software (like say UNIX), the world has standardized on card busses (say like the IEEE 488 and Intel Multibus, an IEEE bus).

Please help to get the 11 out there in this form as we have a chance of convincing the market that the 11 is the best, 16-bit processor, and they needn't go to Z8000, the 68000, or the 8086. Already, these folks have shipped more chips than we ever did 11's. Recall that we were forced into using the

Z80
for Robin. Note also, that there is REALLY ONLY the 370 as the
standard mainframe (recall what happened to Honeywell, Burroughs, Univac). There are many vendors of the 370 ... and
IBM is successful!

If we wait, we are going to have a system in the 11 that is about
as exciting as the PDP-8 was in 1971-75. In fact, as we avoid
making this decision, we are on a clear course to kill the 11.
The demise, I think will be faster than with the 8 cause there
are exciting alternatives in the market.

How about pushing to help make this crucial decision to be an aggressive supplier of 16-bit chips, board, boxes and systems?

The bulls make money and the bears make money, but the pigs get
slaughtered.

"CC" DISTRIBUTION:

JIM BAILEY STEVE COLEMAN MIKE GUTMAN
PETER HERKE WIN HINDLE WARD MACKENZIE
JACK MACKEEN ROY MOFFA

GB3.S1.36

00 BURT DECGRAM ACCEPTED S 26803 O 90 12-SEP-81 18:50:54

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION DATE: SAT 12 SEP 1981

18:43 EST

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

cc: see "CC" DISTRIBUTION

SUBJECT: PRESENTATION OF SEMICONDUCTOR STRATEGY TO THE BOARD

Let's get this scheduled asap. It is important and we all have to understand and agree to it pretty much the same way. There are two developments this coming month that I hope will be useful to this: visit to Japan in regard to acquisition of MOS and bipolar gatearrays; and deciding to sell the 11 at the chip level (which is about to be proposed and has strong support from the Marketing folks).

A part of the presentation should be directed at the glue parts and how they are turned around quickly.
We ought to get into the whole issue of education, turn-around, learning curves and how we are going to get learning when we only do 1 MOS chip/year.

Our current position / strategy is simply:
.Hudson supports Bill, Ulf and Grant, wishing them well
.Hudson may propose to have a fast turn around for gate arrays
.Ulf buys gate arrays outside for hi end
.Bill buys gate arrays outside for mid range and glue
(Meanwhile the mid range is possible to be built from good MOS parts if you don't mind using someone else's architecture.)
.Hudson builds 1 MOS processor every few years (or 1 MOS chip/year) to feed our micros business and now the 11. In 84, their chip will feed the whole VAX base up to 100K systems ... whch is VERY important for us!)

.We set a standard for building MOS parts in the II and then buyout as many standard chips as possible for CRT controllers, comm., disks, voice i/o, etc.

They might not want the sublety of the question of when or if bipolar is replaced by MOS (because it eliminated the whole concept of the mid range), but I sure want this in our version of the dry run. This is the question I asked about last Thursday that we must answer!

Let's get on with the presentation first at PEG, probably waiting for the other Japan folks to return and also after the task force I want to schedule reports on how we can use standard micros parts to build mid range performance systems. (Bill, I'd like you to lead this one!)

"TO" DISTRIBUTION:

JIM CUDMORE BILL DEMMER ULF FAGERQUIST
JEFF KALB STEVE TEICHER

"CC" DISTRIBUTION:

DICK CLINTON MIKE GUTMAN KEN OLSEN
LARRY PORTNER GRANT SAVIERS

ATTACHED: MEMO;52

****
* d i g i t a l *
****

TO: GORDON BELL DATE: FRI 11 SEP 1981 15:56 EST

FROM: KEN OLSEN
cc: WIN HINDLE DEPT: ADMINISTRATION
OPERATIONS COMMITTEE: EXT: 223-2301

EDWARD A. SCHWARTZ LOC/MAIL STOP: ML10-2/A50

SUBJECT: SEMI-CONDUCTOR STRATEGY TO THE BOARD OF DIRECTORS

Some of the Board of Directors are concerned when they read about the goals and huge investments of the Japanese in order to dominate the world of high density semi-conductors. They worry about us and IBM being wiped out eventually. I think we owe them a comment on this subject.

At one of the next meetings, will you present our strategy as it pertains to semi-conductors.

The strategy I would suggest is that we decide how much we can afford, and decide the best way to invest it, then state this to the Board. This, of course, will not be enough to compete with the Japanese in all areas. On the other hand, we've never had the most of everything, and we've always faced that same situation with IBM who, in any one area, could invest many, many times what we could invest.

I then suggest that we say that in addition to that large, but not overwhelming investment in semi-conductors, we will invest in two areas which are perhaps even more important. The first is the systems techniques for fast generation of integrated circuits, and fast, smooth productions of many types. If you look at our computer systems today, the heart of the central processor is a small part of the cost and most of the cost is in the peripheral circuits, It's obvious that the big cost-

saving
is going to be in doing the odd things, not in doing the center
of the central processor.

Secondly, I would suggest that our strategy be that the packaging
and heat transfer of integrated circuits probably has as much
pay-off as the last steps in increasing the density of integrated
circuits. I would suggest that we have a good team with managers
who are experts in science, and concentrate not only dollars, but
interest and effort in this packaging and heat transfer technology.

KHO/ep
KO1:S6.27

GB2.S8.25

****
* d i g i t a l *
****

TO: STEVE TEICHER DATE: FRI 29 AUG 1980 9:04 PM EDT

FROM: GORDON BELL
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: RE: CPU STRATEGY/DECISION METHODS

I think we are all frustrated. Before you tell our designers
to go work for the semiconductor industry, I'd like to be sure
we aren't going to make it here.

Yes, there is a significant push into applications and I

don't
know where the money is going to come from to both forward and
backward integrate. IBM is starting to depend on the semi industry and is apparently coming out with a rash of products based on the intel architecture. They, abandoned their semi group because their group was focussed at the high end. In our case, we are focussed at the low end and our revenue is coming from the mid.

I'm really impressed that we have put together such a good team and that's why I supported Scorpio! We have to continue with our architecture as I see it. The 85+ is really cloudy: semiconductor processing becomes like film processing and we have to all design and get others to build it; or only a few companies build them and we all use them (like Nylon). Given that we are so strongly focussed on use (which I support as hard as I can), then the concern is less with parts ... however, we must have competitive ones (from a performance viewpoint). Architecture really muddies this cause we have a software investment and we also selll architecture.

Let's be calm. We can get through this and all achieve success. Am really glad you have been working in this area and have built our capability. I don't want to demotivate or lose people! I do want to know where we are and how we can be competitive and not lose to others like IBM, Radio Shack r the Japanese by having the pride and drive that forces us to have to do it all ourselves.

WE NEED SEMICONDUCTOR ENGINEERING!
Gordon

GB1.S6.46
****
* d i g i t a l *
****

TO: ROY MOFFA DATE: SUN 17 AUG 1980
9:58 PM EDT
STEVE TEICHER FROM: GORDON BELL

JOE ZEH DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: DRAFT OF BUYING STANDARD SEMIS AND INTERFACING TO SI VALLEY

Subject: Policy update on microprocessors and semiconductor interfaces

The current situation is that we are:
0. developing our own cpu's to get form factor, and other ad hoc chips
1. developing a 2 micron process for cpus, requiring a foundry (2nd source)
2. using the 8080 and acquiring LSI peripherals in ad hoc fashion, although
we are looking at an industry standard for on-board interconnect (II)
3. not connected to any semicomputer company well enough to get advanced info
or to influence their designs
4. likely to need a high performance micro (>20-bit address)
5. building Q-bus modules without benefit of new, one chip peripherals
6. building bounded systems with an implicit bus, versus a planned standard

We should make an explicit decision, like the one to standardize on the 8080,
to have a closer tie with a particular vendor, and satisfying these goals:
1. acquire or jointly develop a 2 micron process for which we have a
production source for chips we design on a second source (foundry basis)
2. standardize on an industry interconnect, II, in order to ultilize one chip
peripherals (buying would be subject to our policy on proprietariness)
3. get advanced information and to jointly specify one chip parts so as to

improve our product lead time and competitiveness
4. select, and possibly use the new, emerging high performance microprocessors
5. determine how to build Q and bounded bus peripherals using the one chip peripherals
6. share CAD, process and product development information to improve us
7. evaluate the strength of various vendors as competitors in their ability to supply machines that will threaten our Small and Mid-range products.

In doing this, we still assume the charter of Hudson is:
1. building our cpu chips that run 11 and VAX-11 programs, given our SW investment and the fact that semicomputer vendors won't design these for us
2. provide a facility for making prototype runs for MOS and Gate array designs
3. do some custom designs, on a rational basis, in order to have capability
4. be the leader in CAD so as to reduce turn around and deal with cpu's
5. be prepared to be a significant design center assuming that in 5-10 years there are standardized processes (foundries) which will make anyone's designs- like Kodak develops film and MOS is the dominant technology because of the high on-chip performance and the inability of bipolar to disipate heat or to be interconnected. Alternatively, the tooling costs are so high that semicomputer companies build all the computer (e.g. Nylon)

We should embark on this selection process with evaluation criteria:
1. ability to work with vendor
2. software and architecture understanding
3. process and CAD capability, past and projected

4. current product array, together with past and projected performance
5. business direction compatibility
6. source of supply as a volume producer.

Should we make an explicit decision now? If so, who will lead us through it?

What are your thoughts on this? Who should this go to? What have I left out?

GB1.S6.21
00 BURT DECGRAM ACCEPTED S 14894 O 24 02-MAY-81 15:50:16

****
* d i g i t a l *
****

TO: OPERATIONS COMMITTEE: DATE: SAT 2 MAY 1981 15:42 EST

FROM: GORDON BELL

cc: ENG STAFF: DEPT: ENG STAFF
    STEVE TEICHER   EXT: 223-2236

LOC/MAIL STOP: ML12-1/A51

SUBJECT: ANDY'S SUGGESTION ABOUT SEMIS IN JAPAN

Andy's observed tht TI, Intel and IBM are all going to Japan for engineering especially as it relates to semiconductors. Given that we have larg amounts of tax credits piling up in Japan, then I say let's go balls out and get our engineering there!

They are really leading in semis and in crts and in volume production techniques. We have the architecture, the software and the knowledge about applications.

Hiring engineers is going to be increasingly
difficulty with our increased emphasis on MBA's and the military
spending. The military contractors compete with us for these scarce resources.

Japan is turning out engineers like crazy! They cost less to
operate 80K vs 120K according to IBM, and they apparently work
harder.

Japan is frightening mostly because they have some real deep beliefs and rituals. As a secondary benefit, as we mix with them, we both change a little.

I say let's go for a really aggressive engineering build plan in Japan.

(Also, they do know something about quality. I'd like to learn
this from them. As I re-read my diary when I
visited there 3 years ago, I realize it did have a major affect on
me and attitudes and understanding in this regard.)

GB2.S6.33
00 BURT DECGRAM ACCEPTED S 5706 O 31 17-AUG-80 22:00:53

****
* d i g i t a l *
****

TO: ROY MOFFA DATE: SUN 17 AUG 1980 9:58 PM EDT
STEVE TEICHER FROM: GORDON BELL
JOE ZEH DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: DRAFT OF BUYING STANDARD SEMIS AND INTERFACING TO SI VALLEY

Subject: Policy update on microprocessors and semiconductor interfaces

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using the one chip
    peripherals
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4. be the leader in CAD so as to reduce turn around and deal with cpu's
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What are your thoughts on this? Who should this go to? What have I left out?

GB1.S6.32

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.___.___.___.___.___.___.___.
!   !   !   !   !   !   !   !
! d ! i ! g ! i ! t ! a ! l !          I n t e r o f f i c e
M e m o
!___!___!___!___!___!___!___!
```

TO: MAY MSG CPR @DOMS   DATE: MON 25 APR 1983 10:42 AM DST

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5197946571

SUBJECT: FUNDING FOR NATIONAL SCIENCE FOUNDATION PROGRAM

Please send this MAILGRAM to:

Senator Edward Kennedy, Russell Senate Office Building,
  Washington, D.C. 20510

Please send Carbon Copy MAILGRAM to:

Dr. Wesley Clark, Committee on Labor and Human Resources
  U.S. Senate, Washington, D.C. 20510

25 April 1983

Senator Edward Kennedy
Russell Senate Office Building
Washington, D. C. 20510

Dear Senator Kennedy:

I would like to support your effort to secure additional funding for a National Science Foundation program aimed at two, important classes of Supercomputers: Symbolic Processing and Numerical Processing. Such an effort is needed if we are to maintain the current lead we have in computing.

The Japanese have a strong MITI based effort in both of these areas, and I believe stand a good chance to take over the lead. If this happens, I believe our industry could go from a strong export position, to a net drain as in the basic steel and manufacturing industries such as automobiles. As evidence of their ability to pull off such a program, one should note that their semiconductors program gave them their current leadership position in: high speed circuits (both ECL and potentially new configurations), high speed memories, large memories, gate arrays, and microprocessor peripherals. In fact, the only area we lead are microprocessors.

Such a program must be a balance of academia, the defense department and industry because we have a limited supply of talent. The talent problem will become more acute since the new laws on emigration will further reduce the supply of talented engineers, many of whom we

train.

A concerted program of 10 to 40 million dollars per year would be appropriate. A consortium of companies knowN as MCC (for Microelectronics and Computer Company) is planning to spend about this amount to accomplish the same goal, thus it would be appropriate to have the government spending in roughly the same amount in order to have a balanced program. (MCC's yearly budget will be about 40 million dollars of which 10 million is directed at the computer designs. The remainder is support for the technology and computer aided design for the machines.)

Again, let me applaud your effort and offer any support you feel is necessary.

Sincerely,

C. Gordon Bell
Vice President, Engineering
Professor, On Leave, Computer Science and Electrical Engineering,
Carnegie-Mellon University

GB5.14

CC: Dr. Wesley Clark
Committee on Labor and Human Resources
U. S. Senate
Washington, D. C. 20510

WPS USERS - Leave HP mode and type <CR>

<subj>MANLEY MANAGEMENT AND MARKETING SERVICES CORP. (MMMS)
<from>MANLEY, ROBERT R.
<to>BELL, GORDON
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<filed>
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<subj>TECH-SEARCH CONSULTANTS--RESUME'S (MR. JOSEPH ODUNAIYA, MR. ABASS WESSEN)
<from>ROCK, JAMES P.
<to>BELL, GORDON
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<log#>9-66
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<answer>
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<subj>FOONLY, XEROX PARC
<from>PETIT, PHIL
<to>BELL, GORDON
<date>80/9/26
<date rec>9/30/80
<log#>9-65
<dispo/date>ULF FAGERQUIST - 10/1/80
<message>DO I SAY THIS? WHAT TO LOOK AT IT? DEAR PHIL, WE

SHOULD HAVE TALKED SEVERAL YEARS AGO. DEC HAS NO INTEREST IN THE FOONLEY AT THIS TIME.
<answer>
<f/u>10/10/80
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<subj>NATIONAL ACADEMY OF ENGINEERING
<from>LIEBOWITZ, HAROLD
<to>BELL, GORDON
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<subj>UNIVERSITY OF CALIFORNIA, BERKELEY
<from>PATTERSON, DAVID A.
<to>BELL, GORDON
<date>80/9/23
<date rec>9/29/80
<log#>9-63
<dispo/date>CC: WAYNE ROSING, DICK ECKHOUSE, ANDY, JOE MEANY, DEMMER, LACROUTE, SAM - 9/30/80
<message>WHAT SHOULD I SAY?
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<f/u>10/10/80
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<subj>RESUME' -- JOHN T. MITZEL
<from>MITZEL, JOHN T.
<to>BELL, GORDON
<date>80/9/27
<date rec>9/29/80
<log#>9-62
<dispo/date>ARMAND LA VALLE - 9/30/80
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<answer>
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<subj>NATIONAL ACADEMY OF ENGINEERING
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<to>BELL, GORDON
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<subj>JOB BROKERS INC.
<from>CARLSON, GEORGE E. JR.
<to>BELL, GORDON
<date>80/9/25
<date rec>9/29/80
<log#>9-60
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<subj>NATIONAL SCIENCE FOUNDATION
<from>CHERN, BERNARD
<to>BELL, GORDON
<date>80/9/?
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<dispo/date>BERNARD CHERN - 9/30/80
<message>I'M SORRY I DON'T HAVE TIME TO REVIEW THIS.
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<subj>NEW YORK UNIVERSITY
<from>SCHWARTZ, JACK
<to>DR. WILLIS WARE
<date>80/9/19
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<subj>NATIONAL RESEARCH COUNCIL
<from>GOODWIN, IRWIN
<to>BELL, GORDON

<date>80/9/22
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<dispo/date>TO LETTERBOOK (GB1.S7.33) - 10/15/80
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<subj>UNIVERSITY OF NEWCASTLE UPON TYNE, THE
<from>RANDELL, BRIAN
<to>BELL, GORDON
<date>80/9/19
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<log#>9-56
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<subj>MAILGRAM--WESTERN UNION (MAILGRAM SERVICE CENTER, MIDDLETOWN, VA 22645)
<from>RABBAT, GUY
<to>BELL, GORDON
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<date rec>9/24/80
<log#>9-55
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<ret-gb>

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<subj>EXCEL PERSONNEL -- RESUME' GL-429
<from>RYE, MARY
<to>BELL, GORDON
<date>80/9/17
<date rec>9/23/80
<log#>9-54
<dispo/date>ARMAND LA VALLE - 9/23/80
<message>PLEASE HANDLE.
<answer>
<f/u>
<filed>
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<subj>RESUME' -- RUSSELL TURNER
<from>TURNER, RUSSELL
<to>FORBES, MARY JANE
<date>80/9/22
<date rec>9/23/80
<log#>9-53
<dispo/date>ARMAND LA VALLE - 9/23/80
<message>PLEASE HANDLE. RUSSELL WORKED ONE SUMMER FOR THE MUSEUM. HE IS A VERY BRIGHT, HARD WORKING YOUNG MAN.
<answer>
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<filed>
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<subj>RESUME' -- KENT K. CURTIS
<from>CURTIS, KENT K.
<to>BELL, GORDON
<date>80/9/18
<date rec>9/23/80

<log#>9-52
<dispo/date>CC: ARMAND, BOB GLORIOSO, BJ - 9/29/80
<message>ANY IDEAS?
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<f/u>
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<subj>HYDRA PRODUCT DESCRIPTION, VOL. 2 (COPY #29)
<from>HYDRA PRODUCT MANAGEMENT
<to>BELL, GORDON
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<date rec>9/23/80
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<dispo/date>
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<filed>
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<subj>PROOFS
<from>SIEWIOREK, DANAIEL P.
<to>BELL, GORDON
<date>80/9/?
<date rec>9/22/80
<log#>9-50
<dispo/date>DAN SIEWIOREK - 9/29/80
<message>WATCH OUT! k SHOULD BE K FOR KILO. CAN YOU GET A STUDENT TO READ THIS? (THE KIVIAT GRAPH PART NEEDS SOME DETAILED REVIEW.)
<answer>
<f/u>
<filed>
<ret-gb>CC: OF PAGES WITH GB'S NOTES.
<roll>

<>

<subj>TEXAS INSTRUMENTS
<from>CRAGON, HARVEY G.
<to>BELL, GORDON
<date>80/9/17
<date rec>9/22/80
<log#>9-49
<dispo/date>TO GWEN FOR FILE (GB1.S15.26) - 10/2/80
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<subj>HERTRICH DEVELOPMENT INC.
<from>HERTRICH, FRED
<to>BELL, GORDON
<date>80/9/15
<date rec>9/22/80
<log#>9-48
<dispo/date>FRED HERTRICH CC: SAM, SNYDER, BJ, GUTZ, KEATING, BRENDER, GROVE -- ALL PAGES (PHIL ARNOLD, JACK BROWN, DEMETRIOS, RIGGLE, SAVIERS--FIRST PAGE)
<message>THIS IS A VERY NICE PAPER. THERE SHOULD BE MORE PAPERS LIKE IT. I DOUBT IF THE ACADEMIC JOURNALS WILL PUBLISH IT. (IT SHOULD BE IN IEEE SOFTWARE ENGINEERING OR CACM OR ACM SIGLANG). HOWEVER, IT WOULD ALSO BE USEFUL IN COMPUTER DESIGN OR ANOTHER EE-BASED (NON-CS BASED) MAGAZINE. GO AHEAD AND PUBLISH IT! OTHERS MAY HAVE COMMENTS...THEY SHOULD FEED TO YOU.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>LEUVEN RESEARCH & DEVELOPMENT
<from>BOUCKAERT, JOS
<to>BELL, GORDON
<date>80/9/?
<date rec>9/22/80
<log#>9-47
<dispo/date>STEVE TEICHER - 9/29/80
<message>FYI.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>NATIONAL ACADEMY OF ENGINEERING
<from>BRIAN, P.L. THIBAUT
<to>BELL, GORDON
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<date rec>9/22/80
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<roll>
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<subj>FAIRCHILD CAMERA AND INSTRUMENT CORP.
<from>LONGO, THOMAS A.
<to>BELL, GORDON
<date>80/9/19
<date rec>9/22/80
<log#>9-45
<dispo/date>
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<f/u>
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<ret-gb>
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<subj>SIRIUS
<from>POUZIN, L.
<to>BELL, GORDON
<date>80/9/12
<date rec>9/22/80
<log#>9-44
<dispo/date>BOB GLORIOSO - 9/29/80
<message>DO I NEED TO ANSWER THIS OR IS IT STRAIGHTENED OUT YET?
<dispo/date>TO LETTERBOOK (GB1.S7.30) - 10/14/80
<answer>
<f/u>10/3/80
<filed>
<ret-gb>
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<subj>UNIVERSITY OF MANCHESTER
<from>KILBURN, TOM
<to>BELL, GORDON
<date>80/9/15
<date rec>9/22/80
<log#>9-43
<dispo/date>TO LETTERBOOK (GB1.S7.32) - 10/14/80
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<subj>TWX--UNIVERSITY OF NEWCASTLE UPON TYNE

<from>RANDELL, BRIAN
<to>BELL, GORDON
<date>80/9/22
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<subj>TEXAS INSTRUMENTS FOUNDATION
<from>HARRIS, S.T.
<to>OLSEN, KENNETH H.
<date>80/9/15
<date rec>9/22/80
<log#>9-41
<dispo/date>SAM - 9/29/80
<message>WOULD YOU FILL THIS OUT FOR STRECKER AND CUTLER?
<answer>YES. SENT NOMINATION FORM INTO MR. S.T. HARRIS FOR STRECKER AND CULTER. - 12/24/80
<f/u>12/1/80
<filed>
<ret-gb>12/24/80
<roll>
<>

<subj>SOUTHWEST RESEARCH INSTITUTE
<from>ABRAMSON, H. NORMAN
<to>NELSON, MS. HENRIETTE
<date>80/9/16
<date rec>9/19/80
<log#>9-40
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<f/u>

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<subj>RAND
<from>WARE, WILLIS H.
<to>SCHWARTZ, DR. JACOB T.
<date>80/9/16
<date rec>9/19/80
<log#>9-39
<dispo/date>CALENDAR NOV. 6 MEETING CS&TB
<message>
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<f/u>
<filed>
<ret-gb>
<roll>
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<subj>TERADYNE
<from>D'ARBELOFF, A.V.
<to>BELL, GORDON
<date>80/9/18
<date rec>9/19/80
<log#>9-38
<dispo/date>KEN OLSEN, CC: MARKETING COMM., DALEY, STEWART, CHISHOLM, VLACH, CRAWFORD - 9/23/80
<message>I'M STILL ON THE POSITION: ELECTRONIC MAIL IS NOT READY TO BE "DISTRIBUTED", BUT SHOULD BE DONE LIKE OUR OWN EMS SYSTEM. WE SHOULD TEST MARKET A VAX BASED EMS USING VAX MUMPS AFTER WE HAVE RUN IT INTERNALLY FOR AWHILE. CSS WOULD TAKE RESPONSIBILITY. NOTE THIS RUNS WITHIN LDP!! THE "OFFICIAL DECMAIL PRODUCT" IS NOT CLEARLY DEFINED/BEING IMPLEMENTED.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>

<>

<subj>C.N.C. OWERS
<from>OWERS, C.N.C.
<to>BELL, GORDON
<date>80/8/25
<date rec>9/19/80
<log#>9-37
<dispo/date>ARMAND LA VALLE - 9/22/80
<message>PLEASE HANDLE.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>AUTOMATIC COMPUTER COMPANY INC. (MR. RICHARD SIEGAL)
<from>BROWN, CLAY (DEC--RL)
<to>BELL, GORDON
<date>80/8/11
<date rec>9/10/80
<log#>9-36
<dispo/date>BOB GLORIOSO - 9/18/80
<message>PLEASE HANDLE THE ATTACHED. GB - "CIRCULATE + LOOK BUT PROBABLY DON'T WANT TO PURSUE". PLEASE CALL SIEGAL WITH OUTCOME. (312-641-6090), THANKS.
<answer>TALKED TO RICH SIEGAL 10/9/80. RELAYED THAT CLAY WAS MAIN CONTACT FOR OEM HELP & WE WERE NOT INTERESTED IN THE CURRENT DISCLOSURE BUT MAY BE INTERESTED IN OTHER THINGS HE WISHES TO DISCLOSE IN OTHER AREAS. - 10/9/80
<f/u>
<filed>FILE #12 - 10/9/80
<ret-gb>
<roll>
<>

<subj>BELL LABORATORIES
<from>O'NEILL, E.F.

<to>BELL, GORDON
<date>80/9/15
<date rec>9/18/80
<log#>9-35
<dispo/date>
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<subj>MSL INTERNATIONAL CONSULTANTS LTD.
<from>REEDER, MICHAEL S.
<to>BELL, GORDON
<date>80/9/16
<date rec>9/18/80
<log#>9-34
<dispo/date>
<message>
<answer>
<f/u>
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<subj>BOSTON UNIVERSITY
<from>TRIOLO, VICTORIA M
<to>BELL, GORDON
<date>80/9/15
<date rec>9/17/80
<log#>9-33
<dispo/date>JOHN MEYER - 9/19/80
<message>YOURS.
<answer>
<f/u>
<filed>
<ret-gb>

<roll>
<>

<subj>FANNON METAL INDUSTRIES INC.
<from>MUNGER, CRAIG L.
<to>BELL, GORDON
<date>80/9/15
<date rec>9/17/80
<log#>9-32
<dispo/date>
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<answer>
<f/u>
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<ret-gb>
<roll>
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<subj>RESUME' -- KEITH D. ORRELL
<from>ORRELL, KEITH D.
<to>BELL, GORDON
<date>80/9/16
<date rec>9/17/80
<log#>9-31
<dispo/date>ARMAND LA VALLE - 9/18/80
<message>PLEASE HANDLE.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>INTEL
<from>O'NEIL, RUSS
<to>BELL, GORDON
<date>80/9/10
<date rec>9/16/80
<log#>9-30

<dispo/date>
<message>
<answer>
<f/u>
<filed>
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<roll>
<>

<subj>BHABHA ATOMIC RESEARCH CENTRE--NUCLEAR RESEARCH LABORATORY
<from>KOUL, RAMESH
<to>BELL, GORDON
<date>80/8/27
<date rec>9/16/80
<log#>9-29
<dispo/date>SENT ORIGINAL LETTER BACK WITH BOOK, "DESIGNING COMPUTERS AND DIGITAL SYSTEMS" - 9/18/80
<message>ASK YOUR LOCAL SALES REP FOR THE BOOK "LOGIC SYSTEM DESIGN HANDBOOK".
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>RESUME' -- NED COOPER
<from>COOPER, NED
<to>BELL, GORDON
<date>80/9/12
<date rec>9/15/80
<log#>9-28
<dispo/date>ARMAND LA VALLE - 9/16/80
<message>PLEASE HANLDE.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>

<>

<subj>STANFORD RESOURCES INC.
<from>CASTELLANO, JOSEPH A. CLARY, ROBERT M.
<to>OLSEN, KENNETH H.
<date>80/9/?
<date rec>9/15/80
<log#>9-27
<dispo/date>BILL PICOTT, CC:KEN - 9/19/80
<message>SURE.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>NATIONAL ACADEMY OF ENGINEERING
<from>PERKINS, COURTLAND D.
<to>BELL, GORDON
<date>80/9/8
<date rec>9/15/80
<log#>9-26
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>UNIVERSITY OF CALIFORNIA, SAN DIEGO
<from>REYNOLDS, ROGER
<to>BELL, GORDON
<date>80/9/9
<date rec>9/15/80
<log#>9-25
<dispo/date>

<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>DATAPRODUCTS CORPORATION
<from>TOMASH, ERWIN
<to>BELL, GORDON
<date>80/9/10
<date rec>9/15/80
<log#>9-24
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>APPLIANCE
<from>CHASE, DANA JR.
<to>BELL, GORDON
<date>80/9/?
<date rec>9/15/80
<log#>9-23
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>HODGE COMPUTER RESEARCH CORPORATION

<from>HODGE, WINSTON W.
<to>BELL, GORDON
<date>80/9/5
<date rec>9/15/80
<log#>9-22
<dispo/date>CIRC. OOD, CLITES, RODGERS - 9/19/80
<message>ANY INTEREST.
<answer>NO INTEREST - 2/19/81
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>EMERSON ELECTRIC CO.
<from>FULLER, R.H.
<to>BELL, GORDON
<date>80/9/9
<date rec>9/15/80
<log#>9-21
<dispo/date>HOLDING IN RED TO CALL FOLDER IN CASE HE CALLS
9/29/80 Mon 8:07
FILED IN "RESUME" 12/29/80 Mon 9:56
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>TOYO CORPORATION
<from>NAGAOKA, SHIGEO
<to>BELL, GORDON
<date>80/9/4
<date rec>9/12/80
<log#>9-20
<dispo/date>KEN - 9/18/80
<message>FYI.
<answer>

<f/u>
<filed>FILE #13 - 9/18/80
<ret-gb>
<roll>
<>

<subj>REQUEST FOR EMPLOYMENT
<from>BOOTHBY, CHUCK
<to>VP RESEARCH & DEVELOPMENT
<date>80/9/5
<date rec>9/12/80
<log#>9-19
<dispo/date>ARMAND LA VALLE - 9/15/80
<message>PLEASE HANDLE.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>UNIVERSITY OF NEWCASTLE UPON TYNE
<from>RANDELL, BRAIN
<to>BELL, GORDON
<date>80/9/2
<date rec>9/12/80
<log#>9-18
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>DENNIS AND COMAPNY INC.
<from>GANAPOL, ALAN
<to>BELL, GORDON

<date>80/9/8
<date rec>9/11/80
<log#>9-17
<dispo/date>
<message>
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<f/u>
<filed>
<ret-gb>
<roll>
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<subj>UNIVERSITY OF TEXAS AT AUSTIN, THE
<from>WOODSON, H.H.
<to>BELL, GORDON
<date>80/9/5
<date rec>9/11/80
<log#>9-16
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>NATIONAL RESEARCH COUNCIL
<from>BLACKBURN, JACOB F.
<to>BELL, GORDON
<date>80/9/5
<date rec>9/10/80
<log#>9-15
<dispo/date>JACK BLACKBURN - 9/15/80
<message>OK BY ME. NOTE ONE ADDITION.
<answer>
<f/u>
<filed>
<ret-gb>
<roll>

<>

<subj>TWX--DR. F. BAUR, SIEMENS CORP.
<from>BAUR, DR. F.
<to>BELL, GORDON
<date>80/9/10
<date rec>9/10/80
<log#>9-14
<dispo/date>
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<f/u>
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<roll>
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<subj>CARNEGIE-MELLON UNIVERSITY
<from>SIEWIOREK, DANIEL P.
<to>BELL, GORDON
<date>80/9/4
<date rec>9/9/80
<log#>9-13
<dispo/date>
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<f/u>
<filed>
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<subj>NATIONAL ACADEMY OF ENGINEERING
<from>RODRIGUEZ, LADY
<to>BELL, GORDON
<date>80/9/5
<date rec>9/9/80
<log#>9-12
<dispo/date>

<message>
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<f/u>
<filed>
<ret-gb>
<roll>
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<subj>UNIVERSITY OF NEWCASTLE UPON TYNE
<from>RANDELL, BRIAN
<to>BELL, GORDON
<date>80/8/28
<date rec>9/8/80
<log#>9-11
<dispo/date>TWX TO BRIAN - 9/15/80
<message>SEE LETTERBOOK (GB1.S6.38)
<answer>
<f/u>
<filed>
<ret-gb>ORIGINAL TO MJ - 9/15/80
<roll>
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<subj>XEROX
<from>GOLDBERG, ADELE
<to>SAMBERG, LARRY
<date>80/9/2
<date rec>9/8/80
<log#>9-10
<dispo/date>ORIGINAL-GB, CC:LARRY SAMBERG, STONEY BALLARD - 9/10/80
<message>(ARE YOU DOING IT FOR GIGI II?)
<dispo/date>CC: TOM SIEKMAN - 9/11/80
<message>FYI.
<answer>
<f/u>9/26
<filed>
<ret-gb>ORIGINAL - 9/11/80
<roll>
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<subj>SOUTHWEST RESEARCH INSTITUTE
<from>ABRAMSON, H. NORMAN
<to>BELL, GORDON
<date>80/9/3
<date rec>9/8/80
<log#>9-9
<dispo/date>
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<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>NATIONAL ACADEMY OF ENGINEERING
<from>NELSON, MRS. E. HENRIETTE
<to>BELL, GORDON
<date>80/9/3
<date rec>9/8/80
<log#>9-8
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>DESIGN AUTOMATION INC.
<from>SOKAL, NATHAN O.
<to>BELL, GORDON
<date>80/9/2
<date rec>9/4/80
<log#>9-7
<dispo/date>GRANT SAVIERS - 9/5/80
<message>OK?

<answer>OK BY ME. THIS WAS MASSBUS BACKPLANE FOR RM03 (3+ YEARS OLD!) - 9/16/80
<f/u>
<filed>
<ret-gb>ORIGINAL - 9/16/80
<roll>
<>

<subj>RESUME' - EARL S. WAJENBERG
<from>WAJENBERG, EARL S.
<to>BELL, GORDON
<date>80/9/4
<date rec>9/4/80
<log#>9-6
<dispo/date>
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<f/u>
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<ret-gb>
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<subj>RYAN, ELLIOTT AND COMPANY INC.
<from>RYAN, JOHN
<to>OLSEN, KENNETH H.
<date>80/8/28
<date rec>9/4/80
<log#>9-5
<dispo/date>JOHN HOLMAN CC: ULF, LARRY - 9/8/80
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
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<subj>TWX--SIEMENS

<from>BAUR, DR. F.
<to>BELL, GORDON
<date>80/9/4
<date rec>9/4/80
<log#>9-4
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>BOSTON RESEARCH DIRECTORS' CLUB
<from>TILL, DEREK E.
<to>BELL, GORDON
<date>80/9/?
<date rec>9/3/80
<log#>9-3
<dispo/date>LARRY PORTNER - 9/4/80
<message>WANNA GO? SHOULD BRUCE?
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

<subj>CNC INDUSTRIES INC.
<from>MILFORD, WILLIAM W.
<to>BELL, GORDON
<date>80/8/26
<date rec>9/2/80
<log#>9-2
<dispo/date>JACK SMITH - 9/2/80
<message>FYI.
<answer>
<f/u>
<filed>

<ret-gb>
<roll>
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<subj>NATIONAL ACADEMY OF ENGINEERING
<from>RODRIGUEZ, LADY
<to>BELL, GORDON
<date>80/8/29
<date rec>9/2/80
<log#>9-1
<dispo/date>
<message>
<answer>
<f/u>
<filed>
<ret-gb>
<roll>
<>

His mission:
1. What were we doing? I was vague except to say we're a sales company interested in some interesting product groups and he queried about Schanin who walked in and said hello. He's going to contact both Parallex and Foundation.

2. Get me to give a talk at their AEA.

3. Get me to join their board. It's well financed by H&Q, Perkins et al, etc.

I said what if we joined forces in some form to beat everyone by being able to license board layouts etc. He said: We are open to everything, including financing, joint ownership, etc. the enemy is outside!

He's returning Oct 28 in the afternoon with his marketing person or their president to discuss any next step. We need to talk...!
ALL of us should be present to pursue a discussion.

Here's what would make strong business sense:

1. Joint development across the board. Note for the first time in history a complete second source.
2. We start building and selling their product.
3. We start designing lamP (which they have access to)... and this is our contribution.

With an arrangement like this, I could get a complete premier team (I have a few friends at a nearby company which could be attracted) on lamP at CMU (to move here) and built by Hydra Company.

Dave stated they were doing well. The company is best characterized as a technical version of Convergent Technology... to go after Masscomp. It is not their intent to build a sales force, but to appeal to the technical OEM. I said we were compatible.

He has 35 engineers equally divided into hardware and software. They'll be shipping in about 6+ months with the hardware about to enter debug stage. They are building a performance range UNIX (of course) multiprocessor (1 to 10) on the National part in something like two basic forms. He made strong arguments for it, and said it's equal to the same speed Motorola. He claims the part is doing well with software because all the VAX software is being ported over because the two architectures are so similar. It sounds like Hydra... the board area is 12 x 12... or European version. He was skeptical of the DEC / National bus agreement being significant, since the boards are too small.

CC: DAVE SCHANIN

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION DATE: SUN 11 OCT 1981 22:52 EST

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION DEPT: ENG STAFF

EXT: 223-2236

LOC/MAIL STOP: ML12-1/A51

SUBJECT: GETTING A PERSONAL COMPUTER SERVER ASAP

Bob and BJ, how are we coming here?

We need to move ahead asap to build and test a PERSONAL COMPUTER SERVER under the direction of Bob. Let's use the multi-terminal computer system we are going to put in the stores, but in addition, it should run under some operating system so that it can be a package we offer on existing systems. The system would probably end up on every operating system and would have general applicability in universities (to get our NOR up there), laboratories and large organizations to start with.

The goal would be to use our conventional systems as a Personal Computer Server to store files, print documents (either on a line printer or LQP), and to communicate with other systems using various protocols.

PERSONAL COMPUTER SERVER

FILE SERVICE
Apple II, CP/M, TRS 80 and 278

PRINT SERVICE
LA120, LP05, LA24, and LQP02. Extended to NIP when available.

COMMUNICATIONS SERVICE
3270 emulation, SNA, DECNET and NI

These facilities should be layered on an existing operating system such as RSX-11/M. If we did this, the package would also run on VMS. It probably will have to end up being offered on everone of our systems including: 10, 20, RSTS, M, and VMS.

There should be lots of systems out there we can look at for a
product definition including those in universities and laboratories on everyone of our operating systems.

Can we move to survey what's out there, then define and breadboard this?

"TO" DISTRIBUTION:

MIKE GUTMAN BILL JOHNSON ROBERT MCKENZIE

"CC" DISTRIBUTION:

ROSE ANN GIORDANO GVPC: JOE MEANY
KEN OLSEN LARRY PORTNER

GB3.S1.27

Would it be possible to have a software only service organization--given the fact that most of what we'll be selling and installing is software? We could accomplish total service by acknowledging that hardware service today is predominantly board swapping! What do hardware-oriented folks do? If we have a "single" staff, we avoid the cost that other manufacturers have.

This makes our total field product: selling, training, installing (mostly software), service/repair (mostly software), helping plan networks, and possibly managing installations or stockrooms.

What youse think?

GB7.19

26 January 1983

Mr. H. Norman Abramson
Chairman, NAE Awards Committee
National Academy of Engineering
2101 Contitution Avenue, N.W.
Washington, D.C. 20418

Dear Norman Abramson:

I would like to nominate Seymour Cray, who founded Cray Computer Corporation, for the 1983 NAE Founders Award. Cray was nominated to NAE several years ago and ranked number one, but declined membership.

Cray has led the world in high speed computers for the last twenty years by designing and supplying the CDC 6600, 7600 and Cray 1.

I think the former nomination, by Fred Brooks, adequately represents that he clearly deserves the Founders Award.

Sincerely,

Gordon Bell
Vice President, Engineering

GB4.S1.18

00 CORE DECGRAM ACCEPTED S 000232 O 32 10-OCT-82
12:29:55

****
* d i g i t a l *
****

TO: MIKE GUTMAN DATE: SUN 10 OCT 1982
12:23 PM EDT
JULIUS MARCUS FROM: GORDON BELL
cc: KEN OLSEN DEPT: ENG STAFF

EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

MESSAGE ID:
5178223268

SUBJECT: SOME SUPPORT FOR LOW END, SHARED 11'S

There is some market support.

The irony of the push to PC's is that most of us use shared systems in order to share files, printers, modems, etc. and this has to continue until we have good communicating nets ala Ethernet. On the other hand we're rushing into the PC fray yelling me too. The PC folks are rushing at us saying you have to share systems, and I'm just waiting for us to internally start working on shared PC's.

We need to figure out how to make it possible for the buyer to get what he needs. Why such a system wouldn't be sold in a store (not ours) is unclear to me. I know we don't have the resources to sell these directly... as evidenced by the drift to higher and higher systems.

ATTACHED: MEMO;36

****
* d i g i t a l *
****

TO: GORDON BELL
10:45 PM EDT

DATE: SAT 9 OCT 1982

FROM: HARVEY WEISS
DEPT: GSG
EXT: 264-7588
LOC/MAIL STOP: HZ/HZ

MESSAGE ID: 5178223193

SUBJECT: RE: SHARED LPC (F AND J VERSIONS) VS PC'S

RIGHT ON GORDON.

I HAVE BEEN TRYING TO PUT ONE IN THE FOAC SHOW LATER THIS MONTH WITH A SIGN ON IT:

JUST UNDER 1000 DOLLARS FOR A DECWORD TERMINAL.

IF I DON'T MAKE THIS SHOW, WE'LL MAKE THE NEXT.

YOU ARE RIGHT, WE SEEM TO HAVE FORGOTTEN WHAT WE HAVE IN THE PDP-11. PARTICULARLY THE "LOW END" WHICH IS AS USEFUL AS THE END OF 7 YEARS AGO.

WE ARE STILL PUSHING THEM INTO THE GOVERNMENT.

ONCE WE GET A TEMPEST CABINET CERTIFIED AROUND THE PC FORMAT (KEYBOARD, MONITOR, BOX), WE WILL ATTACK THE LCP.

10-OCT-82 3:01:01 S 00087 HZEM
HZEM MESSAGE ID: 5178158152

GB3.S8.62

00 CORE DECGRAM ACCEPTED S 000440 O 145 09-OCT-82 21:03:58

****
* d i g i t a l *
****

TO: MIKE GUTMAN DATE: SAT 9 OCT 1982 8:41 PM EDT

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION

DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5178123176

SUBJECT: SHARED LPC (F AND J VERSIONS) VS PC'S

Having just about gotten a great, personal computer in the 730 as our (Mary Jane and mine... and a few other folks), I would like to advocate a type of sharing that we pioneered and I fear we're about to give up.

The personal folks are telling us that they are going to really
sell a lot of systems (eg. 1.5B in 84 for the 350) and I believe
them. The Decmate II and Rainbow have great projections too.
I'm looking forward to new computers here at home (have 2 DECmate I's)
that can do graphics and have better editors and let us do some
real computing, and the VAX at work will be great because it
has no limits in terms of anything I can think of relative to
what I am able to find time to program it to do..

Let me urge you to push what is I think is our most underrated
system, the LPC with Aztec before others get there from all
other directions.

The shared 11 with 50 megabytes as an incredible machine,
providing over 1, 4 drawer file cabinet's worth of data and
allowing a group of say 8 to 16 have an 11/70 all to themselves.
This is like an 11/70 with an RM03 (or 2 RK07's)! The response
should be fbeat the hell out of any PC for say 16 users.

The cost say for 8 users appears to be about (6.5K + 8 x 0.4) / 8
or 1.21K per user. If you put 8 more terminals on it, then this
comes out to .8K. Both of these beat our lowest cost PC's by
quite a lot. Let me describe the virtues of shared systems. Not
every user has to deal with his own files and systems, thus not
everyone becomes a system's programmer. You can share files,
printers, modems, servicepeople, and this lets you move work
around the system easily and communicate with one another.

We've sold a pile of systems like this (eg. RSTS) and the company really grew to its present 4B size selling systems like this eventhough the systems you have are much smaller in cost.

Furthermore, WANG sells shared systems like this and has also grown to 1B on large systems, not the PC's or standalone systems.

Somehow, we all have to find someone and someway to get this lovely, low cost 11/70 out to the world along with the PC's because it seems that many of the PC folks are making shared systems now too. Also, it would seem that the shared system would be attractive to many of the people who sell and resell and otherwise handle our systems because there's more margin.

During the up and coming budget pass I hope you'll be able to fire people up with the inherently lower cost, higher performance and greater advantages of this type of computer. We need to figure out how to sell them too!

"CC" DISTRIBUTION:

ROGER CADY	BARRY CIOFFI	JIM CUDMORE
BILL KIESEWETTER	OPERATIONS COMMITTEE:	PEG:
HARVEY WEISS	JIM WILLIS	

GB3.S8.61

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+---------------------------+
|   |   |   |   |   |   |   |
| d | i | g | i | t | a | l |   i n t e r o f f i c e   m e m o r a n d u m
|   |   |   |   |   |   |   |
+---------------------------+
```

To: Lloyd Fugate, MR2-2/M65
Bill Wise, PK3-1/M86

Date: 2 NOV 78
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

follow up 11/16/78

Please send me the Shoebox I, II, III products information.

```
GB:ljp+---------------------------+
|   |   |   |   |   |   |   |   |
| d | i | g | i | t | a | l |   i n t e r o f f i c e   m e m o r
a n d u m
|   |   |   |   |   |   |   |   |
+---------------------------+
```

To: Lloyd Fugate, MR2-2/M65
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GB:ljp

ABACUS
Abacus 93.80 - 50; 95.80 - 7; 181.81 - 10; 314.84 - 3
Soroban 94.80 - 22

COUNTING AND SIMPLE "DEVICES"
Counting Beads B141.80 - 9; B178.81 - 59
Spelling and Counting Board B148.81 - 2
HDC Industries, "Human Digital Calculator: Add'em up Finger Machine" B285.83
Richmond School Furniture Co., Munci, Indiana, "Junior

Spelling and Number Board No. 50" B323.84 - 20

CALCULATORS - Pascal like
Addac, "Addac" B221.82 - 15
Addiator, Arithma B262.83 - 6; 87 -10
ADDI-COSMOS, "B.U.G Calculator" B131.80 - 288
The Adding Pencil Co., The Adding Pencil, Model B B267.83 - 19
Addometer x85.78 - 30; 96.80 - 14
American Can Company, "American Adding Machine" B137.81 - 125; - 50
Automatic Adding Co., "Golden Gem Adding Machine" B266.83 - 10; 81 - 20
"BABY CALCULATOR" 76.80 - 24; 81 - 8
Bell punch "Plus" 81.80 - 25;
"Calculator" (pascal strip) B237.82 - 3
Exactus 36.79 -
Fairgrove Adder 35.79
Felt & Tarrant Mfg Co.,, "Comptometer"
metal 9.76 - 10; 57.80 - 75;
wood 174.81 - 400
electrified B372.86 - 25; - 25
The Lightning Adding Machine Co. "The Lightning Adder" B260.83 - 10
Pascal Adder B150.81 Roberto Guatelli - 3500
"Perfection Self-adding ruler" B375.87 - 40
"Precise" B188.81 - 25
Quixsum Model C 38.79 - ?
Ratchet Adder B213.82 - 360
"SWIFT" HANDY CALCULATOR B301.84 - 2
Tasco, "Pocket Arithmometer" B309.84 - 10
Todd Protectograph Co., "Star Adding Machine" B 340.85 - 8; 87 - 37
Victor Adding Machine Co., 36 Second St., Sand Francisco 5, Ca., Adding machine B370.86 30

CALCULATORS - Leibniz like
Bunzel Mfg., Vienna, Thomas Arithmometer B143.81 - 840
Contina Ag Mauren,
"Curta" Type II B325.84 - 300
"Curta" Type II B326.84; 87 - 265
"Curta" Type I B87.79

HANS W. EGLI, Co., Millionaire #539 1.75 - 500; #1523 17.78 - 275; #1023
91.76 - 1000; #4493 B161.81- 840; #272 - B136.81 - 800
Odhner, "Original Odhner" B135.80 - 50
Ludwig Spitz & Co., "TIM Time is Money" B243.82 - 220
Tates 22.80- 1276;
Thales 84.79 - 50;
C. X. Thomas de Colmar,
Arithmometer B214.82 - 3000
Arithmometer #1583 - 376; 840?

CAlCULATORS - Monroe like, mechanical/electro-mechanical
Allen-Wales Printing Adding Machine 89.90 - 35
Burroughs,
"Burroughs Calculator" B155.81 - 5; B182.81 - 3
"The Burroughs Adding and Listing Machine" 64.80 - 250; B156.80 - 225; B157.81 - 75
"Burroughs" B173.81 - 19
Model 5 7.76 - 10;
Model A 8.76, 14.76 - 10;
Printing Adding machine 42.80 - 20;
Dalton, Adding and listing machine B244.82 - 35
Friden,
Model D-8 12.79 - 10;
Model 132 23.78 - 10
Marchant 35;
Monroe
"High Speed Adding Calculator" 13.76 - 10;
No. 1 10.76, 90.79 - 10;
Monromatic 11.76, 40.79 - 10;
"Monroe" B299.80 - 25
Wales visible adding machine 88.80 - 175; 35
Wolverine "Adding machine" - 288.33 - 10

ELECTRONIC CALCULATORS
Casio, Mini Card fx-48 Scientific Calculator B283.78
Commodore US*14, Digital Calculator B284.83 - 3
HP 35 - 34.79
Panasonic, "CompuVoice" B239.82
Stanley, Electronic Calculator B324.84 - 2

SECTORS Navigators

Boxwood 21.78 465; B168.81- 10; B169.81 - 18
Ivory 102.80 - 89; 119.80 - 60
Brass 176.80 - 2400
Butterfield 1674-1722, B304.84 - 450
Elliott Bros, 440 Strand, Sector B358.86 - 75
T. Heath fect, 1720-40, England, B338.85 - 395
Iacobus Matinensis, B315.84 - 12,000

SLIDE RULES - Linear
Slide Rule B204.82 - 222
(no name) - German silver - nickel - 277; Coggeshall like with Navigator's scales - B342.85 - 70
AcuMath B376.87 - 10
Aston and Mander, Slide Rule Mark IV B384.87 - 75
T.O. Blake Ltd., Rule B209.82 - 10
Coggeshall slide rule 100.80 - 75; B357.86 - 50
DeMarre, Ballistic Slide Rule B271.83 - 145
EUGENE DIETZGEN CO.,
"DIETZGEN MULTIPHASE STYLE-M IMPROVED DECIMAL TRIG TYPE LOG LOG RULE" B144.81 - 8
Dietzgen, Slide Rule B145.81 - 2
Slide Rule B147.81
Dring & Fage,
Inland revenue four-sided 55.80 - 215; B205.82 - 277;
Duss, Slide Rule B206.82 - 90
"Everard" slide rule B199.82 - 222
Excise slide rule B195.81 - 375
A W Faber, Slide Rule B189.81; - 10
Faber-Castell, Castellslide rule 356.86
Gaugers Rule B208.82 - 10
Gunter Rule, 4.76 - 76; 46.79 - 22; 54.80 - 155; 98.80 - 60
Haulage Slide Rule B307.87 - 10
Hemmi "Sun" b377.87 - 10; Versalog geotec B380.87 - 10
Hoffman, Slide Rule B220.82 -1
Hydralculator 113.80 - 9
Jason, Slide Rule B316.84 - 5
Johnson artificial light exposure calculator - 2
Keuffel & Esser Co., Slide Rule B317.84 - 5; Polyphase 4053-3 B386.87 - 10, 10; Slide rule B387.87 10,10; "Deci-LON" B388.87 -10; log-log duplex decitrig B379.87 -10
L.I.D. Timber calculating slide rule, 30.77 - 120;
Lawrence Engineering Service, Slide Rule B318.84 - 5; b386.87

Halden Calculex, 158.81 - 90; B362.86
Ideas Unlimited, "Horse-meter" B190.81 - 1
Johnson, "Johnson Artifical Light Exposure Calculator" B126.80 - 2
Kempenich, H. "Prestolog" B374.87 - 10
Kenyon Instrument Co., Inc., Huntington, L.I., N.Y., "The Kenyon Calculator" B320.84 - 5
Lord's Calculator 123.80 - 48
Manloves, "Boucher's Calculator" B218.82 - 85
"The Mechanical Engineer", B339.85 - 75,
Nestler's "Rechen Walz" B328.84 - 629
Palmer, Aaron "Palmer's Pocket Scale" B194.81 - 185
Sperry's circular 97.80 - 42
Stanley, "Boucher's Calculator" B234.82 - 240
Wheatstone, "The Harmonic Diagram" B219.87 - 350

SLIDE RULES - Spiral
Fuller's spiral, 138; 51.79 - 220;
Otis King, B311.84 - 84;
Stanley, "Barnard's Coordinate Spiral Slide Rule" B240.82 - 180
Thacher's, 510; 56.80 - 625;

OTHER RULES
J. Archbutt & Sons, 20 Bridge Road, Lambeth, parallel rule, compass and rule B259.83 - 135
Parallel Rule, Brass 75; 40; Rosewood 45; Archbutt & Sons, parallel rule, compass and rule B359.86 - 135; J. H. Huges & Sons Ltd. London, "Capt Field's Improved Parallel"parallel rule and compass B360.86 - 45
Rolling parallel rule, brass with wooden case 90;
Proportional rule and protractor, ivory - 24; Elliott Brothers, London, B364.86 - 35; B364.86 - 30
Protractor and T-square B249.82 - 225; Charles Augustus Schmalcalder, Protractor B361.86 650; A. Jeffery Camborne, Wilton St. Day, Circular protractor B363.86
Trigonometer B250.82 - 1,875
Troughton, London, proportional compass B251.82 - 500

TRIGONOMETER
Lowry "Dowry-bowyer" telemeter 53.80 - 195

MAP MEASURES
Arnof, Map Mileage Reader B217.82 - 10
Depose H.C., Map Mileage Reader B140.80 - 35
Hamilton Watch Company, Map Mileage Reader B215.82 - 25
K & E Map measure 1744T B344.85 - 8
Mileage reader B200.82 - 33
Morris, "Morris's Measuring Instrument" B128.80 - 60
SELSI, Map mileage reader and compass B183.81 - 4; 7
Tacro Inc., Map Measure and Compass B129.80
Wittnaur Watch Co. B343.85 - 8

PLANIMETERS
unsigned B216.82 - 95; B252.82 - 75; B265.83 - 85
Bryan's patent planimeter - 560
Hine and Robertson Co. The Lippincopt Planimeter B303.84 - 100
Keuffel & Esser Co,
radial planimeter B313.84 - 60
"K & E Compensating Polar Planimeter with Adjustable Arms" B321.84 - 75
Leitz Variable ratio planimeter 49.79 - 75;
Palatine Engineering Co. Ltd. Liverpool, "Bryan's Patent Planimeter" B241.82 - 560
Sang "Platometer" 6.76 - 355;
Starhe & Hammerer, Planimeter B371.86 - 350

DRAWING INSTRUMENTS
unsigned B 106.80 - 684; B130.80 - 72; B132.80 - 34; B133.80 - 140
Keuffel & Esser co., "Paragon protractor No. 1225" B322.84 - 65
Scale and Ruled Compass B138.81 - 10
Watkins, pocket-sized set B345.85 - 300

PANTOGRAPH
unsigned B134.80 - 175
Patrick Adie, "Eidograph" B248.82 - 975
W. L. Jones, B346.86 - 450
A & W Smith, Pantograph B153.81 - 465

MEMORY
Barron's Educational Services, Inc., "Metric Converter"

B291.83
"Biomate" B227.82 - 8
Chambon & Baye, "TACHYLEMME" B201.82 - 260
"Consul" Educated Monkey B211.82 - 175; - 65;- 40
Data Products, Core Memory B185.81
Every Man's Own Interest Calculator B149-87 - 75
Goody Manufacturing Co., "Goody Magic Multiplier Pencil Box" B228.82 - 2
Jehu Hatfield, Clock interest table B212.82 - 475
Marion & Co., Hurter & Driffield's Actinograph B306.84 - 165
A. Massim, Paris, Music Box B193.81 - 400
A. M. Maurand, "Le Prompt Calculateur des arts industriels et du commerce" B233.84 - 480
"The MP Handy Guide for Knitting and Crochet" B202.82 - 3
Tachlemme - 260
Thorens Musical Disk - ? 1
Walt Disney Productions, "Mickey Math" B229.82 - 2
Wolverine, "Modern Math Addition" B231.82 - 5

TELEGRAPHY
Bunnell - 61.80 - 45
Electric Specialty Mfg Co., Cedar Rapids, Ia., Telegraph Key B151.81 - 15
J. M Ericsson Printing telegraph 118.80 -626
JJ & E Johnson 79.80
Siemens Brothers & Co., London, Printing Telegraph B175.80 - 510
W & E Co 68.80 - 50
Section of the first Atlantic Telephone Cable B192.81 - 200

TYPEWRITERS
ADLER Favorit 3 ?
Bennett B142.81 - 40
Bing NO. 2 43.80 - 25;
Blickensderfer - aluminum 116.80 - 120
Corona Typewriter Co., Inc. Groton, N.Y.,
No. 3 60.80 - 15;
"CORONA FOUR" B154.81 - 8;
IBM Justowriter 16.76 - 10
MARX Dial 75.80 - 30; 101.80 - 12
MOLLE NO. 3 65.80 - 35
Oliver, "The Oliver Typewriter Model 9" B242.82 - 50

Simplex Typewriter Company, "The New Simplex Typewriter No. 1" B165.81 - 15

"Simplex Portable Typewriter Special Demonstrated Model S" B166.81 - 7

"Simplex Typewriter Model A" B290.83

Typewriter B292.83

UNDERWOOD No. 5 15.76 - 10

ELECTRONIC COMPONENTS

Digital Equipment Corporation, 2 PM Flip Flop B184.81

DEC, PDP-10 Cable connector B294.83

DEC, UART B295.83

DEC, Core plane B296.83

DEC, modules B297.83

Hitachi, c-mos i c B245.82

IBM, plug board for 911 B293.83

Philco, Circuit boards from the Philco 212 B308.84

BOOKS

Abdank-abakanowicz, Les Integraphes La Courbe B187.87 - 150

Babbage, Charles, Passages from the life of a philosopher B223.82 - 500

On the Economy of Machinery and Manufactures B264.83 - 750

Bauernfeind, Dr. G. M. Die Planimeter B326.87 - 150

Bessel, Friedrich Wilhelm, Tabulae Regiomontanae Reductionum Observationum Astronomicarum ab anno 1750 usque an annum 1850 cumputai B369.86 350

Bigelow, Jacob, Elements of Technology B246.82 - 160

Boole, George A treatise on the calculus of finite differences B247.82-275

Bowden, B. V., Editor, Faster than Thought, B257.82 - 5

Briggs, Henry, Arthmetica Logarithimica B277.82 - 1300

Burrington, Richard Stevens, Handbook of Mathematical Tables and Formulas, B287.55

Capra, Balthasar, Vsvs et Fabrica Circini Cvivsdam

Proportionis, Per quem omnia fere tum Euclidis, tum Mathematicorum omnium problemate facili negotio refoluunter, 1st Ed., B334.85 - 255
Chemical Rubber Publishing Co., Handbook of Chemistry and Physics, 31st Ed. 28.79
Cooper, Henry O., Instruction for the use of A.W. Faber "Castell" Precision Calculating Rules B196.81 - 15
Cutler, Ann and Rudolph McShane, The Trachtenberg Speed Ssytem of Basic Mathematics, B255.82 - 5
Day, B. H., Day's American Ready Reckoner, B310.84 - 3
de Beauclair, Rechnen mit Maschinen Eine Bildgeschichte der Rechentechnik, Friedr Vieweg & Sohn, Braunschweig, 1968 B330.78
Eugene Dietzgen Co., Catalogue and Price List of Eugene Dietzgen Co. B268.83 - 39
Flint, Abel enlarged with additional tales by George Gillet, "A System of Geometry and Trigonometry with a Treatise on Surveying" B226.82 - 20
Fisher, George Arithmetic in the Plainest and most Consise Methods Hitherto Extant, Peter Brynberg, London B298.83 - 55
Galilei, Galileo, Le Operazioni del Compasso Geometrico et Militare, B335.85 - 635
Gardner, Martin Logic Machines and Diagrams 1958 B254.82 - 5
Gloesener, Michel Recherches sur La Telegraphie Electrique B163.81 - 110
Good, J. Measuring Made Easy, J. Mount and Page B139.80 - 121
Good, J., Measuring made Easy: or the Description and Use of Coggeshall's Sliding Rule B280.83 - 275
Hart, W. Book of Instructions for the Equationor B305.87 - 135
Hartree, Douglas R., Calculating Instruments and Machines, B261.83 - 60
Hawkins, N. "Hand Book of Calculations for Engineers" B225.82 - 4
Hoare, Charles, The Slide Rule and How to Use It B47.79 30
Hollerith, Herman, Complete specification. Improvements in the methods of and apparatus for compiling statistics, patent application, 1889, B332.85 - 1,500.
Hutton, Charles, Table of the Products and Numbers B2.76 - 68
Jacobi, C.G.J. Canon Arithmeticus sive Tabulae quibus

Exhibentur pro singulis numeris primis B350.87 - 225
Jevons, William Stanley, The Principles of Science, a treatise on logic and scitentific method, B331.85 - 100.
Jones, William (Edmund Gunter), The Description and Use of the Sector. The Crosse-staffe and other instruments. B274.83 - 400
Kentish, Thomas, A Treatise on a Box of Instruments and the Slide Rule for the Use of Guagers, Engineers, Seaman, and Students 159.81 - 50
Keuffel & Esser Co., Catalogue of Keuffel & Esser Co. B269.83 - 34
Kojima, Takashi, The Japanese Abacus, its use and Theory, B256.82 - 5
Leybourn, R & L W, Trigonometria B160.81 - 650
MacNeill, Sir John Benjamin, Tables for Calculating the Cubic Quantity of Earth Work B368.86 150
Molesworth, Sir Guilford L., Pocket-book of Useful Formulae B191.81 - 3
Morin, H. de, Les Appareils de'Integration B180.87 - 150
Musee D'art de Clermont-Ferrant, Blaise Pascal "auvergnat" la famillle a l'oeuvre, 6 octobre - 8 novembre 1981 B258.82 - 10
Napier, Rabdologiae. B222.82 - 6010
Newton, John, Trigonometria Britanica and A Table of Logarithms to 100,000 with Artifical Sinces and Tangents B278.82 - 675
Nystrom, J.W., A Treatise on Screw Propellers and their steam Engines, also A full Description of a Calculating Machine B275.83 - 350
D'Ocagne, Le Calcul Mecanique, B327.84
Nomographie, Les Calculs Usuels effectues au moven des abaques B391.87 - 175
Principes Usuels de Nomographie B390.87 - 100
Traite de Nomographie B389.87 - 175
Ozanum, Jacques, Usage du compas de Proprotion et de L'instrument Universel, B336.85 - 165
Pickworth, C. N. Instructions for the use of A.W. Faber's improved Calculating Rule B302.87 - 75
Prescott, George B. History, Theory, and Practice of the Electric Telegraph B162.81 - 40
Peurbach, Georg, Tractatus Georgii Peurbachii super propositiones Ptolemaei de sinibus & chordis. 1468-1501, 1st

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Rivard, M., _Rectiligne et Spherizue avec la construcion des tables des sinus, des tangentes, des secantes et des logarithmes,"_ B224.82 - 100

Rowning, J., _Directions for Making a Machine to Solve Equations_ B48.79 95

Saxton, E., _Saxton's Logs for Four-place Work._ B276.83 - 36

Scheffelits, M. _Pes Mechanicus Artificialis_ B373.86 - 450

Schoten, Francois, _Tables de Sinus, Tangents, et Secantes_ B367.86 200

Speidell, Euclid, _Logarithmotechnia, or The Making of Numbers called Logarithms to Twenty-five Places from a Geometrical Figure with Speed, Ease and Certainty._ B281.83 - 450

Stone, Edmund, _The Construction and Principal Uses of Mathematical Instruments_ B18.78

Svoboda, Antonin, edited by Hubert M. James, _Computing Mechanisms and Linkages_ 1965, unabridged republication 1948. B253.82 - 5

Stanley, Philip E. _Boxwood & Ivory, Stanley Traditional Rules, 1855-1975,_ The Stanley Publishing Co., Westborough, 1984 B329.84

Thomas de Colmar, _Instruction pour se servir de L'arithmometre, machine a calculer_ B282.83

Thompson, S. P. and E. Thomas, _Electrical Tables and Memoranda_ B366.86

Toyes,A., _Tables de Comparaison entre les Mesures Anciennes usitees dan le Departement de L'Aube,_ B272.83 - 100

Vincentius, 1620, _Logarithmorum canonis descriptio_n B210.82 - 1400

Vlacq, _Trigonometria artificialis_ B279.83 - 600

Wilkes, M.V., D. J. Wheeler, and Stanley Gill, _Programs for and Electronic Digital Computer,_ B286.70

"Enigma" B197.81

"Enigma" B198.81

SHOPPING LIST - COMPARATIVE PRICES

CALCULATORS

ADDOMETER - 30; 14
AMERICAN ADDING MACHINE - 125
ARITHMOMETERS - Tates - 1276; Thomas #1583 - 376; 840; 3000; T.I.M. - 220
"BABY" 24; 8
BELL PUNCH "Plus" - 25;
B.U.G. - 288
BURROUGHS, Model 1 - 10; 5; Model A - 10; Printing Adding machine - 20; 19; visible printing-adding 250; 225; 75
COMPTOMETER, metal - 10; 75;
"CONSUL" Educated Monkey - 175
DALTON - adding and lising - 35
EXACTUS
FRIDEN, 10;
MARCHANT 35;
MILLIONAIRES #539 - 500; #1523 - 275; #1023 - 1000; #4493 - 840; #272 - 800
MONROE, No. 1 - 10; Monromatic - 10;
ODHNER -50
TACHLEMME - 260
THALES - 50;
WALES VISIBLE ADDING MACHINE - 175; 35
WOVERINE "Adding machine" - 10

SECTORS

Navigators - boxwood 465; 10; 18
Ivory - 89; 60

SLIDE RULES

(no name) - German silver - nickel - 277
BARNARD'S CoOORDINATE SPRIAL

- 180
BOUCHER'S CALCULATING CIRCLE
- 275, 85, 240
CIRCULAR CONCISE SLIDE RULE
(Plastic) - 5
CLEVELAND TWIST DRILL
CIRCULAR - 2
COGGESHALL SLIDE RULE - 75;
70; 20; 15; 30
DIETZGEN STYLE M - 8; wood
and paper - 12
FOWLER'S CALCULATING CIRCLE
- 184
FOWLER'S TEXTILE CALCULATOR
- 60
FULLER'S SPIRAL, 138; 220;
GUNTER RULE, 76; 22; 155;
60
HALDEN CALCULEX, 90
HOFFMAN - 1
HYDRALCULATOR - 9
INLAND REVENUE FOUR-SIDED
215; 277;
JOHNSON ARTIFICIAL LIGHT
EXPOSURE CALCULATOR - 2
LEADBETTER SLIDE RULE - 84
MANNHEIM SLIDE RULE - 74
MORRIS' MEASURING INSTRUMENT
- 60
MUSKETRY RULE OF 1918 - 12
PALMERS IMPROVED BY FULLER -
216
PICKETT AND ECKEL log log -
19
SPERRY'S CIRCULAR - 42
STANLEY RULE FOR CALCULATING
ANNUITIES - 280
TAVERNIER-GRAVET - 640
THACHER'S, 510; 625;
THOMLINSON'S EQUIVALENT
PAPER SLIDE SCALE - 43;
TIMBER CALCULATING SLIDE

RULE, 120; 21;

OTHER RULES
PARALLEL RULE, Brass 75; 40; Rosewood 45;
ROLLING PARALLEL RULE, Brass with wooden case 90;
PROPORTIONAL RULE AND PROTRACTOR, ivory - 24

MAP MEASURES
ARNOF - 10
DEPOSE MAP MILEAGE READER - 35
HAMILTON WATCH CO. - 25
SELSI - 7
TACRO MAP MEASURE

PLANIMETERS
?, 95
BRYAN'S PATENT PLANIMETER - 560
LEITZ PLANIMETER - 75;
SANG '"PLATOMETER" 355;

TYPEWRITERS
ADLER Favorit 3 ?
BENNETT - 40
BING NO. 2 25;
BLICKENSDERFER - aluminum - 120
CORONA NO. 3 15; No. 4 8;
IBM Justowriter - 10
MARX DIAL - 30; 12
MOLLE NO. 3 - 35
OLIVER MODEL 9 - 50
SIMPLEX Model S - 7
UNDERWOOD No. 5 - 10

HEURISTICS FOR BUILDING GREAT PRODUCTS (DRAFT)
Gordon Bell, Vice President, Engineering

Five sets of dimensions for building great products need be attended to (roughly in order of importance):

- a responsible, productive and creative engineering group;
- product and design metrics (competitiveness);
- design goals and constraints;
- product evolution, revolution and death; and
- the ability to get the product built and sold.

ENGINEERING GROUP

The Team must have:

- a chief designer/chief programmer to formulate and lead
- management who understand the product space and who has engineered successful products; The most important two jobs of management are:
  - making sure that everyone knows their job; and
  - setting and reviewing work on a timely basis.
- team skills to implement the proposal so that we adhere to the cardinal rule of Digital, "He Who Proposes, Does";
- an understanding of the design, design production (eg. CAD) processes, and manufacturing processes;

Behaviorally, the team must:

- execute the project in a timely fashion;
  - limit projects to less than two years by a small team.
  - not predicate a project on scheduling inventions in the design, process and CAD areas.
- have a written design methodology;
- be open and have external reviews, and clearly written product descriptions for inspection;

- start small, be reviewed and grow on its demonstrated success;
- learn, in order to handle the increase in complexity

PRODUCT METRICS KNOWLEDGE includes:

- products for which there'll be no competitor;
- all product cost metrics
- all product performance and cost/performance

metrics;

. reasons why the product will succeed

. major competitor products by cost, performance and functionality;

. leading edge, innovative, small company products;

. productivity, quality and design process metrics for project management.

DESIGN GOALS AND CONSTRAINTS

. Goals and constraints must be written down and updated from the day the project starts.

. A product can only have a few goals and constraints. The ranking is usually: it must work and have improved cost of ownership, be the shortest time to market, highest performance and lowest cost.

. If a standard exists, follow it or change it for all!

. If a standard is forming go all out to set it.

. Products must be designed for easy translation into in any natural language since we are an international company.

. All products must have be customer installable and maintainable.

. Portability is an important goal.

WHEN TO CREATE, WHEN TO EVOLVE AND WHEN TO STOP PRODUCTS

. Ideas must exist to have products! If we don't have ideas to redefine or extend a market, then we should not build a product.

. A product tree MUST be maintained by each engineering group showing roots, gestation time and life.

Goodness

. offer at least a factor of two in terms of cost-effectiveness over a current product;

. be based on an idea which will offer an attribute or set of attributes that no existing products have;

. build in generality, and extensibility;

. be a complete system, not piece parts;

. be a great system because the components are great;

. if we don't make it, buy it;

Product Evolution

. lower cost products require additional functionality too;

. constant cost, higher performance products are likely to be the most useful;

Revolutionary New Product Bases

. A new product base, must start a family tree from which significant evolution can occur.

Product Termination

. A product evolution is likely to need termination after successive implementations, because new concepts in use have obsoleted its underlying structure.

SELLING AND BUILDING THE PRODUCT

. it has to be producible and work, AND be useful to software;

. a business plan with orders and marketing plans from several marketing persons and groups needs to be in place;

. never build a product for a single customer,

. it must be done in a timely fashion according to the committed schedule, price and functions;

. it must be understandable and easy to use.

GB3.S2.5
2/27/82 Sat 15:42:59
Silicon Valley Engineering/Manufacturing Division RFP
To: PSC, frank mc cabe, lou gaviglia,BASKETT,BRUCE DELAGI

Having spent a few weeks in what I perceive as a substantially more active and aggressive Si Valley product environment, I'd like to discuss how and whether we invite proposals on the formation of a group whose charter is to obtain external products and processes.

RATIONALE

PREVIOUS OPPORTUNITIES WE SHOULD HAVE ACTED ON
Some of the product opportunities that come to mind that

would be covered by this approach include:
1. LICENSING THE 3 COM ETHERNET CONTROLLLERS. (Ours cost twice as much, 1/2 the throughput, took 2 years longer, and will probably cost the world the Ethernet standard because IBM will now enter with theirs in the same time frame. In turn, this will cost us the LAN market and require more, poor projects.) This would also include the transceiver and Pluto.
2. SCRIBE AND TEX AS TYPESETTING PACKAGES. We continue to spend multi-megabucks and get no product. Already, LISA has a better package for typesetting than what we offer.
3. LASER PRINTER CONTROLLER. Stanford's had a 1 board product that would drive a printer for 2-3 years. A company builds it, and we could have licensed it several years ago in lieu of the LN01 and LN03, giving us much lower cost and a 4+ year lead on the market.
4. STANFORD'S SUN TERMINAL. SUN Workstations has been formed as a company, and managed by a former DEC employee. This behavior has delayed market entry by several years, plus created several competitors including Apollo. Our Workstations are yet to ship, and a competitive Workstation project is not yet started.
5. ADA SOFTWARE BUYOUT. We're clearly going to be near the last ones in April 85, 1-2 years after DG, to have an ADA, even though we've spent much more and been at it the longest.
6. VIDEO CHIPS AND CLARK'S GEOMETRY ENGINE. The later is truly a breakthrough, and we could have licensed the chip had we moved aggressively at the right time. Not moving means another, significant competitor and product we won't and may never have.

Together, all these mean lost revenue of perhaps only a few hundred million each year. They also cost >10% of our budget. Far worse are the delays and the fact that competitors form and become quite powerful before we can act.

POTENITAL NEW OPPORTUNITIES
Now, there are significant opportunities in CAD, voice and video VLSI (including where we do the designs), database chips, digital PABXes, etc. Forest has several opportunities in the graphics printing area which we badly need for workstations and printers.

Groups are forming routinely to do CAD programs of all sorts from chip to system, and we can use these products to advantage.

THE VENTURE CAPITAL MANIA OF SILICON VALLEY DRIVES THE PROCESS

Although many of the groups that start up are incredibly mundane because they're merely assemblying micros and software to form PC's and then marketing them, there is the aggressive application of technology to systems, and on occasion, the development of technology.

What such an environment provides is a better natural selection process than what we are currently achieving because the people who get together are unusually competent, the group is small, and the motivations are both financial recognition and independence of a large, conservative or lithargic organization.

SILICON VALLEY STANDARDS ALLOW FAST MOVEMENT AND FLEXIBILITY

Everything seems to be Multibus, and then Multibus II. In this way anyone can put together a system by engineering at most one board... and do it in a month. The processor's either an 8086 family or 68,000. Quite possibly the BI could be significant if National went with us, provided we wanted to be in this market.

Programs are in C for maximum portability.

XEROX RESEARCH PARK A SOURCE OF IDEAS

While Xerox has failed to make the transition into products, PARC has come up with many ideas that have been the foundation of products and companies. Specifically:

1. Development of the Mead/Conway technology, and the notion of Si Compilation whereby chips become like publications.
2. Convergent Technolgy is staffed by Ben Wegbreit and other alumni.
3. Adobe Systems just left PARC to form a company to build software for Laser printers.
4. The laser printer for general purpose printing has a company.

5. Apple's LISA is modeled on Alto, and staffed by former alumni.
6. Bob Metcalfe formed 3Com to exploit Ethernet.
7. Surely people who are trying to push their various computers as LISP machines will get frustrated and form a company.

THE INDUSTRY IS GOING THROUGH A MAJOR RESTRUCTURING
In the first and second generations, the emphasis was on circuitry, being able to build a computer, and write some rudimentary programs to allow people to use it. Some first generation folks like RCA and GE didn't make it into the second generation.

The third generation with ssi/msi let many more in (CA, DG, GA, etc.) because circuits didn't have to be built. Peripheral companies also formed by escaping from IBM's disk plant. Computer companies built operating systems and the interface moved to high level languages- Basic, Cobol and Fortran. For the large systems, a software industry formed. In minis, the COEM-type arrangement was used to do the applications.

In the early part of the 4th generation, micros weren't particularly powerful, or especially useful. The industry transition was basically to copy the 3rd where proprietary operating systems were put on standard micros, eg. Apple II, and Basic was the main language. No standardization, except via BASIC. No applications to speak of. Begin to form the applications market segment. This last period of ten years has been a breeze at DEC because we were able to supply machines people could build on for TOEM, COEM, and our customers were good enough to write applications.

In the fifth generation (this one marked by >16-bit address machines such as the 8086 and current 68,000) there is a TOTAL stratification of the industry into many levels of integration:
.Semis-supply the processors, rams; floppy folks; keyboard cos, etc.
.O/S and other system software suppliers including languages. Note

this came about because the semi folks weren't good enough in
software. Venture capital had this form outside of the semis too.
.System integrators and distributors-only assemble or have PC's
assembled for them. CT, IBM, Osborne, etc. ... many, many start
.Generic software specialists: wps, spreadsheets, graphics, comm, db
.Vertical applications. In several cases, we find people also assemblying their own hardware (CAD stations) to get maximum added value.

With the plethora of venture capital money, things will become totally stratified so that as long as a group can show it adds significant value by being a level, it will form. Having a seperate, industry does several things: the real creators take the risk and get the reward; they can be neutral and non-threatening thereby creating standards; and incompatible lower levels can become compatible.
Note this stratification has allowed companies like Apple nd CT to grow at an unprecedented rate, reach $1B with only 4Kp.
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I think two phenomena will spur it on: ULSI and AI.

ULSI will remain very tricky and difficult, but can be done. There'll be a publishing business where designers can specialize in an area and make unique chips for different businesses. Now we see this happening by the people who design chips in universities, get a Ph.D for it, and then take it with them to form a major startup. Maybe this won't force them into making systems to exploit the chips because people believe that chips should all cost a few dollars, regardless of their proprietariness, what they replace and whether or not the job can be done any other way.

AI-style programming, or knowledge acquisition in the form of Knowledge Engineering will become commonplace. The goal here is to make a bunch of generic programs (properly generalized, XCON is one such program). The other programs are those listed by the Japanese in the Fifth Generation Report...

which require VLSI too. What youse think? Shall we discuss it? Is anyone interested in being part of this?

OUR CURRENT STRUCTURE/BEHAVIOR
Currently, we're irrelevant to computing except to have Barry building Rainbows out of the fat. Just visit a Computer Store, a new OEM, an EE Department, or several Si Valley start-ups. Engineers are so decoupled from the market and lack of urgency (eg. Ethernet) so much that we simply cannot sustain any growth outside that of our existing, diminishing base in what is **<>** to BUNCH (Burroughs...Honeywell) in the traditional mainframe business.

00 CORE DECGRAM ACCEPTED S 007433 O 790 07-JUN-83 20:01:19

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!   !   !   !   !   !   !   !
! d ! i ! g ! i ! t ! a ! l !        I n t e r o f f i c e
M e m o
!___!___!___!___!___!___!___!
```

TO: FOREST BASKETT DATE: TUE 7 JUN 1983
3:46 PM DST
LOU GAVIGLIA FROM: GORDON BELL
FRANK MCCABE DEPT: ENG STAFF
PRODUCT STRAT COMM: EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5202217769

SUBJECT: SILICON VALLEY ENGINEERING/MANUFACTURING DIVISION RFP

GB5.62

Having spent a few weeks in what I perceive as a substantially more
active and aggressive Si Valley product environment, I'd like

to
discuss how and whether we invite proposals on the formation of a
group whose charter is to obtain external products and processes.

RATIONALE

PREVIOUS OPPORTUNITIES WE SHOULD HAVE ACTED ON

Some of the product opportunities that come to mind that would be
covered by this approach include:

1. LICENSING THE 3 COM ETHERNET CONTROLLERS, TRANSEIVER AND PLUTO
(Ours cost twice as much, 1/2 the throughput, took 2 years longer,
and will probably cost the world the Ethernet standard becaussIBM
will now enter with theirs in the same time frame. In turn, this
will cost us the LAN market and require more, poor projects.)

2. SCRIBE AND TEX AS TYPESETTING PACKAGES. We continue to spend
multi-megabucks and get no product. Already, LISA has a better
package for typesetting.

3. LASER PRINTER CONTROLLER. Stanford's had a 1 board product that
would drive a printer for 2-3 years. A company builds it, nd we
could have licensed it several years ago in lieu of the LN01 and
LN03, giving us much lower cost and a 4+ year lead on the market.

4. STANFORD'S SUN TERMINAL. SUN Workstations has been formed as a
company, and managed by a former DEC employee. This bbavior

has
delayed market entry by several years, plus created several competitors including Apollo. Our Workstations are yet to ship,
and a competitive Workstation project is not yet started.

5. ADA SOFTWARE BUYOUT. We're clearly going to be near the last ones
in April 85, 1-2 years after DG, to have an ADA, even though we've
spent much more and been at it the longest.

6. VIDEO CHIPS AND CLARK'S GEOMETRY ENGINE. The later is truly a
breakthrough, and we could have licensed the chii had we moved
aggressively at the right time. Not moving means another,
significant competitor and productte won't and may never have.

Together, all these mean lost revenue of perhaps only a few hundred
million each year. They also cost >10% of our budget. Far worse are
the delays and the fact that competitors form and become quite
powerful before we can act.

POTENTIAL NEW OPPORTUNITIES

Now there are significant opportunities in CAD, voice and video VLSI
(including where we do the designs), database chips, digital PABXes,

etc. Forest has several opportunities in the graphics printing area
which we badly need for workstations and printers.

Groups are forming routinely to do CAD programs of all sorts from chip
to system, and we can use these products to advantage.

THE VENTURE CAPITAL MANIA OF SILICON VALLEY DRIVES THE PROCESS

Although many of the groups that start up are incredibly mundane because they're merely assemblying micros and software to form PC's
and then marketing them, there is the aggressive application of
~rtechnology to systems, and on occasion, the development of technology.

What such an environment provides is a better natural selection process than what we are currently achieving because the people who
get together are unusually competent, the group is small, and the
motivations are both financial recognition and independence of a
large, conservative or lithargic organization.

SILICON VALLEY STANDARDS ALLOW FAST MOVEMENT AND FLEXIBILITY

Everything seems to be Multibus, and then Multibus II. In this way
anyone can put together a system by engineering at most one board...and do it in a month. The processor's either an 8086 family
going to a 68,000. Quite possibly the BI could be significant if
National went with us, provided we wanted to be in this market.

Programs are in C for maximum portability.

XEROX RESEARCH PARK A SOURCE OF IDEAS

While Xerox has failed to make the transition into products, PARC has come up with many ideas that have been the foundation of products and companies. Specifically:

1. Development of the Mead/Conway technology, whereby chips become like publications.
2. Convergent Technology is staffed by Ben Wegbreit and other alumni.
3. Adobe Systems just left PARC to form a company to build software for Laser printers.
4. The laser printer for general purpose printing has a company.
5. Apple's LISA is modeled on Alto, and staffed by former alumni.

6. Bob Metcalfe formed 3Com to exploit Ethernet.
7. Surely people who are trying to push their various computers as LISP machines will get frustrated and form a company.

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The applications market segment began to form. This last period of ten years has been a breeze at DEC because we were able to supply machines people could build on for TOEM, COEM, and our customers were good enough to write applications. Also, IBM believed it couldn't manage a dual distribution channel with one product. (Now they believe it can be done, and are doing. We want out of the OEM business for some reason.)

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Also, these are available as board standards.
.O/S and other system software suppliers including languages. Note
this came about because the semi folks weren't good enough in software. Venture capital had this form outside of the semis too.
.System integrators and distributors-only assemble or have PC's assembled for them. CT, IBM, Osborne, etc. ... many, many start
.Generic software specialists: wps, spreadsheets, graphics, comm, db
.Vertical applications. In several cases, we find people also assemblying their own hardware (CAD stations) form the standards
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What think? Shall we discuss it? Is anyone interested in being part of this?

WPS USERS - Leave HP mode and type <CR>

****
* d i g i t a l *
****

TO: JIM CUDMORE
8:29 EST

cc: BRIAN CROXON
    BILL DEMMER
    STEVE TEICHER

DATE: TUE 19 MAY 1981

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: BECOMING A MEMBER OF SIA

Are we going to accept their invitation?

There's a meeting on the West Coast, June 10 that we're supposedly to be invited to by Tom Hinkleman, their director.

I think we should be.

After reading the information on Japanese CAD/Design discipline, I think we ought to reconsider our posture to Intel, via Carol Peters, on sharing of tools!

We're each going to need all the help and co-operation we can give each other SIA may be a forum for this.

GB:swh
GB2.S5.59

April 30, 1982

Dr. Grassman
Siemens AG

Bereich Medizinische Technik
Henkestrasse 127
8520 Erlangen
Munich, Germany

Dear Dr. Grassman:

Thank you for visiting us in Maynard last week. I enjoyed hearing about your needs for image computation. We're very interested in continuing to supply these needs. I would also like to understand your image processing needs and the feasibility of addressing them.

I'm looking at the problems of using both sides of RX01 and RX02.

Regarding the VAX question, I'm attaching two letters to Dr. Baur. My feeling is still that Siemens could profitably use VAX in many divisions besides, in addition to your own. I think the low end strategy around the 8086, the 432 and their successors is going to be costly for Siemens.

Again, it was nice to meet you and to show you around our musuem.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:mal
GB3.S4.5

CC: Jack Shields
Willi Kister

Attachments: 2

00 BURT DECGRAM ACCEPTED S 30741 O 212 08-SEP-80
14:46:29

****
* d i g i t a l *
****

TO: DR. F. BAUR @FORN   DATE: MON 8 SEP 1980
2:46 PM EDT

FROM: GORDON BELL
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

cc: MR. H. SCHWAB @FORN
KEN OLSEN

SUBJECT: INVITATION TO VISIT MUNICH

ADDRESS FOR DR. BAUR:

SIEMENS AG, MUENCHEN, BALANSTR. 73

ADDRESS FOR MR. H. SCHWAB:

SIEMENS CORP.
186 WOOD AVENUE SOUTH
ISELIN, NEW JERSEY 08830
TEL. (201) 494-1000 EXT. 2603

THANK YOU FOR THE INVITATION TO VISIT MUNICH. I WOULD VERY MUCH LIKE TO VISIT YOU AND SIEMENS. UNFORTUNATELY, I CANNOT COME UNTIL EARLY DECEMBER. WHAT ABOUT DECEMBER 4 AND/OR 5? I WILL CO-ORDINATE THROUGH MR. H. SCHWAB.

SINCERELY YOURS,

GORDON BELL
VICE PRESIDENT, ENGINEERING
DIGITAL EQUIPMENT CORP.

-- TWX/TELEX NUMBERS --

DR. F. BAUR @FORN
SIEMENS CORP.

MR. H. SCHWAB @FORN
SIEMENS CORP.

GB1.S6.55
January 27, 1981

Mr. Helmut Schwab
Siemens Corporation
186 Wood Avenue South
Iselin, NJ 08830

Dear Mr. Schwab:

Thank you for the letter of January 16. Please go through Bill Picott for all terminals components.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:swh
GB2.S1.32

To: Dan Siewiorek

Date: June 19, 1978
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.:
2236

Suggest you pick up the conventions for hyphens, caps, names, etc. we used for Computer Engineering from Heidi. CS will have an incredible problem too and now is the time to iron out the potential inconsistencies and get a workable standard.

Call Gwen in late July re. staying in our house in August.

10 January 1983

Professor Steve Director
Whitaker Professor and Head, Department of Electrical Engineering
Carnegie-Mellon University
Pittsburgh, Pennsylvannia 15213

Dear Dr. Director:

It gives me great pleasure to strongly recommend that Dan Siewiorek be given the Frederick Emmons Terman Award. In looking at the exact qualifications and looking at the spirit of the award, I know of no other person that better personifies this award. Dan is completely devoted to both engineering and to teaching!

Dan has excelled in the teaching, research and transfer of knowledge in four areas: reliability, formal description and evaluation of computers, multicomputer architecture, and design automation.

It has been with great pleasure that I have worked with Dan since 1972 in three capacities: fellow researcher, fellow co-author, and fellow-engineer. In all capacities he has really exhibited the traits of a fine engineer and teacher.

Again, let me add my recommendation that Professor Siewiorek be given the Terman Award.

Sincerely,

Gordon Bell
Vice President, Engineering, Digital Equipment Corporation
Professor, On Leave, Department of Computer Science and Electrical Engineering, Carnegie-Mellon University

GB4.S1.14

Bob Armstrong	TW/D06
Gordon Bell	ML12-2/A51
Jim Bell	ML3-2/E41
Paul Binder	TW/D06
Pete Blackstone	ML3-6/E96
Bill Bruckert	MR1-2/E47
Dave Cane	TW/D06
Peter Christy	ML12-3/A62
Tom Dundon	MR1-2/E18
Dave Dutton	ML21-2/E32
Tom Eggers	MR1-2/E47
Ned Forrester	ML1-2/E60
Bob Glorioso	ML3-2/E41
Paul Guilbault	TW/D06
Pete Jessel	ML21-1/E81
Alan Kotok	MR1-2/E47
Jud Leonard	TW/C04
Satish Rege	ML4-1/B32
Mike Riggle	ML4-1/B32
Steve Rothman	TW/D06
John Shebell	MR1-1/S35
Don Smelser	ML21-2/E64
Sharon Smith	TW/D06
Bill Strecker	TW/D19
Bob Swarz	PK3-2/S20
Pete van Roekens	TW/B10

ID#0225

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Subject: **Site Preparation Guide**

To: Don Busick Date: 78 AUG 15

From: Gordon Bell

CC: Jack Shields Dept: OOD

Loc.: ML12-1

Ext.: 2236

follow up 8/29/78

I just had some discussion with Bill Davis and he informs me that the site preparation guide is not a corporate publication, but rather is done on a product line by product line basis.

What in the world is the rationale for this? Why can't we put together a good guide which could be used for all products.

Is that your responsibility, or engineerings, or whose? (I trust it would be sufficiently good to cover various special cases of the subsidiaries.)

GB:ljp

June 14, 1983

Mr. Hal G. Moore
Chairman
Committee on Lectureships
Sigma Xi, The Scientific Research Society
345 Whitney Avenue
New Haven, Connecticut 06511

Dear Mr. Moore:

I have given a great deal of thought about becoming a National Lecturer of Sigma Xi for two years, and feel I must decline at this time. Recently I have undergone an emergency by-pass operation, and although recovered in principle, I have not yet established a pattern of living which will avoid the next operation.

I would like to keep the form and letter you sent me and respond to it at a later time. If I feel that I have a way of controlling my commitments AND have something that I feel must be said to this prestigious audience, I will forward it to you immediately.

Sorry, I don't feel I can respond at this time.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

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*****************
* d i g i t a l *
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TO: DON METZGER DATE: SUN 23 MAY 1982
8:09 PM EDT

FROM: GORDON BELL
cc: see "CC" DISTRIBUTION DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: RE: SIGNAL INTEGRITY - DON MARSHALL'S GROUP

I have major misgivings about moving the signal integrity to Bernie and want to discuss at EMC at the very least.

This last organizational change was made to allow groups to focus on particular products. Engineering had gotten to the point where a group was involved in all issues. This kind of cloudy thinking on the responsibility for BI in a totally non-
involved group is what we want to change.

I want people who have the responsibility for success to manage
what they are responsible for and I want to eliminate the dilletantes. Jack and I are the only ones who are allowed to be non involved in specific product responsibilities. Jack is
the manager and I am the architect (city planner) for seeing that our products work together and that we have the right product.

BJ has responsibility for 32, 36 and nets/distributed systems (Bernie and the glue products). These too have to be kept separate. BI is the bus for the next generation of 32-bit products and totally isolated from Bernie and 36-bit Ulf.

In a similar way, I think we have to start isolating the overall software so as to make sure we're going to win and have individuals assigned to this.

BJ and I will discuss and get back to you. Dilletantes don't make the gains, only experts.

"CC" DISTRIBUTION:

DON MARSHALL @MLXX BILL JOHNSON BERNIE LACROUTE
DEMETRIOS LIGNOS WILL THOMPSON

GB3.S5.45
July 31, 1983

Page Farm Rd.
Lincoln, Massachusetts 01773

Phillip A. Kaufman, President

Silicon Compilers
105 Albright Way
Los Gatos, California 95030

Dear Phil,

I thoroughly enjoyed the interaction with you, the staff and members of the Board of Silicon Compilers last Monday. My expenses for the trip are attached. I'd like to buy 25,000 shares of Silicon Graphics at your $4 price, and look forward to hearing about the shares I can obtain at the $.20 price level. I'd like to defer payment for the shares as long as possible.

In thinking about the effort, the clearer it becomes that you're going to be limited until a person with significant software engineering management capability is found to head engineering. I don't believe you have anyone on the staff who's shipped a significant software product. It just occurred to me that Carol Peters might be available when she moves to Palo Alto with Peter Christy. Carol has built significant CAD systems. Carver knows her, I believe. She now works in Hudson.

Although I don't really know the field, my suspicion is that you are plowing new ground in some of the programs; as such they might best be described as research. I don't think you can have any programs of this type in the product at all. This work had best be done in the universities. Is there any research in the product?

I talked with Keith Uncapher at ISI and suggested you might have some interaction with them. I think he's interested, and hopefully there's still some kind of relationship with Ron Ayers that could be useful. At any rate, I hope he'll call you.

The model of the business is still of concern. How many of these and other paths could you persue:
1. software only on one or more systems of your choice
2. software sold on an oem'd SUN only
3. franchised tools and training to a small or large company

4. franchised tools and training to a set of independent entrepreneurs
5. tools and training to your own custom design division where you sell design for money, royalty, etc. in a new and clever way
6. Item 5 on a highly geographically dispersed fashion such that you operate near item 4.
7. aren't there lots of other businesses??

It would be worthwhile to have someone construct a business model of each of the components just to see which ones allow you to build the best businesss. Do you have criteria, such as market share in the possible markets, profitability, the best products, largest size, etc. for success? I'd hope the board might look at some of the alternative scenarios by the next meeting.

I think it's essential to have two divisions simply for protection that the tool may take much longer to complete than you think. I really worry about starting to design the perfect tool as the mainline business. Also, if you chose paths 4, 5 or 6 as a major part of the business, you are in effect running today with the present tool!

Anyway, these are just some thoughts which came up as a result of being there and looking at your product plans.

Sincerely,

Gordon Bell

PS
I am sorry, but I'm unable to meet on October 10 or 11, but could be there on the 12th, or any other time in October. I will be at a meeting in Palo Alto on the 26th. Could we set a new date?

Gordon Bell Expenses on Silicon Compilers Visit July 25, 1983

Airfare	662
Red Lion	180.20
Tolls	.60
car miles	
2x2x25x.22	22
Total	864.80

Jim says they have a price competitive product with Apollo @37K for diskless, 8 plane color. The performance is 200X the Apollo! For a disk server the price goes to 60K. Their cost has to be low. They're doing a lower cost and higher cost version. It's Ethernet based. The response has been overwhelming.

They're talking to several 2nd and 3rd tier minicompanies as OEMs--but he's not happy. This would get them 250-500 systems (for $20M). Also standard CAD OEMs. Although they'd like to <feel?> end users, they can't do everything. They're interested in talking to us.

They have 100 people, 4 regional offices and a super VLSI group to keep lowering the cost. They're going out for $10M financing to hold them till going public and we just might be able to help one another. They hope to do $35M in CY84. They're owned by Mayfield Fund, with others including Seven-Rosen, NEA, etc.

I asked about making a low cost, compatible version to complement the product line. He said it sounds fine. He says they have a straight A team, and would therefore like to have an A team on sales.

May 7, 1984

Dr. Roy L. Russo
Editor-in-Chief
IEEE Design and Test of Computers
IBM T. J. Watson Research Center
P. O. Box 218
Yorktown Heights, N Y 10598

Dear Dr. Russo:

Enclosed is the paper emphasizing the need for standards in realizing the Silicon Foundry industry --- as the basis of the next computer generation. (I think it's the REAL Fifth Generation.)

It is a great pleasure to kick off the first issue with this paper. There should be a note that says its an excerpt from my talk at Compcon (the entire paper appears in the June issue of Computer).

Sincerely,

Gordon Bell
Chief Technical Officer

CC: Erich Bloch, IBM

GB8.28

June 19, 1979

Marvin Goldberger, President
California Institute of Technology
1201 East California Boulevard
Pasadena, California 91125

Dear Dr. Goldberger:

Let me urge you to continue the moral and real support for the Silicon Structures Project that Ivan Sutherland, Carver Mead, and the other members of the Computer Science Department are carrying out. It is unique and refreshing in the interaction between the university and industry, and I heartily endorse it!

We're entering our second year as a member of the SSP and continue to believe that there is interesting and useful work being carried on there. Also, it's one of the few places engaged in training teachers, scientists, and engineers who are capable of dealing with the complexity found in the large, silicon structures we know as VLSI. It is ironic that the academic community has taken so long to get organized in this area, given the large funding in the semiconductors.

Dr. Craig Mudge, who just returned to Digital having spent a year there as a visiting faculty member, is an especially enthusiastic supporter - hence you might contact him for another perspective.

The program is off to a good start, but needs all our support.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:swh
GB0003/58

CC: Roy Gould, Head of the Division of Engineering & Applied Science, CALTECH

Ivan Sutherland, CALTECH
Craig Mudge, DEC

BC: Tom Stockebrand, DEC
Dick Clayton, DEC
7 April 1983

Office of the President
Delaware State College
Dover, Delaware 19901

Dear Sir:

Enclosed is my check in the amount of $35.00 to the Sims Scholarship Fund at Delaware State in memory of Mrs. Ella Victoria Sims, mother of John Sims of our company.

Sincerely,

Gordon Bell
Vice President, Engineering

GB5.7

+---------------+
! **d i g i t a l !   i n t e r o f f i c e   m e m o r a n d u m**
+---------------+

Subject: **Emulating or Simulating Other Computers: The Market Possibilities; A Party Line**?

To: Peter Connell

Date: 2 MAY 78
From: Gordon Bell

CC: Marketing Committee, OOD Dept: OOD
Loc.: ML12-1 Ext.: 2236

follow up 5/16/78

In your discussion with Business Week, we should be careful to stay away from the notion of our building computers which are capable of emulating other computers. Emulation means simulating the behavior of another computer in a fashion that is somehow better than the original.

The most common use of emulation is a computer that can interpret a single ISP (Instruction-Set Processor, or Architecture) as in the case of Amdahl, National and various Japanese manufacturers for the 360/370.

There seem to be several uses of emulators:

1. Many manufacturers are and will emulate the 360 and 370. The purposes are obvious: to provide a more cost effective solution than IBM because one has better technology, or lower costs (e.g., hardware, marketing, more production volume). The risks are numerous: lower IBM prices, newer technology, IBM changes the architecture so the software won't operate. The effects are not quite as obvious: the increasing standardization of the 360/370 as the main 24-bit (its address space) architecture and lower costs for the users could occur by the increased competition. Although IBM probably has the patents to stop the emulation, they have chosen not to enforce them. By unbundling the software, they will have to continue to support other manufacturers and because some of the operating system software is in the public domain, anyone can use it.

I hope we never have to emulate the 370, because it will be expensive to do and it will imply that we are in a marketing strategy that is totally IBM dominated...which is why we never consider it now. We believe we can develop and build better architectures than IBM, to be implemented in different segments of the marketplace (e.g., interactive, networks, a larger 32-bit address space, better mapping for executing the languages, and doing applications).

2. We would use an emulator for interpreting another DEC ISP, and possibly our users might use our machines to emulate the machines of another manufacturer. On the VAX-11/780 there is a compatibility mode which permits the interpretation of the standard 11 ISP, while the VAX mode is only a larger address space and different, with cultural compatibility. The writable control store could be used for emulating perhaps another machine.

In an experiment at CMU, with their WCS version of the 11/40, the NOVA was emulated on a reasonably cost-effective basis. We have been asked by various customers to emulate other machines on our WCS computers (11/60; 11/03), and we have in fact emulated a PDP-8 on the 11/60 and run the Operating System at about twice the speed of a regular 8. Emulation could be used, just as IBM did to allow customers to migrate their applications from one machine to another.

3. There is some question as to whether other manufacturers would emulate our ISPs.

We have a patent position with the 11 and have successfully discouraged one company from building a computer that emulates it. A single version of the 10 was built by another company for their internal use, and another company builds versions of the PDP-15 for its own use. We have licensed various implementations of the 11 to Norden for the military market.

Several years ago DCC, recently acquired by DG, built a computer that interpreted the 8 ISP. Both Intersil and Harris have built processor-on-a-chip computers that interpret the PDP-8. (We purchase chips from them.) Of our main machines in production we have patents on the 10, 11 and VAX-11 that would probably preclude or certainly discourage a company from emulating our ISPs.

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Jim Bell	ML3-2/E41	Dick Clayton	ML12-2/E71
Jim Cudmore	ML1-4/E30	Bill Demmer	TW/D19
Ulf Fagerquist	MR1-2/E78	Win Hindle	ML5-2/A53
Ted Johnson	PK3-2/A55	John Kevill	ML1-3/E58
Andy Knowles	MR2-2/A52	Julius Marcus	MK2/C37
John Meyer	ML12-1/A11	Stan Olsen	MK
Larry Portner	ML12-3/A62	Bob Puffer	ML12-2/E38
Bill Thompson	ML12-1/F41		

SINGLE SITE PARALLELISM (MULTIPLE COMPUTERS OR PROCESSORS)

INDEPENDENT COMPUTERS

SHARED PERIPHERALS

COMMUNICATING PROCESSES

COMMON DATA BASE

MULTIPLE TASKS IN A MULTI-PROCESSOR OR MULTI-

COMPUTER

TIMESHARING (njobs)

REAL TIME (n processes)

FRONT END/BACK END (functional)

SINGLE TASK PARALLELISM

GENERAL CONCURRENCY

PIPELINING OF PROCESSES

VECTORS AND ARRAYS

SETS

October 10, 1980

Louis Pouzin
Sirius
Iria B.P. 105
78150 Le Chesnay
FRANCE

Dear Louis:

We encountered a series of difficulties in acquiring the machines for the cooperative research with INRIA. These problems have been resolved and we are now working on scheduling delivery. We have now established a formal program to support external research; in part as a result of the difficulities we have had trying to start up the INRIA cooperation. This program is being manager by Dick Eckhouse. He and Rick Peebles of Corporate Research are working daily to get the machines to you. We apologize for the problems this has caused you but look forward to a valuable cooperative effort.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:swh
GB1.S7.30

CC: Dick Eckhouse, DEC
Rick Peebles, DEC

	CRAYL TT9900	AMDAHL V6	
TECH	ECL	ECL GATE A	NMOS
DELAY	72	74	76
YEAR	1.5	3	20
MIPS	80	16	0.2
TOTAL GATES	600K	150K	10K
COMPS (IC'S)	300K	2K	4
MIPS/IC	266 50,000	8,000	
COMPS/80 MIPS	300K	10K	1.6K
TOTAL GATES 80 MIP SYS	600K	750K	4.0M
# OF FC'S	1	5	400

HEURISTICS FOR BUILDING GREAT PRODUCTS
(DRAFT FOR COMMENT)

Five sets of dimensions for building great products need be attended to (roughly in order of importance):

. a responsible, productive and creative engineering group;

- product and design metrics (competitiveness);

- design goals and constraints;

- product evolution, revolution and death; and

- the ability to get the product built and sold.

ENGINEERING GROUP

The Team must have:

- a chief designer/chief programmer to formulate and lead;

  NO COMMITTEES AS DESIGNERS

- management who understand the product space and who has engineered successful products; The two most important jobs are:

  - making sure that everyone knows their job; and

  - establishing and reviewing work on a timely basis, i.e. MBO.

- team skills and resources to implement the proposal so that we adhere to the cardinal rule of Digital, "He Who Proposes, Does";

- an understanding of the design, design production (eg. CAD) processes, and manufacturing processes.

Behaviorally, the team must:

. do it right the first time;

. execute the project in a timely fashion;

. limit projects to less than two years by a small team.

. not predicate a project on scheduling inventions in the design, process and CAD areas.

. have a written design methodology;

. be open and have external reviews, and clearly written product descriptions for inspection;

. start small, be reviewed and grow on its demonstrated success;

. learn, in order to handle the increase in complexity

PRODUCT METRICS KNOWLEDGE includes:

. products for which there'll be no competitor;

. all product cost metrics;

. all product performance and cost/performance metrics;

. reasons why the product will succeed;

. major competitor products by cost, performance and functionality;

. leading edge, innovative, small company products;

. productivity, quality and design process metrics for projects

DESIGN GOALS AND CONSTRAINTS

. Goals and constraints must be written down and updated from the day the project starts.

. A product can only have a few goals and constraints. The ranking is usually: it must work and have improved cost of ownership, be the shortest time to market, highest performance and lowest cost.

. If a standard exists, follow it or change it for all!

. If a standard is forming go all out to set it.

. Products must be designed for easy translation into in any natural language since we are an international company.

. All products must have be customer installable and maintainable.

. Portability is an important goal.

WHEN TO CREATE, WHEN TO EVOLVE AND WHEN TO STOP PRODUCTS

. Ideas must exist to have products! If we don't have ideas to redefine or extend a market, then we should not build a product.

. A product tree MUST be maintained by each engineering group showing roots, gestation time and life.

Goodness and Greatness = NO CRAPPY PRODUCTS

. be elegant and high quality;

. offer at least a factor of two cost-effectiveness over a current product;

. be based on an idea which will offer an attribute or set of attributes that no existing products have;

. build in generality, and extensibility;

. be a complete system, not piece parts;

. be a great system because the components are great;

. if we don't make it, buy it;

ELEGANCE: WHAT IS IT?

Russ Doane: "every feature contributes two benefits"

RH dictionary: "gracefully refined, dignified, of high quality"
  guality = lack of excess (especially errors)

Elegant design is the use of a part to perform many functions.

Architects say: "Less is more."

Some examples: the stored program computer (use of memory), the   general registers, the Unibus, Pascal, APL.

Several pioneers: "Leave a feature out that can be done another way."

It can sometimes conflict with other goals like orthogonality.

But too much elegance is trickery.

Product Evolution

- lower cost products require additional functionality too;

- constant cost, higher performance products are likely to be the most useful;

Revolutionary New Product Bases

- A new product base, must start a family tree from which significant evolution can occur.

Product Termination

- A product evolution is likely to need termination after successive implementations, because new concepts in use have obsoleted its underlying structure.

SELLING AND BUILDING THE PRODUCT

. it has to be producible and work, AND be useful to software;

. a business plan with orders and marketing plans from several marketing persons and groups needs to be in place;

. never build a product for a single customer,

. it must be done in a timely fashion according to the committed schedule, price and functions;

. it must be understandable and easy to use.

VENUS: WHAT WENT WRONG?

Chief designer: 0,1,2,3,4?

Management: 3 levels; disconnected from project; lack of right reviews; focus on process not product

team: contract preceeded team; organization muddy

understanding: poor on how to design; CAD ok Mfg. very good

timeliness: project always 27 months away plan didn't support the schedule

design methodology: word mouth, too much paper, design to schedule, build breadboard then redesign it!

reviews: inadequate; misaligned goals

learning: inadequate knowledge on how t design, complexity management, and scheduling

product metrics: fine

goals: muddy... now it's time to mar

customer install: fine

elegance & quality: too ideas (and people)

VENUS: NOW

chief designer: Alan Kotok

management: Bob Glorioso, primary focus i
project

team: hierarchy

design methodology:
processes written; hierarchy
specs; quality-based design vs. schedule based;
design will work before its built; design proces
model

understanding: increasing; courses on comple
and SW

reviews: a hierarchy; monthly with
milestones

goals: works; time to market;
performance; cost

WHAT IS A DESIGN METHODOLOGY?

Process characterization
design steps, times, learning
scheduling

Design representation
[physical,functional] x [leve
x
[amount and kind of detail]

Conventions (for names) and rules for creating t
design

WHAT ABOUT A MODERN DESIGN SYSTEM

One Database that has ALL signals, boxes and the
definitions

Hierarchial, with tools to constantly check all
assertions...

no feeding forward of design through a series of
programs

Interactive

Simulation and verification are essential

PRODUCTS THAT HAVE NOT MET EXPECTATIONS

PDP-8/S

VT8/E (Reuters), VT14 (for PDP-14

VT30 etc. (CSS)

VT15, GT40, GT60, Megatek buyout (ENG P/L)

VSV11 (LDP and CSS)

VT20, 21, 61T, 71, 171 (Typesetting P/L)

LA36/BSR, LA36/TU60, LA120/Tu58 (ATT)

Minc, Mini-Minc (LDP P/L)

PDT 110, 130 150 (Specialized customer)

Gigi (EDU P/L)

VT103 (TPG)

11/60, DS315, 11/23

LA34

WS100, WPS78, WPS 278, DECmate I? (WPS P/L)

PITFALLS OF LOW END PRODUCTS

.Customer specialized

.Specialized market not doable with GP Terminal or System

.Done on a limited budget. Just enough spending to lose.

.Marketing Demands It. Engineering Designs It.

.Poor engineering leadership to provide the right solution

.Poor solution compared to competition

.Inadequate product support in marketing or engineerin

HOW CAN WE REDUCE THE TIME TO INTRODUCE PRODUCTS?

By doing quality engineering... NO REWORK in the Testing Phases

Getting the Quick Turn Around Process to a Week
        Prints to correctly build module

Mid-life kickers and multiple implementations per design

WHAT IS QUALITY DESIGN?

Functional Specification in a working, design language

Quality Design

Checking of the Design by Design Walk-through (Code Walk through)

Simulate and verify the design. Prepare test data

Build it and verify that it works as designed

COHEN'S ELEMENTS OF SOFTWARE QUALITY

Packaging

Installability

Ease of Use

Reliability

Performance

Features

Service to Users

Maintainability

Maintainence

Compatibility

Evolvability

Timeliness

... all of the above

System	DEC 100	WPS 78	WPS 278	DECmate I	DECmate II	
Package	desk	stand	stand	pedestal	table top	
What	8/A	cpu in	6102+video	6120+video	-	
	VT52	VT52 base	VT100 box	VT100 box	monitor	
	RX01	RX01	RX02	RX02	RX50+6120	
When	9/75	9/77	6/81	3/82	9/82	
Performance	1	.3	.75	.75	1	
base cost	3.5	2.5	2.1	2.2	1.0	
base+dp	4.5	3.5	3.06	3.2	1.5	
base+lqp	5.7	4.7	4.26	4.4	2.2	
cpu only+crt		2.6	1.6	1.2	1.3	.7
floppies	.9	.9	.9	.9	.3	
cost/perf	3.5	8.3	2.8	2.9	1.0	
cost/perf@ 20% on 3.5	3.5	2.2	.9		.72	

Sat 16:43:43

WHAT IS THE FIFTH GENERATION?

- PR
- TO ENGAGE US (CRITICS, COMPETITORS)
- TO LEARN TO DO RESEARCH
- TO LEARN KNOWLEDGE ENGINEERING AND OTHER AI-BASED TECHNIQUES
- TO GET BY-PRODUCTS FROM FAR-OUT GOALS
- TO REPEAT SUCCESS IN SEMIS AND SUPERCOMPUTERS

THE NEXT GENERATION WILL BE EVOLUTIONARY

.FUJITSU AND HITACHI HAVE RUN THE LIVERMORE KERNELS AT >2 x THE CRAY xmP USING EVOLUTION:

- 25 YEAR OLD LANGUAGE - FORTRAN
- 20 YEAR OLD ARCHITECTURE - 360/370
- 25 YEAR OLD CIRCUITS AND SEMIS--ECL

GENERAL FACTORS IN COMPETING WITH JAPAN

- P = I x E (INTELLIGENCE, ENERGY)
- SOCIETAL VALUES
  - MEDICINE, LAW, POLITICS, ... , BUSINESS
  - SCIENCE, ENGINEERING, ... , MANUFACTURING
- TECHNOLOGICAL INFRASTRUCTURE
  - MATERIALS (SEMICONDUCTORS, MAGNETICS, ...
  - MECHANISMS
  - MANUFACTURING (CONTROL, ROBOTICS,
- MANAGEMENT - ESPECIALLY ENGINEERING AND MANUFACTURING
- QUALITY
- LONG TERM VERSUS SHORT TERM

COMPETING FOR THE NEXT GENERATION

. TURBULENCE DUE TO GENERATION TRANSITION

- NEW INDUSTRIES/PRODUCTS WITH MICRO

- VENTURE CAPITAL <--> ENTREPRENEURIAL ENERGY
  MANY, REDUNDANT, SHORT-TERM PRODUCTS
  THEREFORE, MUCH SHAKEOUT AND LOST EFFORT

PROBLEMS IN RESEARCHING THE NEXT GENERATION

.JAPAN IS BETTER COUPLED TO U.S. RESEARCH THAN AMERICAN INDUSTRY

. RESEARCH ON THE NEXT GENERATION IS HARD

. UNIVERSITIES AND INDUSTRY ARE BOTH ILL-EQUIPPED!
. LACK OF GOALS CREATES LOTS OF POOR PROJECTS
. LOTS OF FUNDING - FEW PEOPLE,
THEREFORE, TURBULENCE AND LOST EFFORT
. LOTS OF POORLY STAFFED, SUB-CRITICAL PROJECTS
. LARGE PROJECTS - LACK OF MANAGEMENT

PARALLEL COMPUTING

NETWORK - WITH LAN OR WAN INTERCONNECT
CLUSTER - WITH LAN INTERCONNECT
FUNCTIONAL - ONE PROCESSOR PER FUNCTION
CLOSE AREA NET CLUSTER - HIGH SPEED INTERCONNECT
TIMESHARING - ONE PROCESSOR PER USER
PARTITIONED - ONE PROCESSOR PER PROCESS

TRANSACTION PROCESSING - PROCESSOR PER STEP
FAULT-TOLERANT - DIFFERENT PROCESSORS ASSIGNED PER
STEP WITH REDUNDANT COMPUTATION
CONCURRENT-TASK - PARALLEL PROCESSING OF A TASK BY
PARTITIONING FOR INDEPENDENT DATA
PIPELINED-TASK - PARALLEL PROCESSING OF A TASK
PARALLEL PROCESSING - PROCESSORS WORK ON ONE TASK

"IF A COMPUTER UNDERSTANDS ENGLISH,

IT MUST BE JAPANESE."

-ALAN PERLIS

THE FOURTH GENERATION

- EVOLUTIONARY USE BASED ON WORD, DATA PROCESSING, PROFESSIONAL APPLICATIONS. EMBEDDED COMPUTING
- INTER-COMMUNICATIONS AND PRODUCTIVITY NEEDS TO INCREASE USE
- WELL-DEVELOPED TECHNOLOGIES, INCLUDING VLSI MICROPROCESSORS, LANS, MAGNETICS, DISPLAYS AND STANDARD SOFTWARE
- NEW ORGANIZATIONS TO BUILD NEW COMPUTERS, BUT
- NEW USES THAT EVOLVE WON'T BE KNOWN FOR A DECADE

THE NEXT GENERATION: REVOLUTIONARY VIEW

- REVOLUTIONARY USE DEPENDING ON VOICE AND NATURAL LANGUAGE COMMUNICATION
- GREATER COMMUNICATION AND PRODUCTIVITY NEEDS INCLUDING ROBOTICS, SPEECH AND NATURAL LANGUAGE, EXPERT SYSTEMS FOR COMPLEXITY AND PRODUCTIVITY
- ROBOTICS, AND ARTIFICIAL INTELLIGENCE, FAST-WANS, ULTRA- AND VLSI AND PARALLELISM
- AVANT GARDE ORGANIZATIONAL COOPERATION BETWEEN RESEARCHERS AND INDUSTRY

THE NEXT GENERATION: EVOLUTIONARY VIEW

- EVOLUTIONARY USE. WIDESPREAD ELECTRONIC MAIL, ELECTRONIC-BASED LOGIC TO ENCODE KNOWLEDGE
- NEED TO HAVE INFORMATION AT "FINGERTIPS" (IN THE SYSTEM AND NOT IN PAPERS AND BOOKS)
- EVOLUTIONARY TECHNOLOGY WITH LARGER, DISTRIBUTED MEMORIES
- NEW COMPANIES. BUILD WITH EVOLVING TECHNOLOGY

A GENERATION IS THE CONVERGENCE OF:

- NEED (EG. THREAT OF ANNIHILATION, GREED)
  FREEING RESOURCES
- TECHNOLOGY AND SCIENCE
  THAT PROVIDE FOR BUILDING MACHINES
- ORGANIZATIONS TO BUILD NEW COMPUTING STRUCTURES
- USE TO CONFIRM A GENERATION (AFTER THE FACT)

THE TRANSITIONS*

TECHNOLOGY TRANSITION

TRANSITION TO DISTRIBUTED COMPUTING BASED ON NI

TRANSITION TO PERSONAL COMPUTERS FROM MINIS AND MAINFRAMES

TRANSITION FROM CONVENTIONAL RACK AND STACK 16-BIT COMPUTERS

TRANSITION FROM TERMINALS TO COMPUTING TERMINALS

TRANSITION TO SOFTWARE FOR END USE VERSUS PROGRAMMER TOOLS

TRANSITION IN HARDWARE DESIGN SKILLS

* TRANSITIONS IMPLY CHANGE (AND PAIN) IN

  . WHAT WE ENGINEER (I.E. PROJECTS)

. HOW WE DESIGN
. HOW COMPUTERS ARE SOLD, PRODUCED, DISTRIBUTED AND USED.

TECHNOLOGY TRANSITION

Transition based on technology evolution is continuing at 20% cost decline per year as shown in the following figure, permitting an incredibly wide range of useful computing devices to be built. The generation* period of seven years** and the seven generations, 55 year period from 1945 to 2000, is described in the appendix on the fifth and sixth technology generations. Economy of scale, also known as grosch's law, does not hold today for any system or component except very large disks, however there is diseconomy of scale for large systems primary memory.

*A generation is concurrence of:

Technology: VLSI = 10^5 trans/chip, Wini,
System(s): Personal Computers, Mini-mainframes,
Need: Communication, Productivity,
Use: (after the fact 1987 we'll know)

A seven year generation is time to:

. get factor of 100 if technology doubles each year
. two design cycles
. factor of 5 if price declines 20%/year
. find a new computer structure (e.g. mini, micro)

From the generations graph, we can observe the following:

- .there is a wider range of useful systems, and these will be appealing to our customers, us and others; (For example, in 1985 we could be selling $1,000 computing terminals with the power of the original LINC, and $600K 10/20's.)
- .the wide range of useful systems will force all suppliers to be more competitive and selective as new suppliers enter on a point product basis and as the 370 becomes a commodity;
- .IBM, Fujitsu, and others are likely to offer a 4341-2 class machine in our $40,000 to $100,000 minicomputer heartland;
- .competitors, could be targetting the following (for 1985):

  - .Cray 1 power, $625K (or in 1990 for $250K);
  - . x3+ Comet power for $100K;
  - . 780 power for $40K;
  - .a sharable VAX (or big micro) in $6.25K to $16K range;
  - .a personal VAX (or big micro) for under $6.25K;
  - .a computing terminal with VT100 capability, and power of Apple II, or original LINC, for $1,000;
  - . computers in $400 to $1,000 range;

.we have not provided aggressive enough products, because:

- .the Q and U bus form factors have constrained system cost and size;
- .the 19" rack and stack, palletable form factor together with poorly packaged components, has been retained; Packaging in other, lower cost form factors enabling carboard box shipment and customer merge is essential.
- .the terminal has not been used as a package; and
- .point products have been insufficiently high quality, software supported, or cost-effective. Even $200 calculators are modular with mass storage, printer, modem and display options.

TRANSITION TO DISTRIBUTED COMPUTING BASED ON NI, INTERCONNECTING:

- departmental and central computers to each other;
- personal Computers to form clusters;
- functional server components to reduce the number of network possibilites that are a product of:
  - hardware systems;
  - the 12 operating systems we support; and
  - the desirable protocols including X.25, IBM, DECnet and other vendors.

By using the server concept each system can be connected to NI, with specialized servers:

- concentrators for interconnecting dumb terminals and personal computers;
- gateways to systems using other protocols;
- repeaters and interfaces to other networks;
- central functional servers for files and printing;
- real time front ends.

TRANSITION TO PERSONAL COMPUTERS FROM MINIS AND MAINFRAMES

Timeshared computers are affected in several ways:

- direct, stand alone use;
- more terminal load can be put on a given computer;
- interconnected clusters of personal computers are a substitution

TRANSITION FROM CONVENTIONAL RACK AND STACK 16-BIT COMPUTERS

The alternatives:

.16-bit microprocessor cards and systems which have 22-bit memory address space and supplied by both semicomputer companies and their OEMS transportable systems such as UNIX are aimed at establishing hardware to be a commodity.
.board and box level systems that are oriented to modern special chip i/o as supplied by the semicomputer suppliers;
.   personal Computer and Clusters,
.   VAX and other 32-bit architectures
. emerging commodity priced 370s in this price class.
.better box-level form factors not possible with 19", FAT produced, Q- and Unibus systems; Systems must be shipped in cardboard boxes, integrated by the customer, and when broken, self-diagnosing with customer replaceability.

TRANSITION FROM TERMINALS TO COMPUTING TERMINALS

The major transition for terminals is semantic, i.e. what is a terminal? Terminals must change in the following ways:

- . larger Personal Computers are an alternative to our conventional, dumb terminals;
- .all terminals introduced beginning in FY83 must be customer programmable with at least firmware ROMS and ram buffers;
- .the interconnection, whether it be U. S. or European Modem, NI, or IBM emulator, must be built into the terminal;
- .decreasing memory cost based on 64K chip will offer fully programmable screens, which in turn will automatically provide graphics; and
- . higher resolution, full-page and color displays.

TRANSITION TO SOFTWARE FOR END USE VERSUS PROGRAMMER TOOLS

We can identify these needs:

.direct use in the office, including providing the ability of OEMs, office managers, organization, and the individuals to tailor their systems;
.better human engineering at screen and in documentation; Documents and help should be built-in.
.all products must be modifyable for use with any natural language;
.applications building tools for particular professional and commercial environments.

TRANSITION IN HARDWARE DESIGN SKILLS

The immediate transitions for system designers includes:

- .standardization and use of general purpose controllers and processors for conventional controllers; We are not using enough standard VLSI! This implies options are programmed.
- .use of gate arrays and other lsi to lower cost of all jelly bean and non-processor logic;
- .VLSI design, where processors and controllers are placed on a single chip;
- .identification of either general purpose or special purpose computers based on VLSI for building the non-processor portion of systems to drastically reduce system cost.

THE UNIBUS HAS TURNED OUT TO BE

"OPTIONAL" SO FAR... IN TERMS OF

PERFORMANCE AND MEMORY SIZE

GIVEN:

1. AMDAHL'S CONSTANT 1 IPs REQUIRES 1 BYTE MP

2. ADDRESS SPACE = 2^{18} BYTES. (.25 MBYTES)

3. 1 INSTRUCTION CAUSES 4 TO 6 BYTES OF ACCESS

4. UNIBUS = 2 MBYTES/SEC.

IMPUTE:

BASED ON SPEED

2 MBYTES/SEC. => .5 TO .33 MIPS = .5 TO .33 MB

> .25 MBY

BASED ON MEMORY SIZE

.25 MBYTES => .25 MIPS => 1 TO 1.5 MBY/SEC.

(1 TO 1.5 MBYTES/SEC.) < 2 MBY/SEC. OF UNIBUS

g.bell
4/28/78

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4/28/78

GENERAL GOALS/CONSTRAINTS

G0.1 MINIMIZE MP.SIZE (PROGRAMS) BY ENCODING & OPERATIONS (BIND IN HARDWARE)

[VAX ISP SHOULD HAVE _< MP.SIZE (OF PDP-11) WHILE PROVIDING 32-BIT VIRTUAL ADDRESS)

G0.2 MINIMIZE PROCESSING TIME FOR COMMON FUNCTION (E.G. MEMORY MANAGEMENT, PROCEDURE CALL, CONTEXT SWITCH)

G0.3 MINIMIZE COST OF EXTENSIONS

G0.4 BUILD GENERAL VS. SPECIFIC MECHANISMS

G0.5 MINIMUM PROGRAMMING TIME

G0.6 PROVIDE A MACHINE IN WHICH THERE IS MORE PROGRAM SHARING THAN WITH ANY OTHER MACHINE

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4/28/75

<u>HSC50</u>

- CI disk server for up to 15 host CPU's
- Controls up to 24 dual-ported disks/tapes using MSCP.
- Local load device (TU58) for operating/diagnostic SW
- Extensive performance optimization
- Potential for functional expansion
- Transfer cost approx $7000
- FRS at end of Calendar 1982

COMPETITION

- IBM 3880
- Add-on back-end data servers
- Traditional disk architecture + networking

HSC50 RISKS

		Cost	Sched	Perf
-	Hardware board density	7	3	1
-	Software Complexity	2	6	6
-	Architectural Instability	3	7	3
-	Inadequate Disk/Tape Menu			
-	High Entry Price			

Dick Clayton	ML12-2/E71
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Bruce Delagi	ML12-1/F41
Bill Demmer	TW/D19
Jake Jacobs	PK3-1/M33
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- a chief designer/chief programmer to formulate and lead;

  NO COMMITTEES AS DESIGNERS

- management who understand the product space and who has engineered successful products; The two most important jobs are:

  - making sure that everyone knows their job; and

  - establishing and reviewing work on a timely basis, i.e. MBO.

- team skills and resources to implement the proposal so that we adhere to the cardinal rule of Digital, "He Who Proposes, Does";

- an understanding of the design, design production (eg. CAD) processes, and manufacturing processes.

Behaviorally, the team must:

. do it right the first time;

. execute the project in a timely fashion;

. limit projects to less than two years by a small team.

. not predicate a project on scheduling inventions in the design, process and CAD areas.

. have a written design methodology;

. be open and have external reviews, and clearly written product descriptions for inspection;

. start small, be reviewed and grow on its demonstrated success;

. learn, in order to handle the increase in complexity

PRODUCT METRICS KNOWLEDGE includes:

. products for which there'll be no competitor;

. all product cost metrics;

. all product performance and cost/performance metrics;

. reasons why the product will succeed;

. major competitor products by cost, performance and functionality;

. leading edge, innovative, small company products;

. productivity, quality and design process metrics for projects

DESIGN GOALS AND CONSTRAINTS

. Goals and constraints must be written down and updated from the day the project starts.

. A product can only have a few goals and constraints. The ranking is usually: it must work and have improved cost of ownership, be the shortest time to market, highest performance and lowest cost.

. If a standard exists, follow it or change it for all!

. If a standard is forming go all out to set it.

. Products must be designed for easy translation into in any natural language since we are an international company.

. All products must have be customer installable and maintainable.

.   Portability is an important goal.

WHEN TO CREATE, WHEN TO EVOLVE

AND WHEN TO STOP PRODUCTS

. Ideas must exist to have products! If we don't have ideas to redefine or extend a market, then we should not build a product.

. A product tree MUST be maintained by each engineering group showing roots, gestation time and life.

Goodness and Greatness = NO CRAPPY PRODUCTS

. be elegant and high quality;

. offer at least a factor of two cost-effectiveness over a current product;

. be based on an idea which will offer an attribute or set of attributes that no existing products have;

. build in generality, and extensibility;

. be a complete system, not piece parts;

. be a great system because the components are great;

. if we don't make it, buy it;

ELEGANCE: WHAT IS IT?

Russ Doane: "every feature contributes two benefits"

RH dictionary: "gracefully refined, dignified, of high quality"

guality- lack of excess (especially errors)

Elegant design is the use of a part to perform many functions.

Architects say: "Less is more."

Some examples: the stored program computer (use of memory), the general registers, the Unibus, Pascal, APL.

Several pioneers: "Leave a feature out that can be done another way."

It can sometimes conflict with other goals like orthogonality.

But too much elegance is trickery.

Product Evolution

. lower cost products require additional functionality too;

. constant cost, higher performance products are likely to be the most useful;

Revolutionary New Product Bases

. A new product base, must start a family tree from which significant evolution can occur.

Product Termination

. A product evolution is likely to need termination after successive implementations, because new concepts in use have obsoleted its underlying structure.

SELLING AND BUILDING THE PRODUCT

. it has to be producible and work, AND be useful to software;

. a business plan with orders and marketing plans from several marketing persons and groups needs to be in place;

. never build a product for a single customer,

. it must be done in a timely fashion according to the committed schedule, price and functions;

. it must be understandable and easy to use.

System	DEC 100	WPS 78	WPS 278	DECmate I	DECmate II	
Package	desk	stand	stand	pedestal	table top	
What	8/A	cpu in	6102+video	6120+video	-	
	VT52	VT52 base	VT100 box	VT100 box	monitor	
	RX01	RX01	RX02	RX02	RX50+6120	
When	9/75	9/77	6/81	3/82	9/82	
Performance	1	.3	.75	.75	1	
base cost	3.5	2.5	2.1	2.2	1.0	
base+dp	4.5	3.5	3.06	3.2	1.5	
base+lqp	5.7	4.7	4.26	4.4	2.2	
cpu only+crt		2.6	1.6	1.2	1.3	.7
floppies	.9	.9	.9	.9	.3	
cost/perf	3.5	8.3	2.8	2.9	1.0	
cost/perf@						
	20% on 3.5	3.5	2.2	.9		.

VENUS: WHAT WENT WRONG?

Chief designer: 0,1,2,3,4?

Management: 3 levels; disconnected from project; lack of right reviews; focus on process not product

team: contract preceeded team; organization muddy

understanding: poor on how to design; CAD ok Mfg. very good

timeliness: project always 27 months away plan didn't support the schedule

design methodology: word mouth, too much paper, design to schedule, buil breadboard then redesign it!

reviews: inadequate; misaligned goals

learning: inadequate knowledge on how t design, complexity management, and scheduling

product metrics: fine

goals: muddy... now it's time to mar

customer install: fine

elegance & quality: too
ideas (and people)

VENUS: NOW

chief designer: Alan Kotok

management: Bob Glorioso, primary focus i
project

team: hierarchy

design methodology:
processes written; hierarchy
specs; quality-based design vs. schedule based;
design will work before its built; design proces
model

understanding: increasing; courses on comple
and SW

reviews: a hierarchy; monthly with
milestones

goals: works; time to market;
performance; cost

WHAT IS A DESIGN METHODOLOGY?

Process characterization

design steps, times, learning
scheduling

Design representation

{physical,functional} x {lev
x

{amount and kind of detail}

Conventions (for names) and rules for creating t
design

WHAT ABOUT A MODERN DESIGN SYSTEM

One Database that has ALL signals, boxes and the
definitions

Hierarchial, with tools to constantly check all
assertions...

no feeding forward of design through a series of
programs

Interactive

Simulation and verification are essential

PRODUCTS THAT HAVE NOT MET EXPECTATIONS

PDP-8/S

VT8/E (Reuters), VT14 (for PDP-14

VT30 etc. (CSS)

VT15, GT40, GT60, Megatek buyout (ENG P/L)

VSV11 (LDP and CSS)

VT20, 21, 61T, 71, 171 (Typesetting P/L)

LA36/BSR, LA36/TU60, LA120/Tu58 (ATT)

Minc, Mini-Minc (LDP P/L)

PDT 110, 130 150 (Specialized customer)

Gigi (EDU P/L)

VT103 (TPG)

11/60, DS315, 11/23

LA34

WS100, WPS78, WPS 278, DECmate I? (WPS P/L)

PITFALLS OF LOW END PRODUCTS

.Customer specialized

.Specialized market not doable with GP Terminal or System

.Done on a limited budget. Just enough spending to lose.

.Marketing Demands It. Engineering Designs It.

.Poor engineering leadership to provide the right solution

.Poor solution compared to competition

.Inadequate product support in marketing or engineerin

HOW CAN WE REDUCE THE TIME TO INTRODUCE PRODUCTS?

By doing quality engineering... NO REWORK in the Testing Phases

Getting the Quick Turn Around Process to a Week

Prints to correctly build module

Mid-life kickers and multiple implementations per design

WHAT IS QUALITY DESIGN?

Functional Specification in a working, design language

Quality Design

Checking of the Design by Design Walk-through (Code Walk through)

Simulate and verify the design. Prepare test data

Build it and verify that it works as designed

COHEN'S ELEMENTS OF SOFTWARE QUALITY

Packaging

Installability

Ease of Use

Reliability

Performance

Features

Service to Users

Maintainability

Maintainence

Compatibility

Evolvability

Timeliness

... all of the above

Sat 16:43:43

OPERATING SYSTEMS, SINGLE USER

- DOMMUNICATIONS
- FILE SYSTEMS
- TERMINAL INTERFACE
- PROGRAMMING ENVIRONMENT
- HIGH PRODUCTIVITY LANGUAGE

PROGRAMMING LANGUAGES

WORD PROCESSING APPLICATIONS

TECHNIQUES

- QUALITY
- PERFORMANCE
- HUMAN INTERFACE

PIONEERS IN:

OPERATING SYSTEMS (DEC 10/20, RT, RSTS, RSX, VMS)

SINGLE USER OPERATING SYSTEMS. PDP-6 WAS BASE FOR OUR INTERACTIVE PROGRAMMING EXPERIENCE.

RT WAS BASE FOR CP/M PERSONAL COMPUTER SOFTWARE

RSTS WAS OUR MAIN MINI- OPERATING SYSTEM FOR 11'S

EDITORS FOR PROGRAMS WERE FORE-RUNNERS OF TEXT EDITORS

WORD PROCESSING- WE WERE THERE VERY EARLY

COBOL AND BASIC LANGUAGE

FILES AND DATABASES

CT

CT-A. MILLER (2,12; Assoc. Prof., neurophysiology, interfaces,
Medical monitoring, Berkley, Holland, Israel, started co.)

RON HAM-SW (>5,15; Databases, languages, and operating system
built first competitive commercial systems, Honeywell)

ERIC BATZ-RSX SW (7, Cutler protege')

ERIC POLLACK-RSX SW Mods (7, Cutler protege')

GLEN JOHNSON (7,9 RCA, interactive diagnostics)

JEFF RUDY-LANGUAGES/HUMAN INTERFACE (5,10 Languages,
editing)

FRANK INFANTE-Outside SW Acquisition (15, DEC10 Cobol)

OFFICE SOFTWARE ON CT, VAX AND 278

BRUCE STEWART (2,20; Univac, Head of ICL eng.managed release of WPS 8, DECword, and Electronic mail)

JACK GILMORE-(5,30, Consultant, technical director of
Keydata, designer of word processing software

BOB TRAVIS-(Architect of Office Software, implmenter of WPS8
also worked with Dan Bricklin, implementer of VISICALC)

BILL ZIMMER (5, Cognitive Psycholog)

WHITESIDE (1, Cognitive Psychology)

<u>OFFICE SOFTWARE ON CT, VAX AND 278 cont.</u>

RON JANSEN-(5,? Office Software Team Leader, Implmented 2 versions of RT-11, our single user system from which much personal software (eg. CP/M) is based)

BOB KUSHLIS (about 28 years old, intellectual leader, implemented many editors, developed Kaola language)

ANTON CHERNOFF (6, RSTS and RT implementer, key leader)

MARK BRAMHALL (10,? Terminal Interface, Leader of RSTS)

RICH WITEK (5,? communications and operating systems)

JEREMY THOMAS (0,15 ICL Office and Terminal Applications program management, responsible for Office Applications)

TERRELL MITCHELL (5 Cobol, EDT designer, responsible for WPS editor implementation)

IAN SMITH (12,16 Electronic Mail, Interactive Op. Sys)

TOM MORRIS (<30, co-designer)

JERRY MELNICK (<30, co-designer)

278

278 PROGRAM- DICK LOVELAND (4,10 Software Management of DECnet,
Product Management of Small Systems)

OWEN FISK-Manager of WPS8 Software

APPLICATIONS SW FOR 278- OLLIE STONE, includes: general acctng,
Dentist, construction, legal office. (7,15 Datatrol; Automated
manufacturing test and diagnostics)

ROBIN, ALIAS VT180 ALIAS VT/Z80

VT180 (CP/M BASED PRODUCT)- BARRY FOLSOM (2,? DG, Special terminals software)

DESIGNER OF SYSTEM- JOHN MORSE (5,? R&D Group)

TERMINALS SOFTWARE AND ARCHITECTURE

ARCHITECTURE- TOM MCINTYRE (5,15 neurophysiologist,
turned computer scientist, Forms Management System)

MICROPROGRAMMING JOHN WAGNER (2,15 former VP of eng.)

MINICOMPUTER COMPANY LESSONS

1. NEARLY 25% SURVIVED
2. ONLY 8% REALLY WON
3. ONLY 2% OF STARTUPS RETAINED AUTONOMY
4. MERGING WAS TRIED BY 10%
5. BUT ONLY 1/3 OF MERGERS WERE SUCCESSFUL
6. BEING A COMPUTER SUPPLIER DIDN'T HELP: ONLY DEC AND IBM MADE THE TRANSITION!
7. IBM ALWAYS WINS... EVENTUALLY (SYSTEM 3... SERIES 1)

MINICOMPUTER TECHNOLOGY (CIRCA 1970)

BASIC INDUSTRIES	MINICOMPUTER COMPANIES
POWER SUPPLIES	OPTIONAL
PACKAGING	ESSENTIAL
CORE MEMORY	OPTIONAL
SEMICONDUCTORS (MSI)	CPU AND MEMORIES
DISKS AND TAPES	PERIPHERAL CONTROLLERS
TERMINALS	-
	OPERATING SYSTEMS
	LANGUAGES
APPLICATIONS	OPTIONAL
	SYSTEM INTEGRATION

MAINFRAME TECHNOLOGY (1950, 1960)

BASIC INDUSTRIES	MAINFRAME COMPANIES
DISCRETE COMPONENTS	
TUBES, TRANSISTORS	PLUG-IN UNITS
MEMORIES	MEMORIES
	PERIPHERALS
	LANGUAGES
	APPLICATIONS
	SYSTEM INTEGRATION

MICROCOMPUTER-BASED COMPANIES

BASIC INDUSTRIES	MICROCOMPUTER COMPANIES
POWER SUPPLIES	OPTIONAL
PACKAGING	OPTIONAL
SEMICONDUCTORS (MICROS, MEMORY, PERIPHERALS)	-
CRT'S AND TERMINALS	-
DISKS AND TAPES	-
BOARD OPTIONS	OPTIONAL
UNIX & DIAGNOSTICS	OPTIONAL
LANGUAGES & DATABASES	OPTIONAL
LAN'S / COMMUNICATION	OPTIONAL
APPLICATIONS	OPTIONAL
	SYSTEM INTEGRATION

MICROPROCESSOR-BASED COMPUTER PRODUCTS

ON A DESK (PERSONAL COMPUTERS)

SMART TELEPHONES
TERMINALS
HOME (AND GAME)
PORTABLE PC'S
WORD PROCESSORS
PC'S
WORKSTATIONS

DEPARTMENTAL AND GROUP-LEVEL COMPUTERS

MICRO
SUPER-MICRO
CLUSTERED, FUNCTIONAL MULTIPROCESSOR
SYMMETRIC MULTIPROCESSOR
HIGH-AVAILABILITY
  SINGLE COMPUTER VIA VOTING
  MULTIPROCESSOR (N+1) REDUNDANCY
  MULTI-COMPUTER CLUSTERS

STRATEGY FOR PRODUCTS (81-82)

. A MINIMUM OF HARDWARE AND SOFTWARE VAX AND 11 SYSTEMS WITH:

APPROPRIATE SIZE/AND COMPATIBILITY PRICED DISKS.

. PHASING OVER TO A VAX-ONLY STRATEGY BY 1985, OR WHEN APPROPRIATE

. STAYING BELOW $250K SELLING PRICE (IN ORDER TO KEEP MACHINES AND BUYING WITH THE USE).

<u>BASE HARDWARE</u>

LEVEL OF MACHINE	VAX	11
CENTRAL	780 -> SUPERSTAR*	(NOTE COMPETES WITH LEN

HUGHES' SEL

	(AT 200K LEVEL)	ECL MACHINE)
GROUP	COMET/HYDRA	11/74; 11/74 MP -> 0 (USE COMET)
SMALL GROUP	NEBULA*	11/44 -> FONZ REPLACEMENT
PERSONAL	LSI-VAX*	FONZ
EMBEDDED CONTROL		TINY

*NOT DOING AGRESSIVELY NOW!

BASE SOFTWARE

. LESS 11 ENHANCEMENTS (I.E. DECREASING OR SUSTAINING FUNDS)

IAS, RSTS, HI-END RT; USE M, SCS, TRAX AS BASE FOR COMPATIBILITY WITH VAX. THAT IS, PROGRAMS MUST BE ABLE TO MIGRATE FROM 11'S TO VAX!

. LAYERED, MODULAR O/S FOR SPECIFIC APPLICATIONS (COMMON PROGRAM INTERFACE; COMMON UTILITIES AND LANGUAGES; COMMON DRIVERS)

. VMS - GP BASE; ADD BATCH

. TIMESHARING

. TRAX-32 FOR TRANSACTION PROCESSING

. TUNED REAL TIME

. BASIC+ WITH EXPORT/IMPORT AND RSTS INTERFACE, FACILITIES AND UTILITIES - AT CURRENT PERFORMANCE LEVEL - PROTECT USER PROGRAMS.

THIS IS OUR BIGGEST USER BASE.

.FILE, DISTRIBUTED DATA BASE AND NETWORK

TO SUPPORT DISTRIBUTED

PROCESSING GIVING ABILITY TO COMPUTE/STORE IN ANY NODE.

BASE HARDWARE OPTIONS

. MODERN, MULTI-DROP, HIGH-SPEED COMMUNICATIONS FOR '80S INTERCONNECTING:

.TERMINALS, PERIPHERALS (E.G. LINE PRINTER) AND SMALL-SYSTEMS

PERMITS DROP-SHIP AND CUSTOMER INTEGRATION

. TERMINALS WITH SOFTWARE SUPPORT FOR:

.DUMB, BLOCK MODE AND LOW COST - A TERMINAL FOR EVERYONE!

. OFFICE

.LETTER/HIGH QUALITY PRINT (WITH GRAPHIX/FAX) FOR ELECTRONIC MAIL

.PAGE CRT FOR WORD PROCESSING (STAN), AND

. ANALYST (LENG) - GRAPHIX CALCULATOR/WORD PROCESSOR - THE MODERN (VECTOR, MATRIX, TABULAR) CALCULATOR AND DISPLAY

- FACTORY ENVIRONMENT
- COMPATIBLE AND LOW COST TERMINALS
- DISTRIBUTED PROCESSING TO PROCESS INTERFACE

BASE LEVEL APPLICATIONS

. DOCUMENTS (VIA WORD PROCESSING), ELECTRONIC MAIL, QUALITY

DOCUMENTS
(E.G., BOOKS)

BELL (ATT/BELL LAB) GROUP BUILDING PBX'S

AS A CUSTOMER PUT IT ON WEDNESDAY:

. "ONLY YOU HAVE THE BASIC ARCHITECTURE IN VAX TO COVER THE RANGE WE NEED FOR DISTRIBUTED PROCESSING. WHY DON'T YOU BUILD IT?

. GIVE US A <u>TRULY COMPATIBLE</u> RANGE OF VAX MACHINES.

DON'T CORRUPT IT (LIKE YOU DID ON THE 11). WE WANT A RANGE OF MACHINES:

- 10 X IBM 3033

- CURRENT 780

- VAX-ON-A-CHIP (FOR TERMINAL USE)

. SW BASE >> HARDWARE BASE (CPU'S ARE 4% OF COST)

. **WE MUST HAVE RELIABLE, SECURE COMPUTERS FOR SYSTEMS WE INTEND TO BUILD."**

. **THEY'LL FUND US TO WORK ON NEBULA AND THE VAX CHIP!**

DUPONT HAS THE SAME REQUIREMENTS

C O M P A N Y   C O N F I D E N T I A L

+---------------+ ID#0181
! d i g i t a l !   i n t e r o f f i c e   m e m o r a n d u m
+---------------+

Subject: **JOB OFFERS**

To: Dick Clayton, Larry Portner, Bob Puffer

Date: 10 AUG 78
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

follow up 8/17/78

Can we offer Ron Smart/John Jones jobs to match/utilize their skills?

GB:ljp

****
* d i g i t a l *
****

TO: PETER CHRISTY DATE: FRI 15 AUG 1980
6:57 PM EDT

FROM: GORDON BELL
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: RE: RE: SW BEIGE BOOK

I want to find a way to get us out of this and consider you a key person. Bruce Delagi is going to be staff in charge of longer range planning... and we want him to ask the tough questions of each group so they can get further out rather than just respond or go along in incremental mode based on the past.

I have some faith too, that we can change. Am really impressed with the moves in the interconnect area and the base architecture we are building there. This is turning out to drive the hardware systems (by size) like crazy. My intent is to have Bruce, Dave Rodgers, Si(or Per Hjerppe),Strecker (or Fuller), Keating(or Husvedt), and you meet regularly to try to generally plan out and formulate questions for the various groups. I want the groups themselves to also get very strong and independent in terms of a/d, planning, mkting, etc. with good couplings to manufacturing (where appropriate) at to P/L.

The SW long term is the place I want to get to, given that we will be a viable manufacturer in the face of IBM and Japan (both of whom frighten me most).

Think we have to interact on this.

GB1.S6.14
****
* d i g i t a l *
****

TO: MARCIA KENAH DATE: SUN 13 JUL 1980 5:15 PM EDT

FROM: GORDON BELL

cc: SAM FULLER

DEPT: OOD

EXT: 223-2236

LOC/MAIL STOP: ML12-1/A51

SUBJECT: BITING OFF LESS SOFTWARE BLUEPRINT THAN YOU CAN CHU

Yeech! I hope Sam can give me something to say to Yaohan if you need me to be the bearer of bad tidings.

I have a problem with the book, but really feel old, and far afield, so probably don't understand the merits or subtleties.

Doesn't come up to a book like Yourdon. Later, should be better.

Makes the fatal mistake of inventing another god damn set of notations, and languages (SPL) that aren't supported. Hence, I can't imagine the value in teaching it, without the support stuff. Not clear that it is particularly good either.

Tries to capture the whole softare engineering world en passant by mentioning all the concepts, with brief writeups. This goes for everything from information hiding, to an ennumeration of the common data structures.

Misses the whole point of design for enhancement as a criterion.
This is where all the money goes in engineering, not designing
for what it does, but rather what it will ultimately have to do.

The whole book is nothing but a documentation of a big, boring
program that is probably full of errors. There is nothing dealing with what the program is supposed to do, the spec., and
then showing the various ways to get from this to the right blueprint, and on down to build the structure. Am deftly afraid of the segmented approach between architects who make the blueprints and the implementors. By the way the blueprints
are drawn, pretty much specifies the construction. The segmentation just doesn't feel right. House implementors put every 2 x 4 in place from a good set of prints. Therefore I
must worry about the segmentation and feel that I should almost
reject it, as implementation, it turns out is the real killer in
a design. He also ignores the whole building in testability, showing how to test it, proving correctness, etc. The arbitrary
levels (mnemonically called A,B,C) also turn me off.
Looks like an inside out, or bottom up rather than top-down design approach. Also ignored performance, and designing for it and tradeoffs, etc.

Maybe I'm making too much out of the fact that I expected a good book on software engineering rather than how to use blueprint to build the Interactive Direct Execution System... which I'm not sure anyone is motivated to want.

No home problemsor unclear how it could be used in a course.

Had a good discussion with Brigham about the SE course he took at CMU, and their work seemed much more substantive, although the output was to build a big, god damn program too. He might be a good reviewer if one needs another one.

Only spent a few minutes looking at it, so I'd like some corrections to this (surely I missed a lot in the brief scan). Unfortunately, it didn't hold my attention, but that happens too when one gets older (or equivalently much younger).

If I am to be the bearer of bad tidings, then I want to be sure I'm light or wlong? Am I?.

GB1.S5.50

****

* d i g i t a l *

****

TO: OOD: DATE: TUE 21 OCT 1980 11:00 AM EDT

FROM: GORDON BELL

DEPT: OOD

EXT: 223-2236

LOC/MAIL STOP: ML12-1/A51

SUBJECT: SOFTWARE ORGANIZATION ISSUES

As we discussed on 10/14:

1. The 32-bit base software would include VMS (with its DECnet interface), RMS, CATS, FMS.

2. Hydra includes CI, standards to HSC50 and Hg (?). Also standards to interface 2080.

3. Interconnects include DECnet standards, co-ordinating all busses, and NI development.

4. The languages include RTE, Datatrieve, DBMS, RDBMS, plus the languages.

5. TPSS-32 is separate but requires support in CATS, FMS.

6. The office program is a set of projects that run on numerous systems as layered products. WPS78/278; WPS200, Word 11 layered, Word 11 bounded, KO WPS, OFIS base going to VMS, RSTS, M; EMS/VMS. Should typesetting be there too?

7. 36/32 co-existence and standards for transportability are part of 36-bit project.

8. RSTS/32 co-existence and standardness for transportability are part of RSTS/SCS.

9. We want a base system as part of KO.

10. There have to be various applications, targets for KO besides the office.

GB:swh
GB1.S7.37

SOFTWARE SALES

$670M

```
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APPLICATION       !
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TOOLS             !
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DECNET  15%       !
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LANGUAGES 20%     !
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                             ! DECNET    10%          !
                  !   OPERATING             !
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SYSTEMS           !
                             ! LANGUAGES 30%          !
                  !     30%  !
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     $4M                     !   OPERATING !          !
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                             !    SYSTEMS  !          !
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----------------  !     60%  !             !          !
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     FY74                          FY79
FY84
```

FROM: GORDON BELL   DATE: SAT 9 FEB 1980 8:37
PM EST
DEPT: OOD
EXT: 223-2236
TO: TOM STOCKEBRAND

SUBJECT: SOLAR THOUGHT FOR THE DAY

What if we make the pool black. Put it virtually outside with
glass over it.   Make it out of steel and set t on concrete (well
insulated on the bottom) and then make the sides have fins so that
it is a big collector/radiator. Then we put a floor over the
top or at the water level and arrange to have a crawl/ airflow
so that air is flowed into the room from around the sides like:

```
floor.....w..water..w...floor.........
c......,..w         w
c         w         w
c air     w  water  w  air
c         w         w
c         wwwwwwwwwww
cccccccccccccccccccccccccccccccccccccc
```

c concrete
w wall Of pool

We'd have vents in floor to let air from wall of pool that was
steel finned out. There would have to be a cold air return too.

If somethinglike this could be built it could Be mmass produced
an` attached to houses as a "solar furnace/swim pool" The thing
I don't understand is how much heat can we get into it. Also,
we are considering dumping additional Heat from extra collectors
in order o to keep it kInd of pass

pasive.

What you think?
r
,

GB1.S1.70

00 BURT DECGRAM ACCEPTED S 36 O 01 13-JAN-80 10:50:10
FROM: GORDON BELL   DATE: SUN 13 JAN 1980 10:43 AM EST
DEPT: OOD
EXT: 223-2236
TO: DON BUSIEK
    BOB GRAY
    GEORGE PLOWMAN
    BILL PICOTT @MR16
cc: JACK SHIELDS
    DICK CLAYTON
    JACK GILMORE
    BOB DALEY
    BOB TRAVIS
    B FTIZGERALD VIA DALEY

SUBJECT: SOLID WIRE ON PEDESTAL 100'S AND THE WPS200

I can't believe that FS just connected a bunch of VT100's on movable
pedestals to our WPS 200 system with solid wire. These are 20ma connections
and they use a really poor connector. Why don't we use a standard modular
jack such that standard phone cables, connectors and telephone installation
procedures can be used?

What are the installation standards here? Who has this responsibility?
Could you send me the standards we do use? I'd like your groups to get together
and work out what we do use. The WPS200 wiring as demonstrated

in our area
is totally unacceptable as an office product in quality, wiring, reliablility,
noise level and aesthetics. As a system, I think the WPS 200 system is fine,
ignoring the fact that it is unsupported because it is a large 8. Will you
convene and segment the problem and decide who's responsible for what? and what
can be done?

For starters, switching the WPS200 to serial lines for both the Draft and
LQP would help matters enormounsly. It would give us greater distance and
get rid of the eyesore that can not be installed. It would also give us
the needed increase in signal to noise ratio and help reliability...and
even allow interchangeable use of fiber optics. In looking at the specs,
I find that FS didn't need to use 20ma, but could have stayed with the EIA.
This cost us in time and engineering at our floor site.   Here again, I want
to get the number of configurations down a lot so that we can make what we
do sell work! Having these infinite options and FS designs just complicates
the already marginal software package...and in order for us to survive here
we have to start limitin options on the 200!
Bob Gray it is clear you have the leadership here, and I'd like to know what
and when we can expect simplification?

Command >

SOME STANDARDS QUESTIONS

(GOVERNMENT'S, AT&T, DEFACTO)

MUST WE HAVE MORE LOW LEVEL STANDARDS (character set, floating point)?

WILL DEFACTO STANDARDS EVOLVE THAT ARE SIMPLY THE 370 AND A

SEMICONDUCTOR CHIP?

HOW MUCH NETWORKING CAN BE DONE WITHOUT FULLY HOMOGENEOUS MACHINES?

(I.e., can users stand it?)

HOW MUCH NETWORKING CAN BE DONE WITHOUT COMMON LANGUAGES AND A COMPLETE

NETWORK ARCHITECTURE? (WILL GATEWAYS WORK EFFICIENTLY ENOUGH?)

WILL A "CHANNEL-LEVEL" INTERFACE CONSTRAIN PRICE OR INHIBIT FURTHER

EVOLUTION OF BACK END PROCESSING?

CAN WE KEEP TRACK OF THE DATA? (WILL DB'S OR DB STANDARDS HELP?)

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+---------------------------+                                   ID#0188
|   |   |   |   |   |   |   |
| d | i | g | i | t | a | l |   i n t e r o f f i c e   m e m o r a n d u m
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|   |   |   |   |   |   |   |
+----------------------------+
```

Subject: **Sony Video Storage Technology**

To: John Kevill

CC: Jim Bell, Dick Clayton, Bob Glorioso, Grant Saviers

Date: 78 AUG 14
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

Sony has an incredible array of small video recorders and transducers. We have got to learn how to operate with respect to these video devices. One device is a small 3" video cartridge, I think actually a tape, although it could have been a disk, in which a few frames of video are stored. I am not sure what they are going to do with it.

The second is a video disk which stores 10 seconds of video. It is used as a teaching device and will be marketed early this Fall. We have to find out what the interface is and how we can use it. Yu Hata should be requested to get us this information immediately. I am writing to Dr. Iwama about it.

The third thing is called a MAV card which is a magnetic video recording card and is scanned vertically. They also had a cartridge which could be used as a carousel for the card which allowed the user to select any one of I think, 50 of the cards on a random access basis, and display the video images so there was a digital selection by keyboard for these image displays.

They also had a video input device which looked like a copier that took in what looked exactly like a copier and put an image down and the image was then transferred to video or to an image card.

All in all, one has to be impressed with the video and with the Sony technology there -- all emphasis on research -- and I would certainly like to get closer to them.

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST: Jim Bell ML3-2/E41 Dick Clayton ML12-2/E71
Bob Glorioso ML3-2/E41 John Kevill ML1-3/E58
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<ln>Adkins
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<g>Dr.
<fn>Gene
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<g>Mr.
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<g>Mr.
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<csz>Minneapolis, MN 55415
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<lst>AOTF
<>

<g>Mr.
<fn>Larry
<ln>Walker
<sal>Larry
<tel>(612)631-6511
<co>Sperry Univac
<add>2276 Highcrest Rd., MS 4702
<csz>St. Paul, MN 55113
<entered>1/11/83
<lst>AOTF
<>

SORT ON <N> IN ASCENDING ORDER
SORT ON <ln> IN ASCENDING ORDER

<N>ABSTRACT: ETHERNET AND THE FIFTH GENERATION/GB3.S4.44
5/18/82 5/18/82 9:00 2 2 <>

<N>ABSTRACT: LOCAL AREA NETS, DISTR.PROCESSING & 5TH GEN/GB3.S7.17
8/24/82 9/7/82 9:17 2 7 <>

<N>ADS - VAX OFFICE WORKER /OC, BERUBE /GB3.S5.18
6/10/82 11/22/82 8:26 8 7 <>

<N>AFIPS CALL FOR PAPER ON LINC & PDP-8/GALLER/GB3.S5.76
7/14/82 8/11/82 14:50 3 6 <>

<N>AI SOFTWARE IDEA FOR ADVERTISING /GB3.S.41
9/24/82 9/27/82 8:31 3 2 <>

<N>AI & Expert Sys:LISP,PRODUCTS,NEEDS &MKTG./WEISS ET AL/GB3.S8.40
11/15/82 11/30/82 11:54 18 4
<>

<N>AI:ARTIFICIAL INTELLIGENCE:EMS-12/3-B.JOHNSON/GB3.S10.28
12/29/82 12/29/82 9:00 7 2
<>

<N>AI:EXPERT SYSTEMS:LISP/EMS-11/14-ABEL,PATEL/GB3.S10.16
12/28/82 12/28/82 16:21 19 2
<>

<N>AI:MKT. & PRODUCTS-LET'S GO AFTER/EMS-10/12/ABEL,FULLER/GB3.S8.73
11/18/82 11/18/82 11:03 6 5
<>

<N>ALPHA OMEGA AGENDA, 10/5&6, LOS ALAMOS/GB3.S7.40
9/23/82 9/23/82 0:03 9 6 <>

<N>ALPHA OMEGA...DRAFT FOR COMMENTS, EMS 8/4, DELAGI+/GB3.S7.59
9/27/82 9/27/82 17:39 4 1 <>

<N>ALPHA OMEGA...SEMINAR TO PRESENT/GET IDEAS,EMS 8/12/FULLER+/GB3.S7.52
9/27/82 9/27/82 17:20 5 1 <>

<N>ALPHA-OMEGA:ALPHA-OMEGA AND CFM/HUSTVEDT,LIPCON,POE,MACK GB3.S7.29
9/13/82 9/17/82 13:10 2 3 <>

<N>ANTIQUE PAYMENT, PLANIMETER/M.KENNEDY/GB3.S8.17
10/15/82 11/30/82 13:30 2 6
<>

<N>AO DISCUSSION WITH FERNBACH&FEIGENBAUM/EMS:FULLER/GB3.S8.9
10/13/82 10/13/82 11:44 5 1
<>

<N>APPLICATIONS PRODUCTS: DOING THEM RIGHT-OC, PEG... GB3.S7.22
9/10/82 10/6/82 12:57 17 11 <>

<N>ARPA HELP IN H/S SEMIS:EMS-11/3-GLORIOSO-GB3.S10.11
12/28/82 12/28/82 15:34 5 2
<>

<N>ARPA - /LETTER TO DR. LEVINTHAL ET AL VIA ARPANET.3
10/4/82 11/5/82 13:37 5 13 <>

<N>AUBURN UNIVERSITY EXEC REPORT OF NO VALUE/PROF LINK/GB3.S2.13
8/11/82 4/30/82 13:05 2 3 <>

<N>A1 DEMO THANKS--BE #1 IN OFFICE SALES/EMS:WYMAN+/GB3.S8.11
10/13/82 10/13/82 12:04 6 1
<>

<N>BACHMAN:RECOMMENDATION/ J.CANTLON,MICH.UNIV/12-10/GB3.S9.32

12/10/82 12/10/82 8:25 4 2
<>

<N>BELL: REPLACEMENT COST FOR RADIO/GB3.S4.12
5/3/82 5/14/82 16:55 2 6 <>

<N>BELL: TRUST/GB3.S9.35
12/10/82 12/10/82 9:21 2 2
<>

<N>BELL: WHAT GORDON LIKES AND DISLIKES/GB3.S2.19
2/16/82 5/12/82 12:45 7 8 <>

<N>BERKELEY OPPORTUNITY:ETHERNET/EMS-11/3-STEVE DAVIS/GB3.S10.12
12/28/82 1/6/83 9:04 4 3 <>

<N>BOB SPENCE: RECOGNITION LETTER/GB3.S5.13
6/2/82 6/2/82 15:32 2 3 <>

<N>BOOK:WHAT ABOUT THIS TO DO?/11/27-FULLER,STRECKER/GB3.S10.26
12/29/82 1/6/83 9:03 5 4 <>

<N>BOOK: DEC COMP. ENVIRONMENT/EMS/12/1/FULLER,STRECKER/GB3.S9.23
12/1/82 12/6/82 9:43 5 2 <>

<N>BOOK: SOFTWARE ENGINEERING, WANT TO WRITE?/ANKLAN/GB3.S4.03
5/4/82 5/5/82 14:41 6 8 <>

<N>BRINCH-HANSEN: LETTER TO- SORRY I CAN'T ATTEND/ GB3.S7.30
9/15/82 11/22/82 11:08 2 4
<>

<N>BROWN: TREATING WITH RESPECT/CHAMPINE/GB3.S5.21
6/9/82 6/9/82 14:30 6 2 <>

<N>BRUCE?/THANKS FOR PRES. WOULD YOU CARE TO LECTURE/GB3.S5.10
6/1/82 1/5/83 16:31 4 7 <>

<N>BUDGETS AND (EMC) ENG. MGMT COMMITTEE /FULLER/GB3.S4.36
5/17/82 6/3/82 15:45 5 4 <>

<N>BUDGET PROBLEM, DEALING WITH, EMS 8/2, EMC:/GB3.S7.60
9/27/82 9/27/82 17:43 5 1 <>

<N>BUSSES, WILL OURS DRIVE US OUT OF BUSINESS/FULLER/GB3.S1.31

11/17/81 11/17/81 15:03 5 2
<>

<N>BUS, GETTING A WINNING STRATEGY, EMS 8/7, DEMMER+/GB3.S7.55
9/27/82 9/27/82 17:28 10 1 <>

<N>CAD BUDGET XTRA 600K MULTI YEAR MULTIWIRE SUPPORT/11/5/81/GB3.S2.30
2/19/82 2/26/82 3:59 3 3 <>

<N>CALTECH EXPENSES PLUS HONORARIUM DONATION TO MUSEUM/GB3.S5.7
5/25/82 5/25/82 12:42 3 2 <>

<N>CALTECH: FASTER VAXES AND SCIENTIFIC COMPU/BASKETT/GB3.S5.49
6/11/82 6/11/82 10:08 8 2 <>

<N>CALTECH: VISITING COMMITTEE TRIP../DEMMBER/GB3.S5.53
6/11/82 1/5/83 16:34 8 4 <>

<N>CERBERUS COME TO THE RESCUE: SOME TO DO'S/JACK SMITH/GB3.S3.39
4/14/82 4/14/82 11:39 9 2 <>

<N>CFM PRODUCTS AND A/D TO GET MORE, EMS 8/14,CHRISTY ET AL/GB3.S7.49
9/27/82 9/27/82 17:14 8 1 <>

<N>CFM:CYCLES FOR THE MASSES-DESCRIPTION STATEMENT/12-6/GB3.S9.25
12/13/82 1/6/83 8:48 4 3 <>

<N>CFM: CYLES FOR THE MASSES, EMS 8/22/82 /CHRISTY ET AL/GB3.S7.43
9/27/82 9/27/82 16:59 18 1 <>

<N>CHALLENGES FOR IN THE NEXT 0 TO 5 YEARS /GB3.S6.6
7/19/82 10/5/82 16:53 18 6 <>

<N>CHIPS, THIS AIN'T GOOD ENOUGH/CUDMORE/12/82/GB3.S2.52
2/26/82 5/12/82 11:19 5 4 <>

<N>CHRISTMAS CARD, TYPE CHRISTMAS=MERRY; NEW_YEAR/12/81/GB3.S2.51
2/26/82 2/26/82 4:08 3 3 <>

<N>CI:AS A STANDARD INTERCONNECT/EMS/11-24/DEMMER,BJ/GB3.S9.9
11/24/82 12/20/82 14:53 4 7
<>

<N>CLARK:RECOMMENDATION LETTERFOUNDATION GB3.S7.27
9/13/82 9/13/82 13:40 5 6 <>

<N>CLUSTERS: YOU MAY NOT HAVE GOTTEN THIS IDEA../DEMMER/GB3.S5.34
6/9/82 6/9/82 15:10 6 2 <>

<N>CMU JOINT PROP. DISC.-DOUG VAN HOUWELLING/FULLER/GB3.S1.19
11/17/81 12/29/81 10:59 7 3
<>

<N>CMU JOINT PROP. FOR DEV. OF PERSONAL C./SLIDES/ GB3.S1.03
10/16/81 5/27/82 10:04 5 8
<>

<N>CMU JOINT VENTURE DISC. WITH ALLEN NEWELL/FULLER/GB3.S1.22
11/17/81 12/29/81 10:59 6 3
<>

<N>CMU JOINT VENTURE PROPOSAL-WOULD LIKE YOUR SUPPORT/11/81/GB3.S2.38
2/26/82 2/26/82 4:02 5 3 <>

<N>CMU JONT VENTURE INTO TOTAL ENVIRONMENTAL COMPUTING/GB3.S1.26
11/17/81 12/29/81 10:58 5 3
<>

<N>CMU LOSS:WHY SIGNIFICANT & NEXT STEP/EMS-10/18/AVERY,OC/GB3.S8.70
11/18/82 11/18/82 11:05 9 3
<>

<N>CMU PROC. AHEAD-EXPL THE CMU/DEC RES. PROP./FULLER/GB3.S1.23
11/17/81 2/23/82 10:26 3 4
<>

<N>CMU PROPOSAL FOR JOINT DEV. OF PERSONAL COMP./FULLER/GB3.S1.33
11/3/81 5/12/82 12:55 5 5 <>

<N>CMU PROPOSAL--US AND THE NEXT ENG. SITE/FULLER/GB3.S1.28
11/17/81 1/8/82 12:33 4 5 <>

<N>CMU RE YOUR PROPOSAL ON ? /JORDAN,GRANGER/GB3.S4.02
4/26/82 5/6/82 10:02 3 12 <>

<N>CMU SUPPORTING MARIO'S PROMOTION/HABERMANN/GB3.S1.25

10/10/81 4/30/82 12:24 4 4
<>

<N>CMU:SPICE & YALE & PPA/EMS-11/3-BJ,FULLER/GB3.S10.9
12/28/82 12/28/82 15:34 5 3
<>

<N>CM'S AS PERFORMANCE ALTERNATIVE TO BIG MACHINES/FULLER/GB3.S6.36
7/26/82 7/26/82 16:02 7 1 <>

<N>COGNITIVE SYSTEMS:R.SHANK/EMS-11/19/BOB NOLIN/GB3.S10.22
12/29/82 12/29/82 8:45 18 2
<>

<N>COGNITIVE SYSTEMS:USE AI/EMS-11/2-HUGHES/GB3.S10.6
12/28/82 12/28/82 15:35 6 3
<>

<N>COMET IN MCA'S TO LEARN MULT. VAX IMPLEM./ARMSTRONG/GB3.S3.47
4/14/82 4/23/82 14:25 7 4 <>

<N>COMET MCA/DEMMER/GB3/S4.28
5/17/82 5/19/82 12:17 6 3 <>

<N>COMMITTEES NOD; C-I T/F;PRODUCTIVITY REV/GB3.S3.12
3/10/82 3/15/82 13:56 4 3 <>

<N>COMMITTEE: COMP. FOR SCI. ADV COMM FRIEDLAND&FIEGENBAUM/GB3.S2.64
3/1/81 5/12/82 11:35 7 4 <>

<N>COMMUNICATIONS, COMPETITIVE RESP./DEMMER ET AL/GB3.S1.04
10/5/81 5/12/82 11:27 5 4 <>

<N>COMPETITION:MID RANGE & HIGH END(SLIDES)-OC PRESENTA/11-29/GB3.S.17
11/29/82 11/29/82 15:04 4 2
<>

<N>COMPUTERS FOR MANUFACTURING, EMS 8/21/82 /CADY /GB3.S7.46
9/27/82 9/27/82 17:06 6 1 <>

<N>CONFERENCE:DISTRIB COMPUTING/EMS/11-24/LACROUTE,PEG/GB3.S9.13
11/24/82 11/24/82 11:55 2 1

<>

<N>CONTRIBUTION: C. IN SCI&TECH CENTERS-MUSEUM/CONT.CO /GB3.S1.17
11/2/81 5/12/82 11:44 5 7 <>

<N>CONTRIBUTION: PLS FUND HAROLD COHEN / COMMITTEE/ 1/30/82/GB3.S2.62
2/26/82 2/26/82 4:16 8 3 <>

<N>CONTRIBUTION: U OF NC FUNDING HELP/CHAMBERLAIN/CAPOWSKI/GB3.S1.54
11/30/81 5/12/82 11:10 2 4
<>

<N>CORP. REPORT CARD-FY82-PRODUCT DEVELOPMENT/GB3.S3.26
3/26/82 5/12/82 10:59 4 6 <>

<N>CRAPPY PRODUCTS:THE SIDE EFFECTS OF SLIPS AND VOIDS/OC + GB3.S7.28
9/13/82 10/13/82 12:17 10 5
<>

<N>CRAY GROUP WHO WANTS TO BUILD A VAX/DEMMER/GB3.S4.33
5/17/82 5/18/82 16:33 12 3 <>

<N>CRAY INTERVIEWING AT CRAY LAB, AN OPPORTUNITY?/BORNSTEIN/GB3.S3.43
4/14/82 4/14/82 13:20 5 2 <>

<N>CT: YOUR FIRST CT & MARKETING/AVRAM/GB3.S5.48
6/11/82 6/11/82 10:06 3 2 <>

<N>CUSTOMER: DUPONT (PENSAK)FOR GOOD RELATIONS-ACT NOW/GB3.S2.04
2/2/82 6/1/82 17:09 7 5 <>

<N>DARTMOUTH - THANKS FOR THE COURSE/RICHMOND/GB3.S6.42
7/28/82 7/28/82 13:17 6 6 <>

<N>DATAFLOW:GOING TO ARPA/EMS-12/4/FULLER/GB3.S10.31
12/29/82 12/29/82 9:20 4 2
<>

<N>DATAFLOW:RESEARCH/EMS-12/4/FULLER/GB3.S10.30
12/29/82 12/29/82 9:19 11 3
<>

<N>DAVIS, GERALD SUMMARY MEMO TO GBELL RE: DEC MARKETS ETC.72
1/19/82 6/1/82 14:40 15 7 <>

<N>DAVIS, GERALD THANK YOU FOR DINNER /GB3.S1.73
1/22/82 6/1/82 14:40 2 5 <>

<N>DAWN, DECISION TO CONTINUE/WILL T./GB3.S1.20
10/8/81 4/30/82 12:36 2 8 <>

<N>DECMATE I & II VS THE WANGWRITER - THE KEY /OC/GB3.S5.4
5/24/82 8/17/82 15:27 3 6 <>

<N>DECMATE I & II: VS THE WANGWRITER/CIOFFI/GB3.S5.51
6/11/82 6/11/82 10:20 4 3 <>

<N>DECSET A VIETNAM I PROP WE LEAVE! SCRIBES-WAY TO GO/DALEY/GB3.S3.40
4/14/82 4/15/82 14:21 3 3 <>

<N>DECSIM: MAKE VS BUY AND SELLING.../GOLDFEIN/GB3.S5.27
6/9/82 6/11/82 14:07 5 3 <>

<N>DEC REIMBURSEMENT $514. FOR CALIF. TICKET/CARLA MASON/GB3.S5.8
5/26/82 5/26/82 8:55 3 1 <>

<N>DEC 10/20 BUSINESS/KNOWLES/GB3.S8.52
11/15/82 11/15/82 14:03 16 3
<>

<N>DEC2080 SLIP CAN'T MEAN NI AND PLUTO WILL SLIP/ULF ET AL/GB3.S3.08
3/10/82 5/12/82 11:05 5 3 <>

<N>DEC2080 SLIP CAN'T MEAN NI & PLUTO WILL SLIP/GB3.S2.17
2/16/82 3/1/82 4:03 6 9 <>

<N>DESIGNING: TRAINING FOR NAUTILUS DOING REAL DESIGNS/CROXON/GB3.S6.35
7/26/82 7/26/82 15:44 6 1 <>

<N>DG, OUR VAX STRATEGY AND THE NEXT DG MACHINES/12/81/GB3.S2.49
2/26/82 2/26/82 4:06 5 3 <>

<N>DPD, HERE IS A FRANK APPRAISAL/ABBOTT/GB3.S1.05

10/5/81 5/12/82 11:54 2 4 <>

<N>ECKERT MAUCHLEY AWARD GIVEN FOR PATTERSON WRITEUP/GB3.S2.21
2/16/82 6/1/82 17:07 4 10 <>

<N>ECKERT-MAUCHLY AWARD, THANKS FOR INTRO /PATTERSON /GB3.S4.10
5/3/82 5/4/82 12:09 5 9 <>

<N>ECKERT-MAUCHLY AWARD, THANKS TO JACK LIPOVSKI/GB3.S4.24
5/12/82 5/12/82 14:32 2 2 <>

<N>ECMA WILMOT MEETING/WILMOT/GB3.S3.38
4/14/82 5/12/82 10:03 3 3 <>

<N>EDUCATIONAL COMPUTER: EDU MARKET../AVRAM/GB3.S5.32
6/9/82 6/9/82 15:06 6 2 <>

<N>EDUCATIONAL COMPUTER: IDEA, CUT A.../AVER/GB3.S5.38
6/9/82 6/9/82 15:33 4 2 <>

<N>EDUCATION: CS GOING INTO C. ENG ED. BUSINESS/12/81/KO/GB3.S2.54
2/26/82 5/12/82 11:47 5 5 <>

<N>EDUCATION: ENGINEERING SUMMER SCHOOL.42
6/11/82 7/28/82 13:04 5 3 <>

<N>EDUCATION: MANAGEMENT IIA: WHAT IS IT?/BERNSTEIN/GB3.S5.30
6/9/82 6/9/82 14:58 12 2 <>

<N>EDUCATION: MIT lifetime program,EMS-10/4/EMC/GB3.S8.57
11/18/82 11/22/82 12:14 7 3
<>

<N>ELECTRONIC MAIL IMPACT - RE CRAWFORD PAPER/ROBERT
ROUSE/GB3.S3.20
3/16/82 5/27/82 10:09 4 2 <>

<N>EMS RESPONSE TO INTERNAL IMPLEMENTATION/CRAWFORD.49
1/11/82 1/11/82 16:13 3 3 <>

<N>ENGINEERING ORGANIZATIONS/GB3.S2.16
2/16/82 6/1/82 16:56 5 9 <>

<N>ENGINEERING PROBLEM LIST FOR MARCH OC WOODS/GB3.S3.19
3/15/82 3/15/82 14:58 9 3 <>

<N>ENGINEERING RE: ORGANIZATION/ENG. STAFF/GB3.S3.02
4/5/82 5/25/82 14:44 6 9 <>

<N>ENGINEERING SPECIFIC ORGANIZATION IDEAS/OC/GB3.S2.15
2/16/82 5/12/82 17:13 5 4 <>

<N>ENG. PROJECTS STRUCTURING (DRAFT)/1/11/82/CORBEN/GB3.S2.55
2/26/82 5/12/82 12:03 6 6 <>

<N>EQUIPMENT NEEDED FOR GUARANTE/CHARLIE ROSE/GB3.S1.41
11/18/81 4/30/82 13:28 3 4
<>

<N>ETHERNETS STARS FOR ENG & TYPESETTING REV/ENG STAFF/GB3.S4.38
5/17/82 5/18/82 16:32 7 3 <>

<N>ETHERNET FOR ENG NET & PRODUCT, 1 YEAR EARLIER/BILL AVERY/GB3.S3.44
4/14/82 5/11/82 10:18 6 4 <>

<N>ETHERNET PRESENTATION IN NY - THANK YOU/GB3.S2.18
2/16/82 2/23/82 10:41 5 8 <>

<N>ETHERNET SI'S CO & ETHERNET:DO IT OR DELEGATE/ENG STAFF/GB3.S3.42
4/14/82 4/14/82 11:47 16 2 <>

<N>ETHERNET SPEECH-PRESS CONFERENCE/GB3.S2.09
2/8/82 5/17/82 17:25 79 7 <>

<N>ETHERNET & LANS CLUSTERS: PRODUCTS & WAY GET THEM/EMC/GB3.S9.36
12/13/82 12/22/82 14:27 8 8
<>

<N>ETHERNET, ICL PRES WILMOT ON USING ETH./LACROUTE/11/81/GB3.S2.39
2/26/82 5/12/82 12:39 8 4 <>

<N>ETHERNET, UNIBUS OF FIFTH GENERATION/GB3.S1.79
1/25/82 5/18/82 14:15 133 21 <>

<N>ETHERNET--KEN'S PRES:HELP AND COMMENTS/JOHN ADAMS/GB3.S4.40
5/17/82 5/18/82 16:31 11 3 <>

<N>ETHERNET: DEC'S BACKBONE NETWORK AND ET.../DENNY BJORK/GB3.S5.26
6/9/82 11/17/82 12:10 7 3
<>

<N>EXPENSE VOUCHER, CHICAGO C. IN SCI CONF 12/7/82/SCHERAGO/GB3.S9.31
12/8/82 12/8/82 15:06 3 5 <>

<N>FAGERQUIST - BACKGROUND/11/29/GB3.S9.16
11/29/82 1/6/83 8:59 4 3 <>

<N>FAN A QUIETER: A MAJOR BREAKTHROUGH/GB3.S3.28
3/29/82 3/29/82 10:25 2 3 <>

<N>FIFTH GEN. PROG. INTEREST LETTER TO YAMAMOTO/GB3.S4.21
5/11/82 5/19/82 13:15 3 6 <>

<N>FLOPPY, DISCLOSURE OF ELEC. FLOPPY/SAVIERS ET AL/GB3.S1.14
11/12/81 5/12/82 11:50 2 7
<>

<N>FOUR WHEELS:OF REINCARNATION--PEG, RAD, TMC,... GB3.S7.24
9/10/82 8/16/82 9:25 28 15 <>

<N>FPS - THANKS + OA IDEAS/TURNER/GB3.S8.45
11/15/82 11/15/82 12:04 5 9
<>

<N>FPS-JOIN MUSEUM?/WINNINGSTAD/GB3.S8.47
11/15/82 11/15/82 12:11 3 1
<>

<N>GATE ARRAYS, BETTER PRODUCTS THROUGH,EMS 8/9,FOLSOM+/GB3.S7.53
9/27/82 9/27/82 17:24 25 1 <>

<N>GATE ARRAYS, CMOS: WHO,HOW AND NEED TO VLSI?/BASKETT/GB3.S6.32
7/26/82 8/6/82 14:33 7 2 <>

<N>GEMINI SIMULATION (COMMENTS ON YOUR STATUS RPT)/KUSIK/GB3.S1.65
1/14/82 1/14/82 9:14 2 1 <>

<N>GIGI SUPPORT-DON'T DO THIS/AVERY/11/8/81/GB3.S2.35
2/19/82 5/12/82 12:28 3 4 <>

<N>HARDWARE:PRODUCTS FOR AP/EMS-12/4/G.BUTLER/GB3.S10.29
12/29/82 12/29/82 9:14 7 3
<>

<N>HARVARD:APPL.SCI VISITING C'EE/EMS/11-24/BORNSTEIN/GB3.S9.12
11/24/82 12/20/82 14:55 5 5
<>

<N>HERTZ, CONGRATULATIONS FOUNDATION/MCWILLIAMS/GB3.S1.46
11/23/81 5/12/82 12:26 2 2
<>

<N>HERTZ, FOUNDATION-RE: TOM MCWILLIAMS/TALLEY/GB3.S1.45
11/23/81 5/12/82 12:25 2 3
<>

<N>HEURISTICS FOR BUILDING GREAT PRODUCTS -- SLIDES/GB3.S3.18
3/15/82 3/23/82 11:18 29 10 <>

<N>HEURISTICS FOR BUILDING GREAT PRODUCTS-PRELIM. DRAFT/GB3.S2.05
2/2/82 5/12/82 12:28 43 14 <>

<N>HEURISTICS FOR BUILDING GREAT PRODUCTS/GB3.S1.61
1/12/82 2/2/82 10:38 31 15 <>

<N>HIERARCHIES/MAURICE WILKES/GB3.S5.35
6/9/82 6/9/82 15:12 5 2 <>

<N>HIGH PERFORMANCE Q&A/OC PRESENTATION/11-29/GBE.29.18
11/29/82 11/29/82 15:05 44 3
<>

<N>HOROWITZ RESPONSE/I FEEL THE SAME WAY/GB3.S1.47
11/23/81 5/27/82 10:01 1 5
<>

<N>IBM COMMITMENT WHAT THEY'RE DOING/WHAT WE SHOULD DO/GB3.S1.18
11/12/81 5/12/82 11:53 6 7
<>

<N>IBM'S:AGGRESSIVE BEHAV.W/UNIV. & RSCH/EMS-10/11/OC,BUTLER/GB3.S8.66
11/18/82 11/18/82 11:41 6 3
<>

<N>IBM, THE NEXT IBM PERSONAL COMPUTERS (I'D BUILD)/AVERY/GB3.S3.46
4/14/82 4/14/82 13:26 4 2 <>

<N>ICL COLLABORATION TO ESTABLISH MAIL STD,EMS 8/14/LACROUTE/GB3.S7.50
9/27/82 9/27/82 17:16 4 1 <>

<N>INTERRUPTS: LTR HARVEY CRAGON/11-2/GB3.S8.32
11/1/82 11/23/82 12:58 5 4 <>

<N>INVESTMENT & COMPLEXITY FOR GUIDING ENG/DEMMER/GB3.S4.35
5/17/82 6/3/82 15:46 11 5 <>

<N>INVITATION NO: BUTLER, COST & PARTNERS CAN'T ATTEND/GB3.S1.44
11/20/81 5/12/82 11:08 1 4 <>

<N>INVITATION NO: CAN'T SUPPT. VAX/780 COMP LAB/PROF PEASE/GB3.S1.35
11/3/81 4/30/82 12:53 5 4 <>

<N>INVITATION NO: INMOS ARCHITECUTRE /BARRON /GB3.S1.64
12/8/81 6/1/82 15:38 3 6 <>

<N>INVITATION NO: RE: DEFENSE LOGISTICS CONF./CARLUCCI/ GB3.S3.36
4/8/82 5/12/82 10:52 3 5 <>

<N>INVITATION-NO-J. RUSSELL NELSON,ARIZONA STATE UNIV./GB3.S5.9
6/2/82 6/18/82 9:50 1 2 <>

<N>ISI, ENVIRONMENT (TALK W BALZER) EMS 8/18/ CHAMPINE ET AL/GB3.S7.47
9/27/82 1/5/83 16:48 6 2 <>

<N>ITINERARY SAN FRANCISCO, MCC MEETING, 7/25 &26/GB3.S6.18
7/20/82 7/30/82 8:51 2 9 <>

<N>ITINERARY - LASL, 10/5 & 6/1982, AO/GB3.S7.34
9/18/81 10/1/82 9:27 3 6 <>

<N>ITINERARY: ALPHA OMEGA, MINN. 11/21-23/GB3.S8.38
11/18/82 11/19/82 14:44 2 8 <>

<N>ITINERARY: AUSTRALIA 12/12/82 THRU 1/1/83/GB3.S7.33
9/18/81 12/10/82 11:38 4 13
<>

<N>ITINERARY: CALIFORNIA 8/8/82 TO 8/11 WITH KALB/GB3.S6.41
7/28/82 8/10/82 13:22 2 7 <>

<N>ITINERARY: JAPAN/TAIWAN JUNE 19 THRU JULY 8/GB3.S5.41
6/17/82 7/14/82 8:10 14 10 <>

<N>ITINERARY: MCC MEETING DENVER, 8/19/82 /GB3.S7.2
8/11/82 9/28/82 13:08 4 14 <>

<N>ITINERARY: MINN/SF/10/27/82--ALPHA OMEGA,TECKNOWLEDGE/GB3.S8.21
10/22/82 10/25/82 4:59 4 7
<>

<N>ITINERARY: PALM SPRINGS/MO/BOSTON 1/12/83 /GB3.S9.30
12/8/82 12/22/82 15:54 5 6
<>

<N>ITINERARY: PARIS/LONDON, 8/24/82 THRU 9/9 /GB3.S6.40
7/28/82 8/27/82 16:58 9 27 <>

<N>ITINERARY: 11/7 THRU 11/13, SF&OREGON/GB3.S8.36
11/5/82 11/9/82 15:26 5 8 <>

<N>JAPANESE ADVANTAGE: IS IT REAL?/BOD,OC/GB3.S4.17
5/5/82 5/19/82 12:34 7 6 <>

<N>JAPANESE: THE ADVANTAGE:IS IT REA.../BOD/DEMO/GB3.S5.20
6/9/82 11/22/82 8:33 7 8 <>

<N>JAPAN CHART COMPANY/PRODUCT COMPETITIVE MATRIX/GB3.S6.4
7/14/82 11/24/82 11:12 33 22
<>

<N>JAPAN COMPANY/PRODUCT COMPETITIVE MATRIX MEMO/GB3.S6.8
7/19/82 8/24/82 13:47 3 9 <>

<N>JAPAN IMPRESSIONS / OC + PEG /GB3.S6.21
7/20/82 10/5/82 16:54 12 15 <>

<N>JAPAN THANK YOU 12 LETTERS 7/82 TRIP/GB3.S6.3

7/14/82 8/2/82 16:31 47 22 <>

<N>JAPAN THANK YOU 6 LETTERS 7/82 TRIP/GB3.S6.2
7/14/82 8/2/82 16:31 26 24 <>

<N>JAPAN, DOMINATE COMP BY 1990 IF 5G EFF SUCCEEDS/ENG STAFF/GB3.S2.61
2/26/82 5/12/82 12:41 6 4 <>

<N>JAPAN-MORE THOUGHTS/AGUERO/GB3.S8.48
11/15/82 11/30/82 11:56 14 9
<>

<N>JAPAN: CHINA COMPANY THANK YOU /GB3.S6.9
7/20/82 7/20/82 14:07 8 3 <>

<N>JAPAN: COMPANY/PEOPLE VISITED HISTORY/INDEX, 6/82 /GB3.S.72
7/12/82 11/24/82 11:14 60 23
<>

<N>JAPAN: CONTACTS SUMMER OF 1978 (JULY)/GB3.S5.5
10/13/82 10/13/82 13:21 7 2
<>

<N>JAPAN: CONTINUING TO BUILD JAPANESE PROFILES/KOBAYASHI/GB3.S7.8
8/19/82 8/19/82 11:07 4 1 <>

<N>JAPAN: ENGINEERING IN--LET'S MOVE/SAVIERS ET AL/GB3.S6.22
7/21/82 10/5/82 16:57 27 6 <>

<N>JAPAN: FUCHI THANKS /GB3.S6.16
7/20/82 9/7/82 12:03 4 7 <>

<N>JAPAN: FUJITSU & MITI THANK YOU /GB3.S6.14
7/20/82 8/2/82 16:30 3 8 <>

<N>JAPAN: FUJITSU, CONFIDENTIAL INFO/YASAFUKU/GB3.S6.52
8/2/82 9/14/82 16:09 3 6 <>

<N>JAPAN: MISC. MSGS. FROM JAPAN & ENG/KOBAYASHI/GB3.S7.9
8/19/82 8/19/82 11:10 11 1 <>

<N>JAPAN: MITSUI THANKS/GB3.S6.17
7/20/82 7/21/82 9:17 4 6 <>

<N>JAPAN: MORIZONA THANK YOU/GB3.S6.11
7/20/82 8/17/82 8:39 2 7 <>

<N>JAPAN: NOTES ON VARIOUS COMPANIES/RESEARCH ORGS/PEG:/GB3.S6.23
7/21/82 11/15/82 18:02 10 13
<>

<N>JAPAN: NTT WE'D LIKE TO BE A SUPPLIER /GB3.S6.13
7/20/82 7/20/82 14:27 3 3 <>

<N>JAPAN: SONY THANK YOU /GB3.S6.12
7/20/82 9/9/82 10:42 5 15 <>

<N>JAPAN: THANK YOU TO MR. T. KUROKI DEC JAPAN/GB3.S.73
7/12/82 7/19/82 16:24 1 3 <>

<N>JAPAN: THOUGHTS ON GREAT PORT TERM/PERS COMP/OLSEN/GB3.S.74
7/12/82 10/5/82 16:47 40 16 <>

<N>JAPAN: TOKYO PRESS CONF.+DEC HISTORY PERSPECTIVES
6/24/82/GB3.S5.75
7/12/82 10/12/82 8:58 26 18 <>

<N>JAPAN: U OF TOKYO/DR. GOTO /GB3.S6.15
7/20/82 9/7/82 14:56 4 8 <>

<N>JAPAN: WATANABE THANKS/GB3.S6.10
7/20/82 7/21/82 9:15 4 4 <>

<N>JUPITER ANNOUNCEMENT: RECOMMEND ARCH/EMS-
10/11/U.FAGERQUIST/GB3.S8.67
11/18/82 1/6/83 8:25 10 3 <>

<N>JUPITER PRIORITIES/HJERPPE/GB3.S7.7
8/19/82 8/19/82 11:00 5 1 <>

<N>JUPITER/OC PRESENTATION/11-29/GB3.S9.19
11/29/82 11/29/82 15:09 9 2
<>

<N>KEYBOARD DAISY CAD AND OUR KEYBOARD/AVRAM/GB3.S4.34
5/17/82 5/18/82 16:33 5 5 <>

<N>KEYBOARD STRAIGHTENING IT OUT SO WE CAN GET ONE/GB3.S3.14
3/10/82 3/15/82 13:55 9 4 <>

<N>KEYBOARD, CAN WE BUY THE BROTHER? /AVERY/GB3.S6.24
7/26/82 7/26/82 13:32 7 1 <>

<N>KEYBOARD: WHAT DO YOU THINK ABOUT .../RON HAM/GB3.S5.46
6/11/82 6/11/82 9:43 5 2 <>

<N>KO REPLY FOR:SOCIAL ECOLOGY RESEARCH/THORSHEIM&ROBERTS/GB3.S8.14.14
10/14/82 1/6/83 8:30 3 6 <>

<N>LAN, CLUSTER AND WAN DEFINITION - SLIDES/C.IN SCIENCE/GB3.S9.21
11/30/82 1/4/83 9:38 8 9 <>

<N>LASL THANKS FOR HOSPITALITY/EWALD,BUZBEE/GB3.S8.5
10/11/82 10/11/82 13:10 3 4
<>

<N>LATTICE LOGIC, WORKING WITH /BHALERAO /GB3.S6.29
7/26/82 7/26/82 15:01 6 1 <>

<N>LATTICE LOGIC--USING CMOS GATE ARRAY DES SYS/LIPPERT/GB3.S4.23
5/13/82 5/18/82 16:35 7 3 <>

<N>LA100:WHAT'S THE STORY?-SMITH/AVERY/RING GB3.S7.21
9/10/82 9/13/82 14:47 1 5 <>

<N>LA12 VS ROBIN:EMS-11/3-AVERY-GB3.S10.10
12/28/82 1/6/83 9:01 8 4 <>

<N>LBL:CONSULTANT/MULTIPROCESSOR WORK OF MAPLES/STRECKER/GB3.S8.50
11/15/82 1/6/83 8:26 5 5 <>

<N>LBL:SPEAKER/CONSULTANT-EMS/11-16-CFM TF/GB3.S10.21
12/28/82 12/29/82 8:42 6 4
<>

<N>LECTURE SERIES: DEC TECNICAL LECTURE SERIES FOR../PEG/GB3.S5.25
6/9/82 6/9/82 14:41 5 2 <>

<N>LECTURE: MEAD ON VLSI & DIGITAL'S BUSINESS IN THE 80'S/GB3.S3.17
3/10/82 6/1/82 17:17 6 3 <>

<N>LINK:GAN,TV & NE NETWORKS/EMS/11-30/EMC/GB3.S9.20

11/30/82 11/30/82 9:52 4 2
<>

<N>LISP AND AI MARKET-HIGH PERFORMANCE AI/GB3.S4.11
5/3/82 5/4/82 11:10 3 2 <>

<N>LISP: LISP AND THE MARKET/CHAMPINE/GB3.S5.24
6/9/82 6/9/82 14:39 4 2 <>

<N>LLL-MULTIPROCESSOR WORK/MICHAELS/GB3.S8.44
11/15/82 11/15/82 11:48 4 5
<>

<N>LLL-THANKS & GOOD LUCK ON IIA/WOOD M.WILLIAMS/GB3.S8.46
11/15/82 11/24/82 12:18 5 5
<>

<N>LNI REPEATER BY THANKSGIVING/11/6/81/GB3.S2.32
2/19/82 2/26/82 3:59 2 3 <>

<N>LRP ENGINEERING REVIEW - 3/18/82/GB3.S3.25
3/26/82 4/6/82 10:01 10 6 <>

<N>MANCHESTER DATAFLOW COMPTER/GURD /GB3.S3.29
3/29/82 6/1/82 17:14 3 5 <>

<N>MANCHESTER UNIVERSITY DATAFLOW MACHINE/SUAREZ/GB3.S3.05
3/8/82 3/9/82 15:19 6 3 <>

<N>MANCHESTER U. DATAFLOW MACHINE, LET'S SUPPORT IT/AVERY/GB3.S3.45
4/14/82 4/14/82 13:24 6 3 <>

<N>MANUFACTURING A/D AND MANUFACTURING../CLAYTON/GB3.S5.55.55
6/11/82 6/11/82 10:28 5 2 <>

<N>MANUFACTURING MKT--WILL IT BE NEXT MKT WE COVET/CADY/GB3.S4.30
5/17/82 5/19/82 12:30 7 4 <>

<N>MANUFACTURING: MEETING TO LAYOUT.../OLSEN/GB3.S5.19
6/9/82 6/9/82 14:26 5 2 <>

<N>MARKETING ADS CONTENT, EMS 8/4, HINDLE+/GB3.S7.57
9/27/82 9/27/82 17:36 12 1 <>

<N>MARKETING MAINFRAMES /WIN/GB3.S9.37
12/14/82 12/14/82 15:15 4 1
<>

<N>MARKETING OUR OFFICE PRODUCTS, EMS 8/4, SPENCER+/GB3.S7.58
9/27/82 9/27/82 17:38 19 1 <>

<N>MARKETING: COMMERCIAL/KO/GB3.S6.37
7/26/82 7/26/82 16:08 8 1 <>

<N>MARKETING: ISSUES ABOUT DOING THE BASICS/ KC /GB3.S6.28
7/26/82 7/26/82 14:54 9 1 <>

<N>MARKETING: LET'S DEFINE BY REVIEWING AND BY EXAMPLE /KO/GB3.S6.30
7/26/82 7/26/82 15:06 6 1 <>

<N>MARKETING: PROPOSED ADS FOR COMMERCIAL USERS/BERUBE/GB3.S6.34
7/26/82 9/22/82 8:59 15 2 <>

<N>MASS STORAGE AND BUILDING LOW END PRODUCTS/12/81/GB3.S2.53
2/26/82 2/26/82 4:09 6 2 <>

<N>MCC PRESENTATION-GOALS/OBJECTIVES BY PRICE/BELL/GB3.S.61
10/13/82 10/13/82 13:26 4 1
<>

<N>MCC RESEARCH PROGRAM LASL: DR. ROBERT EWALD/GB3.S5.69
6/15/82 8/18/82 11:23 5 18 <>

<N>MCC RESEARCH PROGRAM & LASL /OC/GB3.S5.68
6/15/82 8/18/82 10:59 6 5 <>

<N>MCC TRANSMITTAL LETTER, $4K FOR INCORPORATION/GB3.S7.32
9/17/82 11/22/82 12:19 2 5
<>

<N>MCC: ALPHA OMEGA PROPOSAL TRANSMITTAL LETTER /AO COMMITTEE/GB3.S7.4
8/16/82 11/23/82 8:33 4 30 <>

<N>MCC: ALPHA OMEGA PROPOSAL/GB3.S7.3
8/12/82 10/4/82 9:47 145 35 <>

<N>MCC: ALPHA OMEGA SUPPORT MEMO/PEG ET AL/GB3.S6.48

8/2/82 9/24/82 11:27 5 17 <>

<N>MCC: MCC REQUEST FOR SUPPORT FROM DEC / OC /GB3.S6.47
8/2/82 9/24/82 11:25 7 18 <>

<N>MCC: MORE ON MCE PRESENTATION BY CDC /EMC:/GB3.S6.33
7/26/82 7/26/82 15:19 6 1 <>

<N>MCC: MOTIVATION FOR ALPHA OMEGA/GB3.S6.49
8/2/82 11/16/82 10:37 7 7
<>

<N>MCE ALPHA OMEGA DRAFT TO DELAGI/GB3.S4.20
5/10/82 5/24/82 9:32 37 4 <>

<N>MCE CDC'S JAPAN'S 5TH GENERATION PROJECT,DERTOUZOS TO OC/GB3.S3.07
3/10/82 4/26/82 15:07 4 3 <>

<N>MCE (MICROELECTRONIC C. ENTERPRISE) TF MTG/CHENAIL/GB3.S4.32
5/17/82 5/18/82 11:55 6 4 <>

<N>MCF PETITION TO STOP MCF /LOWELL WOOD/GB3.S1.69
1/15/82 5/27/82 9:56 4 5 <>

<N>MCWILLIAMS,TOM: LLL/EMS-11/13-BASKETT-GB3.S10.5
12/28/82 12/28/82 15:45 9 1
<>

<N>MICROS, RILEY'S COMMENTS ON THE 11, 16- & 32-BIT/12/81/GB3.S2.47
2/26/82 2/26/82 4:05 17 3 <>

<N>MICROVAX: THE BOTTOM LINE.../OC/GB3.S5.37
6/9/82 6/9/82 15:31 2 2 <>

<N>MICRO, TASK FORCE ON A COMPETITIVE MICROPROCESSOR/12/81/GB3.S2.45
2/26/82 2/26/82 4:04 10 3 <>

<N>MILL:WALK-THROUGH/FINDINGS/EMS-11/3-BJ,SMITH-GB3.S10.8
12/28/82 12/28/82 15:35 5 3
<>

<N>MIT SEND TO JACK MACKEEN-WILL ARRANGE FOR LOAN/FRANCIS

LEE/GB3.S3.04
3/8/82 5/12/82 11:07 2 14 <>

<N>MIT:AN OPPORTUNITY/EMS/11-1/AVERY/KO/J.SMITH/GB3.S10.4
12/28/82 12/28/82 15:35 4 3
<>

<N>MIT:MTG. TO PROPOSE A PC PLAN/EMS-10/20/SAM,WIN,BJ/GB3.S8.72
11/18/82 11/18/82 11:04 3 3
<>

<N>MIT:NEC IN NE,POOR RELATIONSHIP/EMS-10/11/KEILLOR/GB3.S8.65
11/18/82 11/18/82 11:46 6 4
<>

<N>MIT:PC/EMS-11/15/FULLER,CHAMPINE/GB3.S10.19
12/28/82 12/28/82 16:26 4 3
<>

<N>MIT: WELL, BUT COMMITMENT NEXT VISIT/11/20-HAIRE/GB3.S10.23
12/29/82 1/6/83 9:03 5 3 <>

<N>MOCW AGENDA/ENG STAFF/GB3.S2.10
3/11/82 6/1/82 16:54 8 7 <>

<N>MOTO-OKA HELP, THANKS/DERTOUZOUS AND PENNFIELD/GB3.S2.07
2/2/82 5/12/82 11:48 3 8 <>

<N>MOTO-OKA PRESENTS 5TH GEN. PROJ./1/82/ENG USERS/GB3.S2.57
2/26/82 5/12/82 12:52 5 4 <>

<N>MOTO-OKA THANKS FOR PRES. 5TH GEN. RESEARCH PROG/MOTO
OKA/GB3.S2.06
2/2/82 5/12/82 12:51 3 5 <>

<N>MULTICOMPUTERS, CONSTRUCTING EXPERIMENT,EMS
8/16/FULLER/GB3.S7.48
9/27/82 9/27/82 17:12 4 1 <>

<N>MUSEUM:MANUALS,SOFTWARE/EMS-11/3-MUSEUM-GB3.S10.7
12/28/82 12/28/82 15:35 4 3
<>

<N>MUSEUM:PETROFSKY + LINK DONATION/EMS-11/13-BERUBE/GB3.S10.15
12/28/82 12/28/82 16:17 9 2

<>

<N>MUSEUM: ARTHUR BURKS LECTURE AT THE MUSEUM/GB3.S3.11
3/10/82 3/10/82 14:55 3 2 <>

<N>MUSEUM: BUILDING/HOME COMMITTEE/BLOCH,/GB3.S6.60
8/10/82 8/16/82 16:13 7 12 <>

<N>MUSEUM: CANADIAN AN/FSQ7 FIELD TRIP REPORT/GB3.S8.19
10/18/82 11/9/82 10:41 35 5
<>

<N>MUSEUM: COMPUTER SCIENCE & TECHNOLOGY CENTERS/11/10/81/GB3.S2.36
2/19/82 5/12/82 12:53 5 4 <>

<N>MUSEUM: DONATE LAND AS ENDOWMENT/MATHEWS/GB3.S8.18
10/18/82 10/19/82 8:46 11 14
<>

<N>MUSEUM: FLOWERS LECTURE-OCT. 15 AT MUSEUM/ENG. USERS/GB3.S1.30
11/17/81 12/29/81 11:30 3 4
<>

<N>MUSEUM: GETTING SYMBOL FROM ROY ZINGG, IO../DCM/GB3.S5.39
6/9/82 6/9/82 15:37 4 2 <>

<N>MUSEUM: OREGON MUS. OF SCI & TECH TEMPLETON/GB3.S1.34
11/3/81 5/12/82 12:58 2 6 <>

<N>MUSEUM: REQUEST FOR DEUCE DRUM PROF. MURRAY ALLEN/GB3.S1.07
10/19/81 5/12/82 9:50 3 5 <>

<N>MUSEUM: SYMBOL, NEW HOME FOR /PROF. STEWART,IOWA STATE/GB3.S4.04
5/4/82 5/11/82 9:51 3 5 <>

<N>MUSEUM: WES CLARK DESCRIBES LINC @ MUSEUM/11/14/81/GB3.S2.39.40
2/26/82 2/26/82 4:03 4 3 <>

<N>NASA-NO RE SPACE SHUTTLE EXPERIMENT CANNISTER/ TZANNOS/GB3.S5.12
6/1/82 6/1/82 14:46 2 2 <>

<N>NATIONAL: CHIPS AS MICROVAX.../EMC/GB3.S5.36

6/9/82 6/9/82 15:27 14 2 <>

<N>NAUTILUS CONCERNS/11/23/81/BOB STEWART/GB3.S2.44
2/26/82 5/12/82 12:56 7 4 <>

<N>NAUTILUS PLAN REVIEW/DON MCINNIS/GB3.S3.41
4/14/82 5/12/82 10:01 4 3 <>

<N>NBS MAIL--STANDARD/OC/GB3S.4.29
5/17/82 5/19/82 12:30 5 3 <>

<N>NETWORK SERV BUS--USING ENG AS A PROTOTYPICAL/GB3.S2 1/26/82.60
2/26/82 3/25/82 14:48 3 4 <>

<N>NICOUD--ECOLE POLYTECHNIQUE: RESPONSE TO JEAN-DANIEL /GB3.S7.5
8/17/82 9/1/82 10:33 2 5 <>

<N>NYIT DR. SHURE: THANKS FOR HOSPITALITY/GB3.S5.11
6/1/82 6/2/82 14:46 4 5 <>

<N>NYIT - THANKS FOR COMING/SHURE/GB3.S6.46
8/2/82 8/11/82 14:43 3 4 <>

<N>NYIT, MORE COLLABORATION + A PRO/EMS:BENIGNI,AK/GB3.S8.13
10/13/82 11/8/82 14:05 7 3
<>

<N>NYIT: VIEWING THE NYIT FILM ON COMP..../OC/GB3.S5.57
6/11/82 6/11/82 10:33 4 2 <>

<N>OA,RE-CENTRALIZED ORDER PROCESSING, EMS 8/1,BJORK/GB3.S7.62
9/27/82 9/27/82 17:45 5 1 <>

<N>OFFICE APPLICATION--APPROACH TO DOING/1/16/82/GB3.S2.58
2/26/82 2/26/82 4:14 4 3 <>

<N>OFIS AND CT/WPS SOFTWARE/AVERY/GB3.S4.26
5/13/82 5/13/82 11:30 10 2 <>

<N>OFIS DISCUSSION WITH DAVIES NOT GOOD/EMS:DOCKSER/GB3.S8.12
10/13/82 10/13/82 12:12 12 1
<>

<N>OPPENHEIM:EXCERPT FROM AN OPPEN. PROSPECTUS/OC, PEG...
GB3.S7.25

9/13/82 9/13/82 15:45 3 3 <>

<N>ORGANIZATIONS EVOLVING/ENG STAFF/GB3.S1.50
1/12/82 5/27/82 9:59 15 2 <>

<N>ORGANIZATIONS, THOUGHTS ON EVOLVING/ENG. STAFF/GB3.S1.48
1/11/82 1/11/82 15:03 15 6 <>

<N>ORGANIZATION CHART (ENGINEERING) SHOWING NEW EMC/GB3.S4.06
5/21/82 6/3/82 15:44 9 8 <>

<N>ORGANIZATION--ENG. CHANGES/ENG STAFF/GB3.S4.41
5/17/82 6/3/82 15:44 6 4 <>

<N>ORG CHART--ENGINEERING/GB3.S8.16.16
10/14/82 1/5/83 14:45 9 19 <>

<N>PAPER: DISTRIBUTED PROCESSING AND LIMITS TO ITS GROWTH/GB3.S3.31
3/31/82 4/1/82 14:06 51 16 <>

<N>PAPER: INTRODUCTION TO PROCESSES REQUIRED TO GEN A C./GB3.S3.24
4/14/82 4/14/82 8:20 147 2 <>

<N>PC TIME SHARING CENTRAL/GROUP/PERSONAL DEFINITIONS/GB3.S2.24
2/16/82 3/1/82 3:58 5 3 <>

<N>PC'S: MAKING COST-EFFECTIVE PC'S. LIKE.../KALB/GB3.S5.43
6/11/82 6/11/82 9:34 5 3 <>

<N>PERSONNEL: BJ, NOMINATION FOR VP/OC/GB3.S2.25
2/16/82 5/12/82 12:42 9 6 <>

<N>PERSONNEL: CUTLER - YOU, CHIPS, BOARDS AND DECWEST/GB3.S3.16
3/10/82 5/12/82 11:01 9 3 <>

<N>PERSONNEL: ECONOMY-ADS IN GLOBE ON JOB OUTLOOK/GB3.S3.06
3/9/82 5/12/82 11:06 10 16 <>

<N>PERSONNEL: ENG. SALARIES SLIDES FOR OC/GB3.S3.22
3/23/82 6/1/82 17:15 4 4 <>

<N>PERSONNEL: HIRING WITHIN/WITHOUT, OUT-PLACE/BORNSTEIN/GB3.S4.31
5/17/82 5/19/82 12:29 5 5 <>

<N>PERSONNEL: INDIVIDUAL CONTRIBUTOR (LIST OF NAMES)/OC/GB3.S2.23
2/16/82 4/30/82 12:46 5 7 <>

<N>PERSONNEL: SPECIAL CONTRIBUTOR LIST/GB3.S3.13
3/10/82 3/10/82 14:58 5 2 <>

<N>PHILIPS, THANKS-HOSPITALITY IN EINDHOVEN/PENNENBORG/GB3.S1.11
10/6/81 5/12/82 17:02 5 20 <>

<N>PHILIPS, THANKS-HOSP. IN EINDHOVEN/DRS. TEER & BOSMA/GB3.S1.08
10/5/81 4/30/82 12:54 2 13 <>

<N>PHILIPS, THANK YOU/MR. HOFF/GB3.S1.09
10/5/81 5/12/82 17:03 3 7 <>

<N>PLUTO GREAT.SELL WIDELY AS COMM C./JOHN ADAMS/GB3.S4.39
5/17/82 5/19/82 8:47 5 4 <>

<N>PLUTO, GETTING A REAL START ON /LACROUTE/GB3.S1.32
11/17/81 12/29/81 11:28 5 3
<>

<N>PRINTER: FINDING $'S TO BREADBRD LQP/SHEET FEED/AVERY/GB3.S7.12
8/19/82 8/30/82 14:07 3 3 <>

<N>PRODUCTIVITY VIA FEWER BUT HIGHER QUALITY
MESSAGES/BERUBE/GB3.S6.31
7/26/82 7/26/82 15:11 7 1 <>

<N>PRODUCTIVITY VIA FEWER BUT HIGHER QUALITY MESSAGES/OC
/GB3.S5.40
6/10/82 8/25/82 12:03 6 5 <>

<N>PRODUCTIVITY: RE SW PROD. AND A JOB SHOP.../KEATING/GB3.S5.33
6/9/82 6/9/82 15:08 5 2 <>

<N>PRODUCTS:WINNING HIGH END CPU'S/EMS-11/14/KOTOK/GB3.S10.17
12/28/82 12/28/82 16:22 9 2
<>

<N>PRODUCTS:WINNING-QUICK/EMS-10/26/BJ/GB3.S9.2
11/18/82 11/18/82 16:27 14 2
<>

<N>PRODUCTS: COMPETITIVE/MEMO/11-8/OC,EMC,PEG/GB3.S.37

11/8/82 11/23/82 12:10 16 6
<>

<N>PRODUCT DIFFERENTIATION FOR STORES-11/23/GUTMAN/GB3.S1.15
10/6/81 1/21/82 9:17 2 4 <>

<N>PRODUCT LAYERS: WHERE EVERY GROUP.../HENRY ANCONA/GB3.S5.31
6/9/82 6/9/82 15:03 9 2 <>

<N>PRODUCT LINE MANAGERS--DATA ON REASON FOR/HINDLE/GB3.S4.37
5/17/82 5/18/82 16:32 5 4 <>

<N>PRODUCT STRATEGIES: FRAMEWORK FOR LOOKING AT/12/13/GB3.S9.24
12/13/82 1/6/83 8:49 27 7 <>

<N>PROJECTS: WHICH TO DO, READING OF MCNAMARA /GB3.S6.25
7/26/82 7/26/82 14:38 8 1 <>

<N>PROLOG TODAY! / ECKHOUSE /GB3.S6.27
7/26/82 7/26/82 14:49 2 1 <>

<N>QBUS, USING IT FOR BUILDING COMM SYSTEMS/BUTLER/GB3.S1.38
11/17/81 12/29/81 11:31 6 4
<>

<N>QUALITY PROGRAM AND INSPECTORS VE.../BJ/GB3.S5.28
6/9/82 6/9/82 14:51 5 2 <>

<N>Q VS BI REPORT:THANKS/EMS-
10/16/DEMMER,JESSEL,STRECKER/GB3.S8.69
11/18/82 11/18/82 11:06 5 2
<>

<N>RECOGNITION AND PROFESSIONAL SOCIETIES/PEG/GB3.S3.34
4/8/82 5/12/82 10:55 3 4 <>

<N>RECOGNITION: TURNER'S ARTICLE ON IBM AWARD/DELAGI/GB3.S1.40
11/17/81 11/17/81 15:15 3 2
<>

<N>REFERENCE:PHIL BERNSTEIN/PROF.PAUL MARTIN/HARVARD/GB3.S9.5
11/22/82 1/6/83 8:52 3 5 <>

<N>REFERENCE: BILL JOHNSON FOR MANAGEMENT SCHOOL
CALIF/11/29/GB3.S9.6

11/29/82 1/6/83 8:51 5 3 <>

<N>REFERENCE: FOR DR. MORRIS' PROMO-YES I AGREE/RIORDON/GB3.S1.62
12/4/81 5/12/82 17:09 2 5 <>

<N>REFERENCE: JOHN FISHER/LTR TO R.SCHANK,YALE/11-24/GB3.S9.7
11/24/82 11/30/82 8:55 4 5
<>

<N>REFERENCE: RAJ REDDY /GB3.S6.7
7/19/82 7/21/82 15:45 3 2 <>

<N>REFERENCE: RECOMMEND RALPH PALMER-LOOKS WORTHY/LANDAUER/GB3.S3.23
3/24/82 5/12/82 10:59 2 3 <>

<N>RENTAL CAR FOR HOOPER/GB3.S1.43
11/20/81 3/4/82 12:39 3 4 <>

<N>RESEARCH GROUP:BUILDING 1ST CLASS GROUP-12/6-FULLER-GB3.S10.33
12/29/82 1/6/83 9:02 5 3 <>

<N>RESEARCH:PAPERS IMPROVE R&D /SZAKONYI-WASH DC/GB3.S8.15.15
10/14/82 1/6/83 8:28 2 8 <>

<N>REVIEW ENGINEERING MARCH. REVIEW THOSE WHO NEED/12/81/GB3.S2.48
2/26/82 2/26/82 4:05 8 3 <>

<N>REVIEW ENGINEERING NON-PRODUCT GROUPS 1/82/ENG STAFF/GB3.S2.59
2/26/82 5/12/82 12:03 8 4 <>

<N>REVIEW OF PRODUCTS AND PROJECTS.../BRENDER/GB3.S5.52
6/11/82 6/11/82 14:08 6 5 <>

<N>REVIEW: MORE ON WHAT NOT TO DO/CORBEN/GB3.S5.58
6/11/82 6/11/82 10:35 8 2 <>

<N>RISC/MAURICE WILKES/GB3.S5.29
6/9/82 6/11/82 14:07 5 4 <>

<N>ROYALTY PAYMENTS-CARNEGIE MELLON/OBRIEN/GB3.S1.10
10/5/81 5/12/82 17:09 2 5 <>

<N>SABBATICALS:SHOULD WE?/EMS-11/16/EMC/GB3.S10.20
12/28/82 12/28/82 16:27 3 2

<>

<N>SACRED COWS: AND GOLDEN CALVES/OLSEN/GB3.S5.44
6/11/82 6/11/82 9:37 8 2 <>

<N>SALES: PRODUCT LINE SUPPORT/EMS-11/13-OLSEN-GB3.S10.14
12/28/82 12/28/82 16:16 5 2
<>

<N>SANDIA AND LASL--VAX, LAN, OFFICE & V18X/AVERY ET AL/GB3.S2.37
2/19/82 5/12/82 17:11 12 4 <>

<N>SCORPIO, DISCUSSION AT GVPC/11/21/81/GB3.S2.43
2/26/82 2/26/82 4:04 5 3 <>

<N>SCORPIO:ORGANIZATION REVIEW/EMS-12/6/DEMMER,BJ/GB3.S10.34
12/29/82 12/29/82 9:24 13 3
<>

<N>SCORPIO:ORG REVIEW & INSTALLING TND/EQDM/LIGNOS/EMS/12-6/GB3.S9.27
12/6/82 12/13/82 10:55 12 5
<>

<N>SCORPIO: ORGANIZATION REVIEW/EMS/12-13/PEG,KEN/GB3.S9.33
12/13/82 12/22/82 14:25 17 5
<>

<N>SDF: SMITH, CHARLES DINNER THANKS SYSTEMS DEV FOUNDATION/GB3.S9.22
11/30/82 1/3/83 13:08 8 5 <>

<N>SEMICONDUCTOR STRATEGY, CAN WE ARRIVE AT?/GB3.S1.53
1/12/82 1/12/82 10:02 7 1 <>

<N>SEMICONDUCTOR, YOUR FAULTY PERCEPTION RE SELLING TINY/TJ/GB3.S1.36
11/17/81 6/1/82 16:35 8 4 <>

<N>SERVER, GETTING A PERSONAL COMPUTER/GUTMAN/GB3.S1.27
11/17/81 2/23/82 10:25 5 4
<>

<N>SHARED:LPC(F&J VERSIONS) VS PC'S/EMS-10/9/M.GUTMAN/GB3.S8.61
11/18/82 11/18/82 11:53 7 3

<>

<N>SHARED:11'S, SOME SPT FOR LOW END/EMS-10/10/GUTMAN,MARCUS/GB3.S8.62
11/18/82 11/18/82 11:49 5 3
<>

<N>SIEMENS, NICE TO MEET YOU HERE/GRASSMAN/GB3.S4.05
4/26/82 4/30/82 10:51 3 3 <>

<N>SIGNAL INTEGRITY: DON MARSHALL.../METZGER/GB3.S5.45
6/11/82 8/17/82 16:47 4 5 <>

<N>SPEECH: KEN'S DATA FOR KO/EMS-10/3/A.CRAWFORD/GB3.S8.58
11/18/82 11/18/82 11:55 10 2
<>

<N>SRI, ALPHA OMEGA + JOIN MUSEUM?/MILLER/GB3.S8.43
11/15/82 11/15/82 11:19 4 3
<>

<N>STANDARDS/SEMIS & SYSTEMS DESIGN/PRAKASH BHALERAO,GB3.S8.51
11/15/82 11/15/82 13:40 3 2
<>

<N>STATE OF THE DESIGN-WHAT WE HAVE-WHAT WE WANT/GB3.S1.59
12/3/81 5/12/82 17:15 9 5 <>

<N>STRATEGY: SOME CHALLENGES IN THE NEXT 0-5 YEARS/OLSEN/GB3.S7.10
8/19/82 8/19/82 11:29 19 2 <>

<N>SUMNEY/TECH. POS. OF US COMP. SEMICOMP. CO./GB3.S7.15
8/23/82 9/28/82 11:56 3 4 <>

<N>SUVAX AS COMP.PROD. IN OUR LIFETIMES/11/81/GB3.S2.29
2/19/82 2/26/82 3:58 5 3 <>

<N>SUVAX INTERIM-IN MY LIFETIME-FOR MAY ANNOUNCEMENT/11/81/GB3.S2.34
2/19/82 2/26/82 4:00 4 4 <>

<N>SUVAX, MEETING ON TERMINALS STATUS/CHAMPINE/GB3.S1.29
11/17/81 12/29/81 10:57 5 3
<>

<N>SUVAX, STATUS AS OF 3:45 P.M. 12/2/81/GB3.S2.46
2/26/82 2/26/82 4:05 5 3 <>

<N>TAIWAN, CT05-ENGINEERING/TETSCHNER/GB3.S1.39
11/17/81 11/17/81 15:13 3 2
<>

<N>TAIWAN: THANKS 5 LETTERS 7/82 TRIP/GB3.S6.19
7/20/82 8/2/82 16:31 27 9 <>

<N>TAIWAN: VERSUS AUTOMATION FOR COST/EMS-10/24/KO,J.SMITH/GB3.S8.75
11/18/82 11/18/82 10:28 6 3
<>

<N>TALK/BOOK: ARCH. & IMPL. WITHOUT BRACKETED AREAS/GB3.S4.16
5/4/82 6/1/82 10:24 115 2 <>

<N>TALK: PROCESS REQUIRED TO GENERATE A COMPUTER/SPEECH/GB3.S4.15
5/4/82 5/4/82 12:23 148 2 <>

<N>TECH COMP CENTER:BENCHMARK & EXPERIMENT/EMS-10/13/GANNON/GB3.S8.68
11/18/82 11/18/82 11:07 7 2
<>

<N>TEKNOWLEDGE BOD, NOTES RE FEIGENBAUM/GB3.S8.4
10/4/82 11/18/82 16:28 4 4
<>

<N>TEKNOWLEDGE BOD:/LTR ED FEIGENBAUM/11-2/GB3.S.35
11/2/82 11/23/82 12:12 3 5
<>

<N>TEKNOWLEDGE:ADVISORY BOARD/EMS-10/31/K.OLSEN/GB3.S9.3
11/18/82 11/22/82 9:18 6 4
<>

<N>TERMINALS THOUGHTS ON FOR DUMB, WPS & TECH. USE/11/81/GB3.S2.41
2/26/82 2/26/82 4:03 12 3 <>

<N>TERMINALS, GETTING ARCH. SPECIFIED /AVERY ETAL/1/30/82/GB3.S2.63
2/26/82 6/1/82 16:55 4 5 <>

<N>TERMINAL: WHY WE MUST BUILD GREAT PORTABLE/AVERY/GB3.S7.11
8/19/82 8/19/82 11:18 19 1 <>

<N>THANKS: BOOK-BIRTHPLACES OF EUROPEAN SCI./HARRY GRAY/GB3.S1.67
8/14/81 5/12/82 12:44 4 9 <>

<N>THANKS: FOR TEACHING COURSE/CARVER MEAD/ GB3.S2.14
2/12/82 5/12/82 11:18 5 7 <>

<N>THANKS: MURRAY, DR. JOHN, TEACHING VLSI/GB3.S1.06
10/19/81 5/12/82 11:52 2 5
<>

<N>TMS/AVRAM/GB3.S4.42
5/17/82 5/19/82 12:06 4 4 <>

<N>TND: THE NEW DIGITIAL NEW ENGINEERING-SLIDES/OC/GB3.S9.15
11/29/82 12/16/82 14:09 9 11
<>

<N>TOOMBE, DEAN (TI) PHONE CALL OF 1/14/82/1/14/82/GB3.S2.56
2/26/82 2/26/82 4:13 4 4 <>

<N>TRAINING:ENGINEERING OBSOLESENCE/REYNOLDS/GB3.58.24
10/25/82 10/27/82 10:12 10 11
<>

<N>TRAINING: ENG. OBSOLESCENCE TRANSMITTAL MEMO/PEG ET AL/GB3.S8.25
10/26/82 1/6/83 8:36 3 4 <>

<N>TRAINING: OVER 40 ENGINEERS/PEG/ GB3.S8.27
10/26/82 1/6/83 8:36 6 6 <>

<N>TSONGAS - COMMENTS ON YOUR GLOBE EDITORIAL/GB3.S5.17
6/9/82 6/9/82 13:56 23 6 <>

<N>TSONGAS - TRANSMITTAL LETTER RE HIS GLOBE EDITORIAL/GB3.S5.16
6/9/82 6/9/82 11:13 7 4 <>

<N>TSONGAS: RE MIT MEETING/GB3.S8.2
10/4/82 10/18/82 9:07 8 13 <>

<N>UNIX POLICY:EMS-11/22-BILL JOHNSON-GB3.S10.24
12/29/82 12/29/82 8:47 3 2

<>

<N>UNIX STANDARDS, BRITISH POLICY /CARCHIDI /GB3.S6.38
7/26/82 7/26/82 16:12 5 1 <>

<N>UNIX:MORE COMPETITIVE/EMS-11/1-COURTIN/OC-GB3.S10.3
12/28/82 12/28/82 15:35 4 3
<>

<N>UNIX:MORE COMPETITIVE/EMS-11/8-J.SHIELDS/GB3.S10.13
12/28/82 12/28/82 15:37 3 2
<>

<N>UNIX: FOR MICRO 11 & DECUS/EMS/12/3/CONKLIN,GUTMAN,GB3.S9.11
12/3/82 12/29/82 8:49 3 7 <>

<N>UNIX: SUPPORT/EMC:/GB3.S5.54
6/11/82 6/11/82 10:23 4 2 <>

<N>U OF CAMBRIDGE THANK YOU/DR. HOPPER & HERBERT/GB3.S7.19
9/10/82 9/13/82 12:06 5 4 <>

<N>U OF CONNECTICUT: CORP. CONT. MAY HELP/PETE MCFADDEN/GB3.S5.15
6/4/82 6/23/82 13:15 4 4 <>

<N>U OF NEWCASTLE, DISCLOSURE FOR SECURE DIST
SYS/STRECKER/GB3.S5.60
6/14/82 6/14/82 11:44 4 2 <>

<N>U OF TEXAS-MAKING SCHOOL OF ENG
PROF'NL/WOODSON,GLOYNA/GB3.S4.09
5/3/82 5/19/82 12:37 3 6 <>

<N>VAX ARCHITECTURAL: EXTEN.&REDUCTIONS/EMS-10/24,DILEEP/GB3.S8.74
11/18/82 11/18/82 10:27 17 3
<>

<N>VAX ARCHITECTURE:EXTENDING-NAME/EMS-
10/10/D.BHANDARKAR/GB3.S8.63
11/18/82 11/18/82 11:48 7 2
<>

<N>VAX CENTER: ZK FOR PARALLEL.&EXT./EMS-10/19/CARCHIDI/GB3.S8.71
11/18/82 11/18/82 11:04 4 3
<>

<N>VAX EXTENDED, DUCHAMP'S VECTOR INSTRUC. EMS 8/21/FULLER/GB3.S7.44
9/27/82 9/27/82 17:02 5 1 <>

<N>VAX MARKETING: (& DEV.) VAX'S/CADY/GB3.S5.50
6/11/82 6/11/82 10:10 6 2 <>

<N>VAX PERFORMANCE, EFFORT TO IMPROVE/EMS:DEMMER ETAL/GB3.S8.8
10/13/82 10/25/82 8:59 7 2
<>

<N>VAX & PRIORITIES:PRODUCTS CHARTS & REORG/EMS-10/26/BJ/GB3.S8.76
11/18/82 11/18/82 10:23 5 2
<>

<N>VAX 782 CONGRATULATIONS ON THE 782/GB3.S3.10
3/10/82 4/13/82 13:47 3 3 <>

<N>VAX'S - MARKETING (& DEVELOPING) TO SAVE US/SMITH ET AL/GB3.S5.6
5/24/82 9/18/82 13:09 5 6 <>

<N>VAX,IMPLEMENTATION WHEN HARDWIRED & MICROPROGRAMMED/EMC/GB3.S8.49
11/15/82 12/6/82 16:35 31 8
<>

<N>VAX, PROMOTING FOR PERSONAL COMP. SUPPORT DEV./11/5/81/GB3.S2.31
2/19/82 2/26/82 3:59 3 4 <>

<N>VAX, WHAT WOULD A SIMPLER VAX ACCOMPLISH/12/81/GB3.S2.50
2/26/82 2/26/82 4:06 8 3 <>

<N>VAX-11: PERFORMANCE DATA ON VAX-11.../CUTLER/GB3.S5.59
6/11/82 6/11/82 14:06 4 2 <>

<N>VAX/VMS: RELEASE 1 BOOK/ORPHAN/ANKLAN @CNS1/GB3.S5.22
6/9/82 6/9/82 14:33 6 2 <>

<N>VAX11 USER'S GUIDE: LTR DENNIS GELLER,BABSON/11-2/GB3.S.31
11/1/82 11/23/82 13:00 2 3
<>

<N>VAX:FORTRAN PERFORMANCE/EMS/11-24/DEMMER,BJ/GB3.S9.10
11/24/82 11/30/82 8:57 8 5
<>

<N>VAX:GETTING BACK INTO BUS/EMS-10/26/EMC/GB3.S9.4
11/18/82 12/8/82 10:47 5 4
<>

<N>VAX:HELP ON IMPROVING/EMS-11/24/BOB ROCKWELL/GB3.S10.25
12/29/82 12/29/82 8:49 4 3
<>

<N>VAX:VIA MICROPROGRAMMING/EMS-10/10/D.BHANDARKAR/GB3.S8.64
11/18/82 11/18/82 11:47 5 2
<>

<N>VAX: COMPETITIVENESS NOW AND IN FUTURE, HIGH PERF/KC /GB3.S6.39
7/28/82 8/19/82 11:26 14 12 <>

<N>VENDOR FEEDBACK--COMMENTS ON OUR MKTING FOLKS/ENG.STAFF/GB3.S2.20
2/16/82 5/12/82 11:27 5 8 <>

<N>VENDOR: RIXON INTERFACE W/DEC SENT TO BERNIE/BERNIE/GB3.S1.24
10/10/81 5/12/82 17:09 4 7
<>

<N>VENUS REVIEW CONGRATS...SINCE 5/81/EMS:GLORIOSO+/GB3.S8.10
10/13/82 10/13/82 11:56 5 1
<>

<N>VENUS, GORDON'S VISIT TO MARLBORO/11/8/81/GB3.S2.33
2/19/82 2/26/82 4:00 8 4 <>

<N>VENUS: NEED, LLL MULTIPROCESSORS/EMS/11-16/DEMMER ET AL/GB3.S8.53
11/15/82 11/23/82 11:33 12 6
<>

<N>VLSI THE GREAT SEMINAR, NOW WHAT PEG?/GB3.S3.15
3/10/82 3/23/82 15:31 12 3 <>

<N>VOICE:PLAYBACK/EMS-11/14-AVERY-GB3.S10.18
12/28/82 12/28/82 16:23 4 2
<>

<N>VS100 AND PERSONLA NEBULA, EMS 8/7, CHAMPINE+/GB3.S7.56
9/27/82 9/27/82 17:33 8 1 <>

<N>VS100 AS THE FIRST VT200 (COULD I.../HUETTNER/GB3.S5.47
6/11/82 6/11/82 9:46 3 2 <>

<N>VS11, SUDS AVAILABILITY/11/21/81/GB3.S2.42
2/26/82 2/26/82 4:03 4 3 <>

<N>VS200, GET COLOR QUICK,EMS 8/2,BUTLER+/GB3.S7.61
9/27/82 9/27/82 17:44 3 1 <>

<N>VT100 LOW COST BEST WAY TO GET IT,A
COUNTERPROPOSAL/KO/GB3.S3.09
3/10/82 5/12/82 11:04 17 3 <>

<N>VT102 REPLACEMENT PACKAGING/OLSEN/GB3.S1.16
10/7/81 10/13/81 17:34 9 13
<>

<N>VT192 - SCHEDULE, EMS 8/9 /AVERY+/GB3.S7.54
9/27/82 9/27/82 17:26 7 1 <>

<N>VT192: FINALIZING SPEC BEFORE WE SLIP SCHED./AVERY/GB3.S7.14
8/19/82 9/14/82 16:09 6 4 <>

<N>VT192: PUTTING THE MODEM OPTION BACK IN/AVERY/GB3.S7.13
8/19/82 8/19/82 11:21 4 1 <>

<N>VT200, WHY ISN'T OPAL THE VT200?/CHAMPINE/GB3.S4.08
5/3/82 5/18/82 14:15 4 7 <>

<N>VT200: WHY ISN'T OPAL THE VT200?/AVERY/GB3.S5.23
6/9/82 7/23/82 10:26 4 4 <>

<N>VT201: AND VS100/VT200 SERIES: ../AVERY/GB3.S5.56
6/11/82 6/11/82 10:31 5 2 <>

<N>VT278, CONGRATULATIONS/GB3.S2.22
2/16/82 3/1/82 3:59 2 3 <>

<N>VT:OVERFUNDING-HUETTNER/AVERY/SMITH GB3.S7.20
9/10/82 10/6/82 13:05 4 7 <>

<N>WCC:THANK YOU: JJ SERVENT-SCHEINER & N NEGROPONTE/GB3.S7.18
9/10/82 9/22/82 9:24 5 12 <>

<N>WCC:WORLD COMPUTER CENTER AND WPS-SOURNAC GB3.S7.23
9/10/82 11/16/82 14:31 7 9
<>

<N>WC FIELD (LASL WC11 COMPUTER)/EMS-12/3-AVERY/GB3.S10.27
12/29/82 12/29/82 8:57 7 2
<>

<N>WORKSATIONS ON A WINNING TRACK, EMS 8/14/SMITH/GB3.S7.51
9/27/82 9/27/82 17:17 4 1 <>

<N>WORKSTATION:BEFORE IT'S TOO LATE/EMS/CROXON/12-6/GB3.S9.26
12/6/82 12/6/82 14:05 8 4 <>

<N>WORKSTATION:GETTING BEFORE TOO LATE/12/6-B.CROXON/GB3.S10.32
12/29/82 1/6/83 9:02 8 4 <>

<N>WORLD COMPUTER CENTER--RECOMMENDATION OF EQUIPMENT/OC/GB3.S4.27
5/17/82 5/17/82 8:53 23 2 <>

<N>WPS SITE:LSG CUSTOMER, PITT.EXAMPLE/AK +/12-6/GB3.S9.28
12/6/82 12/7/82 10:25 21 6 <>

<N>WPS-CT300 PHASE 0 OF POINT PRODUCT, EMS 8/21/DOCKSER ET AL/GB3.S7.45
9/27/82 9/27/82 17:04 5 1 <>

<N>WPS8-DILEMA OF INTRODUCING 3 P.C.'S/AVERY ET AL/ GB3.S2.11
4/8/82 6/1/82 16:53 7 6 <>

<N>WRL:CHARTER/EMS/11-16/FULLER,BASKETT/GB3.S8.54
11/15/82 11/23/82 11:25 7 8
<>

<N>YALE: CS DEPT. VISIT/EMS/11-16/MARCUS,FULLER/GB3.S8.60
11/15/82 11/23/82 11:22 10 11
<>

PM EST
DEPT: OOD
EXT: 223-2236
TO: JOHN HOLMAN

SUBJECT: GUIDELINES ON SPACE PLANNING (DRAFT FOR YOU)

In order to get our space plan to meet the 1990 constraint, it is necessary to add some guidelines that we feel will meet the corporate desire to have only 20% of the poplulation in Massachusetts. Rather than require a corporate bogie, we are going to take the position of putting together the most aggressive plan possible...and then see what this is in terms of the effect.

To me, the ideal is reasonably clear: make 495 the highway to connect all sites and to have these sites as close as possible.
Coming off the ideal then, here's the guidelines I'd like each
OOD member to use:

1. No growth in Massachusetts.
2. NH is already commited to an aggressive growth. Grow the Comml and Computer Products Groups in accordance with their growth rates. Leave SR2 as space for growth of SR1. Leave Dist. Processing in TW.
3. Grow systems groups in various volume plants to assist in the move to Dock Mergeable products.
4. Establish a major engineering site in SW for terminals, with
residual in Mass at no growth.
5. Establish a major engineeing site in NE co-located with Mfg. for Mass storage. I.e. this would be the growth site. Furthermore, NH and Mass would be off limits for growth.
6. Plan an organizational move to RI in this go around.
7. Cap building 12 as OCE (office of Central Enginnering) for LP,GB,JM,SF, and MK.
8. TOPS to co-locate in a fixed, no growth building with Will.
As this support and central part of this organization grows, it

would co-locate with systems customers and prototype plants.
9. Consider co-location of low end mass store with low end systems.
10. Point 1, would be subject to allowing only growth for LES (not Terminals) into Hudson 2 as planned.

If we can base a plan on these concepts, I think we have the potential for a better organization with more dispersal to Mfg.
and which starts seed operations in the SW, in RI, and somewhere
else in NE for Mass storage (the growth/product portion).

00 BURT DECGRAM ACCEPTED S 2044 O 20 06-FEB-80 22:06:39
FROM: GORDON BELL   DATE: WED 6 FEB 1980 7:39 PM EST
DEPT: OOD
EXT: 223-2236
TO: OOD:
    OOD: @CLEM

SUBJECT: SPACE GUIDELINES FOR TOMORROW MEETING

Excuse the poor form as I couldn't go back and edit the draft I sent to John.
One sure gets an appreciation of what systems should be designed like
in using this...but I digress.

The attached is a starting point. In addition, I feel we may be
going wrong direction in SS by having it co-locate in Hudson. Namely,
Hudson is going to expand too in the chips area and I don't understand
where they are going to go. Why don't we just let them expand there
as a semi operation, and not make them go somewhere else

because their
site is all used up with hangers on?

We need some really good thinking in this whole area... and
it will have
to be done by a good team that will be in constant
communication with
us. It will be intense for a month or so while this gets
done. Let's
persevere... it is really the design of our organization...
and is
our job.

ATTACHED: MEMO;53

TO: JOHN HOLMAN   DATE: TUE 5 FEB 1980
5:34 PM EST

FROM: GORDON BELL
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1
A51

SUBJECT: GUIDELINES ON SPACE PLANNING (DRAFT FOR YOU)

In order to get our space plan to meet the 1990 constraint, it is necessary to add some guidelines that we feel will meet the corporate desire to have only 20% of the poplulation in Massachusetts. Rather than require a corporate bogie, we are going to take the position of putting together the most aggressive plan possible...and then see what this is in terms of the effect.

To me, the ideal is reasonably clear: make 495 the highway to connect all sites and to have these sites as close as possible.
Coming off the ideal then, here's the guidelines I'd like
each
OOD member to use:

1. No growth in Massachusetts.
2. NH is already commited to an aggressive growth. Grow the Comml and Computer Products Groups in accordance with their growth rates. Leave SR2 as space for growth of SR1. Leave Dist. Processing in TW.
3. Grow systems groups in various volume plants to assist in the move to Dock Mergeable products.
4. Establish a major engineering site in SW for terminals, with
residual in Mass at no growth.
5. Establish a major engineeing site in NE co-located with Mfg. for Mass storage. I.e. this would be the growth site. Furthermore, NH and Mass would be off limits for growth.
6. Plan an organizational move to RI in this go around.
7. Cap building 12 as OCE (office of Central Enginnering) for LP,GB,JM,SF, and MK.
8. TOPS to co-locate in a fixed, no growth building with Will.
As this support and central part of this organization grows, it
would co-locate with systems customers and prototype plants.
9. Consider co-location of low end mass store with low end systems.
10. Point 1, would be subject to allowing only growth for LES (not Terminals) into Hudson 2 as planned.

If we can base a plan on these concepts, I think we have the potential for a better organization with more dispersal to Mfg.
and which starts seed operations in the SW, in RI, and somewhere
else in NE for Mass storage (the growth/product portion).

GB1.S1.63
process record
If <date>=<*>10/29/78<*>
then process record
if <lst>=<*>AOTF<*>
then process record
if <sal>=A<*>
or=

or=
then process record
July 14, 1980

Michael D. Scheer
Specialized Book Service Inc.
100 North Street
Burlington, VT 05401

Dear Michael:

Thanks for the specifics on the order processing situation.

I'm forwarding the letter to Del Lippert, head of Educational Services, and Joe Santini, Marcy's manager, and Marcy so that we can get together and discuss the situation. It's quite possible that we can't perform as a publisher, given that we're a computer company. Given the response time, maybe we can make our rules clear so at least you can depend on us. Thus, I hope Marcy can get back to you. It's ironic we have pretty good software for small businesses (probably publishers too).

Given that my role has been as one of the founders, author and strong supporter, I believe in it and want to see it succeed. Hopefully we can.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:swh
GB1.S5.22

CC: Marcy Kenah, Digital

Del Lippert, Digital
Joe Santini, Digital

00 CORE DECGRAM ACCEPTED S 000220 O 2 04-OCT-82 1:32:42

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION DATE: SUN 3 OCT 1982
11:56 PM EDT

FROM: GORDON BELL

cc: KEN OLSEN DEPT: ENG STAFF

EXT: 223-2236

LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5177510994

SUBJECT: KEN'S SPEECH DATA

Ken wanted some historical data as to where we were first in regard to the current office automation and networking.
My recollections:

Editing/word processing
early computer editing on pdp-1, expensive typewriter 1962?
Teco, first video editor that had virtually all the features of today's word processors. Pdp-6 1965? from mit
SOS, basic editor that is forerunner of all Personal Computer editors. From Stanford 196? (late 60's)
EMACS- written in TECO, forerunner of future, editors for the professionals
wps78 -75 very early word processor (where historically?)

Typesetting
Larry Buckland on pdp-1. the 4096 x 4096 point scope circa 1963 was a factor of 8 to 16 more precise than anything around.
was used for direct typesetting. the result was Information

International Inc. went off and made a whole company around this technology.
PDP-8/11 newspaper typesetting and required networking.
IN 72 at CMU we set a book directly using a 20 and a Xerox printer without any conventional typesetter. The book was mixed graphics and text, and went directly to be photographed for printing.

Networking
More than x % of the computers on the ARPA net have always been DEC computers. The first paper was in 67 and the network came into operation in ?? (I believe seriously in about 72... it was marginal when I came back to DEC in 72.)
DECnet came out in 75 to solve the distributed computing problem
we created when all the minis appeared. It combined the best of ARPAnet by allowing one to build a packet net, while not forcing extra computers. Today there are ?? DECnets!
(Frank Heart at BBN can give us the key dates if Ken needs more.)

Ethernet. Today there are ? Ethernets in ? organizations. Digital has an engineering network with over 300 computers tied together at 15 sites in what we believe is the world'ss largest net. WE also have 20? Ethernets in operation.

Mail
Came out of timesharing on a single system for communication among its users, starting with pdp-10. I forget the first mail program.
All our timesharing systems have mail among them and hence we have more people doing word processing and mail than any other supplier.
We did a joint mail system with Computer Corporation of America and used it from ? to ? as a test site. During this time, an internal mail system, DECmail was developed on the 11 and

was
put into service in ?.

Timesharing
We had the first commercial system by far. GE later marketed the one built at Dartmouth. MIT, SDC and BBN built the first ones followed by Dartmouth and Stanford. This was one form of personal computer... the goal was/has always been to give everyone their own computer.
The TSS8 at CMU and on quickly to dEC was aimed at lowest cost per user and to show that timesharing worked on small computers.
I wanted to beat the IBM 360/67 by 1 to 2 orders of magnitude in price.
TSS8 trained the designers of the RSTS system which we introduced in 71 as the first, mini tss. It was the true, beginning of distributed processing as we know it today that goes into groups and departments.

Computer games
Spacewar was clearly the first, operating in 1963? and built by steve russel at mit. The world is still disputing this, and the museum spends some time every year showing the origin.

personal computers
The LINC, although it was a bit hard to move around (it had big wheels for this purpose). The definition I have includes being able to have a complete file system and be able to automatically write and run a program without any manual operations on files. (Early computers like the LGP 30 required off line flexo program preparation followed by lots of file handling.)

Please can I have your help, sent dates to KEN and I. Also, please add any products that are relevant here.

MJ,
Please give Ken a recent tree to get the overall relationship in time.

"TO" DISTRIBUTION:

AL CRAWFORD MARY JANE FORBES JACK
GILMORE
ALAN KOTOK BERNIE LACROUTE R.L. LANE
ALLAN TITCOMB

GB3.S8.58
July 23, 1982

Mr. Larry W. Sumney
Executive Director
Semiconductor Research Cooperative
1925 N. Lynn St.
Suite 404
Arlington, Virginia 22209

Dear Mr. Sumney:

As you know, Jeff Kalb has replaced Gordon Bell as DEC's official member of the Semiconductor Research Cooperative. While Gordon remains very interested in the project, I'm concerned that Jeff is not receiving all information as soon as it is available. I would appreciate it if you could see that Gordon's name and address is replaced with Jeff Kalb immediately.

Old: Mr. C. Gordon Bell
Vice President
Digital Equipment Corporation
146 Main Street
Maynard, MA 01754

New: Mr. Jeffrey Kalb
Group Manager, LSI
Digital Equipment Corporation

77 Reed Road
Hudson, MA 01749

Thank you for your help.

Sincerely,

Mary Jane Forbes
Secretary to Gordon Bell

MJF/pef
GB3.S14.5

August 24, 1979

Prof. Bob Hopgood
Science Research council
Rutherford Laboratory
Chilton, Didcot
Oxfordshire OX11oQX
ENGLAND

Dear Bob:

It was great to see you again and discuss the SRC and Rutherford Laboratory with you.

I looked at the material and wondered if I could get the first annual report of the distributed computing program from you. Also, is there a report on the Manchester Data Flow Computer? and the CYBA-M? Is there a report yet from the Robert Panel? Any reports you could send would be appreciated.

Sincerely yours,

Gordon Bell

Vice President
Engineering

GB:mjf
GB0004/40

Digital **Interoffice Memo**

Subject: **SRI Visit - Industrial Automation**

To: Jim Bell

Date: 1 NOV 76
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

F/U 11/8

I enjoyed SRI and have a better appreciation of their ability. Their applications are really exciting versus the ho-hum we do when we copy IBM (e.g. power monitor). They're really sold on the LSI-11 as the hot, microcomputer to be used in industrial applications.

We must push to get both internal use (when we can be a customer) plus OEMs who'll develop the end use built on LSI-11's so we can participate in emerging automation market. (They also need more address space.)

[Win/Charlie/Bill Long, are we?]

Robots

They're working to get UNIMATION (largest maker of industrial robots to be our customer.) SRI has an LSI-11 equipped UNIMATE.

[Bill Long/Ted, are we organized enough to accept UNIMATION orders with less than the usual hassle? Are we even aware of them?]

[Charlie, are these OEMs part of IPG plan?]

Vision/Inspection

GE has a nice low cost, low resolution, CCD camera for inspection applications. SRI's now pushing to get a supplier of the system. GE could be it. Note, Reticon, the best supplier is owned 40% by Intel.

[Charlie/Win/Holman/McBride, could we get someone to look at this as a possible product?] The amount of effort going into inspection is very, very large...hence, there's a high payoff. GM's doing quite a lot, for example.

I believe a small effort could get a truly significant product in 2 years (given the external work). They need faster speed (Fonz 11 or LSI-11 with WCS).

Voice

They're not doing much. Raj Reddy at CMU is switching to LSI-11's, and will have an effective system. He'll use a system that's standard, hence others will be able to get copies. This should also help feed other OEMs, users and us.

Threshold technology as an OEM for LSI-11 is really significant, as it gives us a key input/output transducer.

Charlie Rosen, at SRI, told me about the conference on this sponsored by NSF, Nov. 30-Dec 2, at IITRI in Chicago, that you were attending. Could you make sure someone from IPG and Manufacturing goes with you? (Some of our customers will be there and it'll be good to listen and sell!)

GB:ljp

CC:	OOD	MC
	Jim Cudmore	Bob Glorioso
	Win Hindle	John Holman
	Ken King	Andy Knowles
	Bill Long	John Mackeen
	Bill McBride	Stan Olsen
	Mark Sebern	Charlie Spector
	Joe St. Amour	Steve Teicher

April 9, 1979

Dr. Joseph Giarratano
St. Agnes Hospital
430 E. Division Street
Fond Du Lac, Wisconsin 54935

Dear Dr. Joseph Giarratano:

In regards to your letter of April 2, 1979, thanks for the kind words about _Computer Engineering_.

Sorry I can't review your book, but I look forward to seeing it.

Sincerely,

Gordon Bell,
Vice President of Engineering

GB:swh

GB0002/10
10/24/82 Sun
TO: Staff

NOTHING BETWEEN THE CRACKS

PRIORITIES:

Short term:
Today, get overheads and all material for presentation to HOCC.
Get materials to Reno for Winter Report -- it must move.
Schedule Oct. Nov. - see below

Longer term:

Schedule all mailings and make sure people get things on time: <u>we keep the members happy.</u> Harry Huskey invitations should be out on time, with insert letter to "Locals". - Chris and Geri schedule this -- from doing the labels to stuffing etc. using the store women and Bill as appropriate.

<u>Increase membership and financial support.</u>

- At least 25 personalized letter's go out a week -- signed by me or some member of the Board -- to get major acquisitions and get things moving. (<u>Geri</u> let's keep a log of the numbers of personalized letters that go out each week for big bucks. <u>Geri</u>, it's your job to keep me at this and make sure they go out.)

- The December 9th, Pray, Mr. Babbage party should be used for a big membership drive. <u>Chris,</u> your main job is to get the publicity out for this and pull the whole party together. (Huskey should more or less take care of itself...without alot, and Bits and Bites is about done.) The goal should be 100 new members from Pray, Mr. Babbage. Invitations need to go in the mail on November 12th -- want you to use a great big mailing list (get our friends at DG etc., lots of internal Digital -- lets rethink the use of lists). They must send in money for tickets. $5. each for members (who may bring one friend for $5); non-members need to become members for $25 and then pay $5 for themselves and a friend.) -- Get me to call Charlie Conn today and set up a meeting for Friday, when we have all the details of the party and get them to design invites for free, must be done fast to go to the printers by the 5th for a week turn-around. This whole thing has to be quick and dirty, but with lots of style. I want to talk to you and Jamie about it for 15 minutes today. Then lets put the whole thing in final shape on Friday.

- <u>Jamie,</u> after the Pioneer Timeline is complete, then you must drive the planning for the lobby floor space, and the proposals for all the viewing and video equipment.

-

Digital **Interoffice Memo**

Subject: **<u>Adapting Standard Office Copiers for Computer Print Out</u>**

To: Ken Olsen

Date: 14 DEC 76
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

CC: OOD
Jim Bell
Peter Christy
Ed Corell
Jack Gilmore
Bob Gray
John Gunther
Mark Sebern
Tom Siekman

As much as I'd like to take credit for discovering the notion that future office copiers have plugs or mechanical accessories so that computers can be attached to them, I don't think I did.

In 1970 or so CMU got hold of a Xerox LDX (Long Distance Xerography) which ran at about 200 lines/inch, and it was connected to a 10 via an 11/20. This was developed including editors to generate character sets. Now there are about 20 in operation at various ARPA sites.

Recently we began considering alternative printer technologies (plus I have a desire to have a good printer internally and get us started thinking this way) so I started pursuing getting a Telecopier or high-Q Fax of some sort. We could even use a Versatec (Xerox owns them) to get experience in this sort of printing.

We contacted Kodak and Xerox (3-6 mos. ago) and asked them about low cost machines we could connect to, but so far we haven't gotten a good response. Kodak is to come back to us. The idea appeared novel to them. Xerox is thinking our way. We've asked for a standard office copier that we could cheaply interface to. All sorts of ways are possible...turning out the light and using a laser to form the image is probably the best. However, some modifications would have to be made to standard machines to get timing information to form images on a photoreceptor surface.

The Savin copier now looks to be what we want. At $4K and 3 sec/copy with quality gives us a 66 x 20 = 1320 line/min. printer capable of printing anything, plus being used as a copier.

By not having another mechanical device, a user saves service costs, space, training, capital, etc. The Diablo printer is no way to do things, and I want us to go on to get a copier company to do this. For now, we aren't going to talk about this outside.

I don't know where the idea came from.

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST: Ken Olsen ML12-1/A50

CC: Jim Bell ML3-4/E41 Peter Christy
ML12-3/A62
Dick Clayton ML3-3/E71 Ed Corell
ML1-3/E62
Ulf Fagerquist MR1-2/E78 Jack Gilmore NT
Arnie Goldfein ML12-2/A16 Bob Gray
John Gunther PK3-2/F17 Henry Lemaire
ML1-4/A97
Julius Marcus PK3-1/M29 John Meyer
ML12-1/A11
Stan Pearson ML12-3/E13 Larry Portner
ML12-3/A62
Bob Puffer ML1-3/E38 Mark Sebern
ML3-4/E41
Tom Siekman PK3-2/F17

It is clear we need to standardize the design information interfaces to maximize the independence and growth of using gate arrays. Every company uses a different design system for layout, simulation, testing, etc. This problem never got solved with ROMS, or custom-except with Cal Tech's Design Files, but is mandatory for gate arrays.

Should we sponsor a small conference of some of our vendors, suppliers, and with other manufacturers?

Lattice Logic
Signetics
Fairchild
Motorola
National
TI
Univac
CDC
Teradyne

Should it be done as part of MCC?

What you think?

April 9, 1984

Professor Steven Yau, Editor-in-Chief
IEEE Computer Magazine
Dept. of Computer Science
Northwestern University
Evanston, Illinois 60201

Jim Greenlee, Managing Editor
IEEE Computer Society
10662 Los Vaqueros Circle
Los Alamitos, California 90720

Dear Steve and Jim:

Enclosed is a double-spaced, revised copy of the paper: Aren't Standards Our Friends? I also enclosed a photo and brief biography for Jim.

Nearly all of your helpful suggestions were addressed. My wife, who has spent much of her life as an editor, made a pass too, but I believe it can still use some more copy editing. There are now 22 references.

Regarding the title-- I still prefer the one I've given, although it could be extended to: Aren't Standards Our Friends As We Do R&D For Future Generations? or Aren't Standards Our Friends As We Build Future Generation Computers? You folks chose.

Am proceeding to work on the Industry article which is due May 15.

I also enclose an article (again sans references) on the Digital Computing Environment that I would very much like to have Computer publish. The work represents the last six years of my own effort in leading Digital's Engineering organization (of 6000) in the building of a system composed of a collection of systems, forming what I call an environment. I believe this is the first paper to address this kind of system. In many respects, the effort is larger than designing a series of computers such as the 360. I'd like to get your reaction to the paper before I add any more sections.

Sincerely,

Gordon Bell
Chief Technical Officer

GB8.26
****
* d i g i t a l *
****

TO: SAM FULLER   DATE: WED 27 MAY 1981
16:18 EST
    PAT WHITE   FROM: GORDON BELL
cc: GVPC: DEPT: ENG STAFF
    PEG: EXT: 223-2236
    BILL STRECKER   LOC/MAIL STOP: ML12-
1/A51

SUBJECT: STANDARDS: WHAT'S OUR POSITION

Please give a presentation at PEG as a prelude to a GVPC presentation.
It feels like there are more standards than ever of relevance to us,
yet we're less active and less ready to use them. Also, we have no
standards policy.

Please plot ALL the relevant standards by level of integration versus
price bands.

It would seem these are the relevant levels of integration:

END USE
Word processing, teletext, etc.

SPECIAL LANGUAGES
Visicalc
Editors

STANDARD COMPUTER LANGUAGES
ADA, Algol, Basic, Bliss, etc.

OPERATING SYSTEM
Human interface - command language, etc.
Terminal interfaces - including the IBM terminals
Links to other machines (X25, SNA, etc.) - not hardware level
Data management and files
Operating System terminals (e.g. UNIX)

ISP STANDARDS
ISPs - Include alphabets, IEEE Floating Point Standards

INTER-COMPUTER STANDARDS
The plethora of LNI's, CI, IEEE 488, etc.

INTER COMPUTER COMPONENT
to disks
to tapes
to terminals
to controllers (i.e. IBM Channel)

INTER-COMPUTER BACKPLANE BUSSES
S-100 and IEEE improved version P696?, Multibus 796, 896, etc.

INTERCONNECT ON MODULES (II, Semicomputer parts)

The chart should show various categories:
- standardized and enforced
- standardized, not likely to be used
- in process of being standardized
- our own standard(s) for an area (e.g. Unibus, Qbus,

CTI)

- where we have a plan to converge
- where we have a plan not to converge
- where, by adopting a standard, we might get more business

We need a policy!

GB:swh
GB2.S6.25

ID#376

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i n t e r o f f i c e   m e m o r a n d u m

Subject: **Stanford Grant Proposal**

To: Bob Puffer, ML12-2/E38
Jerry Witmore, PK3-1/M40
Contributions Committee

Date: 5 DEC 78
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

CC: Jim Bell, ML3-2/E41
Ulf Fagerquist, MR1-2/E78
Sam Fuller, TW/A08
John Leng, MR1-1/A65
John Meyer, ML12-1/A11
Peter Raulerson, WR (Santa Clara)

follow up 12/19/78

Let me urge you to support the $100K, 2060 grant to Stanford they requested in November. We need more ties. Somehow, I'd like to make/get the $15K that's part of the Semiconductor Industrial Associates Program run by Jim Meindl out of the grant. Also, can we tie this to some internal formal communication channel?

Their brief plea to us is impressive and we can use this work! Also, let's recruit there immediately -- especially LSI.

GB:ljp

Contribution Committee
George Chamberlain, MS/B80
Bob Lane, MK1-2/B11
Bob Puffer, ML12-2/E38
John Sims, ML1-5/B15

D I G I T A L   INTEROFFICE MEMORANDUM

DIST: Jim Bell ML3-2/E41 George Chamberlain
MS/B80
Ulf Fagerquist MR1-2/E78 Sam Fuller
TW/A08
Bob Lane MK1-2/B11 John Leng MR1-
1/A65
John Meyer ML12-1/A11 Bob Puffer ML12-
2/E38
Peter Raulerson WR John Sims ML1-
5/B15
Jerry Witmore PK3-1/M40

15 Februry 1983

Professor Bob White, Head
Dept. of Electrical Engineering
McCullough 150
Stanford University
Stanford, CA 94305

Dear Bob:

Thanks for the dinner and discussion with you and your wife on Saturday. When you come to Boston, I hope you can visit me and the Computer Museum.

I'll plan to visit Stanford for a couple of days on the next trip to the bay area.

Sincerely,

Gordon Bell
Vice President, Engineering

GB4.S1.34
June 26, 1980

Professor Ed Feigenbaum
Professor and Chairman
Computer Science Department
Stanford University
Stanford, CA 94305

Dear Ed:

It was an honor to give the Forsythe lecture at Stanford. Gwen and I enjoyed the trip, the Stanford Computer Science Department, and especially the interaction with you and Penny. I'd like to get a copy of Bill Miller's talk if possible and a videotape of my talk.

Given that Gwen co-authored the paper I gave, I am including her expenses for the two days.

The total expenses were:

Car travel into Boston (25 miles @ .18)	$4.50
Tolls	1.05
Gwen airfare	372.00
Gordon airfare (1/2 shared with DEC)	186.00
Hotel	140.55
Rental Car	46.47
Breakfast (Saturday)	6.82

	$757.39

Since I cannot accept the honorarium, please either do not issue it, or place it in the Stanford Computer Science Department Scholarship fund.

Again, thank you for the chance to visit Stanford and exchange views.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:swh
GB1.S5.11

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Subject: Stanford VLSI Program Opportunity: Visit, Policy, and Si Valley Facility

To: Dick Clayton, ML12-2/E71
Jim Cudmore, HL

CC: Jim Bell, ML3-2/E41
George Chamberlain, MS/B80
Brian Croxon, TW/C04
Dick Eckhouse, ML3-4/T41
Roy Moffa, HL1-2/R02
Craig Mudge, HL1-2/008
Steve Teicher, HL1-2/R02
Joe Zeh, HL1-2/R02
OOD

Date: 6/30/80 Mon
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236
EMS: @CORE

Follow Up: 7/11/80

George Pake, VP of Research at Xerox, sent the attached proposal to me. Some of you have already viewed it. I would like to see it made explicitly part of the semiconductor R and D Program as to whether we do or do not consider becoming a member of it. Similarly, we should wait for M.I.T.'s request in this regard too and even solicit it so as to have a better set of data to work with. Berkley has lots of strength here too. Already we are working with Caltech and Cornell and ??.

I visited them and feel we should put a significant program in place to interact with them, because:

0. Stanford is clearly the best engineering school in terms of quality and quantity. Also, they are number one in Semiconductors and Computer Science.
1. Meindl feels the best to me of the research leaders outside of Broers at IBM. The group is the largest outside of IBM and BTL. Overall, they are both quality and very large.
2. Size will get us the most students. The total department is 44 PhD and 170 MS graduates of which they will yield 30 PhD and 100 MS in this program.
3. It would be an excellent place to insist that we have a mid-career updating program for our SSI/MSI/Standard Chip Logical Designers to go and get MS's. BTL sends 50 per year in this regard. I would like to see someone enter Stanford this fall, going to 2 per year next year, with a research affiliate in residence each year starting fall of '81.
4. They process their own chips on a 5 micron line and at least one-up the other programs by providing 3 week turn-around on their local line.
5. They are putting an EBEAM in place this year to even speed up the turn around more. If we could be a part of this, our own EBEAM work could be accelerated to the point of being able to pay for the whole program by getting an accelerated schedule.
6. It seems a West Coast Engineering facility is overdue. I would like to use the Mountain View home to house various people who will work there on real projects and who will interface to the numerous activities there in universities, semicomputers, and systems generated from this industry.
7. Interacting with Stanford on a more organized basis is needed.

Note that we can interact with them without a formal program, but on the other hand, it would strengthen us significantly to become a member.

I made a commitment to have the necessary people visit and seriously review their proposal. Jim and Dick, will you please get back to me on how we can do this?

GB:swh
GB1.S5.13

Attachment - Xerox Proposal
April 21, 1981

Ed Feigenbaum
Stanford University
Computer Science Dept.
Stanford, CA 94305

Dear Ed:

Jim Wilkinson gave two delightful lectures on the Pilot ACE. He stated these were taken from his three lectures for the Forsythe lecture series at Stanford. Was the lecture taped? Or written? If so, could you please send a copy of it?

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:swh
GB2.S5.37
2 June 1983

Prof. Edward A. Feigenbaum
Prof. John Hennessy
Prof. Jeffrey Ullman
Computer Science Department
Stanford University
Stanford, CA 94305

Dear Ed, John and Jeff:

Thank you for the hospitality and stimulating interaction during my recent three week stay at Stanford.

I'll be helping Bruce Delagi and Tom Gannon get a plan for providing research multiprocessors to Stanford. As I tried to point out, I believe that the design and use of multiprocessors, <u>if they are to emerge</u>, can only be accomplished by many different system approaches and a variety of applications. I believe in the immediate short term of using the machine with existing languages on an ad hoc basis will be worthwhile. On a slightly longer term basis, John Hennessy's SAL looks like the way to express and exploit parallel algorithms. Clearly Stanford has the variety and the talent to make significant contributions.

I'm dedicated to helping provide the computation environment and also want to stimulate the much needed research. I look forward to continued interaction at Stanford.

Sincerely,

Gordon Bell

GB5.51

cc: Bruce Delagi
Forest Baskett
Tom Gannon
Sam Fuller

9 June 1983

Professor Edward A. Feigenbaum
Computer Science Department
Stanford University
Stanford, CA 94305

Dear Ed:

I really want to thank you for encouraging me to visit Stanford and for providing the environment for getting well during May. The letter on the machine reiterates my feeling on the need for research using a parallel machine. In addition, I'm going to ask our AI group to move more rapidly in understanding and measuring performance at all levels from LISP to the application. In addition, we have to work hard to provide a better LISP user environment. I hope we can also work with Teknowledge on this.

Am really flattered about the various possibilities to be on the Stanford faculty. I'm still unclear about the future projects I want to undertake, but I hope to have Stanford part of my activities.

I want to interact with your forthcoming research program on Understanding Parallelism in An AI Application. I look forward to reviewing successive drafts as they occur. Perhaps the best way is for me to stay on SUMEX, and to use it regularly for communication.

Again thanks.

Sincerely,

Gordon Bell
Vice President, Engineering

GB5.50

Ed,

I'd like to accept your offer to pay some of my expenses at Stanford. I'd like to share the lodging and local transportation costs equally between DEC and Stanford.

Stanford expenses are:

Car		$207.67
Gas		13.00
Hotel (Bed & Breakfast)	835.55/2	418.27
		638.94

____
Gordon Bell
6/9/83

The State of the Design
It seems like we have:

. text spec of entire machine, since the box names are incorrect, its unclear whether this has any validity
. text spec of boxes, together with some block diagrams, description doesn't reflect the design
. flow charts specifying behavior of a few parts
. behaviorial description, in TUMS of the boxes, non-operational as a complete system. Even if it operated as a complete system, it is unclear what it means due since the timing interaction of interconnect signals like stalls and micro-interrupts are so complex.
. 500 SUDS logic drawings specifying the machine
. 500 SUDS logic drawings for MCAs
. MCA physical layout, simulation description, test patterns, test data as to whether the MCAs meet their specs

What would be the IDEAL state of the Design?
A document describing all the documents and what the design ground rules are going to be. This would
It seems clear that we must have an accurate, structured design at all stages of the design.
Ideally, this design description is in machine readable form so that it can be checked as much as possible by machine. Since the main design tool is SUDS, this implies SUDS compatilble software that must be written asap.

What would be the IDEAL design system?

0. Information only appears once and notification is made to users of information as it changes. Ideally a data base could do this, however, this has shown to be virtually unworkable using DBMS and the IDEA database. Alternatively, there must be batch update to flag changes.

1. Interactive, with access to any part, with protection of data as to the owner.

2. Report writing ability to get parts out as needed when there are large pieces that need to be looked at or put on the wall. No document should be more than 15 minutes away, with instant access to everything else, including access via SUDS terminals.

3. Overnite batch update of key part such as indexes, rule checking, etc. that is less frequently needed.

4. Calculator functions like the clock checker that operate on the data to give the designers quick access for making critical decisions.

5. Data base-like access of critical information that is structured in order of detail.

6. An index and on line access to all signals, giving:
    .name, together with polarity, location, time

generated, and the source drawing it is created on (derived from SUDS)

. a list of all the drawings it goes to and the time the pin expects to see the signal (derived from SUDS)

. a text description of the meaning of the signal (designer input, together with date created,

. a list of all the specifications that reference the signal

. a list of all the other documents that reference the signal

. a list of people who are interested in the name so that they can be informed of changes on some sort of periodic basis

A program would be run each period to update the index from SUDS or from a journal tape generated by SUDS. A program would be available to either automatically, or on demand report all the changes to names to the relevant persons.

7. Mail system so that designers can ask for information from one another and have an easy way of structuring the ambiguities.

GB3.S1.59
GB2.S6.31
June 30, 1980

Robert J. Robinson
State University of New York at Albany
CS-24
1400 Washington Avenue
Albany, NY 12222

Dear Mr. Robinson:

Sorry, I can't attend. I would hope someone from our Educational Product Line could go. Also, Dick Eckhouse might be interested as he's responsible for our Research liaison with universities. In this regard, I've forwarded your letter to Joe Meany, who manages the Educational group.

Thanks.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:swh
GB1.S5.16

CC: Joe Meany, Digital
November 25, 1984

Mr. Steve Jobs, Chairman
Apple Computer Corporation
10260 Bandley Drive
Cupertino, CA 95014

Dear Steve:

Thank you for the gift of the Macs and Lisas and the moral support that helped open the Museum on November 12.

The physical realization has turned out to be much more exciting than any plan could have communicated. The staff made a very large "stretch" to open a range of galleries. The reviews have been positive and it is easy to spend a half day in productive learning. Knowledgable teenagers are spending their days at the Museum. The most flattering comment to date has been that it is the first American technology museum to be at European standards. Dr. Oliver Strimpel, who did the Museum's Image Gallery has just become the Associative Director and Curator. Oliver was formerly the Curator of the Mathematics Section of The Science Museum, London. The long collecting period and five year breadboard at Digital really paid off in collecting artifacts, building exhibits, doing lectures (ranging from Amdahl to Zuse) and gaining widescale support from computer people and companies.

I want to see this phase aimed at:

.putting a formal educational program in place,

.continued collecting of artifacts (whether letters, films, manuals or machines) in order to record the significant, information processing events, and

. getting broad public support from computer-knowledgeable people who want to learn more about the past and future history of computing.

Again, thanks for the support.

Sincerely,

Gordon Bell
CC: Wayne Rosing

June 25, 1980

Dr. George Stibitz
Dartmouth Medical School
Dept. of Physiology
Hanover, NH 03755

Dear Dr. Stibitz:

Enclosed is a list of the Circuit Drawing you so kindly sent to us.

Hope you are enjoying the beginning of summer.

Sincerely,

Mary Jane Forbes
Secretary to Gordon Bell

MJF:swh
GB1.S5.8

Enclosure - Circuit Drawings

Command > P Q
Put printer at top of form and type <CR>
****
* d i g i t a l *
****

TO: ENG STAFF: DATE: MON 11 MAY 1981
13:46 EST

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: REVIEW AND RATIONALE OF PROPOSED STOCK GRANTS

Note our agreement:

As we reviewed your first pass, it appears to be business as usual.
We don't support many of these grants because we don't see unusual (or
in some cases even adequate) performance. Please bring with you or
submit no more than 25 words or less on the rationale for each
candidate.

Gordon & Larry

GB2.S5.52

Command >
July 18, 1983

Stock Option Committee

In view of my 23 years of service to Digital, I hereby request an extension of the time to exercise the free options in order to cure the rule 16B problem.

The last sale I made was June 29. This sales requires a 6-month extension from that date plus one week in order to cure the 16B issue.

Sincerely,

Gordon Bell

```
+---------------------------+                         GB0001/27
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| d | i | g | i | t | a | l |   i n t e r o f f i c e   m e m o r
a n d u m
|   |   |   |   |   |   |   |
+---------------------------+
```

Subject: **Fixing the Stock Option Plan Before the Next Grant**

To: Shel Davis, PK3-1/C21
Win Hindle, ML10-2/A53

Date: 2/20/79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

I have just spent over three hours, and I end up doing this every two months or so, fooling around with my personal finances as a result of having a very complex plan, the

Monheit Case, 16B, and personal cash flow management. I assume there are officers and other people within DEC that have the same situation. In my own case, it was time that I would have spent working on some product or engineering problem, writing a program, or a paper about computers, etc. Thus, I end up doubly frustrated.

This doesn't mean I am not grateful, it only means things have gotten too complex and the only people who seem to enjoy this are those who like to count and/or manage money. Also, even though the amount of stock I received last year was substantial, there surely must be something that's better traded off. For example, the parking space means much more to me and I would have traded the whole stock grant last year for it, because it gives me freedom!

This thing has been hanging too long and, given the presidential guidelines this year, then let's do something really creative and free our people from the time bind (and the associated parasitic money/manager, experts, lawyers, and trappings) that are now implicit in the plan. The responsibility is yours and I perceive that nothing is being done. Why not start?

GB:ljp

Command: rea

EMS 7-MAY-79
10:01:09 030 1
To: John F. Smith
CC: Dick Clayton, Andy Knowles
From: Gordon Bell
Date: MON 7-MAY-79 10:01:09 EDT
Subject: Stockebrand in Alburquerque factors

Stocky is in the Alburquerque factory doing advanced development on

terminals.

I sense he has trouble coupling into our development groups although Roy
feels we're all trying hard. I am firmly opposed to his doing any product
development.

His most successful work was in this process area doing the semi-automatic
wirewrap machine. Given the competition is building highly

automated factories for calculators, terminals, floppies, etc. Why couldn't
it make sense to have him re-oriented to process automation, Robotics, and
on-line control. He could still do some video work for engineering as this is
also needed in your work.

Command:

September 21, 1976

Professor Harold Stone
School of Engineering
University of Massachusetts
Amherst, MA 01002

Dear Harold:

I re-read the current material you sent in early September and have some comments. Overall, and by chapter it needs lots more tree-structuring by figures and/or tables. A sketch to structure the memory one is enclosed, for example.

Time lines may be necessary to show what's been used and may be used.

It doesn't make the case that computers have evolved more and faster than anything in the history of civilization. See the enclosed paper and figure from a study by Fusfeld. I've also enclosed some papers you might take data from, and I believe it would be worth getting Montgomery Phister, 927B 7th Street, Santa Monica, Ca. 90403, to send some of his data too.

The introductory material doesn't turn me on; could it be put in an appendix for a reader who needs it...but may not get it from the meager explanation? IT seems unnecessary to include since there are good texts to do it. (Let's reprint a chapter.)

The notion of machine interpretation (ala Turing) is potent and covers microprogramming, machine languages, operating systems, languages, and applications functions in a clear way. The architectural book by Tannenbaum explains this nicely.

There's also a phenomenon that's useful in understanding how machines have evolved which we use extensively here. It's explained in the enclosed paper...and some others by me. Computers evolve:

1. Constant cost, increasing performance giving largest gain to existing users. Hence is a natural phenomenon when users-sales/marketing-and developers feed one another!

2. Decreasing cost, constant performance finds new uses.

3. New structures, (new users...eventually).

Also in (2), the minicomputer, the # of users increases rapidly due to market demand (completely elastic).

A table is needed which delineates machines you talk about - might clearly summarize to help reader know more about machines.

1. calculator, micro, mini, main, super; or

2. hand held, desk-table-bench-top, desk based, rack meeting, room; or

3. log (base 2) of price for computer gives $10 to $10M as the metric.

Some of the dimensions of the table:

1. word length
2. memory size
3. speed
4. logic techniques
5. gestation period
6. population size (1976)

A careful delineation of the logic, RT, and PMS levels might help structure each of the chapters (especially measurement, reliability, and CAD). All the structuring of the field is pretty well discarded the way it's organized.

There's little or no emphasis on problems and opportunities...especially as they relate to the research. The report could harm hardware research vis a vis it's impact by NSF readers.

Overall, it looks like a good starting draft.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:ljp

Attachments

STORAGE

MAIN - CONTINUE

. DRIVE TOWARDS SEMI CONDUCTOR USING HIGHEST DENSITY CHIPS IN HIGH VOLUME MANUFACTURE (VENDOR)

. ECC ENHANCEMENTS FOR BETTER RELIABILITY

. EVALUATION OF CCD

- STOP

. 11/74 MULTIPORT MEMORY

. BUBBLE EVALUATION (130 K)

DISK - CONTINUE CURRENT INVESTMENT STRATEGY BUT WATCH RP07 FOR DECISION WITHIN THE NEXT TWO MONTHS. THREE POSSIBLE ALTERNATIVES:

1. BUYING THE HEAD/DISK ASSEMBLY WOULD SIGNIFICANTLY INCREASE CURRENT ENGINEERING INVESTMENT PROJECTION.

2. DOING CIRCUIT CARDS AT DEC MEANS ABOUT THE SAME INVESTMENT PLAN.

3. CANCELLING MEANS SIGNIFICANTLY LESS THAN PLANNED INVESTMENT ASSUMING NO MAJOR CHARGES ARE INCURRED FROM CANCELLATION.

FROM: GORDON BELL DATE: TUE 15 JAN 1980 3:08 PM EST
DEPT: OOD
EXT: 223-2236
TO: GERALD T MOORE
LARRY PORTNER
BILL JOHNSON
OLLIE STONE
OPERATIONS COMMITTEE:
OPERATIONS COMMITTEE: @CLEM

OPERATIONS COMMITTEE: @MR16

SUBJECT: WHY I'M STRONGLY OPPOSED TO THE STORE PRODUCTS DIRECTION

While I support the notion of experimenting with ways to distribute computing, including stores, and the need for us to have software for the mass market (eg. doctors, dentists, printers, garbage collection companies, motor cycle shops, and other small businesses and small business-based professionals), I do not support the tactics of your product direction!

As I understand it, your stated product direction is to find OEM developed, successful, (well used) software applications packages in more vertical markets (e.g. dentists) that operated on our DIBOL based systems (primarly the 8) and to purchase these, test them, document them and enhance them for the widest possible audience. The DIBS and WPS packages are prime examples of this in action. Although both DIBS and WPS have been significant efforts in the testing and documenting, they are trivial in comparison to the so called vertical applications packages that you are looking at for the small business and small business-based profession.

I believe this approach may possibly work, although there are many pitfalls, because the OEM who built the package in the first place just may have supplied the critical training, and programming skills to make the fit between the package and what the user was capable of. Furthermore, since the packages are developed asynchronously and independently, there are no standards that are probably needed so that DIBS and WPS (who don't work together) work with any of the other packages and I believe there have to be lots of common formats, data bases and conventions in order that a customer can cope with the complexity of the applications you are going to attempt to build and sell. Alternatively, having very low cost hardware ala APPLE and a bunch of software writers who are trying to peddle applications in a large, free market a low cost, might be an alternative. Until you buy from APPLE (which I suspect will be next year's idea) the hardware is too expensive to ignore the software problem or too expensive to attract and form the software publishing business ala Apple, Radio Shack.

I do not believe what you are actually doing (versus the plan) will work because:

1. You are developing applications in conjunction with specific users in order to get the business (remember, the first contractor in MK?). As you apply heat to the storekeepers for profit (and sales), they will make some pretty bazaar deals that will only exercise our lawyers.

2. Packages like the dentist's office are being done by a single dentist and are in direct conflict with the above policy. Namely, it may possibly work for that dentist, but it will not have been tested in the marketplace the way the DIBS package and WPS packages were prior to the time you bought them.

3. You are going after too many too soon. We will only win on quality and customer satisfaction, not products that are superficial and do a poor job where the customer wonders why he bought. (In essence, the problem with a marketplace of 4-8 million is that it lulls you into a false sense that you have to be good because there just have to be

a large
number of suckers out there.) Any one of the vertical
packages is easily big enough to support the whole store
program and I think we want to be the quality supplier.

As you begin to go under for the next time, it will be to grasp for
more products (like the multi vertical applications...which are really
products) by getting into the 11 line. This pull will be from your
market as they run out of capacity in the 8's and as they hit all the
limits on disk, especially the need for hard disk and for
communications if they have several sites (office and warehouse). As
in the WPS case, using a large 8 is really not possible because we
don't have the support everywhere in the company to make the
8 a viable large systems product. Here, it is diagnostics,
design of the basic software and hardware, field service and
sales training and the field inventory of parts. Also, I
believe you should move to the 11's via PDT's ASAP.

The bottom line is that I resent you taking terminals into the stores,
making money on them and reinvesting in what I consider to be an
ill-founded product and market direction. It seems highly likely that
you are going to fail in your products, and selling the standard
products will mask and prolong this.

GB:swh
GB1.S1.12

FROM: GORDON BELL   DATE: WED 16 JAN 1980
11:01 AM EST
DEPT: OOD
EXT: 223-2236
TO: GERALD T MOORE
    LARRY PORTNER
    BILL JOHNSON
    OLLIE STONE
    OPERATIONS COMMITTEE:
    OPERATIONS COMMITTEE: @CLEM
    OPERATIONS COMMITTEE: @MR16

SUBJECT: WHY I'M STRONLY OPPOSED TO THE STORE PRODUCT DIRECTIONS

THIS IS A DUPLICATE OF A MEMO SENT OUT YESTERDAY - RULER CORRECTION.

FROM: GORDON BELL   DATE: TUE 15 JAN 1980
3:08 PM EST
DEPT: OOD
EXT: 223-2236
TO: GERALD T MOORE
    LARRY PORTNER
    BILL JOHNSON
    OLLIE STONE
    OPERATIONS COMMITTEE:
    OPERATIONS COMMITTEE: @CLEM
    OPERATIONS COMMITTEE: @MR16

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bunch of software writers who are trying to peddle applications in a
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As you begin to go under for the next time, it will be to grasp for more products (like the multi vertical applications...which are really products) by getting into the 11 line. This pull will be from your market as they run out of capacity in the 8's and as they hit all the limits on disk, especially the need for hard disk and for communications if they have several sites (office and warehouse). As in the WPS case, using a large 8 is really not possible because we don't have the support everywhere in the company to make the 8 a viable large systems product. Here, it is diagnostics, design of the basic

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The bottom line is that I resent you taking terminals into the stores,
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ill-founded product and market direction. It seems highly likely that
you are going to fail in your products, and selling the standard
products will mask and prolong this.

GB:swh
GB1.S1.12

Command >

FROM: GORDON BELL   DATE: WED 13 FEB 1980 12:43 PM EST
DEPT: OOD
EXT: 223-2236
TO: OOD:
    OOD: @CLEM

SUBJECT: STRATEGIC SPACE PLANNING INTERACTION MATRIX - F/U 2/14/80

To help formulate our space strategy, we're trying to somehow
quantify our organizational interrelationships by trying to
create an interaction matrix among OOD and other groups
within the company. In order to accomplish this, we ask that
you do the following: without regard to existing, formal
organizational structure, define your group in the smallest

identifiable, logical operating units that can be separated at different sites.

The following is suggested as a rough first cut:

Cudmore -

Lyle -

Clayton - Terminals, Micros (chips), Small Systems

Saviers - Memories, Small Disks, Large Disks, Small Tape, Large Tape, Adv. Dev.

Johnson - Languages, Applications, 10/20 Systems, Commercial, Base Systems, Small Systems, Technical

Fagerquist - Large 32 Bit, Large 36 Bit, R&D

Demmer - Mid-range, Dist'd Systems, Interconnect

Holman - Power, Packaging, Quality Assurance, CAD, Diag. Eng. Service, Eng. Info., Computer OPS.

Fuller - SA&T System Performance Analysis (Potter), Standards

Meyer - Personnel

Kur - Finance

Bell/Portner - Engineering Administration

Thompson - Quality Assurance, Technology, Test Process

Other - each P/L, Field Service HQ, Manufacturing site, Finance, Admin., Central PPG, OOP, Training, SWS, etc. (please list any we've left out.)

What we would like each of you to do is to refine, alter or affirm this cut for your group. For example, Dick Clayton might volunteer that terminals could be split into video and printing terminals. BJ will probably rethink the above segmentation.

When we receive your inputs, including other groups external to OOD, a consolidated "line-up" of the relevant groups will be created.

We are proposing a scale which is the "interaction coeffecient" (e.g. 10 = most important, (must be adjacent, always work with) (only incidental contact and for no contact).

The proposed scale is:

Scale	Distance	Location
10-	10'	same room
9	100'	same floor
8	300'	same building
>7	1000' approx. 1 mi	same site
>6	5-20 mi	short car
5	20-50 mi	long car, helicopter
4	50-200 mi	plane
>3	200-300 mi	long plane
>2	>3000 mi	International plane
1	-	formal mail, EMS or phone
0	-	no contact

This list will then be returned to each of you, asking to relate each sub-group to all of the others as defined above. Some conflict may arise. ("A" might feel it imperative to locate with "B", while "B" feels quite differently) and these issues will have to be worked out. What we are working towards is a complete, agreed upon interaction matrix with coefficient from which we can draw strategic conclusions.

If the concept, logic or mechanics of this exercise causes problems please let me know. Ohterwise, please return the organizational groups to me by Thurs. February 14th. We'll send a chart, with the list around on Friday and would like your interaction coefficients by next Wednesday so that we can analyze the data.

GB:swh
GB1.S1.66

```
+-----------------------------+                                ID#394
|   |   |   |   |   |   |   |
| d | i | g | i | t | a | l |   i n t e r o f f i c e   m e m o r
a n d u m
|   |   |   |   |   |   |   |
+-----------------------------+
```

Subject: **The Product Strategy and DEC EDP and Manufacturing as the Breadboard**

To: Al Crawford, PK3-2/F34
Ed Fauvre, MK1-2/E06
Bob Grimes, ML1-5/B90
Bernie Lacroute, TW/A08
Larry Portner, ML12-3/A62
Bob Puffer, ML12-2/E38
Jack Smith, ML1-4/A54
Charlie Spector, ML5-2/M17

CC: Julius Marcus, MK1-2/C37

Date: 19 DEC 78
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

follow up 1/2/79

Jack, Charlie, Al and I have discussed the general product strategy and how our internal development can build on and support it.

It seems we should also rethink our approach to all computing that is much more distributed processing versus (the strategy) Central EDP-oriented. This will help us develop a unique (and I believe better) approach. By doing/understanding computing this way, I believe it is not only better, but gives us an edge on IBM.

In this regard we're considering a manufacturing package for the 10/20 from Martin-Marietta that might better be done on VAX. I've asked Bernie to get with Al, Bob and

Charlie in order to make this exploration.

Can we get together and discuss this approach to future internal designs after you meet?

We have one of the world's greatest (most receptive) environments to breadboard fully distributed data processing. Let's take advantage of it.

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST: Al Crawford PK3-2/F34 Ed Fauvre MK1-2/E06
Bob Grimes ML1-5/B90 Bernie Lacroute TW/A08
Julius Marcus MK1-2/C37 Larry Portner ML12-3/A62
Bob Puffer ML12-2/E38 Jack Smith ML1-4/A54
Charlie Spector ML5-2/M17

GB0001/17

BASIC PRODUCT STRATEGY UPDATED SUMMER 1979

Provide a set of homogeneous distributed computing system products so a user can interface, store information and compute, without re-programming or extra work in many styles and the following computer system sizes:

- .as a single user computer within a terminal;
- .at a small, local shared computer system; or
- . via a large central computer or network.

Achieve a single VAX, distributed computing architecture by 1985 (as measured by revenue)through:

- . focusing on homogeneous distributed computing with varying computing styles including high availability and ease (economy) of use as the DEC advantage;
- . building new 11 hardware to fill the product space below VAX;
- .having a new better, physical bus structure and transition plan to replace Q and U busses.

- building new 11 software products that also run on VAX; and
- developing software for 11-VAX migration and 11 base protection.

Provide essential standard IBM and help set international network interfaces.

Define, and make clear statements internally and to our users about programming for DEC compatibility. Tighten DEC user interface standards for editors, forms management, application terminals, command languages, DEC dialects of languages like BASIC, applications languages.

Provide general applications-level products that run on 8, 10/20 and 11/VAX-11 above the language-level to minimize user costs, including:

- word processing, electronic mail, and profession-based CRT-oriented calculators;
- transaction processing and data base query;
- general libraries, such as PERT, simulation, etc. aimed at many professions that cross many institutions (industry, government, education, home); and
- general management libraries for various sized business.

Provide specific profession (e.g. electrical engineering, actuarial statistician) and industry (e.g. drug distributor, heavy manufacturer) products as needed via the product line groups.

Provide cost-effective 8, 10/20 systems through:

- building hardware that runs current operating systems; and
- making market support and DEC-standard language enhancements.

This strategy is intended to cover the full range of DEC's future products. Since technology shifts rapidly and market opportunities emerge that we don't now understand, it may be necessary to provide non-compatible, point products. These should be proposed and reviewed accordingly.

Essence and Rationale of the Strategy

The essence of the strategy is simplicity through adopting a single architecture. This simplicity is needed so that we can build the network and distributed processing structures which our customers are now demanding. The strategy is an evolutionary result of the 1975 choice to extend the 11 architecture and cover its customer base.

Given that the architecture and early customer acceptance are in place, the strategy moves to build our subsequent products on VAX, while continuing to sell 8's, 10/20's and 11's. Focus is imperative in order to avoid the redundant development efforts across base hardware and software, and to move development to fully distributed computing and to applications. The strategy also minimizes manufacturing and field start-up costs and takes advantage of the learning effect by moving to a single architecture.

The motivations for the homogeneous architecture are numerous and include the customer desires for a range of products on which to build products (in the case of OEMs) and applications (in the case of end users). Such a range in size and over time, allows planning and investment of software and it permits computers to be associated with various organizational units (eg. central group, small group, office, the person, or the home) on an "as needed" basis. Although, superficially it appears to be possible to have numerous architectures that are segmented by size and by market, the user requirements to cross both size and applications boundaries are significant. In fact, given that IBM is segmenting its products both by size and application, the main strength of the strategy is to have a single architecture with which a user can be comfortable rather than bounded by a manufacturer segmentation.

The most compelling reason for basing the strategy on the single VAX architecture, besides the technical excellence of the product is the belief that we can not build the truly distributed computing system of the 80's with heterogenous architectures. It is possible to build distributed computing networks as we do today, but the homogeneous architecture approach insures that programs may be assigned to any node, where they will give the same results. There is no need for the organizational and computation overhead signified by different manuals, separate training, recompilation of programs, and translation of data among machines in the network.

This strategy is aimed at beating the competition using our existing highly tuned minicomputer hardware and software to support and grow our existing user base. It provides us with a unique offering in the marketplace of the '80's which is likely to be based on the defacto standard IBM 360/370 architecture and the ensuing defacto architectures coming from the semiconductor companies. Since VAX is fundamentally better than either of these architectures, we must make it the standard architecture via transition from the PDP-11, which has been the standard architecture of the 70's.

The strategy is aimed at high volume through multiple channels of distribution, versus a more stable, low growth through support of an existing multi-system, customer base.

How Can We Win Against IBM?

IBM has or will have: both constant and a decreasing cost a 360/370 line new in the $100 K to $10 M price range with lots of plug compatible competitors, several operating systems to support, a large backlog; a newly announced 8100 for Distributed Processing around the mainframe; RPG-based System 32/34/38 for Distributed Processing and as a Mainframe for small organizations; the aging Systems 3 to 15 for Distributed Processing; the System 1 for the would-be minicomputer buyer; the possibly defunct 5100-series Personal Computers for the scientist, engineer, analyst and small business; and several inevitable products for computing in the terminal. All of these are incompatible, except for the fact that they speak some dialect of SNA. Products are relatively segmented to customer classes and different languages are used to enforce segmentation and hinder application mobility. Finally, they've sold via DPD and GSD, with Office Products no doubt looking on and waiting for typewriter-type entry for electronic mail and word processing.

The 8100 is a radical departure from IBM pricing as 0.5 Megabytes of primary memory and a 60 Megabyte disk are $ 29 K. Memories on all machines are similarly priced. We repriced as a result. The 8100 is exactly in the price range of the systems we sell and where we make most of our revenue. It is the second product in this price range within a year; the Series 1 minicomputer family patterned after the 11/04-11/34 was the first product. The 370 (via the 43xx series) is clearly either in or is coming into our space this go-around or next generation (1984). On the surface, the product is low priced, with lots of capability, but it also has a new communications structure (versus the one we have used substantially unchanged since 1961). This structure permits easy peripheral and terminal interfacing for both the office and factory environment. There is an extensive range of peripherals, terminals and communications to the 360/370. Since the product is sold by DPD, the strategy seems to keep account control and to make the money on software and the numerous locked-in, generally overpriced hard to emulate terminals.

SNA seems finally under control and we must be concerned because it has future built-in capability (e.g. word processing, typesetting, packetized voice). Their strategy seems to be to slowly unfold it, make it the standard, pay no attention to other standards and to make everyone follow their gyrations. A strategy based on being tightly coupled to them (e.g. with terminal emulation or fully compatible across the board) is really risky. We must interface to them "carefully" and be very, very aggressive in our own interconnect plans (both in performance and capabilities). We must collaborate with ATT and the international standards community to set standards.

We must watch how the System 38 is used vis a vis its 48-bit address because it can lock us out and cause others to generate many dead end architectures. It may be a E/H series follow-on breadboard. We can't succumb to this.

Terminals have to play a major part because we can get the cost and volume to lower our system costs. We have to follow the strategy and push co-existence with our earlier systems, but homogeneous networks must be understood and pushed. VAX has to be kept tight with emphasis on performance to avoid the O/S proliferation of IBM (and 11's). Also, the tightness represents the performance/cost edge we have over the 370.

<u>How Can We Win Against Other Competition</u>?

There are established competitors too, such as DG, HP and Prime. DG and Prime have very simple, single architectures and have been most profitable and have grown most rapidly. HP is converging on a single architecture around the 3000, but it will have to be extended eventually. The NOVA will also be extended. The large manufacturers (Univac, Honeywell and Burroughs) which operate with an established base are less profitable, have grown slowly and have multiple, poor architectures. Honeywell, with a simple, but adequate minicomputer architecture seems to be doing well by selling minis to its old line, mainframe base. There is no evidence that they're developing or pursuing the mainframe business actively.

There are probably more significant threats from the companies that can be easily founded to build systems into OEM Winchester disks by using the newly announced zero-processor-cost, 16-bit microprocessors which have 22-bit address spaces and 11/34-11/45 performance. These architectures need to be extended for multiprogramming and to handle larger virtual memories, but many point products, such as RSTS, can be built easily and cheaply and can quite possibly target a specific existing, trained user base.

There are also the Japanese and TI which can be lumped together because of their similar behavior. Both believe in targeted, high-volume products with forward pricing. Neither have an adequate architecture. TI is strictly limited to 16-bits with almost no escape the Japanese are aimed at the 360/370 using U.S. companies (e.g. Service Bureaus) to distribute hardware, <u>and</u> at high volume point products that will go into stores, no doubt.

The strategy supports very high volumes for dumb, pre-programmed (smart) and programmable (intelligent) terminals using the 11 until VAX is appropriate in terms of price and functionality. In the mid and high priced minis, the strategy is compatibility and volume, phasing as appropriate from 11 to VAX. For example, since there is not a high priced 11 after the 11/74 and the 11/44, there is a phasing to VAX (through COMET) and lower priced 11's based on 11 microprocessor implementation. The question here will be how fast we can provide high performance microprocessors using HMOS and narrower line VLSI technologies.

PRODUCTS IN 1981-82

HARDWARE COOMPONENTS

HMOS LSI, with first "test" product

Interconnection hierarchy with software compatibility
1-10 Mhz and/or 10-100 Mhz inter-computer bus ICCS;
50+ Khz comm.-compatible multidrop for terminals, peripherals, and small systems;
0.3-19.2 Khz comm.-compatible for low cost terminals.

Significant competitive memories
Solid state modules for software
Low end floppies and low cost tape
Removeable and low cost disk RL04
Hi-volume mid- and hi-end disks in R80/R81 with backup

Terminals for everyone!
Low cost (dumb) and block mode (VT162)
Office environment for quality printing, electronic mail, and move to full-page text as quick as possible
Professional using graphics (and/or color) with target application software
Factory environment terminals and interface systems

HARDWARE SUBSYSTEMS

Remoteable printers, job entry, concentrators, sensor-control
Communications concentrator - Mercury
Memory (Hierarchy) Management - HSC50 for high end
for R80/R81, RL04, tape and disk cache

KERNEL SYSTEMS based on processor-disk-communications (see family tree figure)

780 replaced by Venus (const. price >3x performance)

780 - Memory Manager - Comm. Concentrator
780 - Multiprocessor
780 - RP/R80-81 + RL02-04
780 - RK/RL04

Comet - RP/R80-81 + RL
Hydra (Including Memory Manager - Comm. Concentrator)

Nebula - R80-81 + RL
Nebula - RL02/RL04 (higher cost, quick to market personal computer)

LSI VAX - RL04 - Graphics Terminal (personal computer)

11/70 with no hi end replacement
11/70 - multiprocessor
11/70 - RP/R80

11/44 replaced by HMOS LSI-11 with >256 Kbytes (J-11) and 11/70 performance

11/44 -
RP/R80-81 + RL

11/44 -
RL

11/24 -
Unibus Fonz RL based on new backplane replaced by HMOS >256 Kbyte

11/23 -
Q-Fonz RL

11/23 -
Q-Fonz - RX (floppy)

PDT Fonz - RX (floppy)

PDT Fonz - TU58

Tiny chips,

SOFTWARE

Diminish the 11 software investment for mature products (RSTS, IAS, MUMPS) and provide only minor enhancements to recent 11 based products (TRAX, PDT Software) to extend the market life and limit the VAX transition risk. Orient new development on VAX and 20 toward IBM compatibility and explicitly invest in tools designed to permit easy customer movement between VAX and 20. DEC 20 development will be aimed at timesharing, high level tools and applications support. Shift the bulk of the PDP-11 software investment to VAX, tracking VAX hardware and aggressively moving to round out commercial capability.

Develop a single VMS operating system to span the product range if technically and operationally feasible; "low end" products will mask the VMS capability for the unsophisticated users or, if efficiency demands, new code compatible at all interfaces with compilers and utilities will be developed. VMS will offer full mainframe capabilities allowing concurrent batch transaction, processing, and time-sharing, along with limited real-time.

. Provide superior data-base capabilities in the two -

three year time frame.

. Focus on data access and data manipulation tools for the non-programmer, heavily based on graphics terminals.

. Provide word processing and electronic mail as applications on the general purpose VAX systems.

. Data integrity will be a feature available independent of high-availability (non-stop) operation through Hydra.

. High-availability (Hydra) will be a standard attribute of VAX systems at the customer option.

- Fire-wall funds to stimulate acquisition of cross-industry applications packages. Provide industry specific applications via internal development or acquisition. Leverage field resources by investing heavily in product quality assurance and self installing systems capacity including remote software update and diagnostic strategies.

- Move systems-level code for 11 based software (RSTS, TRAX) to VAX compatibility mode if technically or strategically viable (under investigation now) otherwise provide user-level compatibility via native mode VMS layered products.

- Shift DECNET strategy to international standards and stronger IBM interconnect and VAX binary image compatibility for distributed processing; constrain PDP-11 DECNET FUNCTIONALITY EXTENSIONS; speed up DEC 20 DECNET capabilities.

- Converge on ease of DEC 20 to VAX movement through common language definitions, (common implementations where feasible), common user-level utilities and data conversion routines. For each new DEC 20 or VAX customer, as time progresses, make the movement between systems more attractive.

Why Change the Current Strategy?

We have arrived at the current strategy by integrating our past customer needs, with the result that nearly every past system we have ever built is being evolved. This evolution creates too many systems with converging functionality. By prolonging the phaseover to VAX, we're unable to invest enough in VAX due to continuing and evolutionary support costs. Also, we're unable to provide applications, or have any slack resources to respond to competitive threats (eg. large micros or focused products such as the 8100).

We are just beginning to get a feel for the expense of putting new software systems in the field, and there are other systems still to come. Since we provide many choices, we find our sales and customers have difficulty deciding what to sell and buy. This makes us difficult to understand and to do business with. Lots of low volume products mean we don't have adequate volume to amortize the start-up manufacturing, sparing and training expenses.

Why Not Aggressively Evolve All Four Base Hardware Architectures?

In reality, our past strategy has been almost a divisional product structure. Customers can choose among the 4 basic hardware computer systems with 2+3+7+1 models and then select the appropriate software system, among 2+2+7+1 software systems for 8, 10/20, 11 and VAX respectively. This gives us several hundred systems. The number of alternatives is too large, resulting in small and decreasing volumes of each of the systems as all architectures are extended to cover a full range that we believe our customers require. We can not afford all the necessary enhancements to support four architectures over the range of size and use that our customers demand.

While any of the architectures can be implemented at any size down to and including LSI chips, there is no significant differential cost of the processor between the 10/20, VAX and an 11 with commercial and scientific instruction-sets. An evolved 8 to handle the strategic range would even be the same cost. The main differentials are: the cost of the memory to hold the tasks and the size of the operating system software. The 10/20 operating systems have been oriented to generality, and while VMS and TOPS 20 have roughly the same functionality, the 10/20 requires 512K bytes of resident memory, whereas VMS require 256K bytes. This occurs because TOPS 20 has evolved and because of the efficiency of VAX architecture. VMS also has real time capability. Similarly, it is now inappropriate to consider 10/20 based architecture for terminals and personal computers, when compared with VAX, because small problems cannot be encoded to be competitive with modern 8- and 16-bit microprocessors. Furtheremore, extensions to the 10/20 architecture would require basic work in the operating system and languages to build a VAX competitive product.

Why Not Segment Products By Market?

Since the 10/20 has significant commercial software and since it is believed that our customers are insensitive to architecture, we might simply have a market segmented approach and use 11's at the low end and 10/20's in the high end. Lower priced 10/20's would be implemented over time as appropriate.

Our technical users (EDU, ESG and even LDP) do not segment computer purchases into commercial vs scientific. A "control" customer such as DuPont doesn't segment its applications either. Even NASA wants COBOL to off-load their mainframe and to do administrative EDP. Universities likewise want a single machine, and hence the software will be "pulled" into existence. Version 4 of VAX COBOL executes faster than the 20's already.

Since there is basic incompatibility between the 11 and 10 architectures, the migration problem is enormous. Now our large commercial customer base is with 11's. Our users perceive VAX and 11 are of the same family.

The 10/20 still requires basic changes (CIS, 30-bit addressing) to bring it up to VAX performance and capability together with compilers and some basic software (eg. multi-keyed ISAM). TRAX-36 and RSTS 36 will also have to build off our 11 base. In short, while it might be feasible to build 10/20 software so that our 11 users could meet our strategic goals for distributed processing, we would still fall short of the distributed system one can build with a single architecture as described in a subsequent rationale.

How Do Customers Preceive The Situation?

In mid October, a group at Bell Laboratories, building PBX systems visited us and made the comments:

> "Only you have the basic architecture in VAX to cover the range of products we need for distributed processing. This includes: terminals, offices and large offices.
>
> Give us a truly compatible range of VAX machines,

starting
with a VAX-on-a-chip and extending through the IBM 3033.
(Don't corrupt VAX, since as in the 11, we must preserve our
software base, given that the processor is only 4%
of the cost.)

The machines must have a reliability and security orientation.

Why don't you do it?

We will help fund the development."

Recent discussions with Stanford, ITT, CERN, NASA (Ames) indicate concurrence even though they are large 10/20 and 360/370 users. MIT is proposing to build a homogeneous VAX-based network. DuPont wants a similar structure, but is less rigid on the need for a homogenous architecture even though they've standardized on the RSTS machine internally for many of their systems. (There's a videotape describing their needs and ideas.) CERN, and NASA (Ames), for example, feel that the large mainframe may be on the way out as we offer small group-level computing with VAX. There are probably 10/20 customers who feel strongly that we should base our future on 10/20's. The main reason to focus on the single architecture is that it is part of the 11 family.

Why Have A Single Architecture?

There are technical, marketing and economic reasons for choosing a single architecture at this time on which to base a major part of our future. However, this does not mean that we must neglect our 12- and 36-bit user base.

While computer networks can and have been built with heterogenous computers and IBM is betting that it can build distributed computing systems with only similar machines, a single architecture is the most effective for distributed computing systems. The homogeneous (identical) architecture approach insures that software will give the same results no matter where executed and therefore programs may be run anywhere in the network, data stored anywhere and programs moved about in their object form without the overhead of recompiling or translation as data is transferred. This also insures that the human interface to the system remains constant, because identical software is executed in different machines instead of relying on software that is specificed to have identical interfaces (e.g. languages, command languages, file systems, utilities).

From a user viewpoint, the homogeneity is ideal, and the success can be verified by reviewing the history of IBM's decision to build the 360 (and not continue with the 1401, 1410, 7070 and 7090 series machines), even though there was an incredible base of these machines. This was also the time that Honeywell established itself with the 200-series and RCA with the 301. The homogeneity provides a simpicity for the entire DEC organization and its customers, and lets us all focus on end use applications rather than choosing a particular operating system and language. Currently, we have too many low level, incomplete choices and the software efforts of us and our users are not focused. An applications base can only be built effectively on a good, stable architecture.

Economically, a homogeneous architecture is essential because it allows us to concentrate and become a focused, high volume manufacturer and take advantage of learning curves. While 10% learning curves mean a doubling of manufactured quantity causes a 10% decrease in cost, they also imply that having two very similar products at one-half volume causes 10% higher costs in each. There are similar effects of learning in hardware, software and sales training costs, although the learning costs are small in comparison with the logistics and start-up costs associated with our many, different though functionally equivalent, products. We become difficult to do business with in the process.

Why Base The Architecture on VAX?

Although we went through the arguments in the spring of 1975 when we decided to build VAX instead of building lower cost versions of the 36-bit architecture, we now have a real machine that met its development goals and has user acceptance on which to base future products in a natural, evolutionary fashion.

Mostly, the choice of VAX in 1975 was based on having a large, PDP-11 user base. Furthermore, the choice to stay with the 8-bit byte was of convenience because of the IBM and communications worlds.

The VAX architecture was designed to permit the building of a range of machines with sizes that are important to us. Our targeted range of implementation was 1000:1 and this is attainable with an LSI implementation for terminal applications in January 1982. This is why a small page size and simple paging system was chosen, versus a larger page size and more complex scheme that would have been particularly oriented at large systems. However, it would not be wise to build the machine 1000 times as large in 1982, because it would take the system size beyond the suggested $250 K selling price limit and into mainframe price and customer expectations territory. Thus, in January 1982 the LSI VAX could sell for several hundred dollars at a board level. An ECL technology machine might be configured to sell for $ 500 K, giving the 1000:1 in price and a range of 64 Kbytes of RAM and ROM for VMS in the terminal to as much as 32 Mbytes in the large configuration (4000 64 K chips, costing $60K and occupying 20 PC Boards).

VAX was also designed to address the high cost of programming. Already VAX has been acclaimed (by a customer in our ads) as the best machine for implementing software. The large address space eliminates the need for much of the effort we spend encoding large programs into overlays. The architecture has instructions for the important data-types, the addressing is independent of the data-types and the important language constants are built into the hardware. There is clear separation among program and data. The procedure call instruction allows more sub-program sharing than with architectures that are dependent on conventions (e.g. 360 and 10/20) and it eliminates a class of systems programming errors resulting from the multiple assignment of general registers among different programs.

The 32-bit address space of VAX appears adequate for the computing needs in the foreseeable future and there is extension capability given that any special needs arise. The address space and protection modes also give us a capability to run sub-programs written in different languages as a single program. This capability is unique and may turn out to be the single most important attribute of the machine. Since only one other computer has the capability, we don't understand it or how valuable it will be.

Another technical reason is based on the encoding efficiency of the VAX instruction-set. The VAX architecture can encode a Fortran program in about 1/2 to 2/3 the space of a comparable large computer such as a 360 or our 36-bit computer, while providing 32-bit addresses versus 24 or 20 bits of addressing for the 360 or 10/20. Benchmarks in BLISS and FORTRAN show this now, and the Common Family Architecture studies also indicate similar results. While memory cost is decreasing, memory is still a significant fraction of system cost. Three years of cost decline at the historical rate of 20%, is required to get factor of 2 the cost difference back. That is, from a memory cost viewpoint, we have a 3-year cost edge on the market. More importantly, there is a similar effect on performance. By having only 1/2 the bits to move between primary and secondary memories, the performance is higher due to disk-MOS memory swapping bottlenecks.

Finally, we have an 11 user base on which to build that is approximately 7 and 50 times as large as our 36-bit base in terms of installed equipment dollars and installed units.

Why Not Use The 10/20 As The Base?

The software and user base on the 10/20 is the major reason to not arbitrarily reject the architecture. On the other hand, since the 11 user base is larger and has grown more rapidly, its software base is larger and we have to protect and build on it as a higher priority.

Right now, the 10/20 requires incremental investment to make it competitive with VAX and the rest of the mainframe market. Extension to provide a large address space, to extend the floating point range to fulfil customer commitments, and to give a competitive commercial instruction set for COBOL are needed. Making these hardware investments requires comparable software investments and we must again wait to compete because there is a new machine and software to support.

Subsequent implementations for small systems will be expensive both in terms of new software and start-up because TOPS 20 has been oriented toward large mainframe generality. Smaller systems will require contractions. Also it stands to only cloud the market more as alternatives for mid-range systems will include 2 VAX and 1 or 2 11-based systems. As small systems are implemented there is a need for compatibility with the even larger 11 base.

Why Distributed Computing?

Distributed computing keys off our strength in interactive computing through timesharing, small systems, real time computation, terminals, and networks. Furthermore, we believe this is what our customers want. The issue is not distributed computing, but solving the problems that it creates.

GB0001/17

EMS 23-JAN-79
08:25:05 320 1
To: Roger Cady
CC: Ulf Fagerquist, Bill Demmer, Bernie Lacroute, Larry Portner
From: Gordon Bell
Date: TUE 23-JAN-79 08:25:05 EDT
Subject: Basic Strategy and Transition machine

The strategy wording got changed by win. I prefered the tighter wording, but
the intent was to not change the meaning. The changes put much higher degree
of standardization on all systems and then addressed applications only
(>>>>I mean ONLY) if they were done in a transportable fashhion and
preferrably an application should be done simultaneously on all systems at
once.

I would like to get you, Larry and Per/Ulf together on this

issue so we can
get the wording you want. To me, your need s can help in the tightening.
I would like to get more stringent, because it helps the phaseover ...and
may even make it possible.

In regard to the phaseover machine, I agree with your urge/need to get it
defined immediately. Ulf, will you Per, Dick Snyder, Lary, and Bernie and/or
Bill, and Bill Heffner, and Dave Rodgers rendevous with Roger in the next
day or two to brainstorm and define Dolphin in these terms...or say that it
can't be done. Rather than issuing the strategy again (as corrected), I
would entertain a tightening as you suggest, but only if you , Ulf, and Marc
agree. In this way we can avoid sending the 1/10 version out and just make
an ECO if we can agree.

Command:

STRATEGY ISSUES

. <u>Interconnect and Communications</u>

CI

NI

NI Local for small systems, (when will it happen)

BI for commonality to solve multiple, good bus problem. Is anyone using it?

Hg for concentrators and new interface.

Comm. hardware, and integration with CSS.

Software for all the protocols, and terminals.

. <u>Terminals</u>

Smart and intelligent terminals

We need graphics for 125, Personal VAX (CSS wants to help in high end).

LQP

Print what we can see

We need a one page display

. <u>Disks</u>

Do we have the right, interfaces in a timely fashion?? (e.g. SDI only on 1 disk, and 3 controllers.)

. <u>Systems Components</u>

Venus

VLSI-VAX

Comet

Nebula - single user, good graphics for PBS - only??

780 mid-life kicker

. <u>VMS</u>

Scheduling: Real Time versus Timesharing versus Commercial (with Batch).

Size: Personal versus group versus Central

Security:

Application focus: TRAX-32?

Data management evolving to distributed?

Standardization for CATS, FMS, Forms with common data dictionary (descriptions)

. <u>Hydra, Other Multi-computers and Multi-processors</u>

FCS with networking versus tightly coupled single center

Reliable versus incremental expansion (MA780)

Hetrogenets vs. Homogenets (on 20's)

. <u>Applications</u>

WPS/EMS/Typeset

Profession Based System (nothing happening)

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. <u>Applications</u>

WPS/EMS/Typeset

Profession Based System (nothing happening)

THE STRATEGY SOMEWHAT SIMILAR TO IBM'S 1964 360 DECISION

<u>SIMILARITIES</u>

. **WE'RE ABOUT THE SAME SIZE WHEN THE DECISION WAS MADE**

. **THEY HAD MANY, COMPETITIVE, INCOMPATIBLE PRODUCTS WITH MANY**

OPERATING SYSTEMS AND EACH PRODUCT REQUIRED ENHANCEMENTS TO BE

COMPETITIVE

. THEY PROVIDED COMPATIBILITY WITH PAST 1401, 1410/7010, 7040/7090

ARCHITECTURES IN EFFORT TO HOLD BASE (FROM HONEYWELL 200 AND CDC

6600)

DIFFERENCES

. MARKET IS DIFFERENT

. 360 RANGE WAS A LARGE MAINFRAME TARGETED AT A RANGE OF LARGER ORGANIZATIONS, ESPECIALLY CORPORATIONS.

SECOND-RATE MACHINES OFFERED TO OTHERS (EG. 1130, 1800, SYSTEM 3)

. VAX AND 11 ARE TARGETED AT A RANGE OF GROUPS WITHIN AN ORGANIZATION FROM THE CENTRALIST TO PERSONAL (TECHNOLOGY COST REDUCTION)

. VAX AND 11 ARE AIMED AT HOMOGENEOUS DISTRIBUTED PROCESSING NETWORKS

. VAX AND 11 COVER A LARGER, BUT SHIFTED RANGE

. 360 WAS A "TOTAL" COMMITMENT. EVERYONE WORKED ON THE 360 WITH NO

INDICATION IT WAS FEASIBLE.

. VAX HAS BEEN IMPLEMENTED

. WE ARE CONTINUING ALL OUR PAST FAMILIES, 8, 10, 20

AGGRESSIVELY

. 11 ONLY MUST BE USED AT THE LOW END OF VAX, AND 8 BELOW THAT

(FOR <u>STORE</u> MARKET)

00 CORE DECGRAM ACCEPTED S 002836 O 290 19-JUL-82 16:52:29

****
* d i g i t a l *
****

TO: KEN OLSEN DATE: MON 19 JUL 1982 3:24 PM EDT

FROM: GORDON BELL

cc: EMC: DEPT: ENG STAFF

PEG: EXT: 223-2236

LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5169995089

SUBJECT: SOME CHALLENGES FOR US IN THE NEXT 0 TO 5 YEARS

Prompted by the Japanese visit and sitting many hours in meetings, we have an incredible number of challenges ahead:

0. We have the greatest product array and strategy in existence
today based on VAX-NI-CI compatiblity and as such should easily
continue our position. We do have to follow it though! DEC has
promoted a major style of computing which has evolved for 22
years that is much deeper than the cabinet skins. (About 7 years
ago I went to a hardware session at DECUS and almost no one
showed up.)

The Japanese approach computing totally as a commodity supplier
problem without a feeling as to what computers can and should do.
Ironically, I think it is the language and Kanji character set
that puts up the boundry. As they get human interaction, they'll
become an even bigger threat because their higher intellect will
enable everyone there to become programmers. Recently, Dr.
Kobayashi, the chairman of NEC stated that every employee MUST
have and use a personal computer.

Right now I don't see us being a great commodity supplier because
the technology depth, and manufacturing aren't good enough. The
DEC versus Brother Keyboard is a good example. We've built an
obsolete, lower technology, relatively poorer keyboard... maybe
because it looked easier or who knows why.

This requires even stronger architectural leadership because
there are so many opportunities around and this is the best

differentiator we have. Most products are dead ends or don't allow enough control or are really poor. (Robin and Rainbow aren't off to a very good start, but they could/should be.)

The bottom line of this point: now our strength is our incredible
architecture and it must remain so. If we are going to be serious in the commodities (eg. floppies, keyboards, monitors)
and commodity computing (8086, 68,000 and 16032 x CP/M, UNIX),
we'd better put the management and resources to succeed. We can
not win at trying a little bit of everything! I don't think there's any way to even look at and decide on some of these issues because we (OC) encourage EVERYTHING and decide nothing.
Making incremental decisions ultimately kills off a direction.

1. Getting everyone settled to sell what we've got and what we
could easily have especially since Patti Seybold blessed us.
Office/tp/data management/dp are the greatest and we've got to
segment and approve the organization now. Julie's great here.

2. Segment the part of the organization in either a quasi or real
divisional structure so that common engineering, manufacturing
and marketing are together. Also, then ask these group

leaders
to come with some recommendations. In this way, the various operational committees can be cut down to manageable sizes and
aligned to a common goal set. The notion of commodity terminals
and personal computers seems like a natural. Also VAX and the
main systems business are another natural.

Right now, decision making seems to be very slow because it has
been clogged by the low end problem for the last 2 years. In engineering complex systems it has been observed that the design
time is proportional to the number of people involved squared.
The meetings are just too large to get the work done. People just want to know what the NEW DIGITAL is and what to do.

3. I'm very excited about the pipeline that's been established
from: technology boutique (expensive, fast response, competitive,
state of the art); systems (constrained to be compatible); and
commodity (designed in Japan or Taiwan) for cost. I don't think
an engineering/manufacturing group can be in more than one mode
at a time. For example, it's crazy to ask a group making state
of the art products to do low cost, third time around products.
This is impossible emotionally for engineers. I've decided to be
less involved in these products, but will continue to provide some direction including sending ideas into the hopper.

4. I share your view of having a great small business computer,
but am concerned about whether you can be articulate enough

as to
what it is to get someone to take on the charter. The parameterized software looks like a key here, but it's the first
pass. Is it the motorcyle shop or the engineering department or
the manufacturer with $10M sales (I can show you a company who's
using a 780 in this mode, including mail)? The range is immense
and hard to define. Given your intense interest, and the ambiguity of the space, you might ask: Is anyone smart enough to
do the job, too smart to avoid the job because of personal risk?

5. There are the Japanese and I hope we get concerned before it's
too late. Fujitsu has 10,000 engineers at Kawsaki all determined
to make them number one. I intend to push to join the Alpha Omega and packaging consortia parts of MCC because they are really a way to reduce the development costs and get the vital
research we need. This would be coupled to the work I would like
to do aimed at a high performance machine structures.

6. An approach is needed to build machines. They aren't fast enough now, nor can they be designed. There are several approaches. This is the highest priority of all, especially since the recent announcement of the Japanese to TARGET MINICOMPUTERS because NTT has asked the big 3 to supply them

machines for distributed processing (again, expecially now that
they've conquered supers and mainframes and are en route to commodity personals). I don't have the answer now, but only understanding that we are headed toward a cliff.

This is the area that I must work in, even though I would also
like to remain part of the management team on an as needed and as
desired basis.

7. Going with National. I fully support this and we must make it
happen!!! They will supply the peripherals (can not be underestimated) and the marketing outlet. I see our leverage and
control as software. This means we would command a premium for
MicroVMS and NOT sell it on look-alikes. This means it is bundled!! We could also bundle UNIX in a similar fashion, or we
could allow it to become a commodity that all the random unicee
suppliers support... probably the best way to not support unix.

8. The organization does bother me both in content and form because I see it becoming typically American and it is the antithesis of the Japanese companies. I looked at the top 17 of
NEC: 13 are engineers, there's a lawyer, salesman, and 2 accountants. About 8 are PhD's. This is typical of a highly divisional structure. Similarly, I had dinner with the head of
engineering of Sharpe, who was a very deep and thoughtful engineer (he has Maxwell's Equations chiseled in stone at their
research center); three days later he became President. They believe in and do real, very directed research (eg. a class 1 room and 0.8 micron line width at Hitachi Central Research) and

this pays off. We have little directed research or advanced development outside of a tiny bit in semis and in disks.

The organizational form is of concern: they have NO marketing groups per se. Marketing is done in either sales or in engineering. This is the famous 3 body problem or 3 stage pipeline. We must get back to this before it's too late. For
example, we've allowed the real time response of our systems to
be dissipated because the engineers only see customers at DECUS.
NEC has the two groups meet quarterly for a week where sales and
engineers listen and present to each other.

WPS USERS - Leave HP mode and type <CR>

EMS 4-APR-79
09:37:44 010 1
To: Ulf Fagerquist, Jan Lounsbury, Roger Cady
From: Gordon Bell
Date: WED 4-APR-79 09:37:44 EDT
Subject: PREPARING FOR 4/11

Talked with Kiester (Commercial) and Shingles. They will input to us on
Monday and include Barlow's "technical comments". Kiester (Commercial and
not Data Services) believes we can (1) minimize follow-on investment by fixing
10/20 problems first; (2) not do follow-on hardware.

I suggest that we do the following to be reworded for DECUS (we must keep our
promise):

1. Small fire-wall effort (PDP-8 model for now versus PDP-15 model).

2. Support 10/20 especially RAMP and multiprocessors (possibly).

3. Cut 20/20 price and 20/60 prices.

4. Cost reduce KL (newer RAMS, 11/24, and better power supply) with spares
by a compaction.

5. Interconnect KL and 2020 with ICCS VAX.

6. Do follow-on machines after resources required for 4 and 5 have completed
the tasks.

7. Build coexistence with VAX and other 10/20s through ICCS. Do not
suggest migration structure, but provide a path so that

users can:

A. Put new work on VMS and communicate with old programs on 10/20s.

B. Do front-end, e.g. editing and filing (off loading on VMS in compatible editing, and do computation off loading with VMS by selecting migration when standard languages permit, especially FORTRAN and COBOL).

C. Buy eventual cost-reduced hardware.

**The above dictated but not seen by Gordon.

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00 BURT DECGRAM ACCEPTED S 25510 O 24 28-MAR-81 12:33:33

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TO: A. M. BERTOCCHI　　　　DATE: SAT 28 MAR 1981 12:31 EST

FROM: GORDON BELL
cc: see "CC" DISTRIBUTION　　　　DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: RE: CORPORATE FINANCIAL STRATEGY

Al,
You shuould understand we have about a dozen engineering groups now... not 1, or were you proposing we go from a dozen

to 2?

We can manage about any kind of split the OC wants us to.
Ken wants
the OC to decide, from the 12 engineering groups that are
presenting
as to where to put the resources. These include all flavors
of
technology, manufacturing process, engineering process
(computer
aided design, etc.), and products. The pressures are clearly
to
get more products abut we must resist, or happily fund.

The transitions from 16-32, 36-32, and doing multiple Personal computers while at the same time, being required to fund the breadbasket (mid range shared systems and dumb terminals), and starting up the office program puts hellish demands on products. With discipline, it is possible to get the transitions to take place so that we don't have to fund all systems forever. Two years ago, we made two very significant errors in not following the product strategy we accepted: Not moving to build an 11 PC, versus perpetuating the 8 AND not moving to make transition software for the 10/20 versus building a transition machine.

"CC" DISTRIBUTION:

WIN HINDLE TED JOHNSON KEN OLSEN
LARRY PORTNER

GB2.S5.27
00 BURT DECGRAM ACCEPTED S 25912 O 51 06-SEP-80 19:23:06

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* d i g i t a l *
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TO: see "TO" DISTRIBUTION DATE: SAT 6 SEP 1980
7:20 PM EDT

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION

DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: THE SECURITY DEMO AND NEXT VERSIONS OF VMS

I would like to help you schedule a demo and a presentation of results of the security project put on by R and D. There is both an impressive demo and a report on security that I feel must eventually be part of VMS. This is not to try and dictate the functions of future versions of VMS, it is to say that as planners of our future products, you must be aware of what the possibilities are. Right now, we have a capability and I would like us to continue working in this direction in an Advanced Development mode, as well as looking at areas, such as the NI where it is mandatory to build in more secure capabilities.

Virtually all of our competitors are developing products based on sthe secure kernel approach. Given that we have capability to do this, I would hate to get into a mode where our customers tell us to do it and we have to come from behind. I think you have the responsibility to find out where the competition is precisely, and when you think this is going to be a necessity as opposed to a nicety. I'm sure the product lines can provide this information. (This has to get factored in along with all the other pulls like Hydra, Personal Vax, better real time, etc. Can you try and sort out these classes of pull so as to not make the whole
evolution of VMS appear like a giant game of rugby whose every release is a happening based on who has yelled the loudest for the next feature?

How about asking Paul Karger for the demo and presentation of results? (When will the new auditorium be available in SR?)

"TO" DISTRIBUTION:

JOE CARCHIDI PETER F. CONKLIN MARION

DANCY
BERNIE LACROUTE   KATHIE NORRIS

"CC" DISTRIBUTION:

DAVE CUTLER   SAM FULLER   BOB
GLORIOSO
BILL HEFFNER   HUSTVEDT VIA CARCHIDI   BILL
JOHNSON
BILL KEATING   PAUL KARGER VIA GLORIOSO LARRY
PORTNER
HARVEY WEISS

GB1.S6.54
00 BURT DECGRAM ACCEPTED S 25852 O 22 06-SEP-80 15:29:54

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* d i g i t a l *
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TO: BILL DEMMER   DATE: SAT 6 SEP 1980
3:25 PM EDT
    BERNIE LACROUTE   FROM: GORDON BELL
cc: see "CC" DISTRIBUTION   DEPT: OOD
                                         EXT: 223-2236
                                         LOC/MAIL STOP: ML12-
1/A51

SUBJECT: PLS CONSIDER VAX (NEBULA) IN THE 23, 23B, 24, 44
POSSIBILITIES

It seem to me with all the churning (ie the Task Force on
What
to Introduce) that is going into the issue of how many of
which of these machines to build (all of which cost about the
same amount) we should refer back to the base corporate
strategy
that we all agreed to last year:

Build VAX's over the long term and build only 11's where we
have to because of the low cost. Putting more 11's out there
where we are acquiring commitments for extensions in the

software
(albeit minimal compared to what we imply with large, mainframe
or central-type computers) is not a good idea.

What I'd like to see:

1. only evolve the 23 to the 23B (with 22 bit address)
2. make 34's as needed, but see if there is a lower entry cost version of the 44 that lets a customer grow
3. hurry up and get Nebula (with 65K rams now available) to the
low end market so as to get the users on VAX asap

Please understand point 3 is for two, VITAL reasons:
1. implied support on multiple operating systems
2. nearly all customers who are buying follow-on type systems will
inevitably outgrow the 11 and will have to switch to another architecture.

THE LONGER WE PROLONG THE MOVEMENT TO VAX, THE HIGHER RISK WE RUN IN LOSING THEM AS CUSTOMERS, BECAUSE THE FUTURE OPTIONS ARE:
a. low cost IBM machines
b. low cost IBM-compatible machines
c. low cost semicomputer company-based systems (whether they be
   made by the semicomputer company or put together by IBM, Apple,
   the Japanese, etc.

These are all better than future 11's with its architectural limits.
Thus, let's get them over to VAX now! Can we please start?

"CC" DISTRIBUTION:

ROSE ANN GIORDANO   IRWIN JACOBS   WARD MACKENZIE
OPERATIONS COMMITTEE: LARRY PORTNER

GB1.S6.53

EMS 30-MAR-79 10:24:31
590 1
To: Bill Demmer, Ulf Fagerquist
CC: Brian Croxon, George Hoff
From: Gordon Bell
Date: FRI 30-MAR-79 10:24:31 EDT
Subject: PROCESSOR STRATEGY

I need your help re-directing and implementing our strategy so we can move to aggressively attack the following critical needs we have identified:

1. Networks
2. Interconnects and communications (hardware/software)
3. Multiprocessors
4. 10 Follow-on
5. "Hurley nets"

As you know, we are headed in the following direction:

1. Drop D36 but look at the MCA technology for use on 32-bit machines.

2. Relocate Venus to Marlboro. We clearly need the Venus staff to move with the project!

3. In addition to Venus, we need to be sure D36 people have the opportunity to look at work on the 10 Follow-on and the other critical programs above.

I'd like to consciously mix Marlboro and Tewksbury people on these projects to maximize the benefits of their collective expertise and experience. If we can move quickly, this is a great opportunity to get people working on the critical programs that have fallen off our lists over the last weeks for lack

of budget and people. These programs are really essential if we are to move
ahead with the Engineering Strategy and win against IBM. Please ask your
people to help us understand how to best make this transition while minimizing
their pain.

I feel really good about what this strategy can do for us in the marketplace,
but am worried about the personal disappointment such a major change causes.
So let's move as quickly as we can on this and stabilize the organization next
week.

Command:
00 BURT DECGRAM ACCEPTED S 12093 O 53 25-JAN-81 16:43:06

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* d i g i t a l *
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TO: see "TO" DISTRIBUTION   DATE: SUN 25 JAN 1981 16:35 EST

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION   DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: THOUGHTS ON ENG. BUDGET AND STRATEGY EVOKED BY BILL DEMMER

Bill's recent pulse to me on the budget allocation stimulated
several thoughts. We plunge into areas sometimes without looking
and rarely do we plan their long term costs. Also, we have
always looked at funding/NOR (the basis for all engineering) and
this now seems wrong. We have to fund according to area or range
needs so that if we have products there, they are the best!

This
ought to be the theme of the April meeting. Instead of
feeling
sorry for an engineering manager whose $/NOR is decreasing,
we
should reward them on the basis of the strength of their
products
in their charter. Similarly, we carefully allocate charters
and
funds so they protect themselves from the do everything
syndrome.
Note that each product area has a different gestation period
depending on the commodityness, size and market maturity (eg.
high end systems 6-8 yrs, terminals and personal computers
less
than 4 years, disks 6 to 4 years). We must also watch the
over
funding because we want and love a product syndrome could
kill
the group by growth. Fund to win!

In the recent past, we have made decisions that reduce
products
and hence we have to manage the budgets (and efforts)
downward by
redirecting the persons to other areas like Bill did when
taking
on the Network area with the resources from what had been
11's.
His mid range manager has a problem emerging when the 24, 44,
Comet and Nebula complete because there is probably only a
Comet
follow on prior to the availability of the Scorpio chip.
Note
the phaseovers (reductions) we must manage: 10/20 to VAX,
larger
11's to VAX until VAX gets down to chip level, 8's to 11's
(we
blew), terminals to personal computers, using server based
model
on the NI versus extending every system, and generally moving
to

generic (eg. OFIS) and specific applications. Fortunately for us, all area reductions are balanced by demands for other area products and the need for lower cost (process funding).

In the systems area it would seem we end up with groups (A/D, and Development) in disks and cpu's along the X 2.5 price bands:

>250K (single group)
100K-250K Comet and its follow on
40K-100K Nebula and ? follow on (an 11/24J to cover all)
16K-40K depends on Scorpio and Aztec,
<16K terminal based depends on Scorpio

Scorpios or combinations packaged with the right disks seem like the way to cover the low end part of the range. We should err to have holes and go for lower prices, driven by semis and disks. We should think multiprocessor or cluster (NI) to get more range.

NI should change the way we design and sell systems, and I'm sure we should head for the clusters approach verus covering range by individual machines.

The Personal Computer (and Clusters) structure is something we really blew by perpetuating the 8 one too many generations. CT100 should have been on the market today and the CT50 could have only been limited by Tiny. Hopefully we have other things to sell and people will wait and not buy PC's instead of our timesharing and terminal based approach. We have to get the 2.5K- 6.25K and 6.25-16K band PCs now, followed by better technology and production processes in both PC's and terminals.

For now, we have to redundantly fund Terminals and PC's until they merge, probably in the middle of this generation. To the terminals folks, this means having computers there that can be programmed: VT200 and LA200 with the computer in the keyboard. (The terminal or computer in the keyboard with a few line display should give us about the cheapest, most portable terminal.)

I see the 5th generation (80-87) as a consolidation generation where having built so much hardware, the market may be limited by useful applications work. It's theme will be the communications, clusters, and personal computers (versus terminals) for everyone especially toward 87. Given the incredibly lower costs we will see across the range, there will be pressure by the big personals on our bread and butter, mid and large scale timeshared systems. The emphasis is clearly going to be on cost, time to market, applications, and various ways to distribute.

It feels like the 6th generation (>87) will be accompanied by some very different capabilities for and structures of machines: voice, and vision; solution to security; never fail, fully redundant and totally different repair/replace structures unlike no other man made systems. We'll have our VAX version of the CRAY 1 at 250K, 400$ the $400 Apple PC's, PC's distributed in every tv and telephone.

Software will change too this generation from tools for programmers (operating systems, languages, data management, and

communications). Our efforts should evolve to support applications programmers who have knowledge about specific domains such as small businesses by providing higher level tools.
The Product Lines then would write specific applications (eg. dentists, structural engineers). The OFIS program is quite different because it provides the package for end use. Finally,
we have to explore tools for the end user to define his own programs, with Visicalc being perhaps the first. We'll continue
our conventional ways to generate software: OEMs, our P/L's, the
field, and probably most important, the independent software publishing business that's evolving to support the PC marketplace. It is important to understand this whole investment
structure now!

The 6th generation should really have a different method of programming when knowledge based systems come into existence. This means that computer science as we know it now (i.e. where
programmers are trained) takes on a role like physics and mathematics, with every discipline taking on its responsibility
for writing down its knowledge so that machines understand it,
rather than relying on papers.

Am not sure what the bottom line is for all this is except to evoke your thoughts. For it to become an active guideline, it has to be "processed" and then incorporated into our strategy.

For now, What youse think?
What's right and wrong with it?
What's lacking?

"TO" DISTRIBUTION:

RICK CORBEN PER HJERPPE TED JOHNSON

OOD:

"CC" DISTRIBUTION:

DICK CLAYTON BERNIE LACROUTE AVRAM MILLER
STAN PEARSON BILL PICOTT

GB2.S4.17

Digital **Interoffice Memo**

Subject: **Stratton Mountain II (and III)**

To: Lorrin Gale

CC: OOD, Bill Green, Ken Olsen

Date: 5 OCT 76
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

Let me congratulate you, Ken, Cherylene, the presentors, and attendees for a worthwhile engineering (LSI) soiree. I feel remiss in not recognizing the need to provide a products/hardware technology congress for engineers and managers which this meeting nicely addressed. Hopefully most were able to present their different perspectives, have the messages received and get feedback. The amazing thing was the quality and quantity (2 days at 14+ hours/day) technical interaction...I came back relatively fresh and encouraged (as opposed to bored and depressed, attendant with large group meetings).

Ken's talk was worthwhile, well integrated, while providing the engineers a chance to query him...providing much food for thought in terms of his view of "engineering management". (Please transcribe the video tape of that section so that it can be edited and possibly digested for complete circulation.)

Given the good precedent of distributing the presentation figures before the conference, a voice cassette for each session could be made available (including the Q and A). (The videotapes appear to be unreadable and add little.) In this way, non-attendees can check out the talks from the library...but in a controlled way.

Would it be worthwhile having a 1/2 day early tutorial ahead of time reviewing physics, manufacturing technology, and the specific technology details?

Next year, could you not change this year's charts, but merely update (ECO) them to show how your projections agree with reality? On the wall charts giving what each chip does, development cost, time, cost/gate and time/gate and other metrics might be useful...and then publish it. The users are really begging for catalogs, ways to estimate their design costs and times, and better interfaces on the design process. If you cut them adrift, which I hope you will soon do to encourage their independence, clean interfaces are mandatory.

GB:ljp

GB0003/50

| **d** | **i** | **g** | **i** | **t** | **a** | **l** | **interoffice memorandum**

Subject: **Stratton Videotapes**

To: Lorrin Gale, TW/D19
Dan Goor, ML12-2/E71
Stan Pearson, ML12-2/E71
Phil Tays, ML11-4/E53

Date: June 11, 1979
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

CC: Dave Hunt, ML1-4/A97
Bill Johnson, ML12-3/A62

follow up 6/25/79

The tapes are tedious to watch. There are too many ah's, jokes, and noisy gaps. They should be able to be cut by at least a factor of 2.

Could you get together and get a priority for retaping them or cutting parts out all together?

In some cases a written synposis or summary is adequate - eg. Cullen's talk can collapse to a 1-3 page paper.

<u>All</u> tapes would have a 1 page summary and slides...then make the tape optional. Prioritize things into a pert flow in terms of must see. I only saw 9 tapes and my strategy. Of these, let me recommend: 1) the strategy talk (only first hour)... and even the 1 1/2 hours could be edited to an hour or less; 2) Plowman's talk - could be cut or have him redo it. 3) Sam's talk, which needs more time. The IBM and network talks could be cut, converted totally to written form and made optional. The marketplace talks can be drastically cut or made written (in outline). I don't know what the other critical talks are.

Let's take the time to get a good set that everyone can use! The total viewing time should be in modules of 1/2 day and we shouldn't expect more than a 1/2 - 1 day of viewing.

Next year, let's use questionnaires to guide, determining what's important.

GB:swh

Note to Dan - all tapes, except the Strategy are enclosed. The library has 2 sets of the strategy - the original is at Bedford under the care of Mike Dick (245-2237).

D I G I T A L   INTEROFFICE MEMORANDUM

DIST:

	Lorrin Gale	TW/D19	Dan Goor	ML12-2/E17
	Stan Pearson	ML12-2/E71	Phil Tays	ML11-4/E53
	Dave Hunt	ML1-4/A97	Bill Johnson	ML12-3/A62

Citation:
For contributions to the understanding of program behavior in the design of multiprocessors, cache and memory hierarchies; and the development of VAX and the Digital Computing Environment

6a
Chief Architect of VAX-11 with significant contributions in the design of every model, including its memory hierarchy, cache, intercomponent structure and the actual logical and physical implementation.

Bill has been devoted to the deep understanding of computer systems starting with languages, programs and how they behave in real systems of networks, clusters, uni- and multiprocessors. He has developed and applied this knowledge to the engineering of DEC's computer systems, especially the hardware part, for cost-effective and greater performance program execution. He has shared some of his insight in clear papers.

In addition to direct contributions, he has become the technical leader for many all of Digital's products. Bill's capability and contributions rank with today's great computer builders, including Amdahl, Brooks and Cray.

6a-significance

The VAX-11 has become the benchmark machine for all minis and micros. For example, the National 32000 architecture is nearly VAX compatible with the same goals, constraints, instruction-types, data-types, etc. subject to patents. VAX removed key program limitations in computers, thereby becoming the basis for extending the state of the art in programs (eg. CAD/CAM) by its: memory addressing and memory hierarchy, mapping of files and program into a single address space, procedure calls, program sharing and multiple languages to be used for a single problem (process). The architecture efficently encodes the standard languages (Basic, C, Cobol, Fortran, Pascal, PL/1) better than any existing computer. VAX was designed to execute the operating systems, VMS and UNIX (C) efficiently, extending architecture appropriately.

VAX is not only a compatible range (1:1000) of models, but extends the concept of range to be a hierarchy of model types and uses (micro/PC, mini, and mainframe). With the VAX-compatiblity basis, all types and models can be interconnected to provide a single, hierarchical environment, the Digital Computing Environment (see 6b and 7).

6b

Chief Architect for the Digital Computing Environent, a hierarchical, homogeneous computing environment based on VAX, including:

- CI-Computer Interconnect, for VAX Clusters (Chief Architect);
- VAX Central and Distributed Clusters (Contributor);
- BI-Backplane Interconnect (Contributor, Co-inventor);
- NI-Network Interconnect (Ethernet) 802.3 (Contributor), for forming Local Area Networks and distributed clusters.

With the compatible, homogeneous computing environment, a user can bind the location of computation, at anytime (purchase, logon, process calls) to a particular node in the hierarchy to meet cost-effectiveness, performance, security or availabilty criteria.

The FIRST model of a symmetrical multiprocessor analyzing the processor and i/o to memory access contention. This work, his PhD dissertation, is the clasic reference in every dissertation or paper on multiprocessors. It's main benefit is to show that multiprocessors can be built and are not limited due to memory access contention.

7

VAX-11 Architecture (engineering significance described in section 6).

Invited paper: W. D. Strecker, "Design Considerations for DEC VAX-11 Instruction Format," 8th World Computer Congress, IFIP Congress 80, Melbourne 1980. Also, W. D. Strecker, "VAX-11/780 - A Virtual Address Extension to the DEC PDP-11," AFIPS Vol 47. 1978. See also 4 patents.

VAX Clusters and the CI-Computer Interconnect architecture and design. A set of 16 VAXes and disk servers can be interconnected within a 50 m radius using a redundant high speed, 80 Mbyte/sec link to form a single computer system, providing for high performance or high availability.

W. D. Strecker, "Clustering VAX Superminicomputers Into Large Multiprocessor Systems," Electronics, Vol. 56, No. 21, Oct. 20 1983. Three patents filed on the communications scheme and its protocols.

The FIRST analytic model of multiprocessor performance due to memory contention (see also 6b). W. D. Strecker, "An Analysis of the Instruction Execution Rate of Certain Computer Structures," PhD dissertation, Carnegie-Mellon University, 1971. Invited paper: W. D. Strecker, "An Anlysis of Central Processor Input-Output Contention," Computer Simulation and Measuring Conference, Aug. 1979, Boulder, CO.

7(next 15)
Memory Hierarchy Engineering using Analysis, Modeling and Simulation. This work included the construction of an early disk and bubble memory cache. It allows the design optimization of memory hierarchies. Invited paper: W. D. Strecker, "Optimal Design of Memory Hierarchies," Eleventh Hawaii Conference on System Sciences, Jan. 1978.

Cache Memory understanding via analysis, modeling and simulation. W. D. Strecker, "Transient Behavior of Cache Memories," ACM Transactions on Computer Systems, Vol. 1, No. 4, Nov. 1983. Invited paper: 3rd Annual Symposium on Computer Archtecture, Jan. 1976, Clearwater FL., also reprinted, see W. D. Strecker, "Cache Memories for the PDP-11," Computer Engineering, Digital Press, p263-268, 1978.

PDP-11/70 System Design. First minicomputer to use a cache memory.

Program Behavior in PDP-11 and VAX for future design decisions. Bill developed a set of analytic and instruction trace driven programs for making design tradeoffs in processor and i/o speed, bus bandwidth, and cache size. These are used in every VAX design.

BI-Backplane Interconnect architecture is a bus for interconnecting computer components (eg. Processors, Memories, Controllers) to form multiprocessor computers. The bus greatly exceeds all current and proposed buses (Multibus II, VME, Futurebus) in terms of performance, distance, lack of limitations, reliability and diagnosability. One patent has been filed.

VAX-11/784 Multiprocessor Design. The 784 is a 4 processor 780; several hundred of the two processor version are in use.

Understanding of PDP-11 architecture to improve future architectures (including micros). G. Bell and W. D. Strecker, "What Have We Learned From the PDP-11?," 3rd Annual Symposium on Computer Architecture, Jan. 1976, Clearwater Fla.

Pulsar multiprocessor was a 16 processor PDP-11 built with LSI-11 chips and designed to provide higher performance at lower cost than the PDP-11/70. It is a breadboard of the now emerging multiple, microprocessor systems where a large number of micros are coupled together to provide mainframe power at minicomputer prices. Computer Engineering, Digital Press, p401-402, 1978.

Floating Point Arithmetic work that contributed to the IEEE floating point format. M. Payne, W. D. Strecker, "Draft Proposal For a Binary Normalized Floating Point Standard," SIGNUM Newsletter Spec. Issue, Oct. 1979.

Extension of the PDP-10 Architecture including Paging Algorithms

Patents:
4,236,206 Central Processor Unit for Executing Instructions of Variable Length.
4,241,397 Central Processor Unit for Executing Instructions with a Special Operand Specifier of Intederminate Lengh.
4,338,663 and 4,241,399 Calling Instruction for a Data Processing System.
3 patents filed: Computer Interconnect
1 patent filed: Backplane Interconnect
August 23, 1982

Mr. Larry Sumney
Semiconductor Research Cooperative
1925 North Lynn St. Suite 404
Arlington, VA 22209

Dear Larry Sumney:

Enclosed is a copy of a program which several of us have defined to improve the technology position of the U.S. computer and semicomputer companies.

The motivation of the program, given on page 5, describes the problem of overfunding research relative to technology. I believe SRC may exacerbate the problem of "knowledge spilling" and hasten the demise of U.S. semis, semicomputers and computing. We need substantial collaboration in the development of technology - which is very expensive to do alone.

I know this is hard to think of for firms that have been so competitive in the past.

I'm delighted to see that your presenting the SRC at DEC on September 17 and I hope we can meet then.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

Enclosure - Post vN Computing
GB3.S7.15

March 5, 1979

Professor Philip Kraft
SUNY at Binghamton
Binghamton, New York 13901

Dear Professor Kraft:

I tried to contact you several times in Boston and failed, so I think the best way to comply with the commitment I made is to try to answer the questions this way.

1. I don't think the supply of programmers has much effect on the design of machines. They are used both for diagnostics and for microprogramming (defining the machines). With many more, there might be more data types in machines; with less, there would be less machines. So far, the ideas for what is in machines come from knowing what the problems the machine has to address are: scientific (moving from integers, to floating point, and now to vectors and transcendental functions), commercial (the Cobol and text data-types), real time (events, Boolean equation solution, control equations, queues), and the operating system (address manipulation, protection and security, queues). With fewer programmers, there might be fewer lanquages, but then again, it seems that most of the significant languages are coming in one way or another from the applications domain. (E.g., SPSS, COGO, Circuit Simulation, Drafting.)

2. Distributed Processing's main effect will be distributed use and programming, too. Programming of this kind, where so many people will be doing it won't be of the procedure kind we have now, but will be more for handling text, pictures, files, and generating simple reports, and communicating with other systems. It's hard to believe that the mix of programmers will drastically increase, but rather, people who are not now using computers, such as I'm doing this instant, will start to use them in the ways previously outlined. I don't think the past use will change too much in the short run, because they are within established organizations, supplying established needs and operating in a self-perpetuating mode. By rights, these central control oriented people would be more effective if part of the distributed processing trend, but I don't think they will. They will simply be the clearing house, do some of the old tasks, the same old way, and maintain the data interchange and ad hoc distributed data base that will grow up around them.

3. Machines are designed for specific workforces all the time. SPSS is for social scientists, COGO for civil engineers, PCLS for people who have to layout Printed Circuit boards. We built a machine, PDP-14 for discrete control and use in controlling transfer machines as used in the auto industry. It was designed so that it could be installed by the particular set of electricians around these plants, and programmed by the engineers who had previously used relays to solve these control problems.

4. Nearly every machine (where by this I mean a piece of hardware or a software machine) is designed to solve a particular class of problems, in a particular applications domain (e.g., Fortran for scientific and engineering calculations). All of these start out a particular way and ultimately evolve, just as natural languages do, to fit the task. They get all the data operations etc. You might look at how Fortran evolved as an example. From the original it got double precision and complex data, it recently had strings added, and there have been constructs to do better in terms of minimizing the errors that are possible to write in a program. Similarly, there is a well-defined set of subroutines surrounding it that all libraries for all machines have. It's hard to have predicted all these changes. We have had mixed success as we get into more specific application domains (e.g., design of a system to help around a clinical lab). These do get evolved too, because rarely are they right the first time. They have to be done by a combination of computer scientists and people who know the application area... the later being the most important. There are many kludgy systems that we would shun, but since they solve the application problem, the users live with them and like them. Any in-elegance is made up for by the fact that it gets the right answers faster and cheaper than by any alternative. In general, the most successful systems come out of the user environments, and the least

successful come from our trying to put together systems that we think they want, unless we are really coupled to them carefully. Ours are usually more elegant and more powerful and more general, but are less likely to be immediately useful.

I hope this answers the questions.

Sincerely,

Gordon Bell
Vice President, Engineering
Professor, Computer Science and Electrical Engineering
Carnegie-Mellon University, on leave

GB:ljp
GB0001/40
to; roy moffa, reid brown, bob glorioso cc: psc
subject: everthing's in a name... let's use Supermicro

SEAHORSE
The DECwest folks were concerned about the 4 digit numbering of Seahorse. I'm less concerned about this right now because I think the basic machine class name isn't right yet. Scorpio would be similarly named.

In the past, it has been important to use names to help position a product, particularly a new one. It is also very useful when we can become identified as the leader with that product.

Names have evolved somewhat along these lines:

```
        super
mainframe
            midi
        mini     supermini
                 micro    supermicro
                   pc
```

Namely, the Supermini (eg. 780) is an evolution of the mini. It does the work the mainframe used to do, and has the large addressing.

The Supermicro is an evolution of the micro (one chip) does the work the mini used to do, and has large addressing. It's in a new price, package and performance class. This also puts it in a new use class.

VENUS AND NAUTILUS POSITIONING
I don't know how we should position Venus except as a mainframe. This would please our 10/20 customers to know that we're going to build large machines. It would also let us price higher than the 780 it was supposed to replace, and then Nautilus could be priced lower than the 780. I don't think there's a new class name here.

We really do need a super name.
Can you folks make the change?
.
****
* d i g i t a l *
****

TO: KEN OLSEN DATE: SAT 30 MAY 1981 17:29 EST

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: SUPPORTING 16-BIT PRODUCTS AND DOING EXEMPLARARY ENGINEERING

There are several reasons a Digital Engineer might not like to
work on 16-bit products:

1. The natural pull of learning about 32-bit products.

2. Pushes from public statements by you that 16-bit products
are
dead, new ones are no good, and the engineers are not very
good.

3. Undermining products being introduced by redesigning them
just
as we are introducing them. Our product phases allow YOU to
do
design, and to have design input, but at the proper time.
The
11/23 you breadboarded, only increases the floor space
required.
Based on past experience, all a new package is likely to do
is to
increase product cost, take longer and increase development
cost.
Please don't redesign the 11/23, the market needs it. We
need
your help NOW to design the customer mergable AZTEC based 11.

4. You are a frightening 16-bit team member, and I don't
believe
people work well when they are insecure. External threats
are
enough to keep us sharp out of fear. The manager or team
should
either be replaced or redirected; not harassed and undermined
on
an ongoing basis.

5. Both of us have problems as designers, because we are not
full
time, nor can we follow-up as the design proceeds through its
critical stages. This causes people to believe we design out
of
emotion, rather than on a rational or business basis. I
believe
our work has to be exemplarary in terms of analysis, ideas,
and
overall quality, since we must raise, not lower the quality
of

engineering. Designs done by us are likely to get derailed in
implementation, causing misuse of resources, and high product cost, particularly when we design by the power of our position,
rather than the power of our ideas. Fundamentally, we have to be
careful that product design responsibility doesn't become ours
for designs responsible engineering teams do not like. When this
happens, the group will prove that it is no good.

You are one of our brightest, and potentially most promising engineers. I value your good design ideas. Unfortunately, like
us all, you have other ideas that aren't so hot, and it is hard
for the organization to sort these out.

I would like to help make you a more effective engineer.

GB2.S6.57

November 7, 1978

Ivan Sutherland
CS 256-80
California Institute of Technology
Pasadena, California 91125

Dear Ivan:

Thank you very much for the CAD Symposium talk, as there have been several favorable comments about it. My family was also delighted to see you again.

I look forward to working with you and hope we can make some sense in the NSF report, even though I'm very depressed about NSF. Right now, I'd even welcome a bright MBA there. The ARPA policy of rotating people through those jobs is essential! How can we get the policy to apply to NSF?

Again, thanks for the help.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:ljp
ID#337
00 BURT DECGRAM ACCEPTED S 20605 O 23 27-SEP-80 17:40:19

****
* d i g i t a l *
****

TO: PETER SMITH
DATE: SAT 27 SEP 1980 5:36 PM EDT

FROM: GORDON BELL
cc: see "CC" DISTRIBUTION
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: RE: SUVAX

I just found out that it was in its current state, requiring funds to go to market, given that only 14 were made. I don't know where the money should come from, but I believe we must do it. I have asked the group to consider not doing the cost

reduction boards that give it comm and disk control, and hence
this would give an apparently higher product cost. My own belief is that the product cost would be lower because there would be no FAT, as the system sans disks would be done in Burlington and site merged with disks coming from Colorado.

This gets us a 2 cab config, but the cost should be less due to FAT charges and inventory (due to less wip). Here we are modelling this.

This project is at very high on the list I believe we must have, and I would like to vote on all the bottom ones to get it! I've been clear that I think we are doing a disservice to our customers, and stockholders and company by delaying the introduction of it and the introduction of the 24. We have to get our customers on VAX, else run a very high risk of losing them when they must ultimately switch. ESG is most vulnerable of all. (What really scares me is the terminal
with a 370 in it that the Japanese are working on, given the 2 chip processor they've built. Such a terminal would be the right workstation to off-load with, given some sort of kernel monitor approach)

In ESG's case, I hope you'll do anything to get it, and not introduce the 11/23 based work station, but go flat out to get this.

If it has to wait, so be it. Our customers will demand it. We can wait, introduce a yawn like the 24, and then scurry to introduce it after the Zenith, Appollo, Three Rivers, and IBM, PRIME, all introduce their own Technical Workstations.

I like leadership products, and want to do it. We'll end up with a perceived followership product the way we're heading.

"CC" DISTRIBUTION:

BILL DEMMER ROSE ANN GIORDANO ANDY KNOWLES
BERNIE LACROUTE

GB1.S7.20
00 BURT DECGRAM ACCEPTED S 11622 O 12 15-FEB-81 15:23:40

****
* d i g i t a l *
****

TO: HARVEY WEISS DATE: SUN 15 FEB 1981 15:21 EST

FROM: GORDON BELL
cc: see "CC" DISTRIBUTION DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: RE: RE: SUVAX AND ARPA

Am delighted you'll be the focus for the ARPA contractor's sale of Suvax's. I think if we go out and get this business with ARPA (Universities), it'll really get us business at large with the rest of the government community.

Some time ago, I advocated a sub product line under one of Andy's to work with this community that would be solely aimed at an advanced, marketplace... especially the research institutes and universities engaged in research. I'm getting real concerned about our ability to be response to this very small group AND I think it is even more important now to interface to them than it was in the past, cause we need better research and ideas for our products on a long range basis.

This distress comes from the fact that as we've gotten larger and had to provide more past contintinuity driven by a large OEM and Commercial base, our product introductions turn to be conservative. For example, we are driven to support all 11's for all time, and this keeps us from driving hard to get this other business.

What we should look for is a way to segment things so that we
can
operate the various parts independently so that we are able
to
keep the on going business, yet interface to the new source
of
ideas we need for future products. If we go to a West Coast
facility, then we might consider putting the "ARPA Product
Line"
there with our engineering group. This could be a formidable
team.

What you think.

"CC" DISTRIBUTION:

JOHN BUCKLEY BILL DEMMER DICK
ECKHOUSE
ULF FAGERQUIST SAM FULLER BOB
GLORIOSO
BILL JOHNSON ANDY KNOWLES SI LYLE
JOHN MUCCI LARRY PORTNER JOHN ROSE
GRANT SAVIERS

GB2.S4.28
00 BURT DECGRAM ACCEPTED S 21556 O 433 05-NOV-81
12:16:59
****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION DATE: THU 5 NOV 1981
7:01 AM EST

FROM: GORDON BELL
cc: SAM FULLER DEPT: ENG STAFF
ANDY KNOWLES EXT: 223-2236
BERNIE LACROUTE LOC/MAIL STOP: ML12-
1/A51

SUBJECT: GETTING A SUVAX AS A COMPETITIVE PRODUCT IN OUR
LIFETIMES

(I'm going to be in TW early Friday morning and
would like to discuss this with Bill. Can you get this together?)

No one is doubting this need. No one has any faith that we can deliver... either funds or shear process delays. Now, it seems that Nat and Don are looking at the possibility of using a micro (say 68K) and having a simple blt
with interface. Several of these could be attached to a Unibus to give a more cost effective multiterminal personal interactive computer.

Bob Glorioso is also looking at the same device.

Stanford will license their connection to a multibus, called the SUN workstation.

Why can't we in the next month, decide on a structure
and then build this?

If we go this way, do we abandon Suvax with its great color, and alternative monitors, etc.?

Can you guys get together and get this running?

I think we want to make this part of the great Personal Computer
announcement in May. This would mean that we would have to have in running sometime by Jan. 1 and then be able to go into
a mode to deliver some time in the summer. This looks completely reasonable in the time frame, if we compare it with
what was done in Robin and what Avery is gearing up to do with
his new CRTs.

Bill,
Maybe you should get with Bob and work out how you guys can build
a highly tuned, pipelined design system so as to get work

like
this done in the 6-9 mos we are going to need in order to remain
in business. I trust we can now have your space in the mill.

Note, this is not an isolated example of our needs. We are dying because of our response time for options in communications,
and we are going to need several voice modules to build various
kinds of human interface ssytems. We do need this kind of design
system.

"TO" DISTRIBUTION:

GEORGE CHAMPINE   BILL DEMMER   BOB GLORIOSO
NAT PARKE

GB3.S2.29
****
* d i g i t a l *
****

TO: JIM MARSHALL   DATE: THU 30 APR 1981 8:13 EST
                                        FROM: GORDON BELL
cc: see "CC" DISTRIBUTION   DEPT: ENG STAFF
                                        EXT: 223-2236
                                        LOC/MAIL STOP: ML12-1/A51

SUBJECT: SUVAX DISPLAY AND ARPA DEMO

The display is really great.

The folks at ARPA, Stanford, and MIT were all clearly impressed and
want them. We have product uniqueness.

It feels like we must figure out how to make it a timely product.

GB:swh
GB2.S5.43

"CC" DISTRIBUTION:

GUS ASHTON BILL DEMMER SAM FULLER
JOHN GIUDICE ANDY KNOWLES BOB KUSIK
JOHN O'KEEFE

00 BURT DECGRAM ACCEPTED S 21556 O 433 05-NOV-81 12:16:59

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION

DATE: THU 5 NOV 1981 7:01 AM EST

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

cc: SAM FULLER
ANDY KNOWLES
BERNIE LACROUTE

SUBJECT: GETTING A SUVAX AS A COMPETITIVE PRODUCT IN OUR LIFETIMES

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"TO" DISTRIBUTION:

GEORGE CHAMPINE BILL DEMMER BOB
GLORIOSO
NAT PARKE

GB3.S2.29
****
* d i g i t a l *
****

TO: JIM MARSHALL DATE: THU 30 APR 1981
8:13 EST

FROM: GORDON BELL
cc: see "CC" DISTRIBUTION DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: SUVAX DISPLAY AND ARPA DEMO

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GB:swh
GB2.S5.43

"CC" DISTRIBUTION:

GUS ASHTON BILL DEMMER SAM FULLER
JOHN GIUDICE ANDY KNOWLES BOB KUSIK
JOHN O'KEEFE
****
* d i g i t a l *
****

TO: WAYNE ROSING DATE: FRI 6 JUN 1980

8:19 PM EDT

FROM: GORDON BELL
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: RE: SUVAX FOR UNIVERSITIES

Hold everything before you talk commits here. I thing we want
to get this checked out in the pl domain too. Somehow I want
to stimulate demand for better products and to get us some
ideas. I don't want to put out a product spec that others will
immediately jump to and leave us in the lurch... a possible
problem here. Am not sure about how to proceed, but want to
talk with others first.

GB1.S5.3
00 BURT DECGRAM ACCEPTED S 4969 O 88 08-NOV-81 15:57:58
****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION
DATE: SUN 8 NOV 1981
3:40 PM EST

FROM: GORDON BELL
cc: ANDY KNOWLES
KEN OLSEN
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: INTERIM SUVAX (IN MY LIFETIME) FOR THE GREAT MAY
ANNOUNCEMENT

Am delighted to see that we are proceeding quickly. My other
candidate is to license the SUN workstation and connect it to
a Unibus (versus the Qbus). Can we look at this?

The big reason is that there has to be software and if we

wait
there will not be software for another couple of years!!!!
Rather than designing our own graphics architecture, can we take the CMU or Stanford architecture in its entirety? (I have
absolutely no faith in our ability to do terminals architecture
given what we have done in the alphanumeric area and with Gigi
and the vt 125. You all know that you have this mess to fix first.)

The goal of interim suvax is to have it part of the BIG
May announcement of Personal computers where we do:
CT, new 278, new cp/m, vt200 new, and interim suvax.

We must put these very HARD CONSTRAINTS ON THE INTERIM SUVAX DESIGN:
IT MUST FIT ON 1 HEX BOARD, IT MUST USE THE SAME HIGH REOLUTION
SCOPE AS WE ARE USING ON THE NEXT 200 (NOT THE ULTIMATE SUVAX
RESOLUTION... BUT THE ONE THAT STAR USES), AND MUST NOT
TAKE OVER SAY 150 IC's! IT MUST BE DEMONSTRATABLE AT
NCC IN MAY!

"TO" DISTRIBUTION:

BILL AVERY	GEORGE CHAMPINE	BILL DEMMER
SAM FULLER	BOB GLORIOSO	

GB3.S2.34
****
* d i g i t a l *
****

TO: BILL DEMMER DATE: MON 28 JUL 1980 9:56 AM EDT

FROM: GORDON BELL
cc: see "CC" DISTRIBUTION DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: SUVAX ORGANIZATIONAL REQUEST (SEE BELOW)

SUBJECT: SUVAX ORGANIZATIONAL REQUEST, NOMENCLATURE AND TARGET SCHEDULES

I've asked Bill Demmer to suggest a program or project manager who would co-ordinate SUVAX among the various groups so that we can move more rapidly to a product. This would include product definition and organization role definitions. There might even become a single, focussed line organization.

I can't identify what our target date for SUVAX is. To some, SUVAX is only viable in 1985 when we have the Scorpio Chip Set, a high resolution scope, and a disk capable of being stuffed in a tube. I think this is crazy...the market will have passed us! It's important to get to market much earlier in order to understand it, so that we can target the appropriate product in the mid-80's. Also, I do not even want to wait for the ideal packaging.

Note, we have the following component schedules: Nebula (2RL) Q182, COMET Q481, Nebula (Aztec) (Q2-Q4)83; the VT125 (Q481 - protos Q281) and the high resolution scope (Q2-Q382); interface to the Canon printer?; and SUVAX chips FY8X?

This could yield these target systems and dates:

Name	Hardware	Software	When

SUVAX Breadboard COMET + Breadboard HR Scope Handlers
Q481
VT125/RL/SUVAX   Nebula/RL + VT125   Handlers
Q182
SUVAX RL   Nebula/RL + HR Scope   Handlers
Q382
SUVAX   Nebula/Aztec + HR Scope   Generic
Q2-Q483
Graphs
SUVAX IN   Terminal-based SUVAX   Lots
85?
A TERMINAL

What youse think?

GB:swh
GB1.S5.63

"CC" DISTRIBUTION:

BARBARA CHAPIN   BERNIE LACROUTE   LARRY SAMBERG
NAT PARKE   PETE HURLEY   LARRY PORTNER
RICK PEEBLES   WAYNE ROSING

****
* d i g i t a l *
****

TO: BILL DEMMER   DATE: SAT 16 AUG 1980 11:59 AM EDT
FROM: GORDON BELL
cc: LARRY PORTNER   DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: RE: THE SUVAX PROGRAM MANAGER ROLE

I hope you got my answer.

Hire him for this! He could really be good in the OA role, but Stewart is going to do this and I don't see how to change that decision. Also, the OA role is strewn with landmines, aligators, and a swamp that we built.

I think the SUVAX charter is clear and I will fight to get it a project where the resources are under his direct control, versus a program that has to somehow influence all the projects
that are seperately funded and have different goals. Notice that the project doesn't have to have the direct management, but it does have to have the control of the budget and the project. (I.e. I assume that the Marlboro folks builds what Harry says, even though they will be managed by Snyder. This is a subcontractor role for them.)

Getting through this won't be trivial, but then again I don't see it as being the hassle of Hydra where there was a real push on the main direction of VMS.

Larry and I will help like crazy.

Now let's get him and get the product versus the 11/23 workstation. (How is the thinking coming on this?
How close can we come in price vs the 23?)

Let's go. We need a great innovative high end personal computer.

GB1.S6.16

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* d i g i t a l *
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TO: KEN OLSEN
10:05 PM EST

DATE: FRI 9 JAN 1981

FROM: GORDON BELL
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-

1/A51

SUBJECT: SUVAX: WHAT DO I TELL THIS TROOP OUT WITH THE TINCUP?

Here's a really significant product. Meanwhile, LDP is making
a full page terminal after their abortive VT105; Graphics Arts is
building another CRT for us to persist in a market where we have
been, are, and are headed to be above all ... LOSERS, the
terminals product line is making a VT134 tht is guaranteed to be
a loser!

Behavior follows directly from your speech #1:
We have ultimate protection of a bunch of losing product line
based products which are supported by the products that I
am responsible for and you consistantly deride me for... and
occasionally get me into a feeling that I must for some idiotic
reason, defend. This, like right now, does occasionally bother
me. Mostly, it's tragic though, because it probably would
be worthwhile to really not bring all these abortions into the
world, even though they are supported by your bill of rights in
speech #1. (As an aside, that's why we are here panicing after
persisting too long with the 278, and trying to sell the PDT.)

Fortunately, Nat didn't ask me why we can't fund SUVAX while
continuing to build the toy hobby stuff. Hopefully, I can
get someone to put money in the cup. The secret weapon I have
is that I know that there will be a bunch of competitors there
who's get the product lines to panic... and then fund.

Hopefully, it won't be too late because the designers will have
left in frustration in having a good design that is overshadowed
by one of these abortions designed by midgets for midgets.

Why don't you spend a few minutes talking to the Suvax design team. We really do need them! If you don't have the time, then just tell me what the party line is and I'll talk with them.

ATTACHED: MEMO;14

****
* d i g i t a l *
****

TO: NAT PARKE DATE: FRI 9 JAN 1981
FROM: GORDON BELL
cc: BILL KOTEF @MESG DEPT: OOD
JIM MARSHALL EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: RE: DG AQUISITION OF MEGATEK

GB2.S1.35
****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION DATE: SAT 10 OCT 1981 18:23 EST
FROM: GORDON BELL
cc: BILL JOHNSON DEPT: ENG STAFF
LARRY PORTNER EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: MEETING ON THE SUVAX TERMINALS STATUS

I just heard from the software developers that we are going to be another year or so in getting the suvax terminals.

What's the story?

There is a general misunderstanding about advanced development:
it apparently is not done with rigid schedules and doneness criteria. In this case, I can't really find the commitments written down in a hard and fast way. Now, I find out that Jim Marshall is no longer involved... which means he is off the hook? No way do I want to see this happen. George should be able to subcontract here, so that Jim is able to fulfil
his commitments to the Corporation.

I would like to meet with you this week, perhaps on Wed en route to MK where I have an OC woods and discuss what is happening
here.

My understanding (which I will get into if necessary by looking up the commits) is that the 20 were to be delivered about
6 months ago. We can not continue to survive given our cavilier
attitude about getting work done in a professional way.

At the meeting, I'd like to just get the written situation about
what our promises have been and where we are on them. This is
simply the witch hunt data... nothing else. I don't want to go over this at the meeting or flog the people.

At the meeting, I want to get the poop on how we are going to get the terminals done? and when, on as near the original schedule as possible?

We may be able to avoid a meeting by getting this information transferred via EMS. This would seem like a good starting point. How about getting it by Monday evening?

"TO" DISTRIBUTION:

GEORGE CHAMPINE BILL DEMMER JIM
MARSHALL

GB3.S1.29

00 BURT DECGRAM ACCEPTED S 10115 O 795 02-DEC-81
23:30:57
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* d i g i t a l *
****

TO: see "TO" DISTRIBUTION DATE: WED 2 DEC 1981
9:54 PM EST

FROM: GORDON BELL
cc: see "CC" DISTRIBUTION DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: SUVAX STATUS AS OF 3:45PM 12/2/81

George is going flat out to build two, high resolution compatible displays for May announcement:

1. 2.2K b/w make based on the Research Group Zebra. Zebra is being produced as a breadboard on a subcontract basis to George.
Zebra is ahead of its schedule for 1/31/81 and is being wirewrapped now. This display will be capable of being used alternatively as color. By replicating two boards, it can be used
with higher resolution color.

2. 6K b/w or color buyout. George and ESG will make a recommendation asap! We will do NO development work, but will
get the supplier to make the necessary microcode changes to meet the SUVAX architecture.

The two displays will be implemented with some kind of
microprocesor
which will be invisible to the VAX user and NO user program
will
reside in the display processor option. The resolution is
roughly 1K by 1K pixels for both displays. Both are
architecturally compatible.

In addition, George's group will reside in MR near ESG in a
space of about 20K sq ft that Landlord Andy will provide.

George MUST have an experienced engineering manager that has
put a product into production right now! In addition, George
will look at desireablity of completing current SUVAX
breadboards.

The Software group will be strengthened and operated only as
a site team at MR, and not as embedded in the 10/20 group.

We must get the necessary software support system for
whatever
microprocessors are in the various displays.

"TO" DISTRIBUTION:

GEORGE CHAMPINE   ANDY KNOWLES   PETER SMITH

"CC" DISTRIBUTION:

BILL DEMMER   BOB GLORIOSO   BILL
JOHNSON
KEN OLSEN

GB3.S2.46

****
* d i g i t a l *
****

TO: BILL DEMMER   DATE: TUE 10 FEB 1981
23:31 EST

SI LYLE FROM: GORDON BELL
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: ANDY'S SUGGESTION ON AN ALTERNATIVE STRATEGY

Just for the record, what is the cost to do: suvax, ct 25 and ct100?

I really want to push to get Denny looking at Suvax as a place to get it out. We really need to get these out to our customers. (Arpa still rumours to pay 54k per 40 machines.

ATTACHED: MEMO;22

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* d i g i t a l *
****

TO: GORDON BELL
DATE: TUE 10 FEB 1981 9:20 EST

FROM: ANDY KNOWLES
cc: BOB KUSIK
DEPT: TECHNICAL GROUP ADMIN
LARRY PORTNER
EXT: 231-6312
LOC/MAIL STOP: MR1-1/A65

SUBJECT: MISSING THE BOAT WITH SUVAX

I'd like to know what marketing has to do with not funding SUVAX and CT25? It is your department, budget and responsibility.
You have been told by KO not to listen to marketing. And we, Technical Group, have asked for a two tier Personal Computer strategy, high and low, SUVAX and CT25 instead of CT100.

Who in marketing is driving you and your product strategy. Certainly not us.

GB2.S4.23
00 BURT DECGRAM ACCEPTED S 13243 O 01 29-JUN-80 00:21:56

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* d i g i t a l *
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TO: see "TO" DISTRIBUTION   DATE: SUN 29 JUN 1980
12:17 AM EDT

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION   DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: SUVAXES: WHO ARE WE GOING TO WORK WITH?

Dick Eckhouse is going to send around a proposal by Andy Van Dam of Brown who wants to work with a manufacturer to get a system like the one that's being contemplated at CMU, MIT, Berkley, U of Washington ... and potentially in every other CS Department once the word is properly spread.

We are going to visit MIT to hear what they are doing as the guest of Dertouzous.

My question is why wouldn't it be significantly better to work with either Brown or MIT instead of Berkley or Washington, given the proximity?

Brown would be especially good given their size. MIT is closest.
Before we go any further, it would seem to make sense to weigh some of these other alternatives.   Also, what do we hope to gain by getting these machines out at all?

It is important that we all remember that the primary goal of a research department is the discovery and dissemination of knowledge. No matter what they say, or what they sign, the information will be broadcast (they are not malicious). They win points among colleagues by transmitting information. This has to be a consideration in what we are going to do...already I think we should see some of the effects.

"TO" DISTRIBUTION:

GLORIOSO AND PEEBLES   BOB GLORIOSO   HURLEY VIA FAGERQUIST
WAYNE ROSING   SAMBERG VIA FAGERQUIST

"CC" DISTRIBUTION:

BILL DEMMER   DICK ECKHOUSE   ULF FAGERQUIST
ANDY KNOWLES   JOE MEANY   PETER SMITH

GB1.S5.38
00 BURT DECGRAM ACCEPTED S 17368 O 50 21-FEB-81 13:46:25

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* d i g i t a l *
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TO: BOB KUSIK   DATE: SAT 21 FEB 1981 13:45 EST

FROM: GORDON BELL
cc: see "CC" DISTRIBUTION   DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: RE: FINDING $ FOR SUVAX

There was some money assigned to it for program management, plus there are two software groups and a kitty for Cutler if we can entice him to do it. Just as soon as we get the machines, I want to start selling him!

Andy and I are pushing about as hard as we can to get the business with ARPA and to get going. I believe we have the bucks that can do it, although I'm sure we could spend more. Right now, we have to be careful about the overall timing so we don't blow the quality and blow big bucks cause we aren't ready. We could sell these like crazy to academe and to ESG if we had them, but I don't know what the shape of the program is overall.

We can't give any iron clad guarantees, but it is the right macchine on which to start planning for what is Andy's Technical Dream Machine that has Scorpio, high resolution graphics, and hopefully a good sized disk all in the form factor of the CT.

Overall, it's pretty high up in my wish list.

"CC" DISTRIBUTION:

BILL DEMMER SAM FULLER ANDY KNOWLES
PETER SMITH

GB2.S4.31

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* d i g i t a l *
****

TO: ANDY KNOWLES DATE: TUE 10 FEB 1981 23:28 EST

FROM: GORDON BELL
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: RE: MISSING THE BOAT WITH SUVAX

Somehow, I don't see how we have the money to do two, if we are tight on just the one now. I'll look at the funding again. Somehow, though, I don't see NOT doing CT, as all the interesting applications seem to take a little more storage and i/o and I have trouble seeing it done on a CT25.

(Would you help Pete Smith and I talk Denny Doyle into doing it in Canada and getting some research funding there?

ARPA says they will pay 54K for 40 of them within the next year. I really want this order like crazy, cause it does all the critical work for the personal vax based on scorpio. Can we do something to do this?

GB2.S4.22

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* d i g i t a l *
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TO: ANDY KNOWLES DATE: TUE 10 FEB 1981
23:20 EST

FROM: GORDON BELL
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: RE: RE: PETER JANSEN & ECS

Sorry,

I'm just pissed at all of us for not getting the low end products. The iterrible irony of it is that I was finally just
too tired to take this one on. We did spend tons of money doing
lots of low end terminals and personal computers: VT55, 105, 103, PDT, gigi, VT's for typesetting, LA's for special customers
with attached mass storage, vt 78 and 278, and no where did we
address doing it right by getting the 11 done.

I would love to do the CT25! It would really be ideal if we want to go into the market with guns blazing. I don't see that we have the money unless we go after a few of the flaky terminal projects.

(Note in the top list, none of them were centrally funded... we were too busy doing the rack and stack that turned out to be too general and too expensive and too big, although at least we made a pile of money with .) MINC seems to be the only exception in the morass of mediocre terminals.

On the 10/20, I think the issue is more the issue of mainframes
in a university. Frankly, I think a number have already said: "We've bought our last mainframe"... we are going to install departmental minis (ala 780) and we are going to{ get incremental student capacity via PC's... look at the incredible difference in cost per terminal of an Apple II vs a large 20... (According to the J/F 81 10/20 Buyline, our best cost is about 8K sans terminal, and for say 9K, you get 3 Apples, with the ability to get more out of the existing system.) Ususally the unis signal a trend, and I think we may be looking at one here! Anyway to tell for sure?

GB2.S4.21
00 BURT DECGRAM ACCEPTED S 10734 O 16 14-FEB-81 14:24:16

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* d i g i t a l *
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TO: see "TO" DISTRIBUTION DATE: SAT 14 FEB 1981 14:18 EST

FROM: GORDON BELL

cc: DENNY DOYLE

DEPT: ENG STAFF

EXT: 223-2236

LOC/MAIL STOP: ML12-1/A51

SUBJECT: SUVAX: WE GOT THE COMPTETITION (PULL), NOW THE

PROUDCT (PUSH)!

I think we'll get the pull now. What concerns me is that engineering isn't driving hard enough to get the product done and have considering it too much as an Advanced Development project with no one wanting it. Now we have the boggie, let's
makee it happen! (I trust that this also falls in Mary's area of responsibility.)
Ed Feigenbaum said it looks like we are about 1 year behind 3 rivers, and it sounds like we are 1 year behind Apollo. Ed wants us to talk with Sclumberger, who he consults with cause they are looking at 3 Rivers, and all would give their eye teeth for Vax instead. If we aren't careful, the world is going to get started this other way, and we'll have the pain fo having to woo them back.

Andy is clearly driving to get the product out and sold at Arpa and we are solidly with him. Hopefully, Denny will take on a key role which Andy and us will work with him to define.

Tell me that the schedule's fine and we're on target!

"TO" DISTRIBUTION:

BILL DEMMER	ANDY KNOWLES	BERNIE LACROUTE
JIM MARSHALL	JOE MEANY	NAT PARKE
JOEL SCHWARTZ	PETER SMITH	HARVEY WEISS

ATTACHED: MEMO;36

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* d i g i t a l *
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TO: GORDON BELL DATE: THU 12 FEB 1981 15:55 EST

FROM: PER HJERPPE
DEPT: CORP PROD MGMT
EXT: 223-6707
LOC/MAIL STOP: ML12-1/T39

SUBJECT: SUVAX

PH/RL0:7.34

Yesterday, one of my old customers from the Computer Science Department at a Swedish University tried to call me. I called
him back and the reason he was calling was that he wanted to find out if we were doing anything in the personal computer domain. They had been looking at APOLLO which they found very
interesting. He said that several universities in UK have ordered or are ordering APOLLO systems. He also said that APOLLO will be opening an office in UK in March. He told me that he would prefer to stay with a DEC solution as that would
be easier for them to integrate into their network, as they already have three 10/20's, as well as several 11's and VAX's.

Unfortunately, I was not able to give him any information at this point
in time. However, I feel it is becoming more and more important to
make sure that we get SUVAX to the market ASAP.

Per

/sa

GB2.S4.27

LP1/S1/16EMS

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INTEROFFICE MEMORANDUM

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SUBJECT: DESIGN OF AN INTERCONNECT SOFTWARE ARCHITECTURE

TO: Bill Strecker TW/A08 **DATE:** December 20, 1979
Tony Lauck ML5-5/E97 **FROM:** G.Bell/L.Portner
Dick Hustvedt TW/D08 **DEPT:** Central Engineering
Cc: Bill Demmer TW/D18 **LOC.:** ML12-1/T32
EXT.: 3-2236/3-82471
Bill Johnson ML12-3/A62
George Plowman ML5-5/E97

Digital clearly needs an Interconnect Software Architecture for its next generation of systems. It is also clear from recent reviews of key programs such as Interconnect, HYDRA, Venus, and the new I/O subsystems that we do not have a consistent, stable, complete approach to an interconnect architecture as yet.

We need to resolve when to use intrasystem, and when to use intersystem communication mechanisms; and in general, what model(s) of communication will be used across the range of distributed systems used by our customers in DEC's future systems.

This is too central a problem to remain unresolved and consequently we are asking the three of you to accept the task of defining the structure of DEC's interconnect architecture. Sam Fuller will devote whatever time is necessary to provide the support, planning, resources, etc.; and ensure the Interconnect Architecture is reviewed and supported by the necessary development groups.

This is a difficult assignment and we won't propose any arbitrary deadlines or schedules, but there is certainly an urgent need to get the Interconnect Architecture resolved.

As an initial task, Sam Fuller will be working with you to establish a realistic schedule and approach for the design effort.

GB1.S1.40
Had an hour discussion with Jolitz on Saturday afternoon. He was confused about the possible scenarios we put forth, but is anxious to have us be an investor, mentor and help market the product.

His still wants and perhaps needs our blessing to make a deal with a first tier VC which he says will come in if we invest. He says its ready to go when we are.

WHAT HAVE THEY ACCOMPLISHED?

. May 1 opened an office
. Aug 1 got $5K
. Aug 26 GOT $150K (TECH. FUND INC, CHARLIE COKASH)

. Sept proto running (1 month)
. Nov software running (3 months)
. Dec demos to VC and potential customers (4 months)

They have gotten a great deal further on essentially no money by favors and by getting people who might join them to moonlight.

NATIONAL PART
They have access to a number of National people to hire; also people who have gone elsewhere (eg SUN) would come to them on a startup. They have access to National workers (eg. Vakavelli?) for understanding the National part idosyncrascies that appear to continue to go on forever! This interface to a sub-culture around the National part, inlcluding people from Greenhills (Steve, please check this out) could be invaluable.

THE MODULES
Their first products are made of the following modules:

. Processor, 4 serial i/o, connection to front panel, centronics port and 32 parallel i/o lines

.Memory with parity of 512K using 64K chips or 2M using 256K chips. By using surface mount (there are several vendors in the valley) one gets double the density. He says there are 3 vendors including TI for surface mount 64K chips. While I agreed that this is clearly the wave of the future, it scared us. He understands that UNIX works with 1 Mbyte.

. Disk, floppy, DMA controllers and interface to IBM PC bus

.4 Port memory for forming clusters of computers. This uses the TI memory. This permits a tightly connected cluster to be built using shared memory for message passing. In effect, he quoted CMUs Cm* computer as the model for this. This is also like the DDE product.

. Processor, but with a slightly modified interface to the shared memory.

. Small, clean table top box which has 4 3 x 6 x 9 cavities and power supply. Note that a floppy or wini are this size. This also allows a card assembly of 6 x 9 x 5 cards. The cards are put together with stacking crimp-on pins forming what amounts to a bus of approximately 50 wires of a normal microprocessor bus.

The modules use what amounts to a PC Board bus that is kept short by not being a bus. It transfers 4 Mbytes per second, which allows a National 16K to run at 10 MHz without any wait states. They are doing a reduction on the number of ICs, including the use of PALs and the PC bus interface design. This interface is not in the IC count of 170 (for .5 Mbyte).

THE PRODUCTS

From the modules, one can build:

. ordinary multi-user system

.server oriented computer with shared memory at the hub and interconnected computers for serving the various users. They are thinking about driving the new low cost laser printers.

. fully distributed network using Ethernet. This is done by using a PC card for the Ethernet interface. Berkeley 4.2 supports this form of networking.

They would like to extend the product offering using the following module types:

. a personal ws using a high resolution tube interface

. a large system using the 32032, enabling a larger system. This would be built from larger cards, and fit in a backplane. They know that all their old modules have to work with this. He said they did and could.

. a portable computer using the CMOS 16K part. This would also use the modules.

In short, I was quite impressed that their thinking did support the low end of the products that he described.

OTHER PRODUCTS

He also said they were interested in building a symmetrical multiprocessor, but this was a dream. He said we would have trouble with the 32032 used as an mP because the chip does too much looking ahead for instructions without being smart about stopping the flow if branch instructions are encoutered. I will get with National on this because if true, really does impact performance including fouling up the cache.

The ECL processor is a dream of Mr. Billings who has built special purpose ECL machines. They also have other people thinking about this dream who would come to work for them.

THE FOLKS

I ask why they thought 30 people could do so much. He said he thought they could ship 1000 systems assuming that all work is subcontracted off shore to both module and FAT house. This is still far fetched with 300K per person.

The notion of clusters of 30 people for tasks is probably quite reasonable. We took it to mean 30 people who did the whole job. He said that wasn't their intent at all.

The plan. He said they need help with it based on how its sold. His glib answer is OEMs.

BOTTOM LINE

They are one of the more inarticulate groups that we may meet.

I should have coached them in their presentation because:

- they didn't listen
- they were too philosophical. Philosophy is boring, but incredibly boring by a 27 year old.
- the product range was too grandiose. This was especially boring to me as a grand product dreamer.
- they walked into what is fundamentally a market driven shop and laid out a plan that was nigh on impossssible. They didn't ask for help.
- they didn't simply play their strength of a simple working product that does have an impressive ability to be expanded and contracted. That is:
  - they built a very impressive product in a very short time
  - they do have a product vision around a few modules that could be the basis of a very good company
  - a set of competent people and access to others

I think they are fast learners!
KEN

We need you at the meeting / dinner with Sys. Dev. Foundation/SDF on Sunday March 13. SDF IS GIVING AWAY THE $100M THAT BURROUGHS PAID FOR SDC.

The minimum we might get is 50K/year (for a historian).
The maximum we would like is a major building.

The guest list, the SDF Director + Board would like are:

- You
- Everett
- General Doriot
- J. Forrester
- G. Bells

Acceptable Others:

Charlie Bachman (will come + I want to hire him)
Pat McGovern, head of IDC/Computer World
Oliver Selfridge
Ed Schwartz

GB4.S1.25

GB0002/44

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Subject: **SYSTEM INTERCONNECT AND TEWKSBURY CHARTER**

To: Bill Demmer, TW/D19
Tewksbury Engineering Managers
OOD
Ken Olsen, ML10-2/A50

Date: May 2, 1979
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

In keeping with our Corporate Product Strategy and it's emphasis on distributing processing, we are redefining the development charter at Tewksbury to include a strong engineering focus on the entire system interconnect area. That is, focus is on links, not just nodes.

This general direction is described in the recent Bill Johnson Interconnect Task Force Report. To this end, in addition to the Mid-range Systems Development responsibility I am asking Bill Demmer to accept responsibility for the Interconnect Architecture and Systems Structure. He will provide the leadership and control processes within Digital for these functions. These include the definition of individual hardware linking mechanisms as well as the total networking system structure and topology.

Specific implementation activity should occur wherever it is appropriate. However, many of the new initial implementations will be driven by one of the Tewksbury development programs. Tight communication and control links should be set up with each system component implementation function to insure that our complete Corporate Product Strategy is implemented in a timely and highly focussed fashion. I would expect to see the Tewksbury organization positioned to support this endeavor by the end of the fiscal year.

GB:swh
00 BURT DECGRAM ACCEPTED S 5281 O 04 16-AUG-80 11:39:01

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* d i g i t a l *
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TO: BRIAN FITZGERALD DATE: SAT 16 AUG 1980
11:33 AM EDT
FROM: GORDON BELL
cc: see "CC" DISTRIBUTION DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: RE SYSTEMS AND CCEG ENG CHARTERS

Congratulations to you, Herb and Brian. It sounds like you are on the right track in making clear charters that will get us a minimum number of systems that are field integratable. Although it sounds great, I have been sceptical and look forward to this output.

Please work to get the charter of commercial hardware engineering to be aligned with the direction that Jack Smith has set to eliminate FAT and to have our systems built at the various point of manufacture and field integrated.

I want to make it clear that Shanzer (Low End Systems) and Croxon (mid rang Systems) are not CPU groups, although there are people in these groups that do design the Processor and Primary Memory structures and how other components connect to them (What I call a PMK... for processor-primary memory-controller for disks, comm, printers, etc.). These folks have the word systems in their group names and I hold them responsible for ALL the systems aspects of a customer configuration up until the point that a customer adds on foreign vendor equipment or that CSS has taken over this responsiblity when they build a system with special

equipment.
Here, if it is a CSS option that has been certified, I still hold the system groups responsible for the integrity of the system. Similarly, I want them to take the responsibility for special options that a specific Product Line builds and adds somehow (it is this area you folks might work on clarifying).

Here's the dilema: you could create the need for continued special, low volume products that require FAT, customization plants. Jack Smith, I and the various systems groups are trying
very hard to eliminate the various FAT plants and to build systems in various category types as follows:

I Hand held
II Terminal based (a single entity)
III Desk based (a set of components in individual boxes that connect together (terminal, printer, disk cabinet housing the computer) Includes the 78, minc, 315, old 310, and newer stuff that'll be in a 14" filing width cabinet under the desk and holding disk and computer (like your 315).
IV System in a cabinet(s) like 23RL, WPS200, ... 44, Nebula.
V. Systems built from a collection of field mergeable units: terminals, disks in a cabinet (RK07, RM's, R80, RP's... not

RL01 because it is integrated in IV.), plus a seperate cabinet
that is built in a volume PMK (processor-primary memory - all the controllers for comm., printer, disks).
VI Systems that are built from a set of usually type V systems
and interconnected via CI

I and II are from single volume plants
III the individual components would all be merged either at the warehouse of one of the component lines, or field merge th whole thing.
IV. Generally move away from these. Several possibilities: FAT sites (don't believe in), volume build the PMK part and field or warehouse merge with the disks that have been stuck in a cabinet in Colorado. The RL01 cabinet effort has been

aimed at cleaning this us. Here the target to clean up:
23RL, 24 RL, Nebula (make it right from the start), 44RL.
V Should be no problem as every component is field merged.
Build
PMK cabinet in volume and have no interplant transsshipments.
VI. We have to direct appropriately.

What I fear:
We don't yet have or are directed toward this clean
segmentation.
Systems mutate... options get added and there are a large,
no.
such that a volume plant can't be a point of manufacture.
Here
is what I worry about in your charter cause you work too
closely
with Salem. I'm trying to eliminate the FAT in Salem and I
view
your specials will necessitate them.

We have to change our way of living:
I believe our inventories are at least 2 x what they should
be
due to having sperate stocks and no good trading mechanism,
having too many products by continuing everything back to
05's
and pdp-8's, and mostly because we have FAT plants that give
us an extra pipeline stage, interplant transsshipment time,
more
stockrooms, and high costs by pulling previously tested parts
like the RL out of boxes and breaking them or breaking disks
by having so much handling.

The Japanese are coming! (No way can they build and ship
like we
do... we are one full inventory turn/year too high and a
factor
of 2 too high inventory last year this required an EXTRA
$300M
in working capital!)

Please join Jack Smith, who has agreed to eliminate the FAT

and
I. Do not make this proliferation continue or this low volume
customization necessary!

It sounds like you folks are on right track. As soon as you get it clear, let's get the same clarity with your counterparts
in manufacturing.

Keep up the good work.
g

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GRANT SAVIERS	HERB SHANZER	JACK SMITH
PETER VAN ROEKENS		

GB1.S6.15

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+---------------------------+
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SUBJ: **Systems 1970-1990**

TO: Jack Smith, ML1-4/A54
Date: 2/26/80 Tue
From: Gordon Bell
CC: Dick Clayton, ML12-2/E71
Dept: OOD
Bill Demmer, TW/D19
MS: ML12-1/A51   Ext: 223-2236
Ulf Fagerquist, MR1-2/E78
EMS: @CORE
Sam Fuller, ML3-5/H33
John Holman, ML12-2/T36
Dave Knoll, ML1-4/P14
Dennis O'Connor, ML1-4/P14

Larry Portner, ML12-1/T32
Dave Rodgers, TW/C04
Grant Saviers, ML3-6/E94
Will Thompson, ML1-5/E29
Dave Thorpe, ML1-4/P11

Here's a cut at the systems between now and 90. Note - we're going to have more than ever before! It doesn't include: the interconnect or Type II and III* systems - but only rack/stack, and free standing. Also it doesn't deal with the standalone high end communications (Mercury) and Mass Storage (HSC50) computers; i.e. Hydra isn't counted as a separate system even though they'll be built this way.

The interconnect structure is going to have some effect:

1. The BI, new backplane, interconnect is basically just a UNIBUS replacement, but will help in being less unbounded and easier to test.

2. The CI, Computer Interconnect, is really just a very high speed DECnet link - but may require testing as a large, Type VI. Large systems, will be built as combinations of Type V, PMK Kernel components (2080, Venus, 780, COMET) AND the HSC50 Computer for Mass Store with associated disks and tapes AND communications controllers (Mercury).

3. The NI is a high speed DECnet link. It will affect systems by:

   a. Eliminating communication controller in systems thereby easing the pain of configuring you go through now. However, this will pop out somewhere else as it is necessary to interconnect to non-DEC systems and non-DEC links (current communication) by some standalone box.

b. Allowing simpler cabling in a hi fi like approach for systems of Types III and possibly Type IV.

*System Types are:

I
Hand held
II
Terminal held (PDT 110, VT103)
IIIa
Table top, bench top, (inst. case), floor stand (PDT-150)
IIIb
Desk (now 19" mtg, possible going to file drawer width

standard of 14+"
IIIc
Cart (MINC)
IV
1 or more connected cabs with internal mtg. of disks (11/23T with RX, 11/44 RL)
V
1 or more connected cabs for PMK Base (Processor-main Memory-Controller for comm, disks, options) with free standing Mass Storage Components.
VI
Multicomputer systems (Hydra)

GB:swh
GB1.S2.17
Attachment

<u>NAUTILUS</u>

Footprint of a Nautilus CPU kernal is :

1. CPU Cabinet 30" x 46.5"
This includes space for Dual CPU, full memory complement and
12 BI option slots.

2. PC 350 23" x 20" placed as a desktop unit.

It's somewhat smaller as a pedestal system.

SCORPIO

2' wide x 2' deep x 28" high *

* This is an AZTEC pedestal system.

KL10

11'3" long x 2'6" wide

VENUS

CPU + memory + minimum i/o: 4' wide x 2'6" depth x 6" high

Console to the right: 2'4" wide x 2'6" depth x 6" high

Minimum Venus Configuration
with all skins: 6'4" wide x 2'6" depth x 6" high

JUPITER

120" long 26 sq. ft.

780

21.5 sq. ft. not including service area

(service area = 39.5 sq. ft. additional)

****
* d i g i t a l *
****

TO: JOHN F SMITH @CLEM   DATE: THU 21 FEB 1980 12:26 PM EST

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION

DEPT: OOD

EXT: 223-2236

LOC/MAIL STOP: ML12-1 A51

SUBJECT: CATEGORIES OF SYS. TYPES (>1 PAGE)

SUBJECT: Categories of Systems Types by Housing (and Potential Build Process) and System Assembly Process Alternatives

System Types (By Housing)

At our next meeting, let's lie on the fact that we have to "type" the systems by category and work on them in a segmented way.

Currently everything is a single glob, and very hard to work with.

Type	Housing type	Examples
I	Hand held	translator, memo writers, calculators
II	Terminal	VT103, VT138, PDT 110, LA124
IIIa	Table top, bench top or floor standing	PDT150
IIIb	Desk	VT78, VT278
IIIc	Cart	MINC
IV	1 or more connected Cabs (not broken apart)	11V03, 11T23, 11/44 RL
V	Type IV, but with free-standing peripherals	11/44 with RK, RM, RP;

11/780, KL,
20's
VI Multicomputer in room housing combinations of type V

Types III-IV include free standing terminals in addition to any
Processor-Memory-K Controller Basic Component.

There are many issues based on type, for example:

We have a problem with type IV systems from a logistic viewpoint with
respect to the disks. All the systems have a problem when we deal
with the vast array of communication controllers and cables. We have
to decide how the various internal controllers for disks especially
and memory are spec'd and added. How the cables are distributed.
Etc.

How's this for the system types?

Manufacturing Process

We need a similar set of definitions for the manufacturing processes.
Are there anymore of them:

Two Stage, FAT Based

1. Conventional FA & T. (Call it FAT) - stationary build and test.

2. Also called S.I & T. (Call it SIT)

3. CSI for a small + medium systems which moves product on an auto line or a build to order basis.

4. MSI?

5. Cold Staging?

6. Dock Merge?

All these currently now run at least one disk and none are true dock merge!

Direct Volume Ship, No FAT Plant

7. Site Merge by Field Service.

8. Site Merge by customer.

I don't feel there are good definitions of these processes. Can we get them?

GB:swh
GB1.S2.7

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GRANT SAVIERS — JOHN HOLMAN — BILL DEMMER
DAVE KNOLL @CLEM — DAVE THORPE @CLEM — DENNIS O'CONNOR @CLEM
WILL THOMPSON @CLEM

Digital **Interoffice Memo**

Subject: **T-11 Product Applications (memo direction)**

To: Roy Moffa
CC: T-11 Active/Interest Group

Date: 10 NOV 76
From: Gordon Bell
Dept: OOD

Loc.: ML12-1 Ext.: 2236

I'm concerned that T-11 will focus on a one chip cpu to the exclusion of:

0. A policy to help all our users and marketers now.

1. Eleven or 8 i/o chips (including using the really nice, recent 8080 peripheral computers (e.g., SDLC, Floppy, CRT).

2. The 8 chip...still the most competitive with 8080 **NOW**! (We appear to have a blind bias to 11 or even 8080...as evidenced T-11 group.)

3. A faster 8 chip.

4. Fonz 11 which is good enough to compete with the new 16-bit Intel computer (8086). Please see the attached concern.

5. Using current chips in low end.

Overall, our marketing of LSI-11 has been misguided. This looks like another classical product mistake in the process vis a vis knowing what we'll be versus competition in the future. Is it possible that we're responding to what we see in the marketplace that's old (i.e., the 8080), and that the newer competitive machines will be even better (e.g., 8080 with 8K bytes in the time frame you're planning)?

Hence the process is assumed designed to produce 2-3 year old products?
Overall, I heartily support T-11 (or preferrably T-S (Tiny Systems) and would like to come and interact with the group especially in helping us understand cost to implement an 8 vs 8080 vs 11 ISP. Please get the Woods Meeting too. Also note a T-11 in 80 time frame will have address problems (see

recent editorial in BYTE).

GB:ljp

Attachment

D I G I T A L INTEROFFICE MEMORANDUM

DIST: **T-11 Active Group**

Al Dziejma	ML5-3/E12	Ken Fine	ML5-3/E12
Bob Glorioso	ML3-4/E41	Martin Hall	PK1
Al Huefner	MR2-2/M67	Jim King	MR2-1/M64
Roy Moffa	MR2-1/M64	Rich Olsen	ML1-2/E65
Mike Titelbaum	ML1-2/E65	Rob VanNaarden	MR2-2/M65

T-11 Interest Group

Gordon Bell	ML12-1/A51	Chuck Bickhoff	MR2-2/M64
Ed Corell	ML1-3/E62	Bill Chalmers	MR2-2/M67
Duane Dickhut	ML1-2/E65	Bill Green	ML1-2/E61
Dan Hamel	ML5-4/P66	Andy Knowles	MR2-2/M52
Jack Mackeen	MR2-2/M65	Rick Perrin	ML1-2/E61
Bill Steul	MR2-2/F21	Steve Teicher	ML1-2/E65

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GB3.S6.19

Dr. Ding-Yuan Yang, Deputy Director
Electronics Research & Service Organization
Industrial Technology Research Institute
195-4, Sec. 4, Chung Hsing Rd.
Chu-Tung, Hsinchu, Taiwan 311, R.O.C.

Dr. Yu-huei Jea, Deputy Managing Director
Data Communications Institute
Ministry of Communications
National Taiwan University
42 Jen-1 Road, Sec 1
Taipei, Taiwan, R.O.C.

Professor Chung-Tao Chang
Dept. of Electronic Engineering
National Taiwan Institute of Technology
P.O.Box 90-101
Taipei, Taiwan, R.O.C.

Dr. Share-Young Lee
Professor & Chairman
Department of Information Engineering
National Taiwan University
Taipei, R.O.C.

Dr. Min-Wen Du
Professor & Director
Institute of Computer Engineering
National Chiao-Tung University
Hsinchu, Taiwan R.O.C.

July 20, 1982

Dr. Ding-Yuan Yang, Deputy Director
Electronics Research & Service Organization
Industrial Technology Research Institute
195-4, Sec. 4, Chung Hsing Rd.
Chu-Tung, Hsinchu, Taiwan 311, R.O.C.

Dear Dr. Yang:

It was a great pleasure to meet you during my recent visit to Taiwan. I was greatly impressed by the drive, intellectual capability and growth I saw in the Chinese Electronics and Computer areas. For many years I have admired and worked with Chinese engineers and finally it was great to see them in their own habitat. The engineers at Digital, Taiwan are really good.

The research work I saw was quite good and clearly the kind needed to make R. O. C. a leader. I was struck by an interesting research idea that I'd like to share with you: Why not install Local Area Networks at the major universities and research institutes and then interconnect these in a single network? This would provide two major benefits: it would let a variety of computing resources be widely available to a larger community, thereby letting more work get done; and it would let distributed processing work be done on an operational network.

It was also a pleasure to discuss the Computer Museum with you and present the vision of continuing to build an international, industry-wide museum for this most significant invention--the "computer. Enclosed is the first report and a museum layout which includes an invitation to become a member.

I would like to invite you to become either an institutional or personal founder to make this a significant international museum. You will note that the list of founders includes pioneers such as Gene Amdahl and Bob Noyce. Dr. An Wang is also a founding member.

The museum also needs artifacts and is dedicated to their preservation. The list is included in the report and grows rapidly.

I'd welcome being able to show you the growing museum whenever you visit this area.

Sincerely,

Gordon Bell
Vice President, Engineering
Curator, The Computer Museum

CC: Dr. Gwen Bell, Director, The Digital Computer Museum
     Dick Yen, Manager of Digital Manufacturing and Engineering

July 20, 1982

Dr. Yu-huei Jea, Deputy Managing Director
Data Communications Institute
Ministry of Communications
National Taiwan University
42 Jen-1 Road, Sec 1
Taipei, Taiwan, R.O.C.

Dear Dr. Jea:

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July 20, 1982

Professor Chung-Tao Chang
Dept. of Electronic Engineering
National Taiwan Institute of Technology
P.O.Box 90-101
Taipei, Taiwan, R.O.C.

Dear Professor Chang:

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July 20, 1982

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Professor & Chairman
Department of Information Engineering
National Taiwan University
Taipei, R.O.C.

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CC: Dr. Gwen Bell, Director, The Digital Computer Museum
Dick Yen, Manager of Digital Manufacturing and Engineering

July 20, 1982

Dr. Min-Wen Du
Professor & Director
Institute of Computer Engineering
National Chiao-Tung University
Hsinchu, Taiwan R.O.C.

Dear Dr. Du:

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Vice President, Engineering
Curator, The Computer Museum

CC: Dr. Gwen Bell, Director, The Digital Computer Museum
Dick Yen, Manager of Digital Manufacturing and Engineering

00 CORE DECGRAM ACCEPTED S 000027 O 6 24-OCT-82 9:34:58

****
* d i g i t a l *
****

TO: KEN OLSEN
JACK SMITH
cc: see "CC" DISTRIBUTION

DATE: SUN 24 OCT 1982
9:17 AM EDT
FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5179647634

SUBJECT: THE USE OF TAIWAN VERSUS AUTOMATION FOR COST

HISTORY (FOR US)
Several years ago when I got the Gardner Denver people to come in and sell us Wirewrap because the 6 couldn't be made error free enough to be built with mortals versus lots of talented technicians, you were sceptical about whether it was worth the investment. The real payoff was to make the 8 cheaply and establish the mini industry. In contrast, SDS had very good machines that were checked automatically,

but wired by hand at only slightly more cost and longer time and were limiting in manufacture.

HISTORY OF OFFSHORE MANUFACTURE IN SEMICONDUCTORS

The US industry went offshore to package semiconductors, even though the invention of automatic lead bonding was strictly American. Today, Hitachi has the world's fastest bonders and materials handlers. They also have the biggest market, and they assemble using high labor rates of Japan versus the cheaper places like Singapore, Indonesia, Philipines, etc. and even the US and Mexico. The US industry is still trying to catch up in this area simply to reduce the wip and have the necessary QC that an integrated line has. This required investment in Mfg. Engineering and in equipment, versus taking the easy approach to hiring more bodies.

RELEVANCE TO US

Today, the Japanese, especially Sieko and Sharp are heavily automated. They are our competitors in the low end terminals, PC's and your small, portable computer. I don't think we want to be their merchandisers, but we might want them to take our designs and have them manufacture for us. Clearly, we are on a collision course where they are going to wipe us out vis a vis the manufacture of these low cost, high volume parts. They've already done it in printers (EPSON=Sieko).

Dick Clayton has a videotape that shows where they are in automatic assembly. I have the calculator that was assembled this way. Let me urge you to watch the tape and look at the calculator and question whether you think offshore assembly is the answer for very long.

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BILL AVERY DICK CLAYTON DICK ESTEN

GB3.S8.75

****
* d i g i t a l *
****

TO: WALT TETSCHNER DATE: SAT 3 OCT 1981
14:52 EST

FROM: GORDON BELL

cc: BILL AVERY
EDWARD LAZAR
AVRAM MILLER

DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: RE: CT05 - ENGINEERING IN TAIWAN

I'd strongly support this. We do need a breadboard and some better specs. Dave Shanin probably has the nucleus of the design as it is substantially better than what we have been doing in the past vis a vis getting the size down. We should be very careful about the ease of doing this. It is easy to build a computer, it is hard to build a cost-effective reliable one. Right now, I don't think I see that many really creative designs coming out of our engineering here. Maybe this is the way to get better designs, but I'm skeptical until shown. Can we make sure the designers there have the latest info on chip availability, and micros design techniques. If they have been in the plant 7 years and not kept up technically by lots of readings and courses, they will most likely build obsolete stuff.

Let's try it. We could win big.

GB3.S1.39

CHALLENGES (TO COLUMBIA) IN GENERATING THE NEXT COMPUTER GENERATION

In June 1980 I helped Bill Miller and Joe Traub and others open Margaret Jacks Hall at Stanford. I hope with this convocation, we can open the CS building as successfully -- and maybe even somehow return to dedicate the Microelectronics and Computer Corporation, center in Austin someday which is another approach to applied research.

Even before the Japanese told us about the 5th Generation, I've been interested in CG's. This fascination surrounds the work on a C structures taxonomy essential for the C. Museum and understanding computer evolution. In the Museum we must have a way to contain and segment our ideas: by generations and by PMS structures whether they be components, computers or programs.

Richard DeLauer, of DARPA, claims we are working on the Nth generation, and I believe that the 5th Generation is already cast. LANS and powerful PC's are the main structures. So the issue now is what is the 6th Generation, what will it look like, and how can we continue to provide interesting computers?

Mostly, I think we all need to be concerned about the future; I'm going to dwell mainly on what we might observe from the past and present in creating it. I have been impressed with the Japanese evolutionary approach to engineering and how they had leveraged the world's Research. I also think they understand the notion of very long term process. On the issue of original research... it is crazy to think we are somehow creative and they aren't. Research is a luxury, not a necessity and they will teach us much. Now that they can afford it!

Last week AJP spoke at the CM, and in passing gave a number of his Pearls:
"If a computer understands English, it must be Japanese."

My concern is that the Japanese have already won. In the past, no one was interested in a race, contest or game. In fact our strength was that everyone was off inventing different kinds of games: board games, physical skill games, simple intellectual games like chess or complex ones like GO. NOW as a guerilla warfare army, we've been drawn into some sort of contest where we seem to be forced to compete! In short, we've been sucked into a contest where we have no knowledge of the rules, we have no notion of how to pick teams or whether the game is played with teams or individuals, whether more money or less money counts.

In the midst of all this, we have all types of forces moving people from institution to institution.

In a recent talk, Mike Dertouzous says there are 4 ways to beat the Japanese in the forthcoming new generation race:
. 100-200M to develop high speed computers with ai functions
. an open policy toward foreign workers in industry and academe
. tax credit for long range and in accord with national policy
. careful reexmination of antitrusts to permit consortia
He argues for forgoing the traditional short term gain at the expense of long term R and D.

While I concur, I am concerned:
. Where's a reasonable plan that would spend 100M? I've only seen one university based plan that's credible based on a record of accomplishment and with experience. What's worse... are there enough people to manage the research.
. open door is fine... but closed or open is probably irrelevent. Debating is time consuming and simply keeps us from working.
. there is no national policy or plan, so why have more R and D credit? I've seen this R and D credit go right to the bottom line to reduce spending in R and D and increase earnings. Similarly, most corporations aren't equipped to do either credible or useful research. Even A/D can be a conflict because so few managers understand the differences between Product Development, Product enhancement, let alone concepts of Basic and Applied Research. On the other hand, it's unclear to me that those engaging in research understand it that well either. There is no public understanding of these activities and clearly we can't manage the flow of ideas through the stages.
. antitrusts may not be the issue, figuring out how to work together and how to do these large, goal directed Research projects is hard and something that I'm afraid we don't know how to do.

We can learn from Japan about how to define, establish and then execute projects of this type. Here, I see the Fifth Generation effort as being 3-5 years ahead of us because they understand large scale, long term interacting processes and they have a plan that started in 1980 and based on the world's research. In contrast to their more directed approach, we have nearly 10 projects aimed at designing and building supposedly revolutionary but highly similar, single instruction, structured data machines here, MIT, Stanford and elsewhere which I believe will be pretty much a red herring...giving us only a few side-effects. I prefer to call these "structures for analogous computation." All, violate the historical notion of evolution since they start with a structure and not science and technology, but are loosely related to a problem. How many of these can we really afford (if the goals is to really manage them to completion with data gathering etc.)? Do revolutionary machines make sense? Are we prepared to run these 10 year, very high risk experiments? This involves incredible personal commitments. I hope to hell we can't afford them all, most likely we'll start them all and finish none. We should be able to learn from ARPA's speech research activity of several years ago, which I regard as highly successful when it was prematurely terminated.

WHAT IS A GENERATION? (Now that we know we need a new one!)
convergence of need that frees resources,
technology, science and ideas to build from, and
a basic structure.

Finally use will tell us that it's a generation after the fact. I can tell you lots about the first and second because of the lst 20 years but the others are

WHAT IS THIS ONE, I CLAIM THE FIFTH ONE WE'RE ENTERING?
Need is intercommunication, technology is MicroProcessor which in turn allows building: small shared, PC's , fault-tolerant structures, etc. and a new technology of LANs for intercommunication

This has created a product-fragmented, stratified by level of integration industry of many entrepreneurs!

A generation has a cyclic nature, much like a cyclotron. The concept to "do a machine" is injected into the accelerator at some stage... I'd like this to be needs driven to a large extent. Technology is the first stage, architecture and design are down stream, followed by the actual building. Software further accelerates the electron. Algorithms and use with critical evaluation (which we often ignore) provide the final stages... and of course by now, the particle has gone around once provided the people don't leave after the first six years. And now it is ready to be accelerated again and attain the critical energy level necessary to use or for going around again. For many generations, going around twice constitutes a new generation. The first time around a new structure is formed, and the second time around it is made useful and gains acceptance. Clearly the PC was like this: the very first PC, the LINC, cost about 40K in 65 and is in the Computer Museum, but not until 75 with the Micro was it really practical. It took about 3 trips around to reach an interesting energy level... which occured in 81 with the IBM PC. Now a trip around takes less than 2 years. This process is highly evolutionary with all parts of an industry providing energy to accelerate.

Note, the Japanese understand the notion of generations and evolution beautifully. The concepts of AI and AI workstations have existed for years in the lab. They started with plenty of cycles on a KL10, are making the very best hardware they can in a computation <?> to execute Prolog at a factor of 10-20x! In parallel, they're working on significant real applications and trying to develop the engineering discipline. Finally, they'll do evaluation on this, and will then go around again with a much higher performance station. They plan about 2 more trips around the cycle by 1990: use with critical evaluation, architect, build, deploy, then repeat the use and evaluation stage to start around again. Mostly I believe the important thing to do is start with use NOT architecture!

WHAT THEN IS THE 6TH GENERATION?

ai...and it will be wonderful or so we believe. One probelm is that I can only identify two "expert systems' that are in operation. Thus, it's hard to evolve a computer unless we have a model of what it is to do. A revolutionary machine is likely to fail--at least if it follows history. What would a new structure look like (usually a new generation has breadboards operating in one of the previous generations)...

So where's a computer like this we can view?

For a revolution--I don't think we have a common view of the future. I believe the Japanese have a better view of one, albeit fuzzy. Therefore, our notion of a 6th Generation may not be realistic at all, if it violates the evolutionary, and needs-based notions of generations.

WHO ARE THE PLAYERS? THE JAPANESE, GOVERNMENT, UNIS AND INDUSTRY

Let me strongly urge particpation in the game plus definition of some new ones by everyone. I wish the effort were better directed though--much like the speech research project. Even a guerilla army needs some leadership. In the past, DARPA has provided much science for industry: Timesharing, speech (only partially completed, but more progress and better focussed than anything else)... it may be poetic justice that the person who cut this off now has to work in developing speech progress, it is also noteworthy that a DARPA researcher wrote the Speak and Spell product description and outlined the basic design, General computation by AEC to form Illiac I... and indirectly all of Cray's machines, Graphics, Packet Switching, and most recently VLSI.

Since the University played such an important role in the past, it's vital and even more necessary now.

Forrester, who headed MIT's Whirlwind, made several comments on building machines in Universities that still hold today: "Experimental equipment merely for demonstration of principle and without inherent possiblity of transformation to designs of value to others does not meet the principle of systems engineering".

I've observed that this lesson should be a law that governs experimental machines: Unless a machine provides about an order of magnitude more power to the individuals who may use it than is available to them, there will be insufficient pull to attract users and test the basic idea. In other words, don't build toys.

WHAT CAN WE LEARN FROM BUILDING PAST MACHINES?
Harvard played a role in the beginning. Aiken was not particularly gratitious to IBM who actually built their Mark I, which at first glance one might consider to be an impossible machine, were it not for IBM's incredible engineering. In fact, this interaction proves to be grist for the computer history mills. None of the later Marks were near the state of the art in technology, and as influential. The most important effect was to train a large number of individuals who are influential in computing.

Columbia was influential too when Wallace J. Eckert got IBM to build the SSEC computer, a first, pre-computer generation machine composed of relays and vacuum tubes.

Eniac at the U. of Penn. was the truly revolutionary machine because it provided several orders of magnitude more performance than the Marks or the Bell Labs relay machines! Out of it came the stored programs concept. The work lead to Edvac, IAS, and the Illiacs directly and indirectly to the computer industry. MIT was evolutionary in structure, but revolutionary in technology with Whirlwind. TX-0 and LINC were even more successful. TX-0 took about - to design and then was in use over 10 years. The circuits were the basis of starting Digital. (Mostly, I believe a machine can only pioneer one thing.)

UNIVERSITY OF ILLINOIS MACHINES

Since I was just at Illinois last week, let me tell you what I learned from their machines and compare them with some of the observations of CMU:

Illiac I 9/52 operated
Concept-use: 4   Project start-use: 3 Concept-retire: 14
Use: 10   Use/lifetime: 33%

Conservative engineering for Aberdeen (Ordvac), copies were made for many other institutions. Design was spec'd at IAS. Implmentation project, not a total project of architecture, software, hardware, etc.

Illiac II 6/63 operated (3 years after 160, PDP-1, 1401, 1604, 7090, etc!)
Concept-use: 5.5 Project start-use: 3 Concept-retire: 9
Use: 3   Use/lifetime: 33%

New architecture, new technology, software took long. vehicle for timesharing, wiped out with commercial machines, Mistakes: Ge vs Si transistors, asynchronous logic (takes twice as long... something many folks still don't understand), didn't trust PCBs and used chassis, Memory was too small, too much to do yet it was far too conservative.

Illiac III isn't talked about. Use/lifetime: 0

Illiac IV Solomon 62, operted 11/75 @ 60 hours/wk
Concept-use: 12 Project start-use: 8.5-10.5   Concept-retire: 20
Use: 6.5   Use/lifetime: 33%
Processing rate: 250 Mips, Mp: 1/Mby, Mp.core: 2Mby MS: 139 Mby

Dan Slotnick, the designer of the Illiac IV a revolutionary machine commented last week:
Agreed that most machines come about through evolution and that's counter to the notion of original research which is

suppposedly the basis of university rewards. The activity of building a machine for study entails a major amount of engineering, something that can be at conflict with science. ("Hamming once engineers science, math, than seat of their pants. Furthermore I am ? the conlift among the theory, engineering and AI parts of CS because it distracts and destroys.????

"Am convinced unis can't and shouldn't build machines. There are too many ideas. I used to have to stop the flow of ideas on interconnection every week. Too much bureaucracy. In a state uni it takes 90 days to get an IC. Too much democracy and too little discipline."

Larry Roberts who headed DARPA, claimed that it was absolutely clear that the machine should have been done with TTL and not ECL technology. People complain bitterly, but in the end, conservative technology seems to work out better. This is what I like to define as a tradeoff as either instructions per second versus instructions per month. The clock was 13 vs 25 Mhz and only 64 PEs were made instead of 256. I worried at the time that the clock for a simple machine by the same vendor was designed to run at 20 Mhz and actually ran at 10 so they may not make such an aggressive goal!

Contributions: got a number of good people working on parallelism at Illinois and elsewhere. Pushed the semiconductor ram somewhat faster than it might otherwise have gone. I IV did operate as the world's fastest machine for some problems and some time... until the Cray 1 came along in production. The fast rams were essential for the Cray 1. Most likely the biggest effect was to stimulate alternatives: TI's ASC, CDC's STAR and the CRAY 1.

With this, let me distinguish between 3 cases of machines: null, evolutionary and revolutionary. The null (make a copy of a previous Instruction set...), evolutionary, (do what is needed to enhance performance based on the knowledge of using the previous machines,) and finally revolutionary machines which are controversial. In the commercial world, the null is risky if the basis isn't there. The evolution such as the Cray 1, or VAX, taking advantage of all we know is probably the safest but still hard. The revolutionary machine is ... well revolutionary, and predictably bloody.

In 1949 Wilkes commented on the null case: "When a machine was finished and a number of subroutines in use, the order code could not be altered without causing a good deal of trouble. There would be almost as much capital sunk in the library of subroutines as the machine itself and builders of new machines in the future might wish to make use of the same order code that the subroutines could be taken over without modification"

Bottom Line about Illinois' machines
The Null Case, taking the IAS Instruction set turned out to be the most influential. Very good engineers were trained and theory of building machines posited.

Their evolutionary machine wasn't good enough. In fact, I believe that the tradition of providing vanity or proprietary instruction sets has cost computing (ie wasted more resources) than any other factor. There should have been significantly fewer machines. Watch what is happening with the IBM PC--finally there's some use, given there's a standard.

The revolutionary machine only had some side effects, but like all revolutions accompanied with much bloodshed. Unfortunately, like the case of Content Addressable Memories, Associative Memories, thin film memories, and CCD memories the world moves on an evolutionary trajectory, and rarely pursues two approaches for the same function!

Now they want to build a msmP at Illinois and the options:

1. Cheap labor of graduate students... brilliant, but unpredictable. Not recommended!
2. Professionals which create a second culture that is very hard to manage and basically unstable. But essential if you build the system. This is what has been done at the CMU projects.
3. Jointly with a company. A hardware/software split may be

the right division of labor. This was used in the pc generations. Why not do it again? It's being used at CMU with IBM for products. The Japanese companies build machines for the various universities, e.g. Tokyo.
4. As a seperate company outside the university and fueled by venture capital...now let's see if it's really venture. (TMC).

Now, let me go on to look at CMU's machines that were somewhat more evolutionary and which had more side effects and cost only a small fraction of Illiac IV to build.

CMU'S MULTIPROCESSORS

I have always been intrigued with multiprocessors, because an engineer likes to solve problems of performance by replicating a simple design intead of massive redesign. In fact I built an early 4P in 66, and have subsequently been involved in a half dozen other mP's. My only interest is trying to understand them so they can be applied to real use.

We started studying multprocessors at CMU in the late 60's, and I became intrigued with them when Bill Strecker's 1970 thesis showed how to compute the performance for p processors accessing a common memory of m modules.

This is the main reference work for multiprocessors, and I'll eventaully forgive the referees--in another 10-20 years--for rejecting the first paper because they didn't understand it or didn't think it ws relevant. There have been dozens of subsequent theses and papers on the subject, embellishing the topic, and they all reference the work. The Transaction just had an article on the subject. In fact, while I was in academe, I was finally successful in getting logic circuit switching theory mainly removed from the IEEE Transactions on Computers. Now, I find that switching theory is back where the object is to show how to switch a large number of processors (say 1000-10,000) to a similar number of memory modules. These papers have the same object: get someone tenure... the result is the same as the irrelevant circuit switching. Computing might go forward faster if we could simply grant the tenures and then have people go to work on the project. The miserable irony here is that I came home, looked at an interesting mP that's just come on the market and it has a switch that far outstrips the theoretical ones that could be operating in 4 years for the cases of interest. One researcher pointed out that he would get off the project of 32 if it couldn't be exended to 1000! These idiotic statements completely ignore the engineering nature of building a machine and mask getting on with the difficult job of building and perhaps impossible job of using the machine.

The issue is not the switch performance now or finding exotic switching structures simply: getting on with finding out whether multiprocessors actually work which is a combination of architecture, system software, language and algorithm design.   I believe that if anyone can demonstrate that an ssmP of say 10 can work routinely in production, we can extend this to lsmP of 100 and then to 1000 rather easily.

In May 71, we proposed a ssmP of 16 processors for AI research which had a one gigabyte, very high bandwidth memory called C.ai. One of the students, an undergraduate, Tom McWilliams was in the seminar. C.ai roughly outlined the Stanford SI and SI, Mark IIA which is being built at Livermore. Unfortunately they became enamoured with building the world's most complex processor.

In August 71, a much simpler design was in place using the PDP-11 as a processor module. The project became known as C.mmp, a 16 processor Multiprocessor.

C.mmp
Concept-use: 5   Project start-use: 4.5 Concept-retire: 9
Use: 6   Use/lifetime: 66%

The project had 2 goals: a capablility based Operating System based on changing the PDP-11 and to examine the use of mP's. The addressing problem using the PDP-11 became a major issue and problem. Ironically, at least a few folks on the project didn't learn this. They went on to make the same mistake, plus a few others when doing the Intel 432. The project is well documented about what was learned in Wulf's book. Maximum speedups were hard to obtain. It is unclear why. I think because it wasn't used long enough!

Cm* a set of computer modules for building a msmP (50) in an open-ended fashion. First paper in Mar 73.

Concept-use: 4   Project start-use: 2 Concept-retire: >10
Use: >6   Use/lifetime: >60%

This was an evolution on C.mmp, also, we forsaw the cluster of functional mP's that are present today and described them for adaptation in machines like Intel's multibus and Convergent Technology's Megaframe. It used the same OS concepts, even though any P could access any Mp, there was a preference to a local Mp, or that within a cluster of 10, and finally to memory outside the cluster. Thus, the machine is problem idiosyncratic. People began to understand this notion of the structure of computation and data with respect to particular physical structures. This is the key to these "structurally analogous computers".

There is still an incredible amount of science (and engineering) needed before these machines can work harmoniously in gangs of 50 without lots of work by anyone other than their trainers.

More interesting: evolution from C.mp in a project sense really paid off. Furthermore, the machine is still being used to collect data on parallelism. This is why it appears to me that CMU is so far ahead, say 10 years, in CS research.

For Multiprocessors, the progress has been slow. In each generation, I renew my optimism in the concept. I said this in the mid 60's with large computers and I said it in the early and mid 70's with minis, and now it just has to be true because the smallest unit is the very high performance processor with the characteristic that the smaller it becomes, the faster it goes.

Maybe there are reasons why mP have never been used:
the most likely, will we always find a simpler way using technology or instruction set to provide the same

performance?
has engineering been too conservative?
the market not there?
too many other designs to try to avoid working on this?
too stogy and too compatiblity constrained?
or we simply don't believe users or compiler writers can cope? Clearly they can't if we don't try them. Happily there are several existing commercial machines at the small to medium scale level emerging with 4 to 32 processors, so maybe the technology will come.

If it does evolve, I would like to plead the case for universities to stay or finally get deeply involved even though you can buy them. Universities stayed remote from semiconductor research too long, and not until their involvenment was there the beginning of VLSI understanding.

As we work on parallelism, I regret that human organization theory can't help us except in an anecdotal fashion. More than a decade ago, Mel Conway wrote that people build computer structures like the human organizations they know. This explains why n people build n-pass compilers; IBM build hierarchically structured protocols like SNA; ARPA has to have a store and forward net independent of its users; DEC believes in democratic (anarhaic) structures like Unibus and Ethernet and multiprocessors and DECnet.

One researcher at Illinois commented that he could see merit in all sorts of physical structures like Illiac, Connection Machine, CAMs, Grids and Tree machines. It may be worthwhile trying various physical structures as you are doing here. To me these interesting physical structures may be premature because I don't think we have enough basic understanding of the notion of computational locality in order to map them into these particular, physical structures. I think this could be the basis of theory and building could be held off until the theory is built. Clearly they are not general purpose! Thus for the sixth generation, I would prefer to bet on highly tailored VLSI for performance like the geometry engine instead of these "general, highly special purpose computers." Therefore, the universities are crucial to develop the basis...my current bet for the 6th G.

If we could use human organization theory it might shed light on parallelism from structures that are connected together in exotic ways. It might also explain, like humans, why its difficult to get more than 6 processors to work together--unless totally top down directed with clear goals (like, take a beach or hill). (For now, I'm mostly only interested in the general case of multiprocessors because I don't know how to do it with the ultimate in connectivity... the memory, let alone by slow or restricted networks such as LANs, trees, hypercubes, etc.

At a time when Amdahl's constant of 1 byte/instruction has increased by at least an order of magnitude, I don't understand how something with a gop (giga-op/sec) can be content with a few megabytes! This kind of computation, I've called "Structurally Analogous Computation" because we're trying to make a physical analog of the computation. In a way, it resembles the very old analog computers that were patched together to solve particular problems such as network flows, simulation of all kinds, filtering of data as in a database, etc. I reiterate, I don't think there's enough basic understanding to do this mapping and hence build many machines.

OTHER PROBLEMS IN BUILDING REVOLUTIONARY OR EVEN INTERESTING C'S

Contrary to popular belief, I am quite concerned about the plethora of money which will mostly just cause excessive swapping and the erroneous, economies-based notion that money can be traded off for science ideas, and talent! The money comes from two sources:

1. The government. This acts to simply churn the small number of capable folks in universities and some labs, moving them from place to place. The nice effect is to raise everyone's salary. Yesterday's NY times contained a report of Aiken's quote.

Since the projects we're talking about are fairly large, they require professors to be very good project managers in a university environment designed for teaching. By being good managers, the reaction after a few years is simplpy: why work at somewhat lower pay and lack of freedom? (I enjoyed a very large pay cut to go into a university because I believe the issue was simply a tradeoff in the power/pay vs freedom plane. But with large projects, the freedom is diminished without the corresponding increase in power or pay. This provides a target for industry to scoop up kernels of the seed corn. In effect, the seed corn is really now poped corn. People have two choices: the established industry and becoming an entrepreneur.

2. The Venture Capital world which draws people from established industries and academe into what are often mundane or low tech products. For example, one high tech company started up in March and were shipping your generic 68,000-based UNIX product in 9 months, the standard gestation time. I recently saw a company of 4, build one board and assemble a UNIX product. Others build NOTHING at all but merely assemble.

Today the goal of a PhD is a chip, a program or algorithm, or system that is capable of starting a company. Recent examples include the Geometry Engine, the Timing Verify of Widdoes/McWilliams, the basis of the Valid Company, and the SUN Terminal, the basis of SUN Microsystems. So finally people can have freedom, fame and riches concurrently...but I doubt it.

Many folks believe that entrepreneurism is the way to beat the Japanese. Maybe it is because it unleashes such an incredible amount of focussed energy... but I wonder if the Japanese are going to feel threatened by 123 different kinds of ??? 68,000 based workstations! On the other hand--it is the basis for real applied R&D as with Amdahl's Trilogy Corporation.

I don't know what the final answer is, but we've got to get organized. Or in the words of Pogo, "we have met the enemy and he is us."

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GB8.14ip, a program or algorithm, or system that is capable of starting a company. Recent examples include the Geometry Engine, the Timing Verify of Widdoes/McWilliams, the basis of the Valid Company, and the SUN Terminal, the basis of SUN Microsystems. So finally people can have freedom, fame and riches concurrently...but I doubt it.

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When I was at Carnegie, I looked at the jobs. The dean's jobs were the hardest. Turf everywhere to fight for and protect, with finite budgets, more programs than money, and everyone with ideas to spend more money, and no action on programs you consider vital by an obsolescing or otherwise inert faculty.

Several of us were called in to a university a couple of years ago to sort out CS... where did it belong? It grew up as programming in the math department which was part of the school of science, the EE's did their thing, and the provost asked for a blue ribbon committee. Several of us, all engineers who do a lot of computing, unanimously recommended that it be part of Engineering. At last look, a new school was established for computing. I thought how dumb... but maybe something good will come out of it. It agrees with my model about the importance of computing. Maybe you'll try it. I'll argue this later, but not very hard.

I remember Herb Toor aging about 10 years in 2 years, as CMU's dean, followed by a heart attack. In february, my heart stopped for awhile, and shortly thereafter had a bypass operation.

I can relate to this, I have many groups that do various kinds of engineering that result in either products, components or processes to make components. In a sense, it's a lot like being a dean.

Why am I here?
The usual rationale. My stacks of books to read on engineering education has grown to where I couldn't see over them. If I have to give a talk, I'll learn the subject matter... just like the reason to teach a course... why else would one ever teach a course except to learn it?

Also, I wanted to take my mind off my problems, and turn them to yours for diversion. As you can see, as a typical engineer, I'm a problem formulator, and occasionally a solver.

What do I see as the issues in engineering education today, and do I have anything useful to add?

As an activist, I feel I must make some comments NOW that I have you that I hope are relevant. Not that I can speak to everything that's relevant. The issues can come from a single problem statement:

HOW TO SUPPLY THE DEMAND FOR QUALTIY, HIGHLY TRAINED ENGINEERS, IN THE FACE OF TECHNOLOGY CHANGE BOTH HERE AND FROM ABROAD (JAPAN) NOW.

THE USUAL WORRY IS WHETHER THE DEMAND IS REAL AND SUSTAINED WITHIN THE TIME SCALE OF UNIVERSITY DECISION MAKING,

THIS REQUIRES MORE TEACHERS: THE BUDGETS ARE FIXED AND THE LOADS GO UP MAKING ACADEME LESS ATTRACTIVE

QUALITY HAS TO GO WITH LARGER COURSES.

TECHNOLOGY IS CHANGING, BUT HOW DO YOU MOVE THE PROFESSORS?

TECHNOLOGY IS CHANGING, BUT HOW DO YOU TRAIN THE AGING ENGINEERS?

THIS REQUIRES $ AND COMPUTING (MY INTEREST) FOR BOTH TEACHING AND RESEARCH!

I HAPPEN TO BELIEVE THAT COMPUTING IS DRIVING A SUBSTANTIAL AMOUNT OF THIS CHANGE, AND I DON'T SEE THE BROAD CHANGE

THAT'S REQUIRED ACROSS ENGINEERING. THIS MEANS THAT MORE EXPOSURE TO COMPUTING IS NEEDED!

FINALLY, THE JAPANESE ARE BEATING US IN THE WORLD MARKETS, INCLUDING COMPUTING.

NOW, TO TOP IT OFF, THEY'VE ANNOUNCED THE 5TH GENERATION OF COMPUTING IN WHICH THEY OPENLY CLAIM THAT THEY'LL OWN COMPUTING BY 1990!

THERE YOU HAVE IT: ENGINEERING DEMAND UP, TEACHER DEMAND, FALLING QUALITY, CHANGES IN KNOWLEDGE IN THE FIELD CAUSING AN OBSOLESCENCE BOTH IN THE FACULTY AND IN INDUSTRY, LACK OF RESOURCES... ESPECIALLY SINCE COMPUTING IS AT THE HEART OF THE CHANGES, JAPANESE COMPETITION, AND THE FUTURE! NEARLY ALL THE PROBLEMS YOU... LET'S SAY WE FACE!

HOW TO SUPPLY THE DEMAND FOR QUALTIY, HIGHLY TRAINED ENGINEERS, IN THE FACE OF TECHNOLOGY CHANGE BOTH HERE AND FROM ABROAD (JAPAN) NOW.
The report, by the NAE in 1981 Academe/Industry/Government Interaction in Eng. Educ exlored the overall issue. George Lowe's opening address was especially insightful.

concern- reward teaching. I've asked several of our groups, and they say you're doing a good job! Let me congratulate you.

Since I'm more remote, I have some concerns: I asked where's the best school? San Luis Obispo. Why? They don't do research, they teach! Their teachers do and teach engineering.

I think the supply is diminished by driving them out with publishing requirements that may be difficult to meet in experimental fields.

I've seen this in virtually every school, especially those who work in building systems, as a sure road to non-tenure. Illinois vs CMU; Northeastern, U Mass drove one of our best engineering managers to us by a non-tenure decision. The students stopped building and we don't get as many students from there anymore. In other cases, they're driven out into high paying jobs and start ups where they become millionaires.

THE USUAL WORRY IS WHETHER THE DEMAND IS REAL AND SUSTAINED WITHIN THE TIME SCALE OF UNIVERSITY DECISION MAKING, Computing has been on an uncontrolled growth since its beginning, and many faculties simply cannot accept the fact that information processing is as fundamental as mathematics, or mechanisms. It took 15 years ater the computer and profession was established, BEFORE a department of Computer Science could be formed in the first university. I know if the computer to were to vanish tomorrow, it would be at least 15 years to get rid of it.

We're also losing them to MBA school, which I regard as a waste of time. You could give a short course and give honorary MBA's. There's even a book.

THIS REQUIRES MORE TEACHERS: THE BUDGETS ARE FIXED AND THE LOADS GO UP MAKING ACADEME LESS ATTRACTIVE
believe that people in industry could help (I'm on the academic board of the Wang Institute of Graduate Education... requirements teach very well, be a great engineer, can do research and knows several particualar fields, yet can teach all the courses. It turned out that the quiz they gave every applicant was a graduate seminar... and they all flunked! no wonder. Unless you've spent enough time, you can't speak the language. Having gone from industry to academe, I had to learn, but people were willing to gamble. Probably couldn't make it into CMU today.

It's important to figure out how to communicate with industry. Dean Louis Padulo of BU suggested a Dean of the Month program, where we communicate between our engineers, the dean, and various department heads. We have a similar program with researchers, where we describe our problems.

QUALITY HAS TO GO WITH LARGER COURSES.
I don't understand why much of the increased load can't be handled by TVI?

I think maybe the pendulum has swung too far to specialization, especially in EE where Computing can occupy a large fraction of a person's curriculum. 10 years ago I was on a series of Computers in COSINE... computers in ee. to get some changes to the curriculum and the courses. about 6 courses.

Now, I think we have to go back into some fundamentals where discrete and continuous mathementics are taught. I noted that YOU folks are taking these courses right here at these conferences.. Digital signal processing, or how to get those functions into a form the computer likes.

TECHNOLOGY IS CHANGING, BUT HOW DO YOU MOVE THE PROFESSORS?
MIT's Centennial Celebration focussed on Continuing Education. They have an excellent report. I urge you to NOT have another task force, report, etc. and simply adopt

theirs. My fear is that nothing will happen, the report took so much work.

Who can blame them? The faculty already is overworked: they can't spend all the money that's been foist on them by ARPA and IBM, the loads are high, and they haven't any time for any more teaching.
consulting, co-operative courses,

TECHNOLOGY IS CHANGING, BUT HOW DO YOU TRAIN THE AGING ENGINEERS?
we badly need continguing education programs
we have to have your help
This is an excellent way to start and improve the necessary relation that must exist between university and academia.

THIS REQUIRES $ (AND COMPUTERS) FOR BOTH TEACHING AND RESEARCH!

COMPUTERS IN TEACHING
lots of reports, and occasionallys some money. I think you'll find that this problem will go away shortly. The $25 slide rule that engineering students used to buy would now cost $150, or about the price of what is becoming a useful computer.

COMPUTERS IN RESEARCH
Let me recommend the recent report by the NSF, U-I Research Relationships: Myths, Realities and Potentials

Here, we have quite a lot of positive experience, and the recent posture of various funding agencies is hopeful, by virtually demanding that we work together. It isn't easy because of the conflicts about owning knowledge, and deadlines that we insist on.

One of the healthiest relationships has been between DEC and CMU to build experimental machines. The only problem in retrospect, is that we should have done more to make it work. Starting in 1970 CMU built about 3 parallel machines.   As a result CMU knows more about parallelism than any other university. I'm sadened by the proposals I read to do research in this area that will yield results that were known 10 years ago.

Several of us with Jerome Feldman put together a successful plea to get computers for CS research. Even more successful than the grant was the idea that companies would get extra benefit for computing equipment. This became a law, and equipment's starting to flow.

Focussed Research Institutes are GREAT: Robotics, Semiconductors at CIT, then Berkely and Stanford, Magnetics at San Diego and possibly CMU, Some fundamentals in optics, ceramic material... we ain't making it folks.

Then there's manufacturing engineerng.

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GIVE THE PAGE OF STATISTICS OF COURSES AT THIS CONFERENCE

cs should be difused 4 years ago I wrote an appeal to the CS&ERB to revamp the thinking about computing so that the other disciplines start doing their share. The problem is that computing people won't let them.

Computers are things to be taught not to fear and to be ordered around view (MBA school... where you know enough to order up some programmers, tools (analyzers, displays, drawers), simulators, and
then they become components of the systems you build.

I'd like to see ALL of this, but I'm greedy, I want more. I'd like to see engineering faculties become entrepreneurs by encoding their knowledge in programs. It already happens; in vlsi Stanford and Berkely have been doing in for years. Cogo and Stress were done years ago. NYIT builds some of the world's best graphics systems, which by the way it sells extensively. It is the only university I know that's also an OEM. After all, what's wrong with packaging this knowledge in a program and getting a royalty? Professors have been doing that for years.

Now there's more work to be done in the form of expert systems.

What are they, what are some examples: interpretation, prediction, diagnosis, design, planning, monitoring debugging, repair, instruction, control.

Let me talk about the system, XCON... XSEL...

Here, I may be reminded of the doctor, lawyer and engineer that were to be guillotined. The first two were spared because they rope ws binding. The engineer just had to redesign it so that it worked.

FINALLY, THE JAPANESE ARE BEATING US IN THE WORLD MARKETS, INCLUDING COMPUTING.

5 years ago was my first visit, last summer my second. I consider them to be the world's greatest engineers.
The threat's described in Feigenbaum's book: The 5th Generation

The issue is the building of computers that can behave as experts, say like engineers or engineering professors, or engineering managers. I've already started one to be me.

The expert system is built by a combination of knowledge engineer and and expert. The design problems enclude knowledge reprsentation, and then getting sufficient knowledge to be able to solve problems.

NOW, TO TOP IT OFF, THEY'VE ANNOUNCED THE 5TH GENERATION OF COMPUTING IN WHICH THEY OPENLY CLAIM THAT THEY'LL OWN COMPUTING BY 1990!
knowledge information processing systems
knowledge engineering

To me this means certainly everyone has thereown machine like I described. This is being done right here at RIT, Clarkson's doing it, and CMU has an institute dedicated to it. Other institutions are moving forward including Standford and MIT that I know of.

Every student will have one. YOU HAVE NO CHOICE, THEY'LL BRING THEM IN WITHIN A FEW YEARS.

It can comunicate with all the others in a community. YOU HAVE A PROBLEM: CAMPUSES MUST BE REWIRED TO SUPPORT THIS. Like our engineering net. We have over 1K computers in the net.

The machines are doing more than communication, but are teaching, allowing people to design by positing, analyzing, simulating.

Expert systems should play a major role in this future by allowing knowledge to be encoded and used, versus being static like in books.

GB5.72
6/83
Rochester

5/6/79

Charles R. Vick
Ballistic Missile Defense
Advanced Technology Center
Data Processing Directorate
P.O. Box 1500
Huntsville, Alabama 35807

Dear Charles:

Although I am honored to be nominated for this talk, I must decline because I have already committed my fall speaking capacity.

It is with deep regret that I can't accept this because I firmly believe in this style of computer and have devoted a great deal of energy to developing products for it.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:swh
GB0002/51

<title>5-YEAR AWARD TALK
<event/date>12/75,11/76,3/78
<>

<title>AMERICAN CAN TALK (TEXT FROM NSF)
<event/date>11/75
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<title>BASIC LANGUAGE TALK
<event/date>1ST TUESDAY-3/75
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<title>CAD SYMPOSIUM
<event/date>5/78
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<title>COMPCON
<event/date>9/74
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<title>COMPUTATIONAL SALES MGR. MEETING--MONTREAL
<event/date>8/73
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<title>COMPUTER ORGANIZATION & ARCHITECTURE--COURSE
<event/date>USC-LA-7/74
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<title>COMPUTERS IN EDUCATION--CHALLENGE
<event/date>MASS STATE COLLEGES-6/77
<>

<title>EDUCATION LECTURE--MANAGEMENT OF TECHNOLOGY
<event/date>SLOAN SCHOOL-4/77
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<title>ESG TALK
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<title>IBM LECTURES - COMPUTER ARCHITECTURE
<event/date>8/72
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<title>INTERACTION AMONG TECHNOLOGY, PRODUCTS AND USERS
<event/date>DECUS-4/75
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<title>IRVINE--THE 2ND DECADE
<event/date>IRVINE-3/75
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<title>MCDOWELL AWARD
<event/date>10/75
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<title>MELLON AWARD SPEECH
<event/date>4/73
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<event/date>IEEE RALEIGH-7/74
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<title>MINI + EFFECT OF SEMIS ON -11 DESIGN
<abstract>EFFECT OF SEMICONDUCTOR MEMORY TECHNOLOGY ON THE DESIGN OF -11'S
<paper>Kaman & Bell
<event/date>10/73
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<title>MUSEUM SLIDE TALK--COMPUTER GENERATIONS
<event/date>8/75
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<title>NAVAL UNDERWATER SYSTEM
<event/date>12/76
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<title>NAVY TALK ANAPOLIS
<event/date>4/75
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<title>N.E. TALK
<event/date>1/76
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<title>NEREM
<event/date>12/74
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<title>NET TALK
<event/date>10/74
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<title>OBJECTIVES--HOW TO SET UP
<date>9/11/72
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<>

<title>PDP-10 MARKETING
<event/date>8/72
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<title>PDP-11 TALK FILE
<date>67, 68, 69, 70, 73
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<title>QUANTUM SCIENCE TALK
<event/date>3/28/73
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<title>RTM'S
<event/date>IEEE-3/71, YALE-10/72
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<title>STANDARDS & PORTABILITY FOR SOFTWARE PROBLEM
<event/date>NRC-1/76
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<title>TECHNOLOGY--3 YEARS
<event/date>MID-ATLANTIC REG. MGRS.-7/74
<>

<title>VAX-11 TALK OUTLINE
<event/date>ANNUAL MEETING-10/77
<>

I'm honored to have this award for three reasons: First as an author, second as a founder of the Digital Computer Museum, and third as an engineer in the tradition started by Eckert and Mauchly.

As an author I needed a deadline. The talk is evolutionary and I hope it will be the basis of the middle section of a biographical monograph on Computer Evolution. Although the examples are historical, I can't claim to be a historian only a biographer. This section is about evolution of computers, and the role of computer scientists and engineers.

As a founder of the Digital Computer Museum, this talk gives me a chance to tell you about it.

<>Entrance DCM. When I talk about the Digital Computer Museum, the image in my mind is of the American Museum of Natural History -- where twelve acres are devoted to the collection and study of the natural world. Similarly, the Computer Museum will collect and preserve all computing history for its study and interpretation. Computing is large and important enough to have its own, special, centralized Museum. Science is too large. National, corporate and local museums don't provide good comparative history.

<>Another gallery. The Digital Computer Museum is a public non-profit charitable foundation whose purpose is to preserve the history of all of information processing. That means that you and your organizations can give the Museum equipment and money and receive a full charitable gift tax deduction. The Museum, in turn, is obligated to preserve artifacts.

<>The Collections poster. The Museum collects the whole range of components that Allen Newell and I outlined in the PMS notation, that is the Museum collects not only computers, but also calculators, memories, links and switches, transducers, controls, and robots.

<>Whirlwind exhibit. Already the collection has grown to the extent that we can claim to have the most comprehensive exhibits of the origins and evolution of computers. DEC got

it started with salvaging Whirlwind.

<>TI exhibit. Its fitting that I'm speaking in Texas because Texas Instruments was our next big donor giving us the heart of an ASC and really helped establish an industry wide effort.

<>Another shot. I want to invite all of you to come see the Museum, join the Association so that you can receive its quarterly report, and consider it for a depository of the important papers and artifacts of computing history. (And, by the way maybe this will help me lure Pres Eckert to come and give a Museum Lecture -- He has a standing invitation from us.)

<>ENIAC with people. Third, as an engineer I am very proud to have the award, and I have many others to thank for it. Like Eckert and Mauchly, I worked with and built on the work of others. Most computer innovations are not made by one person: As a writer my co-authors, especially Allen Newell, and also Dan Siewiorek, Craig Mudge, John McNamara, and John Grason need to be thanked. As a museum founder, Ken Olsen and Gwen Bell, who is now the President of the Museum Corporation, are important. And as an engineer, the first people to thank are Ken Olsen and Ben Gurley, who were responsible for conceptualizing a commercail computer, the PDP-1, based on their development of the TX-0 and TX-2. I

want to acknowledge Ed DeCastro who implemented the PDP-5 and 8, Alan Kotok who worked with me on the PDP-6 for the first timesharing system. Roger Cady and Harold McFarland on carrying ideas for the 11 and although I lead the early design group on VAX, it's really Bill Strecker's work with Bill Demmer leading the development. Dave Cutler was responsible for the design and building of VMS.

<>Computer Generations Cycle. The revolution that the ENIAC started set off this evolutionary cycle. The need for making ballistics calculations started the cycle. This generated resources that allowed a team to integrate technologies into a new machine to be used to satisfy the need. The moment ENIAC started to calculate, it's use set the cycle off again. Users identify new things to do with computers and provide the market resources for new machines. Fred Brooks makes this point clearly in THE MYTHICAL MAN-MONTH, stating, "the incompleteness and inconsistencies of our ideas become clear only during implementation." (p.15) If idea generators, and builders aren't involved in use, they won't understand the evolutionary trend enforced by feedbacks. Closing the loop results in computer evolution -- not revolutionary new machine design.

Like all cycles this one has periodicity. New technologies, needs, or uses can trigger a small spurt -- and the coincidence of all three mark a new generation and a branching of the family tree of computers.

<>Light bulbs. Technology provides the base tools from which computers are developed. Inventor's ideas are the bright lights floating between technology and societies dreams. At the dawn of a new generation a number of inventor's concepts converge into a project. I believe that Atanasoff's work had bearing on the ENIAC, and the team included inputs from Arthur Burks, Sharpless, Goldstein, von Neumann and many others. With each generation, the technological floor becomes higher and user's aspirations also raise, maintaining the gap needed to spur invention.

<>Generation tree. Computer generations can also be seen as a tree, starting with its roots in scientific and business calculation. Here Eckert and Mauchly again are interesting since we would call ENIAC a scientific and UNIVAC a business machine. In the first generation there was really only generic scientific and business machines. In the second generation, super computers, from the scientific branch split off and continue on an evolutionary path determined by Seymour Cray. There's really a merger of the early scientific and business into general purpose for the mainframes covering a price range of 100 thousand to 10 million. Although the idea of the mini, for minimal computer as in the PDP-8 was developed at Digital in the second generation, based on earlier machines like Cray's 160

and our PDP-1, which in turn was based on Whirlwind, it flowered as its own branch in the third generation where IC's permitted numerous companies to start and develop their machines. The minis covered a price range of at least 50 and could be purchased in several levels of integration from boards to turn key systems. The fourth generation is marked by the branching of the micro processor on a chip. It's too early to see the fifth generation, but either it or the sixth must be identified by a means -- such as ethernet -- for all classes of computers to communicate on a network forming a computing mesh; there's an interlacing of the branches to keep them from collapsing by their own weight.

<>Op rate. During the 400 year, ten generation period from 1600 to 2000, the technological change is roughly a factor of 10**12. using the product of processing rate and the memory size to measure computing power, then the computer has evolved almost 20 orders of magnitude since stone-based, manual, single register devices for counting supplemented fingers and toes.

<>Generation is marked by. As the original model showed, three ingredients are needed to create a new computer generation:
a steady supply of funds, useable technology, and the machine design.

<>Babbage. Babbage worked alone because he had no funds to maintain an organization. He was always grovelling for funds and tried everyone's patience by not completing or producing any results but promising the "fantastic" if only monies were available for the next machine that he had in his mind.

Two of the three is not enough. And having only one of the three -- only the machine design as Babbage had -- dooms a project to failure.

<>Stibitz. George Stibitz at Bell Labs had the funds and was working on the same type ballistics problems as Eckert and Mauchly, but felt constrained by the technology of the telephone company; thus his machine had alot of telephone relays.

<>BTL1. The 1939 machine was the first calculator that could do complex arithmetic and operated via Teletypes in an interactive fashion. In September 1940, the computer was demonstrated at a meeting of the American Mathematical Society at Dartmouth College. An interface to the teletype designed by S.B. Williams allowed attending mathematicians to transmit problems from Dartmouth for solution by the calculator in New York. Bell Labs produced four advanced versions of the machine, and by the mid-fifties this line had died out.

Thus, it can be seen that a useable, but traditional technology is inadequate in forming a new generation.

<>Anal engine. Between 1833, when Babbage was working on the analytic engine and 1945, all component technology for the computer had been developed: teletype equipment for i/o; magnetic recording in the form of drums; diodes and triodes; <>flipflop. the Eccles Jordan flip-flop; and switching algebra.
<>Cycle. ENIAC had all three: enough funds, (with the aid of Herman Goldstine), pushed new technology (with the careful engineering of Pres Eckert), and with a new machine design (inspired by John Mauchly) - it went through the entire process and resulted in the first electronic computer.

<>Process. In any machine design, a number of separate, concurrent processes give rise to decision points leading to suspension, continued development, or recycling.

<>Generating a computer structure. The diagram shows seven interacting processes of a complete cycle for evolving a new computer structure.

The first process involves defining the problem: understanding the constraints, setting the goals, and determining the objective function of the design. Then, three mutually exclusive decision processes determine the architecture. Selecting the null architecture is calm and peaceful -- not exciting until faced with virtually insurmountable technology issues in its implementation; selecting to evolve an architecture in order to cope with new technology ideas or needs, is like guerrilla warfare -- a few people die on the line and some get caught in the crossfire; but generating a new architecture means a bloody revolution.

The process of physical design for implementation is concurrent with the architectural design process.

The building process requires complete understanding so that no unplanned side effects occur. The complexity of building computers is so great that even with the greatest care side effects are free. For the lucky designers they're also positive!

The final Process, using the machine, is essential for understanding the next step in evolution and the issues that could lead to revolution.

Within the context of the whole cyclical feedback, each process will be considered individually. The process of problem definition sets the constraints, goals and the objective function based on cost, performance and other measureable factors. The physical laws governing materials with respect to electromagnetic energy and heat transfer are obvious constraints. Yet engineers still try to violate them. And they never win.

<>ENIAC. ENIAC was bounded by the reliability of both vacuum tubes and plugboard programming. Nevertheless, Mauchly was unconcerned. He reasoned that even if ENIAC only ran a few minutes it would accomplish more than Bell Labs slow relay machines. It contained 18,000 vacuum tubes each with a predicted 500 hour life. If the machine had been designed using the tubes at capacity, the exponentially increasing repair time for multiple tube failure of 18,000 tubes each with a 500 hour life would have bootstraped the machine to its death, that is, if it ever lived. Goldstine recorded that by derating the filament and plate only three tube failures occurred per week. The actual failure rate of about one million hours was achieved only by very conservative engineering.

<>ENIAC cabling. Because of the potentially compound problems of tube failure and plugboard connections all problems were run twice to insure accuracy. Franz Alt, commenting on the 40 plugboards and extensive cabling, estimated that the overall effective rate was five percent utilization. Taking into account the amount of time the machine ran, it was 25 to 50 times faster than the relay machines. The fact that such a large system ran is a tribute to careful, conservative engineering, mostly on the part of Eckert.

<>Whirlwind AC Bit Slice. In contrast, Jay Forrester, on the Whirlwind, tackled problems at their source. Concerned with highly reliable, real time computing, he knew that the estimated tube reliability of 500 hours had to be increased by several orders of magnitude. An outside review prodded at the gradual failure mechanism of the tubes and led to marginal checking. By understanding the tube failure mechanism, the manufacturing process, and introducing marginal checking, reliability was raised to five million hours.

<>Von Neumann. At the beginning of a generation suppliers of new technologies are becoming constraints.

<>Selectron tube photo. In the later forties Von Neumann, determined to build the stored program computer, put his

faith in the RCA team that promised to produce a fast parallel memory, the Selectron tube. After two years of work, with vague but optimistic quarterly reports, not one had worked. Julian Bigelow reports, "no one in the ias team was sufficiently expert in electron tube design and manufacture to be able to assist it, but in conference with Von Neumann I made an attempt to list the variables which would have to be kept under control to produce a 50% yield of successful selectron tubes, covering a range of digital capacities from the original goal of 4096 digits per tube, down through 2048, 1024, 512, etc. It appeared that...the goal of 4096 per selectron was far too ambitious, and that acceptable production yields might be far sooner attained if the goal were reduced to 128 digits per tube." This 256 bit Selectron finally became available in 1953 for Rand's Johnniac.

What did Von Neumann do for his memory? He sent an expedition to Manchester where Fred Williams had built random access memory tubes with 1,000 bits, each.

<>WW Tube Memory. The two Mhz clock and 50 K ips speed using MIT adapted Williams Storage tubes cost $1 per bit, or $16,000 per month. Impressive, but expensive.

Searching for a better solution Jay Forrester started to investigate using magnetic cores.

<>Ceramic Core. At first they used wound magnetic tape Deltamax cores. Then beautifully made, but little understood, ceramic cores were found at Philips. According to Forrester, the manufacturers claimed that they could not be used for storage. Theoretically this was true, but it didn't stop Jay Forrester from trying ceramic cores and succeeding.

<>Forrester and Core. Don't be undone by theory, especially if the art is much ahead of it. Forrester commented, "This is an example of where the art was substantially ahead of the theory. Cores worked and could be made by trained ceramicists. Years later scientists understood how and why, but for many years production of ceramic cores was a materials art."

Recognized needs generate funding and provide an objective function against which to make tradeoffs. After initial funding, most of us take ourselves as the archetype user.

<>GB and average man. All of us, including myself, want to design computers and languages as if we're the average man. This proves it to you. I'm absolutely average, so I can do it and tell others how to as well.

<>Wilkinson or Pilot ACE. In 1958, I visited Wilkinson, who

with Turing designed the Pilot ACE. I told him about a symbolic assembly program that two of us built to optimize instructions in a delay line in conjunction with a backing drum memory to give what was one of the first one level memories. He asked me for a benchmark. I compared it with the results using a new program language called Fortran, which he was even more skeptical of. A matrix routine could be coded in only a factor of 4 slower than using Fortran, but a factor of 10 faster than the current method of hand allocating, assembling and key punching programs in row binary. He said that it didn't matter because he could write any matrix program in machine language in 15 minutes: why should we waste the machine's time in doing it? Fortunately, Wilkinson has concentrated on numerical analysis and not designed any computers. A Fortran was ultimately people for Deuce and used our assembler as a base in a hierarchical fashion.

<>Photo of PDP-14. A greater pitfall than designing for yourself, is designing for a proprietary user. Paraphrasing a remark by Charles Wilson of GM: "What's good for General Motors may not be good for anyone else." I don't know how many of you recognize the PDP-14 for controlling transfer machines. [It executed a single loop every 20 milliseconds, and had no real instructions for control or processing data other than the 1 bit accumulator used in Boolean expression evalution. Each time a new problem came up, such as counting

the number of operations or diagnosing itself, a new feature had to be put into the machine. Having started from a special purpose controller, it evolved into a really poor general purpose computer.] This doesn't mean we shouldn't have built a machine to solve the control problem. The designer should formulate the NEXT problem for the machine, not just the one at hand.

<>Military. The ultimate in vanity architectures are computers built for one of the world's largest organizations, the Defense Department. I've never met ANYONE who admits to being either the designer or specifier. The current Military Computer Family effort is designed to take incredible engineering resources out of circulation, guarantee high prices, and worst of all, insure obsolete equipment. Their Russian counterparts base computer designs on US commercial architectures and probably their implementations. No real benefits will come from building the MCF VANITY architecture.

<>Generating #1. While need orients designs and generates resources; as the sole constraint, exact need is detrimental to progress.

Standards represent the ultimate in constraints. Getting the right standards at the right time is essential for widespread implementation. If a defacto standard exists, such as the IBM channel and Unibus, let it be. If a standard is needed, then go all out to create it so that others can avoid the hassle of having to invent in an area that will generally make work. Alternatively anarchy can reign until IBM makes an ad hoc decision, and then it can be accepted in a de facto fashion and we can all try to implement it. [If there's anything I can do to hasten the settling of details surrounding the proposed 802 standard, I would be happy to work on it.

<>Ethernet. My own view is that Local Area Networks are one of the key technologies of the Fifth Computer Generation, and therefore we must settle the standard so we can all start building. DEC intends to interface ALL its products to Ethernet.]

<>Generating #2. The ultimate in standards is implementing a computer based on an existing architecture. [The Null Architecture process is one I highly recommend when deciding to build a new computer.]

<>EDSAC. Maurice Wilkes, who took the 1946 summer course on the ENIAC and EDVAC at the Moore School, returned to Cambridge University and built and programmed the EDSAC. This first, full scale operational stored program computer, was based on a simplified version of the EDVAC and IAS.

In 1949, only one month after EDSAC was operational, Maurice

Wilkes perceived the value of a series of computers sharing the same instruction set. He stated, "When a machine was finished, and a number of subroutines were in use, the order code could not be altered without causing a good deal of trouble. There would be almost as much capital sunk in the library of subroutines as the machine itself, and builders of new machines in the future might wish to make use of the same order code as an existing machine in order that the subroutines could be taken over without modification."

<>EDSAC or Maurice. This advice is even more applicable today than it was then and must constantly be reiterated to us all! In a recent editorial in Computer Design, the editor in chief commented: "the microprocessor revolution ... has more or less stiffled CPU architects except for those involved in mainframe and military or highly specialized system. ... the upswing in 16-bit microprocessor chips is again going to put somewhat of a crimp in architectural innovation... The real renaissance in smaller cpu architectures is just within grasp as the VLSI gate array moves into the realm of the smaller computer manufacturer ... Once again the CPU architect can return to innovations in internal cpu structures."

New architecture, particularly hardware architecture, should be the last resort because it is the beginning of what is fundamentally a six or seven stage work amplifier.

Given that I've introduced null architecture, building successor machines that are compatible with or built on the past, I feel duty bound to state a lesson that RCA ignored and the Japanese eventually learned. [Recent examples include the repackaging of the 3330 into high speed gate arrays in the ???, and the part by part, micrometered copy of the 3850 Mass Storage unit by Hitachi, NEC and Fujitsu (ask Bloch ??).]

If you copy a machine, do it exactly -- not just closely. The test has to be that the software, including all user data and files can't know the difference between the original and the copy. Furthermore, if there is a desire to attract, and then entrap, a given set of users to your machine (or language), then build it with extensions that other machines don't have, and that your users will feel duty-bound to use.

<>Fortran. When no process for standardization exists then a plethora of language dialects develop like Fortran V, stemming from Fortran IV. Similarly, the designer of the 8080 added instructions to the architecture and created the Z80, insuring two architectures, and the attendant waste, when one was adequate.

On the other hand, conservative users and manufacturers want to preserve their economic and emotional investments as long as they can. Enticed by a user base, almost every company produces one too many of a given machine design.

<>Hollerith. The card which was the savior of the 1890 census became so tied to some corporations approach to computing that they could see no alternative methods for input or output. When the 80 column card was on the way out, true believers in card computing evolved a 132 column card. This too was an expensive evolution requiring new equipment. This dinosaur, a large beast created on a small bone structure (or architecture) was created just when the technology should have been let go.

The key is to know which machine is one too many, -- to question whether the bone structure will support the architecture -- and if the limits are close, don't build it.

<>Generating #3. Compatibility extends life in the process of evolving an architecture.

<>abacus/soroban. The original Chinese abacus represents up to 15 in a digit with a combination of 5 and 2 beads. It is similar to what computer engineers invented several times and call the bi-quinary system.

<>SOROBAN.   Ultimately the Japanese refined the abacus, first using 5 and 1, and then 4 and 1 beads for lower cost and faster operation while not radically affecting the installed

base.

<>soroban/calc. This 1979 calculator/soroban is ideal in several ways: low cost storage of a second number is provided; simple operations can be done traditionally and more rapidly on the soroban; users can be gradually trained on the new machine without losing any traditional computational capability; the market is larger; and a culture is preserved.

<>PDP-1 and 4. One of the earliest computers I worked on was the PDP-1, an 18-bit computer, grandchild of Whirlwind and a child of the TX-0. None of us thought of using the Whirlwind ISP, because we needed 2 more than the 16 bits of Whirlwind. Both Whirlwind and TX-0 had excellent system software. Then with the design of the great grandchild, PDP4, to tune the implementation exactly to the architecture saving at most 10% over the PDP-1, I introduced a further ISP and switched to two's complement. Thus, in a family tree of 4, three architectures were probably unnecessary. The world ended up being modulo 8 bits anyway, just as in the original Whirlwind. Perhaps an even greater sin was committed by Computer Controls Corporation because they changed the name PDP to DDP and added a bit to the PDP-1 to come out with the DDP 19. They only sold a half dozen and became part of Honeywell.

<>12 bit. The history of 12-bit computers is similar. The architectural differences of the CDC 160, the LINC, PDP-5 and 8, the 6600 and 7600 ppu's, and those of Honeywell and SDS whose names I forget weren't significant. If we had all copied the 160 the implementations could have remained unique. In Digital's case, they led to the notion of dedicated real time control computing and minicomputers.

<>PDP-5. Computer architects and their implementers who did not make either exact or evolutionary copies of a predecessor machine have cost the entire industry unaccountable billions. In the second generation all that a number of our architectures provided were noncompatible versions of Whirlwind and the 160.

<>Generating #4. New architectures are needed for new forms of computing. Obsolete computers are characterized by inadequate bone structures for coping with different, more modern environments. Several companies who tried to go into business by buying up a bunch of old computer designs, had no chance of high growth. They were self-limited by existing conservative users of these machines. Growing by user base acquistion is like trying to get fat eating tapeworms.

High growth comes from the new architecture of new organizations like Apple, or converting to the VAX base at Digital. But, believe me, when you're dealing with an existing organization with a set of happy and content users, suggesting change, and implementing it, is difficult, but critical, for success.

Now that we've looked at both null architecture and architectural evolution processes, what will the architecture of a revolutionary machine look like?

<>Thomas arithmometer. At the beginning every new structure appears to be quite complex. When Thomas manufactured a calculator using the stepped drum principle of Leibniz, the machine appeared to be very complicated to scientists used to simple slide rules with two moving parts. In 1849, SCIENTIFIC AMERICAN wrote, the Thomas machine "is said to be one of the most astonishing pieces of mechanism that has ever been invented, but to our view, its complexity shows its defectability."

<>Millionaire. Subsequent manufacturers streamlined the machine for manufacture, adding a digit at a time multiplication and continued to make and sell them into the twentieth century.

<>Deuce Drum. In 1957, when I saw a moving head drum on the DEUCE computer, I was awestruck. Two independent 16 track read and write heads were used to select 1 of 256 tracks. The control was via a potentiameter sense in an open loop

fashion. The complexity was beyond my imagination. I was also biassed because the assembler program also turned out to be the best diagnostic.

<>CDC 6600 refrigerators. When Cray's 6600 was introduced in 1964, the refrigerators in each quadrant seemed to create a complex maze of plumbing. But it's really a simple and natural method after its understood. With the high power densities, a built in refrigerator is the best way to cool a computer.

<>Generating #5. The principles of design help in understanding essential versus non-essential complexity both in architecture and it's implementation.

<>Communications Poster. In 1968, Melvin Conway hypothesized that organizations are constrained to produce designs that copy the communications structures of their own organization. This tells us why n people may create an n pass compiler, or why several strong persons will partition a design into separate functional units. [We can see this clearly when looking at the way networks and computers have been designed.]

<>Dupont. One of our customers conceptualized their need for interconnection as nearly total communication among nodes.

<>First level of the tree. Yet, when the network was designed the thoughts, like the organization turned to a three level tree, the first level of which is shown here.

<>IBM telecommunications tree. [IBM's SNA architecture evolved from a tree structured approach to computing where all the terminals and remote job entry stations were hooked to a single mainframe. In some cases loops were provided to connect multiple terminals to a single computer. With needs for total interconnections, the tree has to be cross-linked.]

This explains the difference why SNA,

<>ARPA network. [Packet switching evolved from an organizational model of peer researchers of ARPA. The designers also recognized that not all the peers could be counted on for transferring packets to other peers, nor was it necessarily economical for peers to ship messages, hence a totally separate set of central system computers were provided for message switching.]

ARPA-net,

<>Engineering net slides from EN talk. [Like ARPAnet, DECnet assumes peer communication, but with bottom-up evolution in our style. Hence we provided a network that could be built and operated by responsible peers without central switching.

Our own engineers put together a 300 node network in a dozen sites for own use, with no top-down edict. Just as peers are being loaded with carrying messages for their friends, it looks like Local Area Networks will save them.]

and DEC's approach to networking is different.

<>Unibus. [Unibus as implementing organizational structure allows autonomy of all the nodes.] With the Unibus each computer component operates to a well defined protocol and can be developed and evolved independently of any other one. Hierarchy is imposed by use and convention, not by structure. In this way various groups inside and outside of DEC could build components to a common protocol. This is also why the structure was copied by all micros.

<>Ethernet. Ethernet, a direct evolution of the Unibus, ties computers together without central networking functions, dependence on central power, or on a particular node. [Ethernet will be the Unibus of the Fifth Generation and allow computing to form over a local area, such as a University, research complex or corporation.]

<>IBM 360. The IBM 360 mirrors IBM. Memory is the focus for all work and the single central processor controls all significant decisions in the 360. [A relatively large block the processor is signficant but i/o fans out in a tree. Each

of the i/o processors gets its work from the memory, where it is kept under very strict control. The authoritarian chain is imposed to the extent that the channels and i/o processors are kept so dumb that they can't even diagnose themselves. If anything of significance needs to be done, they must interrupt the central processor.] This authoritarian top down structure has fat but not very smart subordinates doing the i/o.

<>CDC 6600. In the Cray computers, everything is oriented around a single, very high performance processor at the center. [Memory is it's link to the peripheral computers that support it.] Unlike the IBM approach, these lovely peripheral computers operate autonomously of any central control. [Their purpose is to work independently and serve the central master where the work is done. In some operating systems, control is delegated to one of the computers.]

Considering this depressing fact: we should design it right or it's likely that we'll have to do it over. As Watts said: "Designers always build the 3rd best system. The First is ideal and the Second best takes too long." [European modems engineers. These modems permit 1200 baud from the central office to the subscriber, but only a 75 baud back to the central office; this is slower than my typing rate! European designers must think that an enormous amount of information is stored centrally, and subscribers don't need rapid transmission, or to communicate with other subscribers. The system can't be effectively used until all the modems are transformed to 1200/1200 baud symmetrical channels.] We should avoid building the 4th best!

[In the U.S., we aren't exactly stellar in creating effective modems. Vadic selected signalling frequencies to make the best use of the telephone channel. AT&T selected alternative frequencies using the second harmonic so that acoustic couplers couldn't easily be used. Not only are the two standards a pain, but I find that with a poor line, the acoustic coupler will work, whereas the offical standard won't.   Why can't we learn not to foil others; because you will only get trapped in your own foil.]

<>Wilkinson quote. Not only should it be designed right, but designs should be kept simple: Keep It Simple, Stupid. Jim Wilkinson tells how Turing's obsession with building the highest speed machine was kept in line: "in deciding whether or not a feature should be included, the question we asked ourselves was, could we do without it?"

<>Hoare quote. Tony Hoare's statement can be reduced to three design criteria: 1) exclude what you can, 2) only include what you know and 3) since a machine never diminishes over time, allow for growth - don't build to it's limits.

Increasing memory sizes based on continually decreasing cost of memory insure that users will demand extensible machines. [If a 20% per year memory price decline is assumed and a user spends a constant amount on memory, then] Every 3 years another bit is needed to address the memory.

If a machine is extended over once, the design may take on the character of a camel with the bone structure of a dinosaur. It's quite unlikely that a design can be extended gracefully more than once.

Large committees usually violate principles of simplicity, in fact guarantee complications. A corollary of KISS, for Keep It Simple, Stupid might be coined KICC, or Kill It by Complexity and Committees. ADA, as it is proceeding; and Algol 68 are good examples of KICC. [When David Packard was Deputy Director of Defense, he initiated a cheap, light weight fighter that could be mass produced so a large number could be available, numbers and maneuverability are the keys to winning. By the time it was produced, it became just another very expensive, slow fully general purpose fighter, trainer, bomber for decoying and doing everything else that could only be built in 10's not 100's.]

<>Simplicity, naivete, elegance, generality trickery. The wheel of complexity starts with simplicity. Extreme

simplicity, or naivete', is one reaction to too much generality, the last point in the wheel.

No one of us ever wants to introduce unnecessary complexity. But one person's simplicity can be another's complexity. For whom is it simple? The conceptualizer, or architect? The person who has to implement the machine? The person who has to write the compiler? or the ultimate user of a system? The hardware stack mechanism as embodied in various machines is simple for only one small part of the compiler writer. For everyone else, this extreme simplicity can easily result in comlexity.

<>Bowmar & HP. Don't get me wrong, stacks are great but I believe they have limits; I've always put in hardware to support them. If they are the central theme of an architecture, they can create complex implementation. The system programmer will have a complicated problem because there's too much bound in hardware. While stacks have little or no effect on the ultimate system user, nevertheless they slow down machines. [Or two calculators one for reverse and the other conventional. If you give the stack to the ultimate user, that's fine, but several hundred years of the parenthesis convention for algebraic formulation must be unlearned. Of course, calling the new convention reverse Polish notation certainly only made a confusing joke of it all.]

[In 1959, I helped Hamblen in Australia with an interpreter called George which turned the Deuce into a Polish postfix machine. English Electric liked the idea and put it into the KDF9. Over the last 15 years an increasing amount of stack control has been put into DEC's computers, but all of it is accessable to the system programmer, and none binds the hardware to particular stack management. In Computer Engineering, there's an essay comparing the similarities and differences of truly general purpose registers and a pure stack ISP. Stacks represent a naivete in what appears to be simplicty for someone (although I know not who). Furthermore, this naivete trades off complexity for everyone else.]

<>Comptometer Keys. True simplicity is pure elegance. Russ Doane, a DEC engineer, defines elegance as: Every feature contributes 2 benefits; every working part has to do double duty, insuring that excess is left out. Building architects say Less is more. Note how complement arithmetic allows every digit to represent one of two numbers. [In early comptometers, a separate subtraction mechanism was not required as in a sign magnitude representation.] Thus, the user had to do the complementation and was reminded of it by having the digit and its complement written on the keys.

<>Comptometer Ad. A trained operator could do addition and

subtraction faster than on machines with complentation mechanisms.

<>Burroughs. Burroughs original calculators that used sign magnitude were difficult to maintain and their physical elegance contributed to bank managers desks.

<>Burroughs copy. Burroughs then copied Comptometers to get the elegance of operation through simpler, faster and thus cheaper mechanisms.

One's complement arithmetic used to be popular because the Boolean instruction for complement was the same as the arithmetic change sign, [if you forget about the case of having both positive and negative zeros.] Unfortunately, when doing multiple precision arithmetic, the automatic end around carry gets in the way, and it turned out to be difficult to use for doing arithmetic primarily because too much was done automatically for the user. [Similarly, sign magnitude wasn't used for the same reason. In fact, one's versus two's complement was one big reason we built a totally different 18-bit computer when we already had the one.]

The highest leveled elegance, generality, may increase complexity somewhere in the system.

<>Cover of EDVAC Report. The ultimate in generality is the

general purpose stored program computer. Eckert commented on this how the stored program concept came about. Various priced memories elements were available to use as memories, such as Williams tubes, delay times, and drums. Von Neumann coined the phrase "memory hierarchy". The ENIAC team speculated that it would be very difficult to determine how much memory whould be available for various kinds of data, functions and programs. This led to the notion of a common memory pool and the stored program computer which we all know and love.

<>Eniac. The ENIAC was elegant. Nearly all of its parts could be used for two purposes: multiple accumulators carried out arithmetic in parallel and were temporary memory; the function tables, originally used for storing constants and functions, ultimately stored sequences of a program; and the relay buffers for i/o were also fast access memory; the calculator as a whole was ready for generality, or the exploitation of elegance.

[<>Multistable state device.] In my own case, I've gone for generality, three times but I'll only talk about the general register. [The first is taking an elegant idea, extending the flip flop to store multiple stable states. This was invented to simplify the problem of making controls with a few states.

<>Model for interconnecting computer components. The Unibus idea resulted from trying to make a general model for how computer components interconnect when I was writing computer structures.

<>Unibus. The observed model was a series of switches for interconnecting the hierarchy of memories, processors, controllers and devices. In trying to explain that any component must talk with any other component, the Unibus fell out.]

<>Table of General registers use. Strachey invented the notion of general registers for the Pegasus in 1956. In the sixties the 635 and 3600 were evolutionary 1 address, 1 accumulator machines. Then, the Univac 1107 was first with relatively general registers, and the 6600, 360 and PDP-6 all used them. The 6 provided the most generality for use. Now, high performance machines usually are based on having a large number of registers for fast access to immediate data.

[<>ASC. The designers of Texas Instruments Advanced Scientific Computer -- the ASC - a large pipeline machine built in 1970, built in generality even though they were commissioned to build a Seismic Computer for Geophysical Services Inc., TI's division involved in oil exploration. Several of the machines are used for Seismic analysis but the generic aspects of large scale number crunching also made the machine desirable for others - hence the change of the name from Seismic to Scientific. The extra sales, allowing TI to produce 7 at about 10-25 million and not four.]

<>Wheel of reincarnation. If done right, each time complexity is added to peripheral controllers to obtain more generality there is one more turn in the wheel of reincarnation as Myer and Sutherland outlined in 1968. The first stages seem simple; adding a few instructions and possibly an autonomous Direct Memory Access path increase performance without adversely affecting complexity or cost. The critical step is when the controller gets its own program counter. At this point a system should have its own program and the autonomy to execute programs either as a conventional multiprocessor to handle the increased I/O load or as independent computers for I/O as in the 6600. The interesting points are whether a controller executes an instruction or a complete program. Anything in between doesn't seem right!

Three pitfalls may be associated with extreme generality: trickery, loss in performance, and impracticality.

<>CTSS manual photograph. One example of trickery is the concept of operator overload by allowing redefinition of operators. Multics and the IBM 360/67 TSS were the second

system reaction to CTSS, written for the 7090. In Multics' case, while it appears elegant to have files mapped into memory, thereby extending primary memory generality to yet another function, and hence increasing generality, loss of performance resulted.

The reaction to Multics done jointly at MIT and Bell Labs, and to IBM's TSS was back to simplicity with Unix at Bell Labs, and CP/CMS at IBM.

<>Stretch. The last pitfall of increasing generality is caused by using every known idea. Stretch used and pioneered many ideas of the time: The simpler 360 was a reaction to the complexity of Stretch.

Lots of ideas always exist. Trying to use them all in one design is fatal. Huffman coding to have the fewest bits conflicts with simple ISP's that usually require longer strings to express a program. RISC can be carried too far if the data types the programs use aren't included. The notion of not having interrupts because they interfere with reliable software may conflict with building a real time system. Predication of multiprocessors conflict with cost. Building a wholly distributed system on a local area network may conflict with cost, performance and reliablity. Very secure or very reliable systems conflict with, easy and shared access to data, etc.

The reduced instruction set computers is a reaction to the complexity that occurs because so many data types are bound in the architecture because microcode looks so cheap. With RISC, the idea is to get back to a machine that perhaps has NO microcode, thus another wheel of reincarnation, a return to the simple machine all built in hardware, like Seymour Cray always builds. It runs fast and the complexity is in the compiler and for fast machines, in the implementation.

Whether the instruction set is large or small, we should remind ourselves that an instruction set of some sort must be bound versus building the fully general purpose microprogrammed interpreter. Recall the slowness and expense of several machines built about 1975 that allowed binding to the bit for the ultimate in generality. Papers, academic acclaim, and the talks about them reminded me of the trickery of the snake oil salesman because they could do everything. They could if you had enough money and could wait long enough. Decide exactly what's to be executed and then encode the machine to do it. The classical saying is form follows function.

[<u>Groups tend to design at the level they know best</u>. Bodies in motion tend to remain in motion in the same direction unless acted on by an outside force. Because the group is usually structured to the task based on intellectual disciplines, the control of a project is usually at a low level of integration. This gives rise to the old notion that hardware was designed so it could never be programmed by anyone. This saying was so popular that we now say a machine was designed by a team of software engineers.

Preoccupation with the low level, may mean the machine never gets built. Chips are often managed by circuit engineers, and the big effort is to have elegant circuits and also very many types. Only now do we measure and try to manage regularity, the ratio of total to unique circuits on a chip.

<>Microprogramming. With the advent of practical microprogramming, all users wanted to design their own computers. Fortunately high level languages came into existence and the machine language users didn't have a chance to dive into the details of programming the hardware machine. This is another case, like changing the circuit, that the user of a level believes that he can build a magnificant structure if he can only change the shape of the bricks and possibly make them all different.

A similar observation can be made about machine language programming versus high level languages; and the need of systems programmers to first implement a new language before they can do applications.

The alternative of having a machine that's designed by circuit persons is to have a machine that's designed by users such that it can't be built. Now, we can also worry whether the machine can be built or not because the designers, or architects of a machine don't know how to construct machines. PL/1 is a complex machine specified by users and unbuildable for quite sometime for anyone but a very large engineering group. This may be explained by: Conway's law, or a conscious business decision to build the unbuildable for either competitive or user demand reasons. After all, PL/1 came from Share, IBM's user group.]

Let's turn our attention from design of the architecture and implementation to building.

<>Generating #6. Building is sixth of the seven subprocesses of generating a computer. Carver Mead argues for the tall, thin man, a person who understands all parts of chip design including architecture. I'd like the individual to be even taller including the design of the operating software and then applications.

<4004 ad>. Ted Hoff and Bob Noyce wrote about the small team effort for first microprocessor, an example of the tall thin man approach, and the process of Generating a Computer Generation.

The 4004 was designed to be useful in a calculator, yet was not constrained to be only used to build calculators. LSI PMOS technology enabled several thousand gates to be placed on a chip within the base of knowledge in computing. Ted's first experience was the PDP-8, and he knew the power of the minimal computer.

Without this knowledge of minimal, general purpose computers, or had Ted only used a 360 or Fortran, the micro might have been invented several years later. Here, function, (the computer) follows form (the chip).

<>Cray 1. Cray is the only one person who architects, implements and then designs and builds the software. For the last 20 years, he has built the highest performance computers

and provided a catalog of ideas to use in other computers.

Brooks make a statement about segmenting the technical direction from adminstration. He says, a man with strong management and strong technical talent is rarely found. "Thinkers are rare; doers are rarer; thinker-doers are rarest." Musashi tells us to understand the way of the carpenter as both architect and builder.

My own role is now that of a foreman carpenter or perhaps a city planner and developer. I worry about the architecture of the set of buildings and how they relate to one another, together with where the roads go. Architecture of Networks and Local Area Networks in particular are extremely important. The location of the streets, viaducts and sewers have been permanent; Rome has witnessed great stylistic architecture changes.

<>vax. In the case of VAX, DEC started with a small architecture task force consisting of the most talented people we could find who kept the architecture, documented it, built the first machine and wrote the base software for it. If this was second best to having a single individual do it, it was the only humanly feasible way to get to the market fast. The designers were all experienced in design and had all warmed up on other computers, operating systems and

languages.

If at all possible, don't separate architecture and implementation at least more than a few feet. The iteration process is clear and tightly coupled. Fortran, Pascal, the first Basic are other examples of great designs of single individuals.

The super kludges come from committees because they usually contain no designers of any kind. Designers are typically doers and not committee goers. A large committee occasionally produces a useful design, such as Cobol, because the committee can get commitment from its constituents.

[While machines and languages may be cleanly designed, no single architect has emerged for communications protocols probably because no single organization controls the links and nodes. Often there are more than three independent organizations. The evolving communications interfaces to deal with data switching are so baroque and bazar that I fear we'll be set back many years just implementing them. In the past we were lucky in letting AT&T settle this with the international bodies. By splitting AT&T, there's even a free for all to decide who'll represent the US at CCITT.] The three rules I'd like to see for people who attend standards meetings: 1. the attendees should have implemented something; 2. proposed protocol or standard should be in operation somewhere, and; 3. the committee members are responsible for building what they design!

<>Teledial and pushbutton. Communications protocols are very hard to design because everyone wants to specify, design and have the option to change them. They are best understood as an extension of our natural languages and culture. Many dialects of x25 exist. Decades after all the countries had local dialling worldwide dialling was introduced. [In the case of Ethernet, DEC, Intel and Xerox always had many offers to help in the design which we graciously turned down. Now, we have to convince the IEEE the bits are in the right place and that it should be adopted. Honestly, it's well engineered and honestly the bits don't matter. Please get 802 so we can all get to work building... enough arguing.]

Small groups are not only essential for design, but all segmentation has to be kept to minimum. The greater the division the larger the time and segmentation. This is how we get n pass compliers when one should do, separation of operating system and language, partitioning of the secondary memory into blocks, records, files, data managment, and database languages.

Segmentation may be necessary to build large systems quickly and to get the right disciplines applied to the right level. Make it work for you, otherwise the reverse is to have everyone always working with and redesigning the lower level components and not the overall system.

Base the design on a small set of well defined components. If all the designers have done their jobs properly, then the set of components from which one builds a system will be elegant, yet complete. In this way, higher levels can be aggregated quickly because the behavior of each part is well defined. The Cray 1 was built from 2 IC types. The chips that never get completely finished are usually filled with circuit tricks, which aren't enumerated or understood.

<>Babbage. Don't be so ego-centric that you can't borrow ideas and technology. Babbage himself freely used ideas of others. The Jacquard card-driven loom gave him inspiration for program storage sequencing machine control.

<>Jacquard loom. Jacquard only made a minor tweak on
<>Bouchon loom. Bouchon's card controlled loom.

<>Early Computer. If the Computer Pioneers would have used each others ideas more then the computer revolution might have happened faster. The Harvard MARK I could have used relay technology and some of the design techniques developed for the Bell Labs machines; Bell Labs and ENIAC could have used some control mechanisms of MARK I avoiding the large

tube counts.

<Atanasoff drum>. For example, Atanasoff's capacitor drum memory, using regeneration, is the basis of many memory schemes.

Having received the ideas, be gratuitous about crediting everyone who contributed to the machine. The ENIAC and Regenerative Memory patent claims were so broad that they could not be enforced.

[In 1946, Von Neumann, Burks, and Goldstine understood the value of early communication in getting overnight funding to build the IAS machine in Princeton. Part of the agreement was to send working drawings to Los Alamos Laboratory, the University of Illinois, Oak Ridge National Laboratory, Argonne National Laboratory, and the Rand Corporation. According to Julian Bigelow, who led the engineering team on the IAS, at the outset "we anticipated that any mistake we might make in sending out piecewise the fruits of our efforts would be exposed to possibly hostile or competitive criticism leaving us no place to hide, but in fact problems of this sort never arose, and communication with people at these laboratories was entirely friendly and stimulating."

Today, the ARPAnet is a prime example of continued cross-communication - one of the few good things the defense department supports.]

<>PDP-6 bit slice. Borrowing, can help avoid changing everthing at once. I learned this the hard way in designing the PDP-6 about 1964. This bit slice module is my memento. We thought we could change everything, that there would be little risk in doubling the circuit speed using a new mechanical packaging technique placing connectors on both the front and back of the modules in order to get the requisite numbers of pins; specifying a new architecture with a megabyte address when everyone else was at most 256K; organizing a flexible structure that would permit building a large multi-processor in an evolutionary fashion so that we could build subsequent machines on the same base; presenting a straight forward interface which as a side effect probably started the whole idea of third pary vendors at Stanford, and predicating the design on timesharing -- a concept that was just being breadboarded at BBN, MIT, Stanford, and SDC.

Only 20 PDP 6s were made and several are still in service. The team stayed together and gained experience for the PDP 10. I would have hated to say to customers at the time that we were selling them an advanced development effort for our own, and others, interactive computing. Thinking of the 6 as a breadboard, probably the main mistake was not changing the packaging more to allow wirewrapping. Then the mechanical

problems of building the PDP 10 would have been to allow wirewrapping. Wirewrapping was the second generation, a technology that allowed computers to be mass-produced and not handcrafted. This was the key to the formation of minicomputers and the explosion of the computer population.

<>Illiac IV. [A more recent example is the ILLIAC IV, built at the beginning of the 3rd computer generation for scientific use, based on the yet undeveloped technology of semi-conductor memories. ILLIAC had a steady, seemingly, inexhaustible supply of funds that were thought as the universal solvent making up for under-developed technology and a trivial but complex architecture.]

<>Whirlwind. [Whirlwind is one of the great success stories: First running in 1951, the ANFS Q7, a production model built for the early warning system is still running and protecting us. The Whirlwind design team investigated other machines and technologies to design a machine for solving significant, real time, interactive, and control problems. Every other computer built in the forties was either oriented to arithmetic computation or data processing. The original task of project Whirlwind was to build an Aircraft Stability Control Analyzer, requiring real time simulation of an aircraft. This need constrained the problem in three ways: reliability, accuracy, and speed. Over 100 simultaneous equations, with an accuracy of .1 percent, had to be solved

at a 10-20 herz rate, forcing a parallel organization.

<>Bush. Like ENIAC, the program was conceived as an extension of the work on analog and differential analyzers in MIT's servo-mechanisms lab. As the work progressed, the transition from analog to digital was based on a suggestion by Perry Crawford who worked for Vannevar Bush. Crawford's ideas, based on his 1942 thesis on digital computation, were critical to the decision of both ENIAC and Whirlwind to become digital computing projects. The MIT team, led by <?> investigated the efforts of ENIAC and EDVAC. They made two unusual design decisions for the period. The serial approach was ruled out in favor of going to a parallel computer. They also moved from the 40 bit word length convention to a 16, bit word, 32 feet long. To a large extent the word length was chosen to gain speed and accuracy within the size and cost constraints.]

It's really a good idea to build in generality, so that systems may be used for some different purposes than those intended. Whirlwind also had significant spinoffs. It was built to demonstrate the SAGE air defense system using real time input from radars whose information was transmitted via phone lines. It also had the first crt's and light pens. In addition, Whirlwind was used for at least two purposes not conceived in its design but that fell out of it: the first computer speech research and Linvill's work on sample data.

<>WW Module. Build real things, not toys. The Whirlwind modules were taken verbatim by Burroughs and by ERA for the 1101, and the machine itself was built by IBM to serve the SAGE system. ENIAC was the breadboard for the UNIVAC machines. These real, engineered efforts at universities were significant spurs to American industry, the economy, and computing.

<>WW. Forrester was interested in sound engineering practices, stating, "Experimental equipment, merely for demonstration of principle and without inherent possibility of transformation to designs of value to others, does not meet the principle of systems engineering." MIT never got into the computer business -- but the Whirlwind did provide many businesses with proven designs and trained engineers.

[The abacus, a simple calculator, started well before my categories of pre-computer generations. It is such a good idea and simple device, that it has been claimed to be invented in Egypt, the Roman Empire, and China. If it is a good idea, then everyone will take credit for it.]

<>Core. At MIT, Forrester did not depend on outside suppliers but did his own experimental development on the core memory. MIT's University Research Corporation did not

see fit to patent the core because they considered its commercial applicability would be negligible. Forrester got MIT to patent it, and to his chagrin (and probably many others) kept many patent lawyers in business for years. He stated, "The Patent effort and litigation took about 1000 times the effort of the design. It took six years to convince industry to use the core and then six years to convince them they hadn't invented it." In this case, IBM lost the suit against Forrester and MIT, but they still will not readily admit it. I was recently told that IBM invented the co-incident current core memory; An Wang and Jan Rachjman of RCA also claim invention of the core. It was such a good idea at the time, everyone wanted the credit, just like the abacus. The idea did come from the university environment where openness across disciplines and cultures are much more likely to occur than in industry.

<>Generating #7. The cycle includes using the machine -- something I've always wanted to have more time to do. Eckert, Mauchly, and Babbage, were often thinking about the next machine before they realized the full potential and had all the bugs out of the one at hand. Eckert and Mauchly left the Moore School and the ENIAC project during the infancy of the machine and never lived with the UNIVAC systems very long.

<>WW. Forrester not only realized computers should be used but that understanding and training about a revolutionary new device requires the device. Can you conceive of universities without the computer? In 1948 that was the case. when forrester argued: "if a high speed computer capable of 1 to 20 thousand instructions per second were sitting here today, it would be nearly two years before the machines were in effective and efficient operation. ... this represents one-half of the viscious cycle in which an adequate national interest in computer training cannot be developed until the equipment is actually available." I believe this two year period should be called the Forrester constant.

The problem is still here. The 1979 Feldman report argued for funding for equipment for experimental computer science. Carnegie, Stanford, and MIT, still need more computing power for training tomorrow's pioneers.

<>Fortran. Perhaps the overwhelming reason to use computers before you build them is that Hardware follows Software. Nearly all mechanisms that appear in computer hardware structures start with software implementations. John Backus of IBM tells the story on the introduction of floating point. He observed that many customers were running their 701s with a floating-point interpreter, slowing the machine to 50 multiplications were second. He tried to get the engineers to include floating point hardware, but they were more interested in speeding up the drum. He then created, "The most incredible design for building floating point into the 704." It involved adding four or five new registers, which was unheard of in those days. At the next meeting of the engineering design committee, he remembers, "I stood up and spent an hour describing my insane design and people listened. At the next meeting Gene Amdahl got up and said, 'Backus, you're an absolute idiot; you can build in floating point without adding any registers at all to the computer, and it will cost almost nothing, and here's how to do it.' And that's how it happened."

<>Turing. The one level store of the Atlas came from using Mercury. The assembly program I wrote had a one level store, because the two levels were so difficult to program. Furthermore my reaction to program a Turing designed machine, which really made the programmer work, established in my mind that the machine ought to be understandable.

Thus, one of the key results of using is the whole notion of the adversary design. The one level stores were invented to overcome the hardware. The invention of the stored program I started with was a reaction to the unreliable and inflexible way of programming the ENIAC, iterating that hardware follows software and that we learn from advesary designs. The ASC and Cray 1 seemed to be reactions to the inflexible, ILLIAC IV.

<>Fortran. On occasion, software may follow hardware. This is rare and often wrong. The first Fortran had instructions to manipulate the sense lights, sense switches and tape of the 704. Also, the DO loop was oriented to the index register instructions. Some of these primitives have stayed with us, but most were dropped. I believe all the algorithmic languages should have been extended to handle vectors and arrays. Had this happened, we would have these operators in machines. The Cray 1 is causing this extension so that software is following hardware.

<>Pencil Evolution. Finally, use it and describe it so it can be evolved. Go around again. Those who build machines describe, it's like playing Pinball. The reward of building the machine is to build the next machine. No matter how good a design is the next one can always be better as Pentel, has shown in their evolution of the homely, but important pencil.

GB3.S3.24

DATE EVENT/TITLE
WHERE

1980
12/16 PATENT AWARD LUNCH
MILL CAFETERIA
GB (SAY A FEW WORDS) + GB AND ANDY GIVING OUT AWARDS

1981

1/16 EXTERNAL RESEARCH GROUP FROM UNIVERSITY CS DEPARTMENTS
ECKHOUSE MEETING, 9:00 AM
SHERATON TARA
80-90 ATTENDEES, SUGGESTED SUBJ: THE WORLD OF TOMORROW--HOW DO WE GET THERE?
TALK: ?

<---TO BE PREPARED

1/28 ACM/GENERATING COMPUTER GENERATIONS
SAN FRANCISCO

1/30 U OF TEXAS
TEXAS
TALK: GENERATING COMPUTER GENERATIONS

3/11 CMU, DISTINGUISHED LECTURE SERIES
PITTS.
TALK: GENERATING COMPUTER GENERATIONS

5/20-21 DECUS (MARYANN OSKIRKO, DON FROST)
FLORIDA
TALKS: GENERATING COMPUTER GENERATIONS AND LIMIT TO DISTRIBUTED PROCESSING

Archival
1980
10/8 5-YEAR AWARD LUNCH
POWDERMILL RES.

SHORT TALK

10/14 PUBLIC AFFAIRS SEMINAR
WESTON
PANEL: COMMENTS ON GEORGE BALLS SPEACH--THE INTERNATIONAL ENVIRONMENT OF THE 80'S

10/15 IEEE
MUSEUM/MR CAFETERIA
TALK: GENERATING COMPUTER GENERATIONS

10/30 NAE SYMPOSIUM
WASHINGTON D.C.
PANEL: ACADEME, INDUSTRY, AND GOVERNMENT INTERACTION IN ENGINEERING EDUCATION

9/30 ENG.PERIPHERAL BUYOUT WORKSHOP
COLONIAL INN, CONCORD
TALK: 45 MIN PRESENTATION--YOU HAVE PACKAGE (8:30 TO 9:15)

10/2 ICCC
NEW YORK
PANEL: VLSI DISCUSSION

10/7 BOSTON SALES OFFICE
LEXINGTON SHERATON
TALK: DISTRIBUTED PROCESSING

11/24 DEC CUSTOMERS
LONDON OFFICE
TALK: DISTRIBUTED PROCESSING
TALK: OFFICE OF THE FUTURE

<---TO BE PREPARED

11/26 INFOTECH LECTURE

ENGLAND
TALK: DISTRIBUTED PROCESSING

12/1 NEWCASTLE
ENGLAND
TALK: GENERATING COMPUTER GENERATIONS

I'm honored to have this award for three reasons: First as an engineer in the tradition started by Eckert and Mauchly, second as a founder of the Digital Computer Museum, and third as an author. First, as an engineer I am very proud to have the award, and I have many others to thank for it. Like Eckert and Mauchly, I worked with and built on the work of others. Most computer innovations are not made by one person: As a writer my co-authors, especially Allen Newell, and also Dan Siewiorek, Craig Mudge, John McNamara, and John Grason need to be thanked. As a museum founder, Ken Olsen and Gwen Bell, who is now the President of the Museum Corporation, are important. And as an engineer, the first people to thank are Ken Olsen and Ben Gurley, who were responsible for conceptualizing a commercial computer, the PDP-1, based on their development of the TX-0 and TX-2. I want to acknowledge Ed DeCastro who implemented the PDP-5 and 8, Alan Kotok who worked with me on the PDP-6 for the first timesharing system. Roger Cady and Harold McFarland on carrying ideas for the 11 and although I lead the early design group on VAX, it's really Bill Strecker's work with Bill Demmer leading the development. Dave Cutler was responsible for the design and building of VMS. Many others also contributed.

As a founder of the Digital Computer Museum, this talk gives me a chance to tell you about it.

<>Entrance DCM. When I talk about the Digital Computer Museum, the image in my mind is of the American Museum of Natural History -- where twelve acres are devoted to the collection and study of the natural world. Similarly, the Computer Museum will collect and preserve all computing history for its study and interpretation. Computing is large and important enough to have its own, special, centralized Museum. Science is too large. National, corporate and local museums don't provide good comparative history.

<>Hollerith. The Digital Computer Museum is a public non-profit charitable foundation whose purpose is to preserve the history of all of information processing. That means that you and your organizations can give the Museum equipment and money and receive a full tax deduction. The Museum, in turn, is obligated to preserve artifacts. The collection not only includes computers, but also calculators, memories, links and switches, transducers, controls, and robots, that is the whole range of components that Newell and I outlined in the PMS notation. Already the collection has grown to the extent that we can claim to have the most comprehensive exhibits of the origins and evolution of computers.

<>TI exhibit. Its fitting that I'm speaking in Texas because Texas Instruments was the first outside donor giving us the heart of an ASC and really helped establish an industry wide effort.

<>Another shot. I want to invite all of you to come see the Museum, join the Association so that you can receive its quarterly report, and consider it for a depository of the important papers and artifacts of computing history. (And, by the way maybe this will help me lure Pres Eckert to come and give a Museum Lecture -- He has a standing invitation from us.

<>Computer Generations Cycle. As an author I need a deadline -- like this one. The talk is evolutionary and I hope it will be part of a biographical monograph on Computer Evolution.   Although the examples are historical, I can't claim to be a historian only a biographer. The focus in this talk is the middle of the evolutionary process, that is, the computer engineering needed to implement ideas before they become obsolete.

The revolution started by ENIAC generated this evolutionary cycle. The need for making ballistics calculations started the cycle. This generated resources that allowed a team to integrate technologies into a new machine for satisfying the need. The moment ENIAC started to calculate, it's use set the cycle off again. Users identify new things to do with computers and provide market resources for new machines. Fred Brooks makes this point clearly in THE MYTHICAL MAN-MONTH, stating, "the incompleteness and inconsistencies of our ideas become clear only during implementation." (p.15) If idea generators, and builders aren't involved in use, they won't understand the evolutionary trend enforced by feedbacks. Closing the loop results in computer evolution -- not revolutionary new machine design.

Like all cycles this one has periodicity. New technologies, needs, or uses can trigger a small spurt -- and the coincidence of all three mark a new generation and a branching of the family tree of computers.

<>Light bulbs. Technology provides the base tools from which computers are developed. Inventor's ideas are the bright lights floating between technology and society's dreams. At the dawn of a new generation a number of inventor's concepts converge into a project. Eckert and Mauchley are rightly given the major credit for ENIAC, but Atanasoff's work preceding it is recognized as influential, and their colleagues -- Burks, Sharpless, Goldstein, von Neumann and many others -- also deserve credits. With each generation, the technological floor becomes higher, the user's aspirations rise, and the gap that spurs invention is constant.

<>Generation tree. Computer generations can also be seen as a tree, starting with its roots in scientific and business calculation with ENIAC, a scientific; and UNIVAC, a business, machine. In the second generation, super computers branched from the scientific root and continue on an evolutionary path determined by Seymour Cray. At the same time early scientific and business machines merged into the class of general purpose mainframes ranging in price from 100 thousand to 10 million dollars. Although the idea of the mini, for minimal computer as in the PDP-8 was developed at Digital in the second generation, it flowered as its own branch in the third generation when IC's permitted numerous variants and companies to start. The fourth generation is marked by the branching of the micro processor on a chip. It's too early to see the fifth generation, but either it or the sixth must be identified by a means -- such as ethernet -- for all classes of computers to communicate on a network forming a computing mesh with an interlacing of branches to keep them from collapsing by their own weight.

<>Op rate. During the 400 year, ten generation period from 1600 to 2000, the technological change is roughly a factor of 10**12. Using the product of processing rate and the memory size to measure computing power, then the computer has evolved almost 20 orders of magnitude

<>toes. since stone-based, manual, single register devices for counting supplemented fingers and toes.

<>Generation is marked by. Three ingredients are needed to create a new computer generation: a steady supply of funds, a useable technology, and the machine design.

<>Babbage. Babbage only had the machine design and was destined to work alone because he had no funds. He tried the patience of government agencies and friends by repeatedly requesting funds without producing results. He always promised the next machine that he had in his mind if only monies were available, even though the technology was not within grasp.

Two of the three is not enough. And having only one of the three -- only the machine design as Babbage had -- dooms a project to failure.

<>Stibitz. George Stibitz at Bell Labs had the funds and was working on the same type ballistics problems as Eckert and Mauchly. He was constrained by the technology of the telephone company; that is to use ... alot of telephone relays. The 1939 machine was the first calculator that could do complex arithmetic and it operated via Teletypes in an interactive fashion. In September 1940, the calculator was demonstrated at a meeting of the American Mathematical Society at Dartmouth. An interface to the teletype designed by S.B. Williams allowed attending mathematicians to transmit problems from Dartmouth for solution by the calculator in New York.

<>BTL2. Bell Labs produced four advanced versions of the machine, and by the mid-fifties this line had died out. Thus, it can be seen that a useable, but traditional technology is inadequate in forming a new generation.

<>ENIAC. ENIAC had all three: Herman Goldstine insured a steady flow of funds from the Army; a variety of technologies, including

<>tubes. vacuum tubes, teletype and card equipment for i/o; magnetic recording in the form of drums; diodes and triodes;

<>flipflop. the Eccles Jordan flip-flop; and switching algebra were available for use under the careful engineering of Pres Eckert, and a new machine design was inspired by John Mauchly.

<>SubProcess. In any machine design, a number of separate, concurrent processes give rise to decision points leading to suspension, continued development, or recycling.
<>Generating a computer structure. Seven processes interact in the evolutionary cycle of a new computer structure. The first process involves defining the problem: understanding the constraints, setting the goals, and determining the objective function of the design. Then, three mutually exclusive decision processes determine the architecture. Selecting the null architecture is calm and peaceful -- not exciting until implementation when almost insurmountable technology problems emerge; choosing an evolutionary architecture that copes with new technology or needs, is like guerrilla warfare -- a few people die on the line and some get caught in the crossfire;   but generating a new architecture means a bloody revolution.

The process of physical design for implementation is concurrent with the architectural design process.

The building process requires complete understanding so that no unplanned side effects occur. The complexity of building computers is so great that even with the greatest care side effects are free. For the lucky designers they're also positive!

The final Process, using the machine, is essential for understanding the next step in evolution and the issues that could lead to revolution. Within the context of the whole cyclical feedback, each process will be considered individually. The process of problem definition sets the constraints, goals and the objective function based on cost, performance and other measureable factors. The physical laws governing materials with respect to electromagnetic energy and heat transfer are obvious constraints. Yet engineers still try to violate them. And we never win.

<>ENIAC plugs. ENIAC was bounded by the reliability of both vacuum tubes and plugboard programming. Mauchly reasoned that even if ENIAC only ran a few minutes it would accomplish more than Bell Labs slow relay machines. It contained 18,000 vacuum tubes each with a predicted 500 hour life. If the machine had been designed using the tubes at capacity, the exponentially increasing repair time would have bootstraped the machine to its death, that is, if it ever lived. Goldstine recorded that by derating the filament and plate only three tube failures occurred per week. The actual failure rate of about one million hours was achieved only by very conservative engineering. Because of the potentially compound problems of tube failure and plugboard connections all problems were run twice to insure accuracy. Franz Alt, commenting on the 40 plugboards and extensive cabling, estimated a five percent utilization rate. Taking into account the amount of time the machine ran, ENIAC was still 25 to 50 times faster than the relay machines. The fact that such a large system ran is a tribute to conservative engineering, mostly on the part of Eckert.

<>Whirlwind. In contrast, Jay Forrester, on the Whirlwind, tackled problems at their source. Concerned with highly reliable, real time computing, he knew that the estimated tube reliability of 500 hours had to be increased by several orders of magnitude. An outside review prodded at the gradual failure mechanism of the tubes and led to marginal checking. By understanding the tube failure mechanism, the manufacturing process, and introducing marginal checking, reliability was raised to five million hours.

<>Von Neumann. In the later forties Von Neumann, determined to build IAS, put his faith in new undeveloped technology for a fast parallel memory promised by RCA. After two years of work on the Selectron tube, with vague but optimistic quarterly reports, not one had worked.

<>Selectron tube photo. Julian Bigelow reports, "No one in the IAS team was sufficiently expert in electron tube design and manufacture to be able to assist it, but in conference with Von Neumann I made an attempt to list the variables which would have to be kept under control to produce a 50% yield of successful selectron tubes, covering a range of digital capacities from the original goal of 4096 digits per tube, down through 2048, 1024, 512, etc. It appeared that...the goal of 4096 per selectron was far too ambitious, and that acceptable production yields might be far sooner attained if the goal were reduced to 128 digits per tube." This 256 bit Selectron finally became available in 1953 for Rand's Johnniac.

What did Von Neumann do for his memory? He sent an expedition to Manchester where Fred Williams had built random access memory tubes with 1,000 bits, each.

<>WW Tube Memory. Jay Forrester did the same. The two Mhz clock and 50 K ips speed using MIT adapted Williams Storage tubes cost $16,000 per month to operate. Impressive, but expensive. Searching for a better solution Jay Forrester started to investigate using magnetic cores.

<>Ceramic Core. At first they used wound magnetic tape Deltamax cores. Then beautifully made, but little understood, ceramic cores were found at Philips. According to Forrester, the manufacturers claimed that they could not be used for storage. Theoretically this was true, but it didn't stop Jay Forrester from trying ceramic cores and succeeding. Forrester commented, "This is an example of where the art was substantially ahead of the theory. Cores worked and could be made by trained ceramicists. Years later scientists understood how and why, but for many years production of ceramic cores was a materials art."

<>Forrester and Core. Forrester did not depend on outside suppliers but started his own experimental development on the core memory. MIT's University Research Corporation did not see fit to patent the core because they considered its commercial applicability would be negligible. Forrester got MIT to patent it, and to his chagrin (and probably many others) kept many patent lawyers in business for years. He stated, "The Patent effort and litigation took about 1000 times the effort of the design. It took six years to convince industry to use the core and then six years to convince them they hadn't invented it." In this case, IBM lost the suit against Forrester and MIT, but they still will not readily admit it. I was recently told that IBM invented the co-incident current core memory; An Wang and Jan Rachjman of RCA also claim invention of the core.

<>Turing. In 1958, I visited Wilkinson, who while working for Turing, designed the Pilot ACE, the prototype of English Electric's Deuce that I had been programming. I told him about a symbolic assembly program that two of us built to optimize instructions in a delay line in conjunction with a backing drum memory providing one of the first one-level memories.   He asked me for a benchmark. I compared it with the results using a new program language called Fortran, which he was even more skeptical of. A matrix routine could be coded a factor of 10 faster than the current method of hand allocating, assembling and key punching programs in row binary but still a factor of 4 slower than using Fortran. He said, none of this matters, "I can write any matrix program in machine language in 15 minutes: why should we waste the machine's time in doing it?"

While, I admit that the Turing influence was extreme, after initial funding, most of us still take ourselves as the archetype user.

<>GB and average man. All of us, including myself, want to design computers and languages as if we're the average man. This proves it to you. I'm absolutely average, so I can do it and tell others how to as well. A greater pitfall than designing for yourself, is designing for a proprietary user. Paraphrasing a remark by Charles Wilson of GM: "What's good for General Motors may not be good for anyone else."

<>Photo of PDP-14. I don't know how many of you recognize the PDP-14 for controlling transfer machines. This doesn't mean we shouldn't have built a machine to solve the control problem. The designer should formulate the NEXT problem for the machine, not just the one at hand.

<>Military. The ultimate in vanity architectures are computers built for one of the world's largest organizations, the Defense Department. I've never met ANYONE who admits to being either the designer or specifier. The current Military Computer Family effort is designed to take incredible engineering resources out of circulation, guarantee high prices, and worst of all, insure obsolete equipment. Their Russian counterparts base computer designs on US commercial architectures and probably their implementations. No real benefits will come from building the MCF VANITY architecture.

<>Generating #1. While need orients designs and generates resources; as the sole constraint, exact need is detrimental to progress. Standards represent the ultimate in constraints. Getting the right standards at the right time is essential for widespread implementation. If a defacto standard exists, such as the IBM channel and Unibus, let it be. If a standard is needed, then go all out to create it so that others can avoid the hassle of having to invent in an area that will generally make work. Alternatively anarchy can reign until IBM makes an ad hoc decision, and then it can be accepted in a de facto fashion and we can all try to implement it.

The ultimate in standards is implementing a computer based on an existing architecture; this is the null architecture design process.

<>EDSAC. Maurice Wilkes, who took the 1946 summer course on the ENIAC and EDVAC at the Moore School, returned to Cambridge University and built and programmed the EDSAC. This first, full scale operational stored program computer, was based on a simplified version of the EDVAC and IAS. In 1949, only one month after EDSAC was operational, Maurice Wilkes perceived the value of a series of computers sharing the same instruction set. He stated, "When a machine was finished, and a number of subroutines were in use, the order code could not be altered without causing a good deal of trouble. There

would be almost as much capital sunk in the library of subroutines as the machine itself, and builders of new machines in the future might wish to make use of the same order code as an existing machine in order that the subroutines could be taken over without modification."

<>EDSAC or Maurice. This advice is even more applicable today than it was then and must constantly be reiterated to us all! In a recent editorial in Computer Design, the editor in chief commented: "the microprocessor revolution ... has more or less stiffled CPU architects except for those involved in mainframe and military or highly specialized system. ... the upswing in 16-bit microprocessor chips is again going to put somewhat of a crimp in architectural innovation... The real renaissance in smaller cpu architectures is just within grasp as the VLSI gate array moves into the realm of the smaller computer manufacturer ... Once again the CPU architect can return to innovations in internal cpu structures." I couldn't disagree more.

New architecture, particularly hardware architecture, should be the last resort because it is the beginning of what is fundamentally a six or seven stage work amplifier.

Given that I've introduced null architecture, building successor machines that are compatible with or built on the past, I feel duty bound to state a lesson that RCA ignored and the Japanese eventually learned.

If you copy a machine, do it exactly -- not just closely. The test has to be that the software, including all user data and files can't know the difference between the original and the copy. Furthermore, if there is a desire to attract, and then entrap, a given set of users to your machine (or language), then build it with extensions that other machines don't have, and that your users will feel duty-bound to use.

<>Fortran. When no process for standardization exists then a plethora of language dialects develop like Fortran V, stemming from Fortran IV. Similarly, the designer of the 8080 added instructions to the architecture and created the Z80, insuring two architectures, and the attendant waste, when one was adequate. At least the Z80's a superset.

On the other hand, conservative users and manufacturers want to preserve their economic and emotional investments as long as they can. Enticed by a user base, almost every company produces one too many of a given machine design.

<>Hollerith. The card which was the savior of the 1890 census became so tied to some corporations approach to computing that they could see no alternative methods for input or output. When the 80 column card was on the way out, true believers in card computing evolved a 132 column card. This too was an expensive evolution requiring new equipment. This dinosaur, a large beast created on a small bone structure (or architecture) was created just when the technology should have been let go.

<>Generating #3. The key is to know which machine is one too many, -- to question whether the bone structure will support the architecture -- and if the limits are close, don't build it. Compatibility extends life in the process of evolving an architecture.

<>abacus. The original Chinese abacus represents up to 15 in a digit with a combination of 5 and 2 beads. It is the bi-quinary system we invented several times.

<>SOROBAN. Ultimately the Japanese refined the abacus, first using 5 and 1, and then 4 and 1 beads for lower cost and

faster operation while not radically affecting the installed base.
<>soroban/calc. This 1979 calculator/soroban is ideal in several ways: low cost storage of a second number is provided; simple operations can be done traditionally and more rapidly on the soroban; users can be gradually trained on the new machine without losing any traditional computational capability; the market is larger; and a culture is preserved.
<>Core. And like the core memory, the idea is so good that many claim the invention.

<>PDP-1 and 4. One of the earliest computers I worked on was the PDP-1, an 18-bit computer, grandchild of Whirlwind and a direct descendant of the TX-0. None of us thought of using the Whirlwind ISP because we needed 2 more than the 16 bits of Whirlwind. Both Whirlwind and TX-0 had excellent system software. Then with the design of the great grandchild, PDP4, to tune the implementation exactly to the architecture saving at most 10% over the PDP-1, I introduced a further ISP and switched to two's complement. Thus, in a family tree of 4, three architectures were probably unnecessary. The world ended up being modulo 8 bits anyway, just as in the original Whirlwind. Perhaps an even greater sin was committed by Computer Controls Corporation because they changed the name PDP to DDP and added a bit to the PDP-1 to come out with the DDP 19. They only sold a half dozen.

<>12 bit. The history of 12-bit computers is similar. The architectural differences of the CDC 160, the LINC, PDP-5 and 8, the 6600 and 7600 ppu's, and those of Honeywell and SDS whose names I forget weren't significant. If we had all copied the 160 the implementations could have remained unique.

<>PDP-5. Computer architects and their implementers who did not make either exact or evolutionary copies of a predecessor machine have cost the entire industry unaccountable billions. In the second generation all that a number of our architectures provided were noncompatible versions of Whirlwind and the 160.
<>Generating #4. New architectures are needed for new forms of computing. Obsolete computers are characterized by inadequate bone structures for coping with different, more modern environments. Several companies who tried to go into business by buying up a bunch of old computer designs, had no chance of high growth. They were self-limited by existing conservative users of these machines. Growing by user base acquistion is like trying to get fat eating tapeworms.

High growth comes from the new architecture of new organizations like Apple, or converting to the VAX base at Digital. But, believe me, when you're dealing with an existing organization with a set of happy and content users, suggesting change, and implementing it, is difficult, but critical, for success.

Now that we've looked at both null architecture and architectural evolution processes, what will the architecture of a revolutionary machine look like?

<>Thomas arithmometer. At the beginning every new structure appears to be quite complex. When Thomas and successors manufactured a calculator, the machine appeared to be very complicated to scientists used to simple slide rules with two moving parts. In 1849, SCIENTIFIC AMERICAN wrote, the Thomas machine "is said to be one of the most astonishing pieces of mechanism that has ever been invented, but to our view, its complexity shows its defectability."

<>Millionaire. Subsequent manufacturers evolved the machine and continued to make and sell them into the twentieth century.

<>Deuce Drum. In 1957, when I saw a moving head drum on the DEUCE computer, I was awestruck. Two independent 16 track read and write heads were used to select 1 of 256 tracks. The control was via a potentiameter sense in an open loop fashion. The complexity was beyond my imagination. I was biassed because my program also turned out to be the best diagnostic.

<>CDC 6600 refrigerators. When Cray's 6600 was introduced in 1964, the refrigerators in each quadrant seemed to create a complex maze of plumbing. But it's really a simple and natural method after its understood. With the high power densities, a built in refrigerator is the best way to cool a computer.

<>Generating #5. The principles of design help in understanding essential versus non-essential complexity both in architecture and it's implementation.

<>Communications Poster. In 1968, Melvin Conway hypothesized that organizations are constrained to produce designs that copy the communications structures of their own organization. This tells us why n people may create an n pass compiler, or why several strong persons will partition a design into separate functional units.

<>Dupont. One of our customers conceptualized their need for interconnection as nearly total communication among nodes.

<>First level of the tree. Yet, when the network was designed the thoughts, like the organization turned to a three level tree, the first level of which is shown here.

<>IBM telecommunications tree. This explains the difference why SNA,

<>ARPA network. ARPA-net,

<>Dec net. and DEC's approach to networking is different.

<>Unibus. With the Unibus each computer component operates to a well defined protocol and can be developed and evolved independently of any other. Hierarchy is imposed by use and convention, not by structure. In this way various groups inside and outside of DEC could build components to a common protocol. This is also why the structure was copied by all micros.

<>Ethernet. Ethernet, a direct evolution of the Unibus, ties computers together in a local area without dependence on central networking functions, central power, or on a particular node.
<>IBM 360. The IBM 360 may mirror IBM. Memory is the focus for all work and the single central processor controls all significant decisions in the 360. This authoritarian top down structure has fat but not very smart subordinates doing the i/o.
<>CDC 6600. In the Cray computers, everything is oriented around a single, very high performance processor at the center. Unlike the IBM approach, the peripheral computers operate effectively autonomous.

Keep in mind that we've looked at some very good designs. Now consider what Watts, the Father of Radar said: "Designers always build the 3rd best system. The First is ideal and the Second best takes too long." Clearly guidelines are needed to avoid building the 4th best.

<>Wilkinson quote. Jim Wilkinson tells how Turing's obsession with building the highest speed machine was kept in line: "in deciding whether or not a feature should be included, the question we asked ourselves was, could we do without it?" This can be translated into Keep It Simple, Stupid.

<>Hoare quote. Tony Hoare's statement can be reduced to three design criteria: 1) exclude what you can, 2) only include what you know and 3) since a machine never diminishes over time, allow for growth - don't build to it's limits.

<>Cost per gate. Increasing memory sizes based on continually decreasing cost insure that users will demand extensible machines. Every 3 years another bit is needed to address the memory. Lack of understanding of this phenomena has been the fatal flaw in nearly every design since 1950. Most designs cannot be extended gracefully more than once.

Large committees usually violate principles of simplicity, in fact guarantee complications. A corollary of KISS, for Keep It Simple, Stupid might be coined KICC, or Kill It by Complexity and Committees. ADA, as it is proceeding; and Algol 68 are good examples of KICC.

<>Wheel of complexity. The wheel of complexity starts with naivete, or extreme simplicity, usually as a reaction to too much generality. No one of us ever wants to introduce unnecessary complexity. But one person's simplicity can be another's complexity.

<>Simplicity. For whom is it simple? The conceptualizer, or architect? The person who has to implement the machine? The person who has to write the compiler? or the ultimate user of a system? The hardware stack mechanism, the theme of various machines, is simple for only one small part of the compiler writer. For everyone else, this extreme simplicity can easily result in comlexity.

<>Bowmar & HP. Don't get me wrong, stacks are great but I believe they have limits; I've always put in hardware to support them. If stacks are the central theme of an architecture, they can a create complex implementation that runs slow. The system programmer will have a complicated problem because there's too much bound in hardware. Stacks usually have little or no effect on the ultimate user.

<>Elegance. True simplicity is pure elegance. One of our engineers says elegance occurs when Every feature contributes 2 benefits; every working part has to do double duty, insuring that excess is left out. Building architects say Less is more.

<>Comptometer Keys. Note how complement arithmetic on a Comptometer allows every digit to represent one of two numbers. Thus, the user had to do the complementation and was reminded of it by having the digit and its complement written on the keys.

<>Comptometer Ad. A trained operator could do addition and subtraction faster than on machines with complentation mechanisms.

<>Burroughs. Burroughs original calculators that used sign magnitude were more complicated and thus more costly to maintain. Their physical elegance and simpler operation insured their appearance on bank manager's desks.

<>Burroughs copy. Burroughs then copied Comptometers to get the elegance of operation through simpler, faster and thus cheaper mechanisms.

<>Generality. The highest leveled elegance, generality, may increase complexity somewhere in the system. The best example is the general purpose stored program computer. Eckert commented on the how the stored program concept came about. Various priced memories were available such as Williams tubes, delay lines and drums. Von Neumann coined the phrase "memory hierarchy". The ENIAC team speculated that it would be very difficult to determine how much memory should be available for various kinds of data, functions and programs. This led to the notion of a common memory pool and the computer which we all know and love.

<>ENIAC. The ENIAC was elegant. Nearly all of its parts could be used for two purposes: multiple accumulators carried out arithmetic in parallel and were temporary memory; the function tables, originally used for storing constants and functions, ultimately stored sequences of a program; and the relay buffers for i/o were also fast access memory; the calculator as a whole was ready for generality, or the exploitation of elegance.

In my own case, I've gone for generality, three times but I'll only talk about the general register.

<>Table of General registers use. Strachey invented the notion of general registers for the Pegasus in 1956. In the sixties the 635 and 3600 were evolutionary 1 address, 1 accumulator machines. Then, the Univac 1107 was first with relatively general registers, and the 6600, 360 and PDP-6 all used them. The 6 provided the most generality for use. Now, nearly all machines have a large number of general registers.

<>Trickery. Three pitfalls may be associated with extreme generality: trickery, loss in performance, and impracticality. One example of trickery is the concept of operator overload by allowing redefinition of operators. Multics and the IBM 360/67 TSS were the second system reaction to CTSS, written for the 7090. In Multics' case, while it appears elegant to have files mapped into memory, thereby extending primary memory generality to yet another function, and hence increasing generality, loss of performance resulted. The reaction to Multics done jointly at MIT and Bell Labs, and to IBM's TSS was back to simplicity with Unix at Bell Labs, and CP/CMS at IBM.

The last pitfall of increasing generality is caused by using every known idea. Stretch used and pioneered many ideas: The simpler 360 was a reaction.

Trying to use all the new ideas around in one design is often fatal. Huffman coding to have the fewest bits conflicts with simple ISP's that usually require longer strings to express a program. RISC can be carried too far if the data types the programs use aren't included. The notion of not having interrupts because they interfere with reliable software may conflict with building a real time system. Predication of multiprocessors conflict with lowest cost. Building a wholly distributed system on a local area network may conflict with cost, performance and reliablity. Very secure or very reliable systems can conflict with, easy and shared access to data.

<>PDP1. The reduced instruction set computers is a reaction to the complexity that occurs because so many data types are bound in the architecture because microcode looks so cheap. With RISC, the idea is to get back to a machine that perhaps has NO microcode, a return to the simple machine all built in hardware, like Seymour Cray always builds. It runs fast and the complexity is in the compiler and for fast machines, in the implementation.

Whether the instruction set is large or small, we should remind ourselves that an instruction set of some sort must be bound versus building the fully general purpose microprogrammed interpreter that's always looked so enticing. Recall the slowness and expense of several machines built about 1975 that allowed binding to the bit for the ultimate in generality. Papers, academic acclaim, and the talks about them reminded me of the trickery of the snake oil salesman because they could do everything. They could if you had enough money and could wait long enough. Decide exactly what's to be executed and then encode the machine to do it. It probably can not do everything well.

<>Generating #6. Let's turn our attention from design of the architecture and implementation to building, the sixth of the seven subprocesses of generating a computer. Carver Mead argues for the tall, thin man, a person who understands all parts of chip design including architecture. I'd like the individual to be even taller including the design of the operating software and then applications. If at all possible, don't separate architecture and implementation at least more than a few feet. The single designer is better still: Pascal is the sole product of Wirth.

<>7600. Cray is the only one person who architects, implements and then designs and builds the software. For the last 20 years, he has built the highest performance computers and provided a catalog of ideas to use in other computers.

Small groups are not only essential for design, but all segmentation has to be kept to minimum. The greater the division the larger the time and segmentation. This is how we get n pass compliers when one should do, separation of operating system and language, partitioning of the secondary memory into blocks, records, files, data managment, and database languages.

Segmentation may be necessary to build large systems quickly and to get the right disciplines applied to the right level. Make it work for you, otherwise the reverse is to have everyone always working with and redesigning the lower level components and not the overall system.

<>vax. In the case of VAX, DEC started with a small architecture task force consisting of the most talented people we could find who kept the architecture, documented it, built the first machine and wrote the base software for it. If this was second best to having a single individual do it, it was the only humanly feasible way to get to the market fast. The designers were all experienced in design and had all warmed up on other computers, operating systems and languages.

<4004 ad>. Ted Hoff and Bob Noyce wrote about the small team effort for first microprocessor. The 4004 was designed to be useful in a calculator, yet was not constrained to be only used to build calculators. MOS technology enabled several thousand gates to be placed on a chip. Ted's first experience was the PDP-8, and he knew the power of the minimal computer. Without this knowledge of minimal, general purpose computers, or had Ted only used a 360 or Fortran, the micro might have been invented several years later. Here, function, (the computer) follows form (the chip).

Brooks make a statement about segmenting the technical direction from adminstration. He says, a man with strong management and strong technical talent is rarely found. "Thinkers are rare; doers are rarer; thinker-doers are rarest." Musashi tells us to understand the way of the carpenter as both architect and builder.

<>Distributed. My own role is now that of a foreman carpenter or perhaps a city planner and developer. I worry about the architecture of the set of buildings and how they relate to one another, together with where the roads go. Architecture of Networks and Local Area Networks in particular are extremely important. Rome's streets, viaducts and sewers have been permanent, although great architectural changes have occurred.

Base the design on a small set of well defined components. If all the designers have done their jobs properly, then the set of components from which one builds a system will be elegant, yet complete. In this way, higher levels can be aggregated quickly because the behavior of each part is well defined. The Cray 1 was built from 2 IC types. The chips that never get completely finished are usually filled with circuit tricks, which aren't enumerated or understood.

<>Kludge. The super kludges come from committees because they usually contain no designers of any kind. Designers are typically doers and not committee goers. A large committee occasionally produces a useful design, such as Cobol, because the committee can get commitment from its constituents.

The three rules I'd like to see for people who attend committee meetings: 1. the attendees should have implemented something; 2. a proposed protocol or standard should be in operation somewhere, and; 3. the committee members are responsible for building what they design!

<>Babbage. Don't be so ego-centric that you can't borrow ideas and technology. Babbage himself freely used ideas of others. The Jacquard card-driven loom gave him inspiration for program storage sequencing machine control.

<>Jacquard loom. Jacquard only made a minor tweak on Bouchon's card controlled loom.

<>Early Computer. If the Computer Pioneers would have used each others ideas more then the computer revolution might have happened faster. The Harvard MARK I could have used relay technology and some of the design techniques developed for the Bell Labs machines; Bell Labs and ENIAC could have used some control mechanisms of MARK I avoiding the large tube counts.

<Atanasoff drum>. Having received the ideas, be gratuitous about crediting everyone who contributed. The ENIAC and Regenerative Memory patent claims of Eckert and Mauchly were so broad that they could not be enforced. Atanasoff's early capacitor drum memory, using regeneration, is the basis of most all primary memory schemes.

<>PDP-6 bit slice. Borrowing, can help avoid changing everthing at once. I learned this the hard way in designing the PDP-6 about 1964. This bit slice module is my memento. We thought we could change everything: that there would be little risk in doubling the circuit speed; or using a mechanical packaging technique placing connectors on both the front and back of the modules in order to get the requisite numbers of pins; specifying a new architecture with a megabyte address when everyone else was at most 256K; organizing a flexible structure that would permit building a large multi-processor in an evolutionary fashion so that we could build subsequent machines on the same base; presenting a straight forward interface which as a side effect probably started the whole idea of third party vendors at Stanford, and; predicating the design on timesharing -- a concept that was just being breadboarded at BBN, MIT, Stanford, and SDC.

<>PDP-6. Only 20 PDP 6s were made and several are still in service. The team stayed together and gained experience for the PDP 10. I would have hated to say to customers at the time that we were selling them an advanced development effort for our own, and others, interactive computing. Thinking of the 6 as a breadboard, probably the main mistake was not changing the packaging more to allow automatic wirewrapping. As a side effect, wirewrapping then allowed computers to be mass-produced and not handcrafted. This was one key to the minicomputer population explosion.

<>Generating #7. The cycle includes using the machine -- something I've always wanted to have more time to do.

<>Whirlwind use. Generality allows systems to be used for some different purposes than those intended. Whirlwind was built to demonstrate the SAGE air defense system, the forerunner of modern air traffic control. In addition, Whirlwind was used for at least two purposes not conceived in its design but that fell out of it: the first computer speech research and Linvill's work on digital control.

<>WW. Forrester was interested in sound engineering practices, stating, "Experimental equipment, merely for demonstration of principle and without inherent possibility of transformation to designs of value to others, does not meet the principle of systems engineering." MIT never got into the computer business -- but the Whirlwind did provide many businesses with proven designs and trained engineers.

<>WW Module. The Whirlwind modules were taken verbatim by Burroughs and by ERA for the 1101, and the machine itself was built by IBM to serve the SAGE system. ENIAC was the breadboard for the UNIVAC machines. These real, engineered efforts at universities were significant spurs to American industry, the economy, and computing.

<>WW. Forrester not only realized computers should be used but that understanding and training about a revolutionary new device requires the device. Can you conceive of universities without the computer? In 1948 that was the case. Forrester argued: "If a high speed computer capable of 1 to 20 thousand instructions per second were sitting here today, it would be nearly two years before the machines were in effective and efficient operation. ... this represents one-half of the viscious cycle in which an adequate national interest in computer training cannot be developed until the equipment is actually available." I believe this two year period should be called the Forrester constant.

The problem is still here. The 1979 Feldman report argued for funding experimental computer science equipment. Universities still need more computing power for training tomorrow's pioneers.

<>Fortran. Perhaps the overwhelming reason to use computers before you build them is that Hardware follows Software. Nearly all mechanisms that appear in computer hardware structures start with software implementations. John Backus of IBM tells the story on the introduction of floating point. He observed that many customers were running their 701s with a floating-point interpreter, slowing the machine to 50 multiplications were second. He tried to get the engineers to include floating point hardware, but they were more interested in speeding up the drum. He then created, "The most incredible design for building floating point into the 704." It involved adding four or five new registers, which was unheard of in those days. At the next meeting of the engineering design committee, he remembers, "I stood up and spent an hour describing my insane design and people listened. At the next meeting Gene Amdahl got up and said, 'Backus, you're an absolute idiot; you can build in floating point without adding any registers at all to the computer, and it will cost almost nothing, and here's how to do it.' And that's how it happened."

<>Fortran marked..

On occasion, software may follow hardware. This is rare and often wrong. The first Fortran had instructions to manipulate the sense lights, sense switches and tape of the 704. Also, the DO loop was oriented to the index register instructions. Some of these primitives have stayed with us, but most were dropped. All the algorithmic languages should have been extended to handle vectors and arrays. Had this happened, we would have these operators in machines. The Cray 1 is causing this extension so that software is following hardware.

<>Drafting. Finally, use it and describe it so it can be evolved. Go around again. Those who build machines say it's like playing Pinball.

<>Pencils. The reward of building the machine is to build the next machine. No matter how good a design is the next one can always be better as Pentel, has shown in their evolution of the homely, but important pencil.

GB3.S3.24

GEORGE BALL TALK
OFFENSIVE: A PERIOD DECAY

<u>WHO PAYS FOR THE 80s?</u>

G. BELL
10/13/80

Consider three islands: one manufactures goods, the second supplies energy, and the third is their customer and advisor. Since advice has no real economic value, the wealth will shift until the manufacturer and energy supplier own the customer.

How did we ever get in the position of being bought out?

As presumably the most intelligent and educated nation of people in the world, we think that everyone should have a high prestige job -- the ones that lawyers and mba's get -- without putting our intellectual resources to the supply of primary and secondary goods; thus becoming non-competitive in these areas. The pull is to the tertiary, sales and service sector, and to the quaternary, legal, education, and information sector, and into our national overhead, that is military spending that takes money and provides NO output.

Fundamentally, the US consumes and spends more than we produce or supply creating fundamental instability. We must have self sufficiency otherwise we have no base of power or influence, let alone the ability to own our own land!

We can achieve self sufficiency in the long run by changing practices to build for quality. The cathedrals that have stood 600 years are among the most cost effective buildings in the world with uses ranging from hospitals and schools to the most magnificent ceremonies. Our national automobile industry looking at short life and high maintenance costs is doomed -- they might have made out okay building for the sheiks if the Japanese had not come in with a quality product with lower operational cost, thus changing the rules of the game.

Self sufficiency is necessary for international power. Just remember the golden rule: He who has the gold rules. Since we have no gold, we can't rule. Consider the Japanese loan of 24B to China versus our loan of 2.4M. Who will China trade with and listen to? Certainly not the US State Department that has neither military teeth nor an economic base.

Our own military can smother us and further decrease self sufficiency both directly and indirectly. As we all know: productivity is output divided by input. Billions in to defense, nothing out, (except some sales to places like India that could blow up in our face). Self defense as an ultimate goal would lead to a military state and consume everyone's output. At present the situation is abysmal: DOD only sells hope, for defense...not defense. Furthermore, the secondary effects of the military are insidious. Business, universities and government conspire as a mutually supportive, non-questioning alliance. Universities are supported by defense grants and won't speak up. Businesses won't reject the military. They are good customers, selling paraphenailia in turn to Germany and Japan (our strongest manufacturing competitors for real goods). These countries have the advantage of then deploying their creative and productive work force to compete with us in real markets, not the business of building rusting and corroding junk to be maintained and obsoleted by massive military bureaucracies.

U.S. industry is no longer competitive, and hence there is no one to pay. We are being beaten from within due to an obsolete goal framework. The young in the U.S. are not challenged by the discipline and hard work associated with technology and manufacturing, the seamier kinds of work. Everyone wants to manage; to get ahead by increasing the roi. Right now the highest roi is achieved by marketing and distributing Japanese products like TRW, a large defense contractor and now Fujitsu's computer distributor. Our best people sell out to them, and we have no goal structure that stops us from committing this fundamental error. Recall the classic story of the Monkey's Paw:

> In this story an English working family sits down to dinner. The son leaves to work at a factory, and the old parents listen to the tales of their guest, a sergeant-major back from service in the Indian army. He tells of Indian magic and shows them a dried monkey's paw which, he says, is a talisman that has been endowed by an Indian holy man with the virtue of giving three wishes to each successive owner. This, he says, was to prove the folly of defying fate.
>
> He claims that he does not know the first two wishes of

the first owner, but only that the last was for death. He himself was the second owner but his experiences were too terrible to relate. He is about to cast the paw on the fire when his host retrieves it and despite all the sergeant-major can do, wishes for 200 pounds.

Shortly thereafter there is a knock at the door. A solemn gentlemen is there from the company that has employed his son and, as gently as he can, breaks the news that the son has been killed in an accident at the factory. Without recognizing any responsibility in the matter, the company offers its sympathy and 200 pounds.

If you ask for 200 pounds and don't express the condition that you do not wish it at the cost of the life of your son, 200 pounds you will get whether your son lives or dies. What kind of an environment do we leave?

The Bad News is that we won't make it: we will be bought out. The Good News is that we can have a back up strategy based on three ideas:

1. Let's recognizie that we're the smart ones and have fun-- let the Foreigners be the working stiffs supplying us with goods and energy. I'm confident that young people will discover that inventing and engineering can be more interesting than twiddling the roi functions that are really pretty dull and playing the semantic accounting games that lawyers and politicians play. Then we'll be ready to build things again if we have to and can remember how to work.

2. Let's use computers to keep good control of who owns our resources. Let the Japanese teach us, and even own us as indicated by the three island model. They'll probably do a better job.

3. Let's remember the banana republics. When we're ready and if they don't treat us right we can simply kick the 'em out.

GB1.S7.31
10/13/80
Ken Olsen

The engineering group is kind of nervous this morning and in order to make them at ease we've given cards to this table and they're going to rate every speaker from one to ten and we'll keep score up here as to how they do.

You see they have a tendency to try and make elegant presentations and some of them have prepared colored slides and they really wanted to sound like brilliant technical people and even Gordon finally got around to making some graphs on semilog paper. In the Woods Committee the Operations Committee jumped all over Gordon. With his truly brilliant graphs he put a lot of things in perspective. It was the inconsistency between what he was saying and what he said when he read off the specifications of IBM's new machine. He said "We'll kill em -- We'll kill em"; but he didn't put that in his strategy. All his brilliance didn't show how we're going to get IBM. So yesterday we really shook up the engineering people. We said what we really want to know is what are you going to do to get IBM. Now this kind of upset them because all the colored slides that showed how brilliant they were didn't show how we're going to get IBM. Now you guys in the audience (most of you) are part of the problem because you always want to work on certain hard problems and skip the whole strategy. They know what you want. There are some questions to which there are not obvious answers to because it doesn't make any difference which way we go. You could flip a coin and after ten years it makes no difference.

Like - Do we do all our commercial work on the 2020 or all our commercial work on the VAX or do we do it on both. In twenty years it would make no difference. In five years it would make no difference. We as a group of technical people would love to spend the next five years arguing that question. It almost seems unethical not to settle that one first. Meanwhile, we'd be dead because we don't have a plan. Now what we're trying to get engineers to do today is if they don't sound like they've got the slick presentation, we want to know what the strategy is to get IBM or protect ourselves from IBM.

IBM has an awful lot of money but they don't have much experience in our market. Gordon is convinced we've got everything. Now without much notice we've changed their presentations to try to figure out a way how we're really going to get our act together to do just the right things and don't leave any room for the competition. Don't trap people on the hard questions that don't make any difference which way you go. It's sort of like taking your kids to MacDonalds -- Do you get a whopper or a double hamburger. You can spend all day arguing over that question and it doesn't make a bit of difference. There are more important questions. Now lets see if we can stick with the important questions. How are we going to leave no room for the competition? And if anything looks hard forget it -- remember, it probably doesn't make any difference at all. And make sure we have plan. Now, I hope they didn't prepare too carefully. I'm a little worried about their slides. I gave a presentation with Cal Mowen ?? at the Chicago financial analysts a few years ago. And my daughter and her husband were going to school there so we got them invited to the luncheon. I prepared particularly well for that talk; maybe because my daughter and her husband were there. I wrote it out and it was a good speech. My daughter afterwards said "that was a terrible speech - the only good part was in the middle where you had to break and ad lib something". So, if they're not completely prepared, I think it's going to be better because we'll get what they're really thinking. So, encourage them, say the questions, make sure we stick with strategy, not just the hard questions which have been an excuse to keep us from doing marketing and sometimes an excuse to keep from doing engineering for many years. Let's get on and leave no room for the competition.

Gordon Bell

I want to start by introducing two people whom I invited with Andy's approval and the host's approval. They are Bill Strecker and Dave Cutler who are senior consulting engineers. There are only two of them in the Company so, in fact, you can tell they're important. This is the highest rank we have within engineering for people who do things. We give other kinds of titles for engineers who manage. The purpose of the managers, of course, is to make an environment where these people can really do work. Bill Strecker is the VAX architect and in addition provides a lot of the technical basis for many of our machines, including the 11/70 and how those machines operate. Dave Cutler is both the software architect of RSX-11M initially and now most recently VMS. This title of "senior consulting engineer" is not very well defined. Personnel go wild of course because it's not defined with all the sheets and things, but it's a secret process by which I have to approve it, somebody has to recommend it and then I tell Ken and that's how they get there. What the real meaning I'm coming to is, however is that if the products that they're involved in are really of key significance and probably sell over a billion dollars then that's good enough for me for a title. So I'd like you to welcome these two people to the group.

Now on with the strategy. I'm starting from a competitive standpoint. This is the IBM A100 which is essentially last in competition. It's the only product outside of a selectric that I think I would personally want that IBM has ever made. I have several selectrics and I hope our new typewriter of the third world will do us well so that I can get rid of the selectrics. It's a very impressive piece of hardware: four megabyte address space, low cost, $29,000 for half a megabyte of memory and a 60 megabyte disk vs what we're looking at for about 100K right now and it's right in our heartland if you looked at where we're getting our revenue, very good communications and I think our communications is probably down in the 1961 era. That's the last time I did a piece of communications hardware and it seems to all be patterned after that. There's an incredibly good range of peripherals for both the office and the factory and then they've got some unbundled software for other things.

On the surface that's an excellent product and IBM will make a bundle with it. On the other hand, here's (by the way, I'm not an IBM watcher and if you spend all your time looking at IBM or even much time this is about as much as I know, then we're sure doomed for failure because we don't have time to do anything else -- just looking at IBM would take all of our time) IBM 80-100. It looks like (what we've found) IBM has a lot of Digital watchers and this is why I want to go into what they've got now. I don't even know the price ranges here but this is like $10,000, $100,000 megabuck and ten megabucks. So the 370/360 architectures 370 architectures in here. Here are the 3031's, 3032's, and so on. This is what all the plug compatible people are going after. There are a lot of operating systems in that range all of which are incompatible and there's an 80/100. This is a new 80/100 which comes down in this range. Very neat products for something called distributed processing. This is done by the data products group. If you go down here, there's essentially the distributed processing group which is doing system 7, 3-15, and 32 34 and I don't know where their prices fall but their in there somewhere. It looks about like that with the accuracy of my felt tip pen. And of course, since somebody told them why Digital was getting all the market they had to get a mini and so there's the mini. Then there's a personal computer and they built a 5110 which is down there. Somebody ought to tell them you've really got to have a computer in a terminal and hopefully they will respond to that and put in something like the PDT's. So, in fact, it looks like they have really watched us and they've emulated our strategy and have every possible way of doing everything with a whole bunch of organizations. In my view, there is no way to distributed processsing with that. My marketing actually consists of the last customer that I talked to. I want to be very up front about it. On Wednesday I talked to a customer and he wanted a lot of (of course this is the peverbial if we do this he's going to buy a lot of computers and so on and this a customer billing PBX's, this is AT&T) and essentially what they said is something that at least I feel too and this the strategy that I put forward on Monday (or Tuesday or Wednesday) of the Operations Committee. Essentially, we're the only ones who have the basic architecture in VAX to cover the range we need for distributed processing. Why don't you build it? Give us a truly compatible range of VAX machines. Don't corrupt it like you did on the 11. We want a range of machines. That is something that a program will run on any of those machines and they said start with something that's about ten times the 3033 in power. Something with current 780 and then going down with the number of machines here with a VAX on a chip or terminal use. Their software base is much much greater than their hardware base. Cpu's tend to be about 4% of the cost. And then they wanted realiable secure computers for the system. Something that we're just dabbling in now. And, here was thing because they said hey, if you're having trouble funding it, we'll put up the money for a couple of your products. So we're ready to go outside to get some funding here for some of these products, I believe. I sat in on a DuPont presentation and they had basically the same requirements. The strategy of the day before that I had outlined was essentially this which is: the main part of this is to provide a compatible set of distributed computing products and that got ammended to be products on VAX 11 so provided a compatible VAX 11 set of distributed computing products so a user can compute in a transparent fashion in any of the following styles and sizes without extra programming or extra work. Either within the terminal small local shared system for a group or in a large system serving several groups. There's a style of computing here that's an economic style that you apply the machine where the work is and if the database gets distributed appropriately. So, it's this and that's in essence what the strategy proposal is.

In terms of what that means, I'm going to get down into hardware but essentially some of you might ask "Why have one architecture?" and I don't want to be too contencious with Ken today but we have a number of architectures and we have DECnet and we try to link them all together in that way and I think we do probably a most impressive job of being able to have those machines communicate.

There is an issue of sort of volume and learning curves in terms of whether we have a special system. Whether we go and market in what is fundamentally a special systems way or whether we're big engough in every area and every system that we make ala IBM, namely everything. IBM can do about any product they want in a point space because presumably they're big enough to not care. But in fact we observe that we've got a thing called 10% learning curves on most of our products which means that every time you double the volume you get 10% less cost. You build two products in exactly in the same then it turns out that you paid 10% more for each of those products which means that your fundamentally more uncompetitive in that way.

There is a technical reason and that is that it really is the only way to build the distributed systems that I'm talking about. That is, if you want to compute dynamically or even statically and move jobs from machine to machine there has to be much more compatibility than we have right now. Right now we're spending most of our machine power in communications -- that is, translating from machine to machine we've got to get a lot more basic level of compatibility. Formats are different, answers are different; if you fundamentally start with a multi-machine, then tie it together with the DECnet. So, in fact, I believe distributed processing as I know it or as I want to know is: we're not there, we're just in the embryotic stage. I believe must have a single family and it's clear to me that IBM is absolutely going down a disasterous path vis a vis their approach to distributed processing because it's going to introduce so much overhead in the way computing is done. I would also point that, in fact, some of our profitable competitors, DG and PRIME, have single architectures and it really is a bitch competing with that and even HP is beginning to close their ranks. I like, frankly, to build something besides cpu's and operating systems.

On the issue of why I am basing the strategy on VAX -- We designed it for a wide range of use, that is, the idea of implementing a bunch of machines over like a 1,000 to 1 range. What does that mean? It means that we have plenty of address bits so that we can address a lot of objects. We can't address all the objects that you would have in a network -- too much. But, in fact, there's a reasonable address space here like four billion things. So there's kind of an issue of addressing that we can really look at a whole bunch of things. There's a very contentious issue that you may hear something and if don't if this works small page size if you get into an argument with somebody and they say well your page size is too small, let me recommend an excellent book called "Computer Engineering" which has just been published by Digital Press that discusses this to a certain degree. But, fundamentally the issue of that was to allow one to build small programs so that we really did orient the architecture so that we could build a computer in a terminal and have it be transparent in this network space. We did also something called very good encoding. That is we took the primary language constructs and put them in hardware and assuming we believed that the hardware for the processor was going to be cheaper and cheapter in the future and in fact it is. So that if you compare us say with the 370 or you compare us with actually even a PDP-10, what happens here while still having much addresses we are able to encode the same programs in somewhere around a half the space. So half the space you say, well half the space -- memory is cheap, it doesn't matter, who cares? Well it turns out the memory cheap argument is one thing but it turns out every three years, that is at 20% reduction per year which is what memory does. You got memory to the dollar now, next year it will be .8 and the year after that it will be .64 and the year after it's like .51 so you could say well all I have to do is wait three years and I'll have a competitive product. So for starters, we got like three years on IBM just in that encoding alone, namely, we can express the same problem in the scrunched space. There are problems that in fact if it's all data of course that doesn't hold. But basically we've paid a lot of attention here and that helps in the small systems area but the interesting thing is that it really helps in the high performance end too because it means there's less bits to move around so that essentially big jobs are smaller and you can get the work done faster. We have a lot of data types that give a lot of power and essentially it builds on the 11 base. And also IBM told us in 1964 when those three guys went up on the mountain in New York state that the world should be an 8-bit byte. Well, we didn't totally believe them but we believed them enough to build the 11 that way.

What does this mean? What am I proposing? Fundamentally, here is the product strategy that I would like to see and I think this is the way to get at the products like the 8100 so in the 81-82 time frame I'd like to have a minimum hardware and sofware VAX and 11 systems and then a phasing with VAX and 11 with the appropriate size and the compatiblity priced disks. So we've really got to build disk systems at this point phasing over to probably a VAX only strategy by '85 or whenever it's appropriate. That's strictly technologies issue in terms of when is really cost effective to do that. We've already made the decision in the high end through this last strategy thing. And then the other is I want a really stay below the $250,000 selling price level just for a number of reasons because that's where we are right now and also that that turns out to be a system that is really a nice size system because it goes into the group level and 250K is about what it costs to operate a professional in an organization if you amortize this over a few years it turns out that's like one other person. So it means an easy decision in terms of whether you want a computer in your group or not. I tend to think of computers as should be useful helpful things. This means, here I say I'd like to see the sort of 81-82 time frame essentially base hardware that looks like this. 780 this a thing called superstar which essentially is an echo base machine at the current price leve, not the $250,000 price level. I want to warn us here that we had a fellow with us called Len Hughes who just went to SEL. Well Len was in the semiconductor area and Len happened to be working in with Motorola on the echo work there and Len knows all about what we knew about the echo chips and we can be damn sure that we're going to see an SEL machine in probably two years when Len goes down there and drives them and they get that machine. If anyone wants to bet since this is off DEC premise and I think that's illegal I would certainly be amenable to wagering in this particular thing. I know Ken says you can never predict the future but I'm willing to go out on a limb in this particular case. After all we did train Len and I think I know how he thinks in this domain and if he doesn't think that way, SEL will. So first there would be a machine at a central kind of level which is essentially the level that we've got got now. There's a machine here at ???group level which is essentially a machine that we're building called common hydra -- you'll hear more about those. In the 11 domain we're going to introduce shortly a really very hot commercial machine. That is a machine with the instruction set that's oriented more to Cobol. In fact I just got the performance figures on that last night. I think it's going to be a very respectable machine here. We're also introducing a multiprocessor system there. Down here at the group level, here is the machine I would use. I'd get that thing out, put a disk with it and add a half megabyte of memory and sell it for like $20,000. That's what I'd do. We could do that very easily, get it in there and go after the bloody 8100. We would make pulp out of the 8100 if we did that. It would be so terrific. It's embarrasingly trivial to do.

Our pride would probably get in our way because it's so easy.

LSI VAX and that's one that's really important in terms of getting some technology base and using it at the personal level. And I really think it's important to put the computers in the terminal as we've started with PDP's and as we would do in the future. On the 11 side we've got various LSI replacements that will be available in those same time scales. Which are the machines that if you can't move an application then one would stay on 11 in a much more bounded way. So we would give a choice there for quite some time.

Basic software strategy is fundamentally 11 enhancements, that is either decreasing or sustaining funds in IES, RSTS the high end RT. I want to use DM, SES, TRAX as a base for compatibility with VAX. And that is, we're not doing this right now. I want to be able to build current 11 program based and move in exactly on to VAX in the commerical domain and in the TRAX and in the real time area. Those programs have to be built so that anything we do there move over. Layered modular operating systems for specific applications -- that is really treat it oriented to domains which means to us a common program interface so that one can write a program in any one of these computational styles and then run it within another system or in another operating system. Common utilities and languages so that we don't have redundant efforts there and that we have compatibility and then common drivers so that we don't have a range of hardware support problems. Right now we have a system called VMS which I would call a general purpose base pretty much for interactive computing. There are some things to do to make that more toward VAX those can be added. There are some things that perhaps we might to make it more oriented to some of the time sharing facilities although it's quite good in that domain. TRAX 32 which is an upward compatible version of the TRAX that we've just announced for transaction processing and then some very small tuned real time systems for the real time market.

I'm assuming the BASIC+ is something that our users -- we've got an incredible base there vis a vis RSTS. I want to be able to provide an export import package that is a way of moving from this system to that system which really means a file transportation mechanism so that and this would mean that we would have a language on VAX. WE would have the same facilities and the same utilities at at least the current performance levels so that users could take those programs they've written, protect that investment base they have in RSTS for BASIC+ programming. Not RSTS programming -- BASIC+ programming. Move them over. And then the key to the whole thing is really building a distributed data base, distributed file systems so that we can really network in the way that I'm advocating.

There's other parts to the system and that includes some other base hardware things to make a system like this go. And that means first getting a really cost effective communication system via some form of a multidrop or loop kind of network. IBM's announcement had a loop approach. There are two or three other approaches. We happen to use multidrop. We must have this kind of capability. IPG has a multidrop ??up there?? and we'd use something like that. Much higher speed because in addition to the terminals I think it's essential that we have all the peripherals or most of the peripherals and that we couple to other small systems. That is, compute in the terminals. This, incidentally, because of the nature of this communication allows a drop shipment. In this way we essentially can plug together systems that are really going to work at a customer site simply by the nature of that serial communication link. We have terminals with software support for and I'll say first that the theme we came up with yesterday or something, and we didn't even have a marketing person there, is we need a good word. With the persistence we're putting in, we want everyone to have a terminal. Where a computer is located within a group, everyone's got to be on the terminal, so in essence that means having a lot of the current dumb terminals that we have today -- I think they've got to be generally block mood oriented because we're wiping out our systems -- that is transmits data by block instead of a character at a time. Our systems are dying because of our interactive heritage here and they've got to be low cost and cheap so we want a manufacturing posture that's aimed at high volume.

In addition there's an issue of having these programs or these terminals for different environments. The key thing is the office environment here and this is a printing and how to do that whether its a letter quality kind of thing ala the queme the weelies or whether one using the acupuncture approach and lots and lots of pins and does it in a Digital fashion, but that looks quite good. I hope we can do it the Digital way. I think it's the right way to do it because it gets us graphics, it gets us one product, it gets us volume, it gets us a more reliable system, it gets us a quiet system. The letter quality things really make a racket. The other thing is a page crt for word processing and then a terminal here that I hope Dick was going to show. I don't know whether he did or not. This is a modern graphics calculator word processor for what all of us would have. That is, it deals with vectors, it deals with matrices, it deals with tape tables. It's a calculator and once you calculate on a table it then displays the results in pi charts or graphs or what have you. In a factor environment we clearly have to have the terminals and the interface. So that's all I have. That's a framework for looking at this, looking at the various sizes of systems and technologies and for looking at software.

John Kevill

I'd like us through the strategy that we're on in three areas: hard disk, floppy disk, and tape; where we're making the investment today, where the technology's going, and where I believe DEC has to go. In floppy disk, we're trying to track the independent suppliers of floppy disks; Shuggart, Memorex, Calcomp. We are not up with the state-of-the-art and in the next three years we need to close that. If we look at the volumes you're projecting, we're talking about 50,000 to 75,000 floppy spindles a year. It's definitely we have to leverage and get control of. I can't speak for our progress -- we've had some problems.

In the disk area, we've split it up into three areas. I believe clearly with the introduction of the RL and later this year the introduction of the RL02 we have got a leadership product on the low end. In my experience, I believe we're building the lowest production cost removeable disk drive in the world. I know we're beating some former companies I was associated with. I believe we have techniques that we can apply to the low end to cut our costs even lower. The key is volume and automation. If any of you have been to Rockrimon, they are producing a production out there which is to give us excellent costs on our low end disks. Today in the mid-range DEC is investing the maximum amount of money that I spend in the product called the R80 and I'll talk about this product in detail later. That's where we're stepping out of the volkswagen era and into the Grand Prix race car era. It's the highest technology product in disks this company has ever attempted to product and it's a major step forward. We also believe we cannot abandon the mid-range removeable market. The architectures Gordon is talking about I believe will require some media removeable. So we're making a concentration in two areas in that market of fixed disk high technology and a removeable media drive to be its companion.

In the high end we are in a position today of buy-out. However, when I make the R80 I will have gone some 80 to 90% of the way towards a large disk. Mechanics set has to change. We've done the basic technology work. I believe, given the success of that product, we can talk about making high end disks large capacity for the large system market as a family concept on top of our mid-range investment.

In the tape area, we are evolving to $62.50 per coated recording. It's becoming the industry standard. It will be the major data interchange path. Today it is the only way we data interchange with an IBM computer and we believe it's important. It's a buy-out program at the current time. I don't believe we possess the technical capacity to take it on at this point. We're short engineers who understand tape technology. We have chosen to build a low end product that's come through a significant piece of difficulty but it's on the road to success.

In the tape sub-system area, as we go into large capacity fixed disks, we have to back them up some way. We've got to be able to get the data off. We're going to have to tie our high end tapes and our disks together in some sub-system intelligence which can move the data back and forth between tape and disk and back our high end up.

When I look at disk metrics and how we measure them, we can come down here. I want you to point to the top one. It is the most important measurement of the disk, aerial density, tracks per inch ?? bit per inch. It starts with the media and heads. It's the most important entity we have to design a product. It is the one which we have the lease control over today. And a major piece of my strategy is to make Digital independent and capable of supplying its own media and heads. Today we've got to wait for somebody else to develop the surface technology and the head technology in order to design a product around it. That means we do not control technology entry point in a product that I think we're making a lot of money off of.

When I look at the high end of the line, we measure the performance of the disk at cost per megabyte. But cost isn't a linear function and when I go to the low end of the line I've got to talk about an entry price.

We're trying to restructure, at this point, mass storage engineering so we have a group focussed on low cost at the low end. There are some things we have to do. Dick and I have talked about this. We've got to start integrating mass storage or the storage products in terminals and small systems in with the system.

```
+---------------------------+                                ID#375
|   |   |   |   |   |   |   |
| d | i | g | i | t | a | l |  i n t e r o f f i c e   m e m o r
a n d u m
|   |   |   |   |   |   |   |
+---------------------------+
```

Subject: **6250 Tapes (Via TU78) Urgency**

To: Mike Gutman, ML1-3/E58
John Kevill, ML3-6/E94
John Mucci, MR2-4/M38
Joel Schwartz, MR2-4/M51

Date: 5 DEC 78
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

CC: Peter Raulerson, WR (Santa Clara)

follow up 12/19/78

On visiting SLAC they emphasized the non-negotiable need. They can go elsewhere, but we have to tell them so by mid-January (as per our contract). Let's not let the date pass so we get them in trouble.

GB:ljp

D I G I T A L   INTEROFFICE MEMORANDUM

```
DIST:           Mike Gutman       ML1-3/E58   John Kevill      ML3-
6/E94
                John Mucci        MR2-4/M38   Peter Raulerson  WR
                Joel Schwartz     MR2-4/M51
```

COMPUTER TYPE TAXONOMY

(FOR COMMON MINI AND MICRO-BASED STRUCTURES)

```
|Single C-----|1 Pc----------|1 Bus---------|Pc + nK's  Unibus-type
|(10-100us.)              |(uniprocessor)|
                          (PDP-11, LSI-11*, VAX-11)
|(1 cabinet)|             |P-M / P-K Bus-|Pc + nK's     traditional
mini
|           |             |                          IBM PC* structure
|           |             |
|           |             :attached P|C--|C + Pf|Cf*    eg. attch'd
array proc.
|           |                      (VAX-11 + Floating Point Systems
FPS-164)
|           |
|           |n Pc----------|1 bus      |1Pc + nCf       NCR Tower*,
Plexus*
|           |(multi-P)    |(eg. Multibus)
|           |             |
|           |             |Symmetric.mP|ssmP (2-6)   Arete'*,Elexsi
|           |              (for perf. &|msmP (10-100)      Synapse*
|           |               high avail.) |lsmP (100-1K)
            Cm*,Sequoia*
```

```
|           |                          |vlmP (1K-10K)
|           |                          |ulmP (>10K)            NYU
Ultracomputer*
|           |                                                (paper)
|           |multi-instr/data-------------|Dataflow architectures
|           |
|
|Close Area---|reg. connect--|memory--------|grid
| Net (.1-1ms.)           |
| (1 room)  |             |links---------|tree       Columbia DADO*
|           |                          |binary n-cube Caltech 64
computer*
|           |
|           |ad hoc connect|via P or M closenets         functional
simulators*
|           |
|           |switched------|bus-----------|CAN high avail. cluster
             Tandem
|                                      |                   Auragen*
|                                      |backpanel cluster
Convergent
|                                                Technology Megaframe*
|
|Local Area---|spanning tree,---------------|LAN cluster,
fmCmultiC
|Net(1-100ms.) ring, central topologies
            |             Cambridge Ring Computer*
| (1 building                                                     |
|  or campus)                                          |homogeneous
cluster      Xerox STAR
|                                      |        Apollo Domain*, SUN
Workstations*
```

|

|Wide Area---

Net (.1-10s)

(global)

Notes:

* micro-based computer structures

C := Computer; P := Processor; K := Controller

Cluster := collection of C's acting as a single C

(interprocessor communication times) determine parallel processing grain

*function := arithmetic, array processor, signal processor, communication (front end), database (back end), display, simulation

COMMON PROCESSOR-TYPE TAXONOMY

```
|single instr-|hardwired----          |simple--------|minimal  eg.
PDP-8, NOVA minis

| single data            |            |                   |complex

|           |            |

|           |            |pipelined_____|load/store      eg. RISC,
MIPS,Ridge 32

|           |                         | " + multifunction units
            eg. 6600

|           |

|           |microprog.___________________|simple        eg. 8086*

|                                     |CIS   eg. 360, VAX, 68,000*

|                                     |P.language   Symbolics 3600
(LISP)

|

|single instruction,________________________|vote (detect only)

| single data, high availability       |vote (det./corr.)      eg.
Stratus*

|                                     |TMR (det./corr.)

|

|single instruction,_________|open microprog|array processor    eg.
FPS-164

  multi-data             |

                         |hardwired   |vector           eg. CRAY 1
```

A COMPUTER STRUCTURE TAXONOMY WITH A CRITIQUE OF THE STRUCTURES

A taxonomy of computer structures is given in Fig. ? designed to show the difference in hardware approaches for providing computational parallelism. The PMS notation and definitions are used to form the taxonomy:

Csimplecomputer := Pc - Mp - Xio

Cmultiprocessor := Pc(1:n) - S - Mp

Xio _
Pcprocessor := Kprog - Dpe (a controller

Mpmemory (for program and data) := Mpr|Md

S

Quite surprisingly, there are only four different approaches to obtain parallelism:

The single instruction processor which

CLASS CALCULA

ORDER	FAMILY -complexity	GENUS -structure	SPECIES
Analog	single part	drawing instruments	protractor, pen etc.
		fixed rule	proportional rules
	2-3 part	gunter rule	gunter rule
		sector	sectors
		slide rule	straignt, circular, spiral, log-log
		level reference	gunnery level
		integrator	mileage reader
	multiple part	drawing instruments	pantograph
		level reference	quadrant, sextant etc
		integrator	planimeter, etc.
	complex	level reference	auto-pilot
		equation solver	harmonic analyzer etc
			tide predictor, etc
	programmable	diff. analyzer	Bush, Hartree

		analog computer	Genl Precision, etc.
Digital	single register	stone, bead	counting table, abacus, soroban, etc
		Pascal wheel	Pascal wheel, strip, keyed wheel
	two register	tab indicator keyed wheels	Burroughs
	3-4 register	stepped wheel	Leibniz, arithmometers automatic stepped wheel
		rotary	Baldwin, Odhner, Curta, etc.
		motor-driven wh.	Monroe, Friden etc
		battery electronic	"pocket" calcs.
	complex	tabulator	Hollerith census, Powers-Samas
		equation-solver	ABC machine, pocket calculators,
		relay calculators	Bell Labs I difference engines
	programmable	relay calculators	Bell Labs II-IV, Z3-4
		analytic engine	Babbage, Harvard MKs
		tabulator	Hollerith, Powers,etc

plug-board ENIAC
battery electronic
pocket

CLASS MEMORY

ORDER -interface	FAMILY -technology	GENUS -structure of access	SPECIES
Non-mech.	Physical state	Fixed-permanent	stone marks, Napiers
		Fixed-erasable	Quipu, beads, abacus
Writable or Readable	Paper	Fixed	
		Linear	scroll
		Cyclic	rolodex
		Random	book
	Mech. stable	Fixed	switches
		Linear	piano roll
		Cyclic	drum, disk
		Random	card
	Chem. stable	Linear	microfilm
		Random	microfiche, videodisc
	Magnetic	Random	rope
	Electric charge	Random	capacitor
	Electronic	Random	diode, semicon. rom
Writable & Readable	Mech. stable	Fixed	calculator registers
		Random	Zuse memory
	Wave storage	Cyclic	mercury, optical, &
			magneto-strictive
	Electric charge	Cyclic	Atanasoff drum
		Random	Williams

tube,
capacitor,
semicond.
Magnetic flux Linear tape, wire
Linear-cyclic datacell
Cyclic fixed-head
disk, drum
Cyclic-linear disk
Random core, disk

Electronic stableFixed flip/flop,
relays,
stepping
switches
Random semicondustor
array,
relay array

Chemically stableLinear photo store

+---------------+
! d i g i t a l ! i n t e r o f f i c e m e m o r a n d u m
+---------------+

Subject: COMMENTS ON THE TAXX

To: Mike Leis
Bob Peyton
Chuck Youse

Date: 10/21/77
From: Gordon Bell
Dept: OOD
Loc.: ML12-1
Ext.: 2236

Follow Up 11/5/77

I'm delighted to see a really tiny structure for the TAXX mechanics. Let's hope the real thing is like the breadboard. As we move into the final definition of the product, I hope we can keep our options open vis a vis packaging for the multiple possible uses. Let's make this an OEMable component and get the whole market since there are NO competitive suppliers!

The goal should be to allow sales and/or use of the unit in any of the following configurations:

1. <u>OEM mechanics only, no electronics</u>. Here, a user would use our recommended r/w electronics, interface and algorithms to control the tape. The algorithm would be specified in either or both 11 and 8080 code. This would cost $50 (at the outside) and sell for $100.

2. <u>An interface that would get out to an 8080/T-11 bus</u> so that the host computer would control it. The characters are assembled in the interface. Here we probably should assemble characters versus bit-banging simply to give the most flexibility in the program and operate the system at full tape speed (E.g. suppose this is the way the cassette is integrated into the LA or VT100). This would give a system cost of only $125 and maybe sell for $250. People like Heathkit might even buy at this level.

3. <u>A fully integrated system</u> as you are proposing with all the electronics <u>on 1 board</u> and <u>coming out to a serial/line</u>. This would be packaged in several configurations, depending on the use, or people would integrate it into products in a more expensive fashion. Preferrably the control computer would be a T-11! (We must continue the prototype and layout with the 8085 however. T-11 designers note how great it would be if we could simply plug in a T-11 (8-bit mode) <u>with no board</u> <u>change</u>. Please consider helping do this!)

4. <u>A basic computer system or a performance enhancement</u>. This would have options to 3 for a second serial line and to enhance performance using as much CCD or RAM buffering as needed. This would give us the performance and line splice market. Applications programs such as the BSR should also run in the splice simply to reduce cost. Here, we need a version that is implemented with the T-11 (versus 8080) for doing fancier applications and giving file support.

Note with a T-11, a user merely adds a terminal and he has his own computer system...in a fashion identical to the RXT11. (TA versus floppy--the cost for the system would hopefully be 1/2 that of RXT11)

What do others think?

What is the right direction?

GB/mjf

CC: Ed Corell, Len Halio, Andy Knowles, Art Massicot, Roy Moffa, Steve Teicher

<u>Mass Storage Staff</u>
John Kevill, Bob Peyton, Grant Saviers

D I G I T A L   INTEROFFICE MEMORANDUM

DIST: Ed Corell ML1-3/E62 Len Halio ML5-
2/E93
John Kevill ML1-3/E58 Andy Knowles MR2-
2/A52
Mike Leis ML1-3/E63 Art Massicot MR2-
2/A52
Roy Moffa MR2-1/M64 Bob Peyton ML1-
3/E63
Grant Saviers ML1-3/E58 Steve Teicher ML5-
2/E93
Chuck Youse ML1-3/E63

00 CORE DECGRAM ACCEPTED S 000449 O 293 14-OCT-82
2:23:45

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION DATE: WED 13 OCT 1982
7:58 PM EDT

FROM: GORDON BELL
cc: see "CC" DISTRIBUTION DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

MESSAGE ID:
5178529504

SUBJECT: TECH. COMP CENTER FOR BENCHMARKING AND EXPERIMENTING

We must set up this system in MR area so that we can start to

run
customer benchmarks and work on performance enchancements:

```
      _____________________________L(CI)____________________
     |                                                      |
     |----Pc+Mp--------------------------                   |
     |                   |.-------------|.---------Mp+Pc----|
     |                   Mp('MA780)     Mp('MA780)          |
     |                   |._____________|._________Mp+Pc----|
     |----Pc+Mp__________|______________|            +Pfps
     |----HSC
```

Where: Pc=11/780 CPU, Mp=Primary memory, L=Link, Pfps=FPS 164

This is two, 782's, connected via CI and having one system with
an FPS 164. It could be run as 1, 2, 3 or 4 computers, depending
on the number of operating systems used. It would come up as a
single system with Pfps, then a 782, a second 782 forming the 4
processor 782 and finally the CI.

The work would proceed in sequence for Uniprocessors, array
processing, microprogrammed extensions to VAX, multiprocessors
and multicomputers:

1. Benchmark the 780 and establish the set of benchmarks. Understand them and their operation on other computers.
2. Add the Pfps, benchmark and understand the performance.
3. Using 780 microprogramming and working with compiler and architecture people, make enhancements to the 780 both specifically and generally to the VAX architecture.

4. Open the multiprocessor for customer benchmarks. LASL's interested and might like to have one for

experimentation
among their 50 780's. Compare with others.

5. Work on multiprocessor benchmark enhancements.

6. Start the work on multicomputer understanding using CI and
especially HSC in terms of system throughput.

We aren't starting this crucial work. It would also sell VAX's.
We desperately need a leader to drive this both within and across
the various organizations: ESG/LDP, and VAX/VMS architecture (for
microprogramming tools and enhancements).

Can I please have a list of leaders, workers and projects?

"TO" DISTRIBUTION:

TOM GANNON	BILL LONG	PETER SMITH

"CC" DISTRIBUTION:

DILEEP BHANDARKAR	RON BRENDER	PETER CHRISTY
BILL DEMMER	FRED ENGEL	SAM FULLER
WIN HINDLE	DICK HUSTVEDT	BILL JOHNSON
JESSE LIPCON	ROBERT MCKENZIE	KEN OLSEN
MAHENDRA PATEL	BILL STRECKER	

GB3.S8.68

GORDON BELL
Vice President, Engineering
Digital Equipment Corporation

THE ENGINEERING OF THE VAX-11 COMPUTING ENVIRONMENT

ABSTRACT

The VAX-11 architectural design and implementation began in 1975 with the goals of a wide range of system sizes and different styles of use. While much of the implementation has been "as planned", various nodes (eg. computers, disk servers) and combined structures (eg. clusters) have evolved in response to the technology forces, user requirements and constraints. The future offers even more possibilities for interesting structures.

GB5.32

+---------------+
! d i g i t a l !   i n t e r o f f i c e   m e m o r a n d u m
+---------------+

Subject: **Technical Director (Thoughts)**

To: OOD

Date: 16 MAY 78
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

follow up 5/30/78

- Someone I can talk with regarding technology and use (needs in products) -- respected in technical community.

- A staff role...responsible for measuring/controlling our technology resources just as we do with people (personnel), space, and $(controller).

- Monitors and characterizes technology capabilities of groups including productivity.

- Owns R&D, RAD process money.

- Matrixed into existing or future organization (e.g., NMOS, Bipolar, ECL Technology, System Development Managers).

· Maintains directory of standards and procedures

? Architecture role-up

? Entire space of tau = Res, A/D, Dev, Product support, Mid-life kicker

? Responsible for past sins, ala chief engineer, problems, etc.

· Entire levels-of-integration

· Entire processes/products -- stays out of product development except to evaluate

? Reviews special programs: RAMP, RAMEP, PAMP, Packaged System Program (PSP).

· If we have TEE POT (see attached), he is Strategy Manager.

GB:ljp

Attachment

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Jim Bell	ML3-2/E41	Dick Clayton	ML12-2/E71
Jim Cudmore	ML1-4/E30	Bill Demmer	TW/D19
Ulf Fagerquist	MR1-2/E78	John Kevill	ML1-3/E58
Julius Marcus	MK2/C37	John Meyer	ML12-1/A11
Larry Portner	ML12-3/A62	Bob Puffer	ML12-2/E38

****
* d i g i t a l *
****

TO: MAURICE WILKES

DATE: THU 11 JUN 1981 14:39 EST

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

cc: SAM FULLER
BOB GLORIOSO
KEN OLSEN

SUBJECT: TECHNICAL LEADERSHIP

Ken asked me about your Technical Leadership concern. Since this is of consistent concern to me, I would like to get your worries too. These should be open to all parts of our community.

What bothers you most about our leadership or lack thereof? People (leaders), technology, process or products? Research, A/D,

products,
or what? Micros... very large computers? Applications?

We need your help to understand this and then focus us.

GB2.S6.43

EMS 3-JUL-79
16:38:40 050 1
To: Jim Cudmore
From: Gordon Bell
Date: TUE 3-JUL-79 16:38:40 ED
Subject: Presentation of technical papers

I'd like to get your paper on guidelines for technical papers more widely
accepted within ood.   I would eliminate any reference to discussing product
ideas before they product comes out!

I am really pissed about the paper on Comet your people are putting out
becau

1. They should be working on the product..not wasting time on the paper 2.
Bittner, who is apparently the presenter of the paper is giving the paper is
giving something on which he has no jurisdiction or authority and he did not
even do the work. The Comet CAD stuff was not his work...he should not
present this work It is immoral and unprofessional and should get you a lot
of professional rivalries..which are justifiable 3. No, NEVER talk about
the product until it is done! 4. The COMET is not at the state of the art,
even if it did work as a circuit. It will get a polite yawn. When we ain't
got taht much to how being mysterious is a hell of a lot better.

5. the Fonz
stuff is pretty good, the product is interesting and the work should be
described.

Command:
February 13, 1980

Professor Thomas J. Allen
Massachusetts Institute of Technology
E52-536
Cambridge, MA 02139

Dear Tom:

Could I please have a copy of your article or work that was described in Technology Review, November 1979 by you, Lee, and Tushman?

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:swh
GB1.S1.68

January 29, 1979

Professor Steven Shapiro

Electrical Engineering Department
Steven Institute of Technology
Hoboken, N.J. 07030

Dear Steven:

Confirming our conversation on January 26, 1979: I'd be pleased to meet with the high level leaders of the Technion when they visit here. The visit to DEC should, however, be co-ordinated with Jerry Witmore, who heads our Education Products Group. His phone number is 493-2149.

Thank you and Mike for thinking of us.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:ljp

CC: Mike Dertouzos, MIT
Jerry Witmore

DOCNO8/23
ID#435

September 27, 1979

Professor Ad J. VanDeGoor
Technische Hogeschool Delft
Afdeling der Elektrotechniek
Mekelweg 4, Delft 8
NETHERLANDS

Dear Ad:

How delighted I am to hear of your appointment at Delft. Congratulations.

Don't know whether you ever got a copy of the Computer Engineering book we wrote about DEC's computers but I'll send one anyway.

Hope to hear from you. Give my regards to Annie.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:swh
GB0004/64
Enclosure

CC: Professor dr.ir. S. Middelhoek, Dean of Electrical Engineering

TECHNOLOGY PROGRESS

- **SEMICONDUCTORS**

  . **DENSITY $2^{t - 1962}$**

  = 60 - 80%/yr (conservative)

- **CORE PRICE IMPROVE 30%/YEAR**

- DISKS (62 - 80) - DENSITY 41%/YEAR

- TAPE (52 - 73) - 23%/YEAR DENSITY

29%/YEAR DATA-RATE

- POWER (COST/WATT), PACKAGING 0

- MINICOMPUTER - 20% PRICE DECLINE PER YEAR

- TERMINALS - 10 20% DECREASE IN PRICE PER YEAR

9/23/82 10 pm phone conversation with ed feigenbaum,
415-493-5618 home, 669-1236 vacation house on weekend

BECOMING A MEMBER OF TECHKNOWLEDGE PLANNING COMMITTEE
First year is spectacular. Have best staff. Are solving problems and building tools to generalize this. Plan to be a DEC and be big and important in 20 years. Has resigned from BOD.

Invited me to be on this planning group which meets quarterly with first meeting on October 29 dinner and 30th all day. Mtgs in Palo Alto. Compensation: 1K shares at $1, price now $13, 1K/day plus expenses.

Noted article on 5G in Oct. 4 Fortune

ALPHA OMEGA AND ITS LEADER

Must get our act together. Can cream the Japanese
Don't use the AFP. It will suck up too many resources.

Don't make it a PIPS project. Make it a Knowledge Engineering, Symbolics, Expert System.

Initially, we should go all out and launch a requirements study. Don't do it from a technology push.

Absolutely agrees with the notion of parallelism and science of it.

Location: don't move people, electronic communication is bad
LASL bad, isolation, dream that this is the wartime
LLL not quite as bad, still an hour away from Si Valley
SRI, ok
Stanford, new building a possiblity. Get SDC Corp to do building and have MCC and Govt to fund it. Si valley gets HP, Apple, IBM, Xerox, Fairchild, DEC?, ...

Likes 6th Generation as the name.

PERSON
Elliot Levinthal, Dir. Defense Sciences (parallel to Kahn), ARPA lives in Watergate apt. in Wisconsin Ave. ideal person. knows the image processing. entrepreneur, scientist, etc. Likeable, knows business, engineering and science (research).

ID#317

| d | i | g | i | t | a | l | i n t e r o f f i c e m e m o r a n d u m

Subject: **A Quick Analysis of The Cost of New Products**

To: Bruno Durr, PK3-2/S56
Gene Gross, PK3-2/A55
Ted Johnson, PK3-2/A55
Gerry Moore, PK3-2/A66
Dick Pascal, PK3-2/A66
Jack Shields, PK3-2/A58

Date: 30 OCT 78
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

follow up 11/13/78

I have posited a product strategy that aims to minimize the number of products that we sell and support. In presenting the strategy to the Ted Johnson staff, the intent was to get specific criticism of it, and possibly gain general support. The lack of useful response was frustrating, but I realize the conflict between the service organizations that want a small number of products and sales who want more products and to keep all products.

Now, I would like to ask you for help in trying to analyze the effect of the current and proposed product strategy. This could take various forms, but perhaps the simplest way would be to study the effect of the multiplicity of say VAX, 11/70-74, and 2020 so as to be concrete. Here, I would ask, what would the start-up be if we only had just 1 or 2 of these? (Say, eliminate the 2020 and study what the costs would have been.) I'd like to see this in all three of the organizations, and I would hope that it isn't a big deal, that is you can just send me information now or do a back-of-the-envelope analysis to prove or disprove the point.

Let me reiterate. Could I emplore you to send me a simple analysis on multi or incremental product sales, field service, and software support effects (cost, efficiency, profitability, inventory, or whatever)?

Help!

D I G I T A L INTEROFFICE MEMORANDUM

DIST: Bruno Durr PK3-2/S56 Gene Gross PK3-2/A55
Ted Johnson PK3-2/A55 Gerry Moore PK3-2/A66
Dick Pascal PK3-2/A66 Jack Shields PK3-2/A58

2 November 1982

Mr. Edward A. Feigenbaum
Teknowledge Inc.
525 University Avenue
Palo Alto, California 94301

Dear Ed:

I thoroughly enjoyed the interaction with the Teknowledge Advisory Board and Board of Directors and hope my inputs were useful. Enclosed are comments on the questionnaire. Teknowledge has the highest fraction of capable individuals devoted to a single enterprise that I've ever seen.

Teknowledge's share of my expenses for the trip were (DEC will pay the rest):

Airfare (one way)	$405.00
Hotel	80.13
Taxi to S.F. Airport	32.00
Total	$517.13

I'm requesting that the DEC BOD allow me to serve on Teknowledge's Advisory Board.

Sincerely,

Gordon Bell
Vice President of Engineering

cc: Barry L. Plotkin

GB3.S8.35

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! d ! i ! g ! i ! t ! a ! l !          I n t e r o f f i c e
M e m o
!___!___!___!___!___!___!___!
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TO: see "TO" DISTRIBUTION   DATE: TUE 15 FEB 1983 1:28 PM EST

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION

DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5191029518

SUBJECT: TEKNOWLEDGE TECHNOLOGY BOARD PRODUCT INPUT

GB4.S1.33

I'm on this board which meets quarterly, on Saturdays in Palo Alto.

They're looking for a workstation on which to build their product.
They'd OEM this. The current list of candidate hardware in

order:

1. HP 98 with bit map. Can have up to 8 Mbytes. Uses 68K, expect
68020. Good image. Lots of options. Good company. Runs UNIX.

2. IBM 9000 uses 68K -- may not have enough storage -- but CMU may
help 'em and provide SPICE.

3. SUN Workstation -- Forest's 68K based system that Stanford
licensed to many vendors.

4. Apollo -- when the new prices hit, this may be a competitor.

5. DEC -- ? Good supplier. Like VAX. No product.

6. Xerox -- Good product, but company's impossible.

I said we'd like to sell them a product. They weren't convinced MicroVAX was the way to go, until I told them about range. Unfortunately, all of them spent their lives on 20's and they all want their own, private stations !

I believe HP may wind up with the order, if they go this way because Portable Standard LISP (PSL) IS BEING USED BY HP RESEARCH LABS NOW. It runs at about 1/2 x 780 using the 68K at 12 Mhz. For 50K, one gets B/W, color at 3 bits/pixel.

I'm arguing that they should distribute a PSL for several systems and not get into the proprietary workstation business. They might also put up GLISP on top to improve the programming environment. They'll put up other utilities.

They're looking for various packages including screen drivers, etc.
Raj Reddy recommends IBM's/CMU Canvas -- based on Spice.

We should sell them our tools, like FMS, CMS, etc. to facilitate programming.

Let's go out there and get the order.

"TO" DISTRIBUTION:

NORMA ABEL	MAHENDRA PATEL	BRUCE RYAN
BILL STRECKER		

"CC" DISTRIBUTION:

FOREST BASKETT	SAM FULLER	PETER JESSEL
BILL JOHNSON	KEN OLSEN	JACK SMITH

WPS USERS - Leave HP mode and type <CR>

****
* d i g i t a l *
****

TO: LARRY PORTNER DATE: SAT 23 FEB 1980
3:38 PM EST
MITCH KUR FROM: GORDON BELL
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1
A51

SUBJECT: I GAVE LORRIN THIS PERMISSION

We have to go over by the 50K to find out whether this sort of thing will work and whether we can ultimately save big $ by restructuring the whole conferencing scene.

ATTACHED: MEMO;40

****
* d i g i t a l *
****

TO: GORDON BELL* DATE: WED 20 FEB 1980
12:18 PM EST
ULF FAGERQUIST FROM: JAN JAFERIAN
cc: LORRIN GALE DEPT: CORPORATE
RESEARCH
EXT: 223-7525
LOC/MAIL STOP: ML3-2
E41

SUBJECT: TELECONFERENCING STRATTON V: EXCEPTION TO PLAN

LORRIN GALE HAS BEEN ADVOCATING THE USE OF TELECONFERENCING FOR STRATTON V TO INCREASE THE AMOUNT OF OVERALL PARTICIPATION.
HE HAS BEEN IN CHARGE OF A SUB-COMMITTEE THAT HAS BEEN DIS-CUSSING THE FEASIBILITY AND COST OF LINKING SIX SITES (TEWKSBURY, MERRIMACK, COLORADO SPRINGS, MARLBORO, AND TWO

IN MAYNARD) TO STRATTON, THEREBY ADDING ABOUT 250 PEOPLE
TO THE MEETING. THE COST IS EXPECTED TO BE IN THE $50K-$75K
RANGE.

THIS COST WAS NOT INCLUDED IN THE ORIGINAL STRATTON BUDGET PRESENTED TO OOD ON 20 DECEMBER 1979. HOWEVER, LORRIN SAYS HE HAS DISCUSSED THIS WITH GORDON AND HAS RECEIVED APPROVAL TO SPEND AN ADDITIONAL $50K.

IN ORDER TO MONITOR THE TELECONFERENCING EXPENSES, AND EVENTUALLY TO ANALYZE ITS COST EFFECTIVENESS/RETURN, I AM ESTABLISHING A SECOND STRATTON PROJECT ACCOUNT, SEPARATE FROM THE ORIGINAL APPROVED STRATTON BUDGET. IN EFFECT, I FEEL ACCOUNTABLE TO MANAGE OUR APPROVED FUNDING LEVEL, I ALSO AM ALERTING YOU TO AN OVERRUN AS A RESULT OF TELECONFERENCING.
SINCE I HAVE NOT RECEIVED ANY NOTIFICATION OF ADDITIONAL FUNDS
BEING ALLOCATED, NOR ANY FEEDBACK REGARDING THE USE OF TELE-CONFERENCING PER SE (EXCEPT IN A 2/15/80 MEMO FROM LORRIN REFERING TO A CONVERSATION HE HAS HAD WITH GORDON), I AM, AT THIS TIME, TREATING TELECONFERENCING AS AN EXCEPTION TO PLAN.

GB1.S2.31
****
* d i g i t a l *
****

TO: PAUL SAIA DATE: FRI 26 SEP 1980 6:40 AM EDT

FROM: GORDON BELL
cc: see "CC" DISTRIBUTION
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: RE: TELECONFERENCING

I would fundamentally like to see a video link that includes Marlboro, Spitbrook Rd, Merrimack, Tewksbury, and Hudson. IN my planning thoughts, this is part of a backbone link that goes up 495, perhaps with Hudson a switching center for MR

and
Maynard.

I couldn't be more frustrated with our leadership, or rather lack thereof in telecommunications on this point. I had hoped
and assumed we would have our first experimental data point between ML and MK by now such that we would be in this next planning and implementation phase.

It is important to point out that the microwave link was proposed in 75 and could have been easily installed then, it had a year to payback at that point, I believe, assuming it carried some voice. Now it probably can't be installed (it takes multi approvals), and we are forced to go with the phone company and they will put it to us in the future vis a vis tariff, making the whole thing only a factor of 2 or so better than the helicopters.

The bottom line: yes, I believe we need it; I'm going on a limb, assuming this is going to be a useful service/facility that will pay off. You have my support, but that ain't worth a hell of a lot when dealing with the communications morass. Please try and get it done, the more who try to push the spaghetti, the more chance we have of something moving.

Good luck!
gordon

"CC" DISTRIBUTION:

DICK CLAYTON MURRAY COPP AL CRAWFORD
ALAN KOTOK

GB1.S7.18
00 BURT DECGRAM ACCEPTED S 6957 O 234 07-JUL-80 13:48:05

****
* d i g i t a l *
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TO: ALAN KOTOK DATE: SAT 5 JUL 1980

8:20 PM EDT

FROM: GORDON BELL
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

cc: AL CRAWFORD
OOD:

SUBJECT: HIGH PRICED TELECONFERENCING DECISON

Please forgive me for not being able to fulfil my part of our agreement when I encouraged you to make the teleconferencing proposal. Please decide how to proceed and I will vigorously support you. I see three options:

1. Continue to wait and let nature take its course. Given your
recent MBA degree, watching this will be post graduate study.

2. Turn the project back to CORPORATE COMMUNICATIONS. Advise those responsible and get back to direct product engineering. Minimize interaction, especially recommending a colleague.

3. Forget the whole thing today and get back to products.

I believe option two is the best because:

.I see only risks.

.The project will have continued and interminable hassle through
AT&T, space (rooms), and all self-proclaimed television experts.
It seems to be the epitome of a self-stopping project, which everyone has enjoyed reviewing and stopping. I see no change.

.It might not work (remember the Picturephone?). Although great
for discussing rational things, it's not clear that as leaders we
can get our point across without being physically there.

.Video conferencing is part of a bureucratic morass which has no
clearly defined processes, criteria or documentation.

.There is no clear way to tradeoff among space, capital, expenses
or computers. Furthermore, there is no trade-off among these among customers and various DEC functions. I think it is vital
for it to follow the corporate guidelines for review.

.Finance who approves this, also runs Administration and the helicopters. We all love helicopters. Helicopters automatically
get the $'s using the linear growth model we use.

.It is a clear, new line item, albeit one which is only 0.1% of
the requests for capital. The first rule of budget trimming is
to cut the most visible, newest line item, especially if it is a
small one both to perpetuate the old and to feel good.

.Finance has no understanding or methodology to permit the tradeoff of capital for expense because they also operate Administration which always has infinite demand for its services
because the cost is zero. They can't understand the concept of
using direct expense budget to control it.

."Management" has at one time, probably "opinionized" on this and
as such everyone is afraid to either mention this or let us go
ahead, lest they get tarred by the same brush if it fails.

.When it is really obvious or when the phone company thinks it is
good for us, then it will be available. You might try to get the

phone company to build it as a service at an obscene rate.

.Communications is Al's responsibility. Please join me in continuing to encourage him into accepting this responsibility
and providing the service we should contract for.

.Not working on teleconferencing fits what I think is good practice for an engineer:

.Be productive and build things in an environment where you
are needed, appreciated and people know how to say yes (not
just no) and thank you.

.Avoid people and groups who practice irrational thought whether for reasons of size, their incompetence, my incompetence, or malice.

.Offer suggestions and help to those who have the responsibility so they may behave responsibly.

In short, enjoy building, help all understand and expand their own capabilites, but leave when the pot you're about to
be boiled in has fire under it.

.Most of all, we need your help on products, both Hypervax and
Suvax are important in terms of providing significant computing.

Let me know what you want me to do here.

Gordon

PS. You're right, it's a hell of a high price to pay for a large company. I don't intend to live within this kind of environment.

ATTACHED: MEMO;30

****
* d i g i t a l *
****

TO: GORDON BELL
5:30 PM EDT

DATE: WED 2 JUL 1980

FROM: ALAN KOTOK
DEPT: OOT
EXT: 223-7381
LOC/MAIL STOP: ML3-5/H33

cc: ARTHUR DEAN
SAM FULLER

SUBJECT: VIDEO CONFERENCING DECISION

I have not heard whether you, Larry and Al Bertocci discussed the proposed system, and whether or not we have a go-ahead. This thing has dragged on so long, that my patience is almost expired. I now gather that the thing is somewhere in some budgeting cycle, looking for money. If it was worth doing last year, it ought to be worth doing this year.

Although I realize we cannot make decisions based on hiring a particular person, I really believe we have a first rate guy lined up to do this project, who can only be hired if we have a project. He presently has an outstanding offer from another firm, and can only wait until Tuesday.

It seems as if nobody can make any decisions in this company anymore. Is that the price of giant size? It may be too big a price to pay.

GB1.S5.43
00 BURT DECGRAM ACCEPTED S 6984 O 236 07-JUL-80 13:5434

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* d i g i t a l *
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TO: A. M. BERTOCCHI
8:27 PM EDT

DATE: SAT 5 JUL 1980

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION

DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: TELECONFERENCING, DECISIONS (OR LACK THEREOF) AND US

The attached note to Alan does not begin to convey my frustration and disgust with our behavior, especially my own in allowing this to happen. It appears that anyone of us can stop anything that another one of us has approved for any reason. If rules for the significant interactions among our groups were identified then we could avoid wasting our own time and that of our talented individuals. May I offer the four processes that need definition.

- .organizational planning
- .space
- .computer resources
- .capital equipment

There is a meta-one: a listing of our significant planning and operational processes.

I don't give a damn what the rules are, all I want is to have them clearly stated, reasonably stable and open. Is this too much to ask???

"CC" DISTRIBUTION:

AL CRAWFORD
LARRY PORTNER
MITCH KUR
OPERATIONS COMMITTEE:

ATTACHED: MEMO;104 MEMO;30

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* d i g i t a l *
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TO: ALAN KOTOK
8:20 PM EDT

cc: AL CRAWFORD
OOD:

DATE: SAT 5 JUL 1980

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DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

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ATTACHED: MEMO;30

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* d i g i t a l *
****

TO: GORDON BELL
5:30 PM EDT

cc: ARTHUR DEAN
SAM FULLER

DATE: WED 2 JUL 1980

FROM: ALAN KOTOK
DEPT: OOT
EXT: 223-7381
LOC/MAIL STOP: ML3-5/H33

SUBJECT: VIDEO CONFERENCING DECISION

I have not heard whether you, Larry and Al Bertocci discussed the proposed system, and whether or not we have a go-ahead. This thing has dragged on so long, that my patience is almost expired. I now gather that the thing is somewhere in some budgeting cycle, looking for money. If it was worth doing last year, it ought to be worth doing this year.

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GB1.S5.45

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* d i g i t a l *
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TO: KEN OLSEN

DATE: SAT 5 JUL 1980

8:29 PM EDT

FROM: GORDON BELL
cc: see "CC" DISTRIBUTION
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: WOULD LIKE YOUR HELP TO RESOLVE THIS CONLICT

I think I have followed the process for identifying conflict with
another member of the Operations Committee. Al and I talked about video conferencing for engineering several months ago. The
conclusion of the meeting was general agreement to go ahead with
the project subject to detailed review by Al and his troops. After no written feedback from Al, we met again last week. I could not detect that any review had taken place and that they
had only sat on the project. After this meeting, Al and I weren't even able to carry back the same report.

Larry and I thought the late June meeting results were:

1. Al's in favor of the project.
2. We (engineering) felt that it had sufficiently high
roi and benefit in terms of time for engineering, that we would
pay for it directly off the top of our budget in the next 2 years
as the analysis showed that we would end up spending less overall. Hence we would get more engineering done for same $'s
with less travel time and expenses.

From his ems on Monday Al added that "it must be included in FY
81 Capital Budget -- prioritized list -- for Corporate decision-making on what to exclude." I don't even know what the
hell that is, furthermore, I don't even know why he had

wasted
our time meeting to discuss the subject.

Subsequently I called Al, and learned a bit more: He implied you
were ambivalent on it, hence I believe he was. This is ok too,
but just tell me directly so we don't waste time.

Although you clearly have the perogative to live according to your own whims, I think it is important for the rest of us to have and use clear cut open rules. We simple engineers need them.

"CC" DISTRIBUTION:

A. M. BERTOCCHI SHEL DAVIS WIN HINDLE
LARRY PORTNER

GB1.S5.46
00 BURT DECGRAM ACCEPTED S 6975 O 235 07-JUL-80 13:49:54

****
* d i g i t a l *
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TO: A. M. BERTOCCHI DATE: SAT 5 JUL 1980 8:23 PM EDT

FROM: GORDON BELL
cc: OPERATIONS COMMITTEE: DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: TELECONFERENCING, ALAN, YOU AND US

The attached note to Alan does not begin to convey my frustration
and disgust with our behavior, especially my own in allowing this
to happen. It appears that anyone of us can stop anything

that
another one of us has approved for any reason. If rules for the
significant interactions among our groups were identified then we
could avoid wasting our own time and that of our talented
individuals. May I offer the four processes that need definition.

- .organizational planning
- .space
- .computer resources
- .capital equipment

There is a meta-one: a listing of our significant planning and
operational processes.

I don't give a damn what the rules are, all I want is to have them clearly stated, reasonably stable and open. Is this too much to ask???

ATTACHED: MEMO;30

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    SAM FULLER

DATE: WED 2 JUL 1980
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GB1.S5.44
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* d i g i t a l *
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TO: ALAN KOTOK
8:30 PM EDT

DATE: SAT 5 JUL 1980

FROM: GORDON BELL
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: TELECONFERENCING- I DOUBT IF A DECISION WILL BE MADE

Alan,
Al and we met with Larry finally when Al could do it.

Al sent a memo to me stating what he thought we agreed to, which
was not the same as we thought we agreed to. In essence it was:
1. He supported the proposal
2. It has to be done as part of the Capital Budgeting as part of the FY 81 to be part of someting called the priotitized list
as to what to include... as part of the corporate decision making.
3. We would be willing to reduce the Engineering budget over the
next two years to directly fund it.

We thought it was only items 1 and 3. We propoposed 3 simply to
show that it is possible to tradeoff expenses for capital when
one has a good plan. His memo after the meeting was a blow which
I will never recover from.

The offer was to reduce complexity and to show how one can
trade-off expenses for capital in a simple way got shoved
under the table.

Al, Win and Ken are running the company from building 10. All
decisions about Space, Who gets what equipment, and what the
capital equipment budget is are made there in what appears to
be closed, unclear processes in a top-down arbitrary way. The
fact that I thought I could approve a plan, or comit to a product
plan based on an expense budget (where capital or computers or
space is implied in the numbers) seems to be a farce, given that
these other variables are controlled somewhere else in an
arbitrary, capricious way. Somehow, I feel responsible for
results (including getting us better facilities) and that there
is no way to perform against these plans, is tying me in a knot,
and I don't want to be a party to wasting any more time on this...
either yours or mine. Therefore the answer is:

We should not bother to engage in anything having to do with
teleconferencing between ML and MK due to the problem of getting
any way to do the planning or approval of capital equipment. It
is a hell of a frustrating way to do anything.   This, like
computer equipment and space is another issue that I, nor my

peers can not discuss in any kind of rational fashion, let alone
straighten out.. Furthermore, I can not even read a memo or listen to what is generally a content free discussion on any of
these subjects because it is such a waste of time and so frustrating.

Order processing is an example of another such process but we in engineering have been spared this. I have been been only mildly harassed as a bystander, but have had to listen to the vacuous arguments.

My reasons why it is not worthwhile persisting any longer are based on a whole set of things:
1. None of these 3 areas have any formal processes, objectives
or responsible persons assigned to them, nor is there anyway of judging one proposal against another.
2. If there is any need to cut the budget, I believe it will be
this 400K, even though we will pay for it in 1 or 2 years (a
hell of a lot highert than some of the squirrely projects or capital that it would compete with. The cut is obvious because it
is a clear, line item. I recall us spending 30 minutses cutting
the library budget back to a flat budget (requiring layoff) severl
years ago, while allowing several fat, incompetent groups to grow
at a 20% rate, simply because "libraries can get out of control"...
despite my cries to the fact that our output in the library and
cost per unit output (books, information delivered) has been declining. At the same time we built a brand new library in a
building far away from here that spent more than the library budget.

The issue was that this part of a 20M$ expenditure where there
was no visibility as to the 50, 400K line items that formed it.

This year, I expect another 1 or 2 helicopters and airplanes to
be approved simply due to the linear growth way we do planning.
We've all liked these since our childhoods and will support getting
more due to the hassle we get into at airports and the fact that
we can't plan what to do if we have to drive or spend the time.
Never mind the fact that just this afternoon 10 people met
with Larry, BJ, and I this afternoon for 2 hours, with 2 hours
of driving to discuss the WPS Product development . (Here
we spent only about 10M, lost revenue of maybe 100M, and lost
some of the market share and customers that we need. All of
the concerned parti
parties who fouled it up will suffer probably with only 10%
raises and only average stock options granted worth about 5
times what a very good, unique individual contributor will
get for developing a product that will bring in 1-2 billion
in revenue.

3. We have gotten so big in some sort of sick way that the old
Do the right thing rule is absolute bullshit in light of mediocre
bureaucrats and people who only exist now to check on anyone
who comes forward with a proposition. I think we will get to
a situation soon where there won't be anyone coming forward.
Cutler is extremely concern, and I have to go off and work
with Jack Shields to find out why Jack requires 50 signatures
before a product can be released to the field. Presumebly
these 50 add something, but NONE are categorically capable,
in some real sense of tcarrying Dave's listings. Here, I don't
want Dave to leave, so this fight is not optional. If the 50

would leave, I think I would personally sponsor the going away
party, it's clearly not company policy to allow any rewards
like parties for jobs well done, except in the sales
department.

(Maybe we could get milk from this sacred cow because
teleconferencing obviously could be used to minimize these
needs. ... but don't hold your breath.)

4. We have to also support not only the checkers in 3, but also
the studiers in tgroups like telecommunications who are asking
when we should build such a system. I have tried to tell Al
that when he goes to play golf with all the other large
corporate executives who play with the real golf players that he
could really one up em by telling them about our
teleconferencing.
My guess is that we have spent more than 400K on studying
teleconferencing in Al's department alone to get paper.

This would get him pioints and even a golf game, but he's worried
about how he's going to make this big 4ooK decision in light of
a 400M request... and I'm glad he's worried. I'd be petrified
given our state of decision making, ability to discuss, to have
any clear criteria, etc. Therefore, again, I can't blame Al,
he's OK, it's just that the company did him in. Therefore he
has to say no to someone, and it had best be to you instead
of the 21M$ board shop in Phoenix.

5. We have to spend money doing dumb things like sandblasting
your conference rooms rather than putting insulation up which
would save money because there was a rule someplace apparently
and the space people are afraid to change anything that is
working becuase space has such high level concern about

what it is. This has resulted in more expensive buildings becaue
no one wants to make a mistake here. At a recent meeting a number of us were present who had earned our golden plummer's helper and golden shovel awards (I only have the plummer award,
but an honorary golden crowbar award... for taking care of the
Mill for a few years and for making a bunch of changes including
the sandblasting which apparently no one can undo now, just as
I had a bitch of a time doing the first one) You get the shovel
if you put up a building. We all agreed that it was the worst
experience that we had. We get all the bad things: relatively
expensive buildings and questionable results. The capital budgeting favors open offices and I am now ready to wquestion this wisdom given the noise, etc. But it appears to be cheap and you can write the furniture off in a few years.
Again, notice that we budget (control) the input, not the results.

6. Our capital is really stetched because of inordinately high
inventories. This comes about for a few simple reasons including
the way (where) we build (a design problem in manufacturing and
engineering), forecast (strictly bottom up by clerks with no concept of what people buy) , and flow (through every god damn
plant in the country and Far East) prodcucsts. This is a disaster of vast proportions.
There's conservatively about 150M in i
inventory carring charges and waste work in flowing products in this morass as a conservative estimate.

7. We can and do hire, creating expenses of vastly more than the 400K. A helicopter pilot creates a lifetime expense of

something like several million doollars, vastly more than this experiment. There is no process to validate hiring requests
versus capital equipment which we can get rid of through depreciation. People are a much greater drain. The good ones
get trained, tired and turned off (and leave). The slow ones just say no or ask others to do things. (One of the joys of work to me now is the museum and its because we all do work including putting on lectures, building exhibits, archiving, writing papers, understanding)... however, when I interface to
a large group to get a piece of equipment, or information or make a slide or a poster or generally do anything it is so depressing because there are intermediaries who manage and generally only screw things up. Again no concept of quality and
output, only input. For the 100K we spend, we do more work than
just the cost of the interface people alone. Now I begin to understand all those books nd papers on big bureucries and groups. I don't think DEC is especially worse, it's even better
than most, it's just the size and so we might as well all go back to our desks and cancel something. (There are some bad people though, one of the "management" in MR thought he was entitled to some of the building's plants, so he took them because he had the right as a part of his status and power.)

Well, Alan I am not going to help you anymore on this one. You have to decide whether you want to keep pushing. I still feel that it is very important process, but I have no idea what the so called prioritezed list - for Corporate desion -making on wh
what to exclude list is that Al told me about. Based on my past experience on space, buildings, getting computer equipment, getting EMS slots, ... etc. I can't begin to tell you when or how or where or who to talk with (Ken likes t make sure things like this are presold when the9 come before the Operations Committee, but make damn sure you do it carefully, because we all hate politics.) Buy I doubt if the Operations Committee will get involved in

this one because it's only 400K, unless there's a good chance to say no and let us show the world what hard headed, tough minded, results oriented, down tto earth, futuristic (Ted just went to the Aspen Institute), solid (we eat lots of carbos) business men we are. If you want to bring it before us, I'll gladly stand behind you (especially if you have presold it), and if it looks like it can't go through, then I'll probably be a hell of a long way behind you.

As to bringing in a competent person. If they are a friend and has to work in the middle of this dreary bunch, I say no because I think you should valuable your friendship more. If the person can work in anothe group where he can really feel good and get something accomplished, then why not get them there? On the other handthere are days I worry about getting things done i
too.   Which reminds me: I think it is time we got to work on the array processor in earnest. .. assuming we can somehow get the machine to use for this.

Let's really concentrate on projects that will produce results... my tendency is to forget the whole damn thing.

Let's get together and figure out the possibilities, there's never been a better time to do engineering.

ATTACHED: MEMO;30

****
* d i g i t a l *
****

TO: GORDON BELL DATE: WED 2 JUL 1980
5:30 PM EDT

FROM: ALAN KOTOK

cc: ARTHUR DEAN DEPT: OOT

SAM FULLER   EXT: 223-7381
LOC/MAIL STOP: ML3-5/H33

SUBJECT: VIDEO CONFERENCING DECISION

I have not heard whether you, Larry and Al Bertocci discussed the proposed system, and whether or not we have a go-ahead. This thing has dragged on so long, that my patience is almost expired. I now gather that the thing is somewhere in some budgeting cycle, looking for money. If it was worth doing last year, it ought to be worth doing this year.

Although I realize we cannot make decisions based on hiring a particular person, I really believe we have a first rate guy lined up to do this project, who can only be hired if we have a project. He presently has an outstanding offer from another firm, and can only wait until Tuesday.

It seems as if nobody can make any decisions in this company anymore. Is that the price of giant size? It may be too big a price to pay.

GB1.S5.41

Messages 9/25

1. It is all arranged for Jim Bell to give the presentation Thursday the 28th to Connecticut General.

2. Harvey Nathanson (412) 256-7544 from Westinghouse Research Lab called. Re: Taming Westinghouse on GAAS Development Program.

3. Dick Clayton called to say today was Ed Corell's last day.

4. Wayne Rosing (8-247-2322) called. Re: NDS

5. Mary Breslin, X7535. Would like permission to hire Peter Czukor -- 8 years experience as programmer/operating systems.

6. Kathy Johnson (Bill Demmer's secretary) called to invite you to a DEC Family Day open house at the Tewksbury facility on Sunday, October 29. They will also be inviting some town officials.

MJ - messages September 25

1. Call Bob Puffer -- no message.

2. Nancy Hilsinger - Re: John needs 1 hr. with Gordon as soon as possible.

3. Joyce Gray - X5518. Re: scheduling a meeting for October 17 with Stan.

4. Linda (Mike Tomasic's sec.) X7558. Re: 1 hr for Mike and GB - Subject: EBOD process.

5. Bernie Stoler (301-588-7358) called Gordon. Re: He is from Century Graphics (A division of Anken Industries) and would like to know about our useage of microfilm/fiche. Sounded like you would probably be able to fill him rather than Gordon.

6. Myler Kelley X2752. Would like to set up a meeting with Gordon, Bruno Durr, Larrry Portner, and Bill Johnson for 1 hour on October 23 to discuss software/software services issues. (I'm not really sure if her name is Kelley Myler or Myler Kelley -- can't find either one in the book -- sorry.)

7. Jan (Bill Heffner's sec.) X2091 Tewksbury. Re: setting up a meeting.

8. Cheryl Maynard in Tom Rarich's office called: Re: She sent a memo to Gordon today and forgot to enclose the attachment. Throw out the first one without the attachments -- She will send another complete package. It was to Gordon and Bernie Lacroute and the subject is Performance Information.

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<co tel>612-854-7472 JOHN ROLLWAGEN
<co address>7850 METRO PLACE, MINN. MINN. 55420
<co tel2>LES DAVIS, VP ENG. 715-723-0266
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<name>MCLEAN, DR. WILLIAM H.
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<organization address>382 SPRINGFIELD AVENUE, SUMMIT, N.J. 07901
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<organization>CARNEGIE-MELLON UNIVERSITY
<co address>VICE PRESIDENT FOR MANAGEMENT
WARNER HALL
500 FORBES AVENUE
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<name>WARTER, PROF.
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****
* d i g i t a l *
****

TO: MARY JANE FORBES DATE: WED 1 OCT 1980 8:51 PM EDT

FROM: GORDON BELL

cc: MURRAY COPP
AL CRAWFORD
ALAN KOTOK

DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: AT&T SERVICE ON (223-3525). I WANT HELP AND ANSWERS.

Please forward or copy this to the appropriate person for our quarterly report on service. Gwen, my wife, talked with someone today about our absolute disgust with the phone service
on this extension. Apparently, we are being labelled as "paranoid", whatever that means, or we are expecting a level of service that is well outside of what anyone expects.

For the record:
All I want is to be able to transmit information at 1200 baud using either of the 2 modems I have at home. One operates using the Bell compatible frequencies and the other uses the Vadic scheme (and operates when the line is really bad). We have two for reliability! Also, the line is so poor that

I have to use one at 300 baud when I call into the ARPA network at a number in Cambridge (Massachusetts, not England).

I don't really care if voice is as bad as it is, somehow I can listen and talk over the cruddy line.

You may note that I requested that a NET&T person work the weekend of Labor Day to get me a new line so I could work. Somehow the phone line finally worked, and I said go ahead and fix it for real some other time. We have had a cadre of troops through our house, starting with the installer, who I recalled because he left the house in shambles with a big, black board in the middle of the living room and a telephone jack that had fallen off the wall. Still, based on looking at the phone bill on 259-9144, which I use as a backup, there is a very high probability that the phone will not allow me to communicate.

I really don't want to spend anytime recording this saga. Aside from the phone bill and memories of talking to various people, none of which have been able to provide reliable transmission (yesterday it kept hanging up all day), I have not kept a log of the effort expended to try calling and to use the line. I still don't intend to record the events, unless it is necessary.

Therefore, all I ask:
Is asking for 1200 baud unreasonable? (If so, then get me a radio link or some reliable form of communications.)
(I'll consider moving to a closer site where I can get a decent data rate as an alternative.)

Do you want me to log the out of service events? Can you supply equipment for me to try and diagnose the line so that I can give a clue as to what is happening?

Are there any other services that I can investigate to get a line?   (I know that we can put a lot of signal processing at both ends of the line so that the meager number of bits per second I want can go through.)

Am I responsible for getting information at 1200 baud over the
line or can the phone company do it?

Who do I call when the various lines won't get me through?
(and can they do anything to help?)

Please, please, all I want is the 1200 baud, sans voice.
What can I do?

Could you please reply in a formal fashion? (Here, I expect to use the information to decide on a further course of action
... get rid of all phones, radio telephone, move to Maynard and install a private link, build or buy better modems that will work over any type of line, etc.)

Please help!

gordon bell
vice president of engineering
Digital Equipment Corporation
PS
I might add that already working over this phone line has changed the way I hope others others will connect terminals to
computers. Henceforth, I have asked that we build no more terminals which do not have adequate error checking and retransmission capability. While it will take several years to
accomplish this, I feel, based on this experience that I don't
believe any other user should be subjected to this kind of line
or inability to communicate when using telephone lines.

GB1.S7.25

<u>Customer Segment Letter</u> - <u>Sample Only</u>

Dr. Joseph Lassiter
Vice President of Engineering

Teradyne, Inc.
183 Essex Street
Boston, Massachusetts

Dear Joe,

I enjoyed our discussion the other day and am glad to try and help you in regard to setting the future direction of computing at Teradyne.

Since we very often face the same dilemma within engineering here, let me assure you that even though there is an increasingly large development effort centered on VAX, I can heartily recommend buying a 2020 to run TOPS 20 so that you can begin using BLISS immediately for your system's programming on 11's and VAX's. Since there are other programs of interest to our community that run on TOPS 20, then I don't see any conflict. These currently aren't available on VAX and won't be for a while and some may never be. It is imperative that programming be in a standard language (certainly never in a machine language), and I would think that most of it should be on VAX for new applications. For the old applications, leave them on the 20, and it may be necessary to get more 20's as long as production work is designed to run on either machine.

We are really proud to have you back buying 11's and VAX-11's from us for use in testing systems. Furthermore, I hope we can work with you in the definition of the testing problem as we see it, and possibly share programs with you.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:ljp

GB0001/15

Confidential, Please Read and Return Or Destroy

ALTERNATIVES FOR TERMINALS AND TERMINAL BASED COMPUTING SYSTEM

ENGINEERING
(AND A PROPOSAL)
(G Bell, Independence Day, 1981)

BACKGROUND

There are various reporting structure alternatives for the printing, video and computing terminals engineering organization. These groups, along with 16-bit systems, reported to Si as a former engineering manager. A recommendation for a structure is given, together with the rationale and alternatives.

In late April, Si and I proposed to the Operations Committeee that these areas be part of BOTH engineering and The Computer Products Group in a dual reporting fashion. Therefore, all the alternatives connect to Bell/Portner in some fashion.

RECOMMENDATION

Mike Gutman is now in charge of conventional, multi-user 16-bit systems.

Obtain a replacement for Si as a Product Engineering Group (PEG) manager for terminals and computers built into terminals. Have that manager organize the work for maximum product autonomy, while building on common components and architecture.

This structure permits a team formed with Si to focus on the marketing, manufacturing and engineering aspects of products.

SUMMARY

The following sections describe the recommendation:

- Si's Old Job AS Engineering Manager
- The Proposed Organization (Product Group Level View)
- Win's Four Organizational Alternatives
- Proposed Organization (Detailed)
- Rationale Based On Many Organizational Design Criteria

Why Not One Of The Other Proposed Alternative Organizations?

SI's OLD JOB
Si...
16-bit Qbus hardware
Also, VT278 hardware for WPS and Retail Products
16-bit Unibus hardware subcontract to Tewksbury

VT/LA and Terminal based hardware components (monitors/kbd)
Computing Terminals (CT), both hardware/software
Technical Director and A/D coupling

Mike Gutman now has the responsiblity for our conventional, multi-user, 16-bit systems based on the Qbus and Unibus. Both the Micros and Semiconductor groups supply chips and boards for these products too. Bill Johnson subcontracts the software and Grant supplies mass storage.

The following engineering (outside this area) is also associated with terminals and table-based, personal computing systems:
CT software
Disks, subcontracted and independently funded
WPS 278 software
VT278 software for Retail Products Group
Terminals engineering who are building 2 Computing Terminals
Modems for terminals
Special semiconductors and PDP-11 microprocessors

THE PROPOSED ENGINEERING ORGANIZATION (PRODUCT GROUP LEVEL VIEW)

Bell/Portner
(Product Engineering Group, PEG)
32-bit systems
Large computer systems
[Terminals and table-based (personal) computing system]
16-bit systems (part of Si's old job)

Networks, communications and distributed systems
Software
Mass storage
Semiconductors
Power, Packaging, Physical Interconnect

Technical Director (Standards, architecture, R&D)

(Engineering Administration Staff)
Administration
Finance
Personnel
Technical Operations
Strategic Planning
Corp. Product Management
Quality and Operations Analysis

Recording Secretary

The product area, [Terminals and Computing Terminals] is the group and work being examined as to how it can be best organized.
Engineering Staff total is 20 persons... and has become basically ineffective as a team or problem solving group.

PEG has the product responsibility and is beginning to function as a team, although it runs the risk of becoming too large at its current level of 2 + 9. The members and the team are good.

WIN'S FOUR ORGANIZATIONAL ALTERNATIVES
Win suggests the following alternatives:

1. B/P manage the details of how to get Si competitive products
B/P
    8 Current Product groups
    CT
    VT
    LA
    Technical Director
    7 Current staff groups

2. Keep all computers together and all terminals together
B/P
    7 Current Product Groups
    16-bit
        CT
    VT
    LA
    Technical Director
    7 Current staff groups

3. Combine CT and VT in one group and LA in another group
B/P
    8 Current Product Groups
    CT/VT Products
    LA
    Technical Director
    7 Current staff groups

4a. One form of the Proposed Organization
B/P
    8 Current Product Groups
    Terminals and Terminal Based Systems
        CT
        VT/LA
    Technical Director
    7 Current staff groups

There are several other alternatives based on having all the engineering associated with the products that Si's group will be marketing together. I like the following one, for many reasons.

PROPOSED ORGANIZATION (DETAILED)

4b. Maximum autonomy for the various products
B/P
    8 Current Product Groups
    Terminals and Terminal Based Computing Systems
        CT
        VT
        LA
        VT278 (including hardware and ALL software)
        Common components (keyboards, modems, CRT's)
        Strong, Common Advanced Development and Architecture
    Technical Director
    7 Current staff groups

There are several variants on this, including putting all the components under one person and all the products under another. I'd like to hire the engineering manager and have him organize the product area to get the best performance for these criteria:

RATIONALE BASED ON MANY ORGANIZATIONAL DESIGN CRITERIA
The reasons alternative 4b feels right:

Bell/Portner and Other Product Engineering Self-Preservation
There are a large number of Product Engineering Groups. For the first time in several months, it looks like we have a management structure and set of managers that really work. Based on recent experience with Bernie, having an effective manager can turn around a group in a week, converting a set of warring peers into a team. Even though there are a very large number of technical issues of concern, I have confidence in the current PEG members. Having someone take over Si's job should provide the added quality we need in engineering management.

Many Engineering Areas Need Our Attention
Taking on the work that Si did is going to significantly delay our work on quality, productivity and engineering training. Also, it saps us of any spare, problem solving capability.

Technical Issues In Terminals and CT's Are Open
A strong manager will create a strong team and we really need a strong team to compete in this area. We must have at least one more strong, technical manager in order to both survive and win. Aggressiveness, new products, control of architecture and interfaces with other engineering groups are of concern. Although Avram (an entrepeneural leader) and Bill (a very good manager) are both highly qualified, the product space is very large, dynamic and most competitive. We need help here!

Protection From Me (and Passers By)
Currently the projects have little protection, or any overall management structure to say no to off the wall suggestions. All the projects in this area appear to be "flat out" trying to do work. Requests put the projects in a state of pandemonium, requiring preparation time for presentations and not work.

Strong, Autonomous Product Focus
It provides us with a very clear product by product focus, while letting us get any economy from the many common components and technology.

Separation of Terminals and Computing Terminals
If there is a transition away from dumb terminals to computing terminals, we can take advantage of it. However, both groups are retained allowing common architecture and technology.

Strong and Clean Coupling With Si's Team
Basically, the main products that Si is selling are in one group: VT, LA, CT and WPS's. This will give us the best coupling with the market for direction, while at the same time let us also drive and be decoupled technologically.

Strong and Clean Coupling With Manufacturing
VT's, LA's and CT's are manufactured within Esten's plants at Westfield, Phoenix and Albuquerque. This is all these plants build. Floppies are made at Springfield and various components are made in the far east.

Very Good Coupling For Shared Technology and Work
These products all share a lot in common, and hence within the group there could be a very strong function that we must have at critical mass. The common technology across all parts:

modems
power and packaging, including noise and radiation control
keyboards
monitors (although the LA's don't need them, VT/CT do)
use of roms for more intelligent terminals
common modules for terminals and computing terminals
including: comm., rom, some video, printers, mass store

architecture of communications to operate on non-DEC systems
architecture for use on DEC systems (badly missing now),
especially VT and VT (graphics)
human factors for much of the design, including editing
imaging based on dot matrices for fonts and graphics
common approach of servicing and customer installation
use and programming of standard VLSI

Printers have unique problems of printing, paper handling and possibly printer-only editing, if we build them.

Computing Terminals require mass storage and programming. Hence, there is the need for software both within and outside DEC.

Provides A Strong Technology Focus For All These Areas
We are late in the video area with respect to both lower cost terminals or for high resolution, one page displays. The later exist or are needed soon on WP Systems.

Minimal Amount of Interaction With Other Parts of Engineering
A single group can manage the interaction with other parts of engineering. This means all engineering will be more effective. Note, that when two groups providing the same function approach a third group about an interface, there is an inherent arbitration function (actually a fourth group) needed.   Hopefully there are only these interactions:

Common terminal architecture interface with software
Mass storage (CT and VT)
Semiconductors (all, and all have unique VLSI too)
Ofis software (for both CT and VT)
Other operating system software for CT

The Revenues In These Market Directed Products Are Similar to other product groups. Both the terminal and computing terminal revenue streams (in $B) are less than the other areas.

FY	VT	LA	CT/278	16-b	32-bit
81	.16	.16	.05	1	0.6
82	.2	.2	.06?	1.1	1.0
83	.22	.27	.13	1.2	1.5
84	.29	.3	.4	1.3	2.0

The Proposal Is Similar To Other Parts Of Engineering
While not a reason per se to reject other alternatives, I would like someone else to manage the people who manage projects. Note,

B/P(level 2)
- Mass storage (level 3)
  - CX (Level 4)
    - Big Drive Projects (level 5)
    - Controllers (level 5)
      - Specific controller project (level 6)
- ...
- Large Computers
  - Venus Program
  - 36-bit
    - Jupiter
- ...
- Terminals and Terminal Based Computing Systems (Personals)
  - CT family of products
    - CT Product Management
    - CT Hardware manager
    - CT Software
    - CT product assurance
  - VT products
    - VT project

- LA family
  - LA200, etc.
- Components
  - Keyboards, monitors, etc.
- Single VT278 mogul
  - Product manager
  - Software, including WPS, RPG, etc.
  - Hardware

... etc.

Prior to Si's leaving, we seemed to getting improved focus on products. This has to continue, but we need help to do it.

Having The 278 In The Group Is Desireable, Though Not Necessary
We still need better focus and drive around the 278, especially the WPS software. The three parts can remain seperate: hardware, software (and Product Management) and WPS software. Mike Gutman should also focus full-time on PDP-11 Products!

WHY NOT ONE OF THE OTHER PROPOSED ALTERNATIVE ORGANIZATIONS?

Alternative 1
Alt. 1 adds two more direct reports, plus requires Bell-Portner to see that the various charters are established among the groups as to the plethora of components and architectures. It would require the establishment of a functional equivalent to that of the proposed organization. This function would could be in one of the three groups, and while it might be clean, we would often end up as arbiter. I don't know how to handle the advanced development and architecture that is getting us into the current trouble.

Alternative 2
Alt. 2 has nearly all the problems of 1, except that there might be something gained by having the two types of computing systems together. It could surpress the focus on CT and thereby limit building the personal system. Historically, we have not been able to focus our management attention in such a way to build a personal system because the pressures are to perpetuate time shared systems.

Probably the worst problem is that it puts in jepordy the conventional 16-bit business which we must have. Mike Gutman has to focus here!

Alternative 3
While alt. 3 allows video technology to be shared across VT's and CT's, we run the risk of doing a poor job in both areas by having resources go to either area. It has problems similar to alt. 1 in that someone has to take on many common functions. Alt. 3 may be better than 1 because it groups our lagging video together.

Alternative 4a
This alternative would certainly be acceptable and let us focus on both terminals and computing terminals. Similarly, there could be a strong advanced development and architecture function which we need for all terminals. Computing terminals have unique and intense problems which are going to consume Avram for the next 3 years! It is just about as good as 4b.

TERMINAL SALES

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GB0004/38

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SUBJ: TERMINAL SPECIALS (E.G. LA124)

Date: 8/20/79 Mon
From: Gordon Bell

TO: Distribution

Dept: Office of Development
MS: ML12-1/A51
Ext: 223-2236

Why don't we have CSS build the custom terminal specials? They are modifying for character sets anyway, and special terminal will be geographically sensitive (e.g. UK GPO, Japan Kanji characters, Bell Canada).

Of course, we would need a better link to CSS so that the important features (e.g. file systems, editors) that cross all the markets migrate back into general purpose products.

Distribution:
Bruce Delagi, Gerry Butler, Dick Clayton, Stan Olsen, Stan Pearson

00 CORE DECGRAM ACCEPTED S 002512 O 353 14-JUL-82 14:43:00

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION DATE: WED 14 JUL 1982 1:36 PM EDT
FROM: GORDON BELL
cc: RAD: DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5169488093

SUBJECT: WHY WE MUST BUILD A GREAT PORTABLE TERMINAL/PERSONAL COMPUTER

TRIP TO JAPAN, STIMULATE THESE MANY THOUGHTS:

MOTIVATION
0. Japanese consumer electronics makers are entering the computer market both with components (eg. TEAC is 1/2 digital with floppies and Wini's) and systems (eg. Sony).

1. Lots of small, portable, relatively useful products are

now on the
market including:

a. Computing calculators with narrow paper, and mass storage
b. Sony typecorder
c. Brother $200 thermal ribbon typewriter and calculator
d. Viewman
e. Purse-sized computer terminal
f. Low cost Timex computer
g. Grid systems using Sharp EL panels

2. Emerging Components:
    a. EL and LCD panels
    b. 64K CMOS rams and many other CMOS parts;
    c. 256K rams & large roms
    d. Sony micro diskette
    e. Modem chips, codecs, telephone interfaces
    f. Voice synthesizers and analyzers
    g. A plethora of 2K-8K gate CMOS gate arrays.
    h. Videoprocessors

3. Personal need of a product like Dynabook that does the functions that are emerging in today's personal computers.

4. The size would help drive the cost, styling and the market. We need a more aggressive cost and functional target to push us.

5. Our manufacturing technology is not good enough to build low cost terminals. If we get some reasonable distribution channels going, then we could do a joint venture with high volume supplier such as Brother, Sharp, Sony or some other supplier who is good at low cost, high volume units. They'd teach us.

6. This product is inevitable and I think possibly more desirable

than current, bulky PC's. We must work on it before we find that we're behind and that someone else is taking the market.

7. Within a few (say <5 years) a unit such as this will provide the functionality of today's large PC's. This is more than many users can handle anyway.

SOFTWARE FUNCTIONS - What it does

- Standard, correcting typewriter mode
- Good word processor
- Visicalc
- Scientific calculator (possibly compatible with TI and/or HP programmables)
- Business calculator
- Virtual Terminal (for all common terminals)
- Terminal compatibility with new very small terminal system
- File transfer to/from DEC system
- Standard Basic?
- Games (optional)
- Very fancy alarm clock
- Calendar keeper ala WPS
- Forms entry/WPS math for expense account data, order entry, etc.
- Datatrieve (eg. for names, addresses, comments, fields)
- Voice would ideally be the interface. Failing this, we could use handwritten input and keyboard. Voice annotation and dictation are a must.
- Telephone message interface

HARDWARE REQUIREMENTS

	IDEAL	GOOD	ACCEPTABLE
Display**	24-66 lines;1Kx1K	8 lines	1 line or 8 lines
Print* qual.	"LA100"		"LA12" none?
Graphics	yes	video text	none
TV i/o	yes		none

Keyboard	Brother "std"	--	Brother "portable"
Handwriting	yes (notes)	--	none
Voice	recognition	"Pro 350"	none
Modem	"LA12"		300 b acoustic
Fax	full	no scan	none
File	Sony Micro flopy		Micro cassette
Pc	VAX	don't care	
Mp	256K		65K
Power	solar	6-12hr. batt.	AC
Size	"Typecorder & Sony floppy"		Briefcase/2
Weight	2#		5#
Clock	yes		yes

* Need not see printing if display is good.
** (Ability to browse & deal with multiple, overlapping windows)<-too wild?

COMPUTER AND CALCULATOR SIZES AND PRICE RANGES

Wrist watch watches	25 - 160	Casio
Purse/shirt pocket calculator	10 - 62.50	thin
Hand held/coat pocket	10 - 62.50	HP35
(Programmable)	62.50 - 160	
Paper stack sized	160 - 1000	Typecorder
Portable typewriter	160 - 400	
Typewriter	400 - 1000	?
CRT-based PC	1000 - 6250	VT182

DISPLAY - I met the head of engineering who has subsequently become head of Sharp. They have various solid state displays and will soon have an 83X8 line LCD. He commented on the Grid System portable computer. Sharp also has Maxwell's Equations in concrete at their R & D center.

Having tried to edit on the Sony (40 characters) and Brother typewriters (16 characters), I think we should not make people suffer, but pay the extra price (say $500 selling price) for something that can be used.

The 8 line display be totally program transparent to a standard 24 line CRT by having two characters define the bottom of the window. On entry it would start at 8, go to 24, and stay there,

scrolling off the
top. At anytime the window bottom could be moved back, independent of
the cursor. Any action on the cursor would snap the window back to
24, displaying the bottom part of the "CRT".

KEYBOARD - I'd like a regular typewriter keyboard although the $200
Brother is acceptable. It should be quiet.

PRINTER - I now believe a printer of some sort is nearly always
required for the foreseeable future. Here, it would be nice to print
high quality so that personal notes and letters could be sent. It
would be possible to have this printer modular, but given the small
Brother portable, the typewriter doesn't seem to add much size or
cost.

The printer would be used to supplement editing, for personal
correspondence, forms, order confirmation, calculator, etc. I typed
on the big, office, Daisy Wheel Brother which had a 16 character
display and did most of the important functions of our WPS. It was
very impressive and especially nice to have no carriage motion until
the line was ready to be printed.

The $200 little, thermal, sub-portable Brother was most impressive!
It too had a 16 character display and includes a calculator mode.
It's the size of a Sony Typecorder, so it occupies about 1/4 briefcase
and is 1 1/2" - 2" x 8 1/2" x 11" - or "paper stack" size" or 1/2 the

size of a portable.

MASS STORAGE - Although it's too late to redo our decision, the Sony 31/2" Micro floppy looks to be ideal and could obviate the need for the 5 1/4". The project engineer gave one of the best presentations I've ever seen on why it will become the dominant drive. He started with goals and constraints and went into detail of all kinds. He believes they've got a technology base that can live for 10 years in terms of form factor and cartridge.

For this computer, it could be acceptable to limit response time to small tapes since they would only store files that would mostly be in memory.

APPROACHES

I don't think we can achieve the "ideal" within two years. Rather than waiting, we can take two, two-step approaches:

1. Build the right sized unit now and put in whatever is possible, giving up some level of functionality. Don't worry cost, but put in the most functions we can for the "Typecorder" size. The next incarnation would have more capability and approach the ideal.

2. Large size first with right functionality, then cost (and size) reduce.

I strongly prefer the first approach targetting small size to get our thinking down. The Nebula with VS100 and good copier

output
is what I want. Therefore, it's important to constrain size, not
function in our design! Such a product could be easily spec'd and
built either here or with one of the major Japanese vendors.

"TO" DISTRIBUTION:

BILL AVERY PAUL BAUER ART CAMPBELL
DICK ESTEN BARRY JAMES FOLSOM SAM FULLER
JOHN KIRK TOM KOBAYASHI AVRAM MILLER
KEN OLSEN GRANT SAVIERS JACK SMITH
DON WILSON

****
* d i g i t a l *
****

TO: DICK CLAYTON DATE: THU 28 FEB 1980 1:52 PM EST
FROM: GORDON BELL
cc: see "CC" DISTRIBUTION DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1 A51

SUBJECT: LOCATION OF TERMINALS/SMALL SYS. ENG. F/U 3/14/80

I believe we need a general space strategy for T/SS along these lines:

0. Identity of a non-Mass site to accommodate the anticipated high growth by June 1, considering locations of people and manufacturing.

1. Space requirements in Maynard/Hudson would be at a reduced

growth plan. Growth would be at new site including a significant move.

This is based on the following goals and constraints:

0. Retaining our talented people.

1. No growth in Massachusetts. Watch out for overpopulating NH in light of high Commercial and other growth, and desirablility.

2. We are open to a Terminals division proposal, and independent of an actual division, we can have a virtual division by co-location.

3. Coupling process related parts of engineering and manufacturing to focus on cost, producibility, and support. This implies strong engineering presence in SW.

4. Coupling PM to systems and internal group customers for 50% sales. Coupling to systems groups for software and for protocols. This implies strong engineering presence in NE.

5. Terminals and small systems engineering should co-locate to build on common parts and technologies, and because the next generation terminals will become indistinguishable.

6. Co-locate a part of low end Mass Storage for responsiveness and competitiveness.

7. Current rack and stack systems are outside the new, very

high volume focus of small systems. Qbus options will be done everywhere.

Would you please prepare a plan?

GB:swh
GB1.S2.34

"CC" DISTRIBUTION:

STAN OLSEN
LARRY PORTNER
GRANT SAVIERS
JOHN HOLMAN
ART CAMPBELL
HERB SHANZER
BILL PICOTT @MR16
DICK ESTEN @CLEM

+---------------+
! d i g i t a l !   i n t e r o f f i c e   m e m o r a n d u m
+---------------+

Subject: **Naming, Identifying and Segmenting the 11- Based Terminals**

To: Al Dziejma, Len Halio,
Mike Wurster

CC: Distribution

Date: 10 MAY 78
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

Follow up 5/22/78

Somehow the name and numbering for our 11-based terminals as the Programmable Data Terminal or PDT doesn't feel or sound quite right. These products have to be segmented and clearly identified with appropriate fan fare and whoopla. (This was the same issue as the VAX name.) (It is essential that it not be called or labeled as simply an Intelligent Terminal (IT) -- which connotes nothing!)

Also, I'm concerned that there be too many identifying model numbers for what are variations in systems configurations (e.g., with/without tape). Is it the 100 series where VAX is 700 series and 11's so far are 00-99?

The naming format should be:

0. Maybe let us grab an important generic name (e.g., Digital) or create a name (e.g., Frigidaire).

1. Give room to create future terminals and to grow.

2. Have a good pronounceable (feel) sound - preferably one syllable.

3. Build on any image we have, yet

4. Segment - show the world we have (or now endorse) a new computer (package).

5. Be a major part of 11 image.

6. The product should somehow also be segmented from the dumb, and fixed function video terminals (e.g., VT100, 105, 161). It also might have a visual clue (e.g. painting a gold strip around bezel) and permit other options (e.g., color monitor) and FONZ (different color).

Some options for names:

PDP-Series/Model #
identifies it by series # as a terminal and programmable

PT/Model # identifies it as a terminal and programmable

PDT-11/Model # ties it to an 11 (also rhymes with PDP)

PT-11/Model # ties it to an 11

IT-11/Model # People talk about IT's, the 11 is necessary to attach to an 11, I means nothing

DP-11/Model # Distributed Processor

PC-11/Model # Personal Computer (maybe we want to save this one)

T-11/Model # Terminal and 11 (easiest to pronounce)

DT-11/Model # Desk Terminal-11; also permits Lab Terminal (LT) too

Surely there are better identities. What was considered? This is important -- can't we be more creative?

GB:ljp

<u>Distribution</u>

Marketing Committee	Ed Corell
OOD	Andy Knowles
Jim Bailey	Roy Moffa

George Beason	Dick Schneider
Dick Berube	Mike Tomasic
Bill Chalmers	Jim Willis

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Jim Bell	ML3-2/E41	Dick Clayton	ML12-2/E71
Jim Cudmore	ML1-4/E30	Bill Demmer	TW/D19
Ulf Fagerquist	MR1-2/E78	Win Hindle	ML5-2/A53
Ted Johnson	PK3-2/A55	John Kevill	ML1-3/E58
Andy Knowles	MR2-2/A52	Julius Marcus	MK2/C37
John Meyer	ML12-1/A11	Stan Olsen	MK
Larry Portner	ML12-3/A62	Bob Puffer	ML12-2/E38
Bill Thompson	ML12-1/F41		
Jim Bailey	PK3-2/M18	George Beason	ML5-2/E93
Dick Berube	PK3-2/M18	Bill Chalmers	MR2-2/M67
Ed Corell	ML5-2/E93	Roy Moffa	MR2-1/M64
Dick Schneider	ML11-4/E53	Mike Tomasic	ML12-2/E71
Jim Willis	PK3/M34		

00 BURT DECGRAM ACCEPTED S 23434 O 33 30-MAY-81 13:09:02

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION

DATE: SAT 30 MAY 1981 13:04 EST

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION

DEPT: ENG STAFF

EXT: 223-2236

LOC/MAIL STOP: ML12-

1/A51

SUBJECT: TERMINALS ARCHITECTURE AND COMPATIBILITY

It is clear that our highest priority is to have a terminals architect. I am really disgusted about our recent products in
this area. Clearly, these have to be dealt with right now as they are crisis level. I don't see anyway our software can support this hodge podge. Here are the problems I know of:

Gigi and VT125: 2 problems, compatibility with each other (it blows my mind that they are not subsets of one another); and their compatibility with the 100 so as to run the software
the way the CUSTOMER WOULD EXPECT IT TO WORK! Here, I would like to see a plan to address these two issues.

VT278 compatiblity with VT100. Here, we have to acknowledge that a VT100 is actually a VT100+VT52. There is no such a terminal as a VT100 mode only terminal. This is the same issue
with VAX, which includes an 11! When we ever put in a backward
compatibility mode, then all successsors are stuck with providing this, cause the software depends on this mode.

VT131 block mode terminals. Is there any expectation that these will work on or be supported on DEC systems? This one really bugs me, cause the control is totally different than any of our editing terminals. How we could build this is unintelligible to me. I want it clearly spelled out in the sales literature that it will not run, nor will it be supported on DEC systems!

What will EMS support? How about the 100 mode part of a 100?

Coping with the additional capabilities of CT terminal emulation.
Here, I would anticipate that CT should be able to behave precisely as a VT125... but since there is only a single display, then I don't see how it does all the stuff. While

the 125 is cute with the ability to run the two screens independently, it looks like it should not be used or supported
at all, cause it's not something we can perpetuate in follow-ons!

We seem to have built the messiest set of products I have ever
seen, and we are going to be spending several years cleaning this up. Before we introduce ONE more product, I want clear statements about how each of them are going to be fixed.

Please understand that a terminal is just as complex and has the same costs as supporting a given cpu architecture such as VAX or a 10. This means it really has to be nailed down precisely so that it can be used AND we can not have an arbitrarily large number of different terminals.

Please get together individually and then with me and give me an
indication of when we are going to have this problem under control. Sam, will you figure out how we are going to do this?

"TO" DISTRIBUTION:

AL CRAWFORD SAM FULLER BILL KEATING
JOHN KIRK BILL PICOTT CHARLES A ROSE

"CC" DISTRIBUTION:

ART CAMPBELL SI LYLE JOE MEANY
AVRAM MILLER

GB2.S6.55

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION DATE: MON 17 MAR 1980
2:53 PM EST

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION DEPT: OOD

EXT: 223-2236

LOC/MAIL STOP: ML12-1
A51

SUBJECT: TERMINALS BUSINESS LOCATION F/U 3/28/80

From: Stan Olsen, Jack Smith, Gordon Bell

Would you please prepare a proposal for the movement of terminals
and small systems engineering, marketing and manufacturing (headquarters) to some non-NE site. Given the growth in NE, and
the possibility of 15 thousand engineers here, both Ken and Win
believe we need to look at this as one such proposal.

Undoubtedly we will need other groups to leave NE to achieve the
Massachusetts cap constraints. We envision having a site that
might grow to near our current size by 1990. We all support making this proposal. In fact, two of us (SO, GB) have tentatively agreed to rent a house and spend significant time at
this new site.

All of us have favorite sites and want to input to your site evaluation process with names and criteria (proximity to other
manufacturing sites, universities, schools, engineering base, ability to grow engineering, culture, climate, etc.). The site
selection process should be open and criteria explicit (sites,
criteria).

The complete terminals business unit would co-locate: terminals
engineering, TPG and terminals manufacturing headquarters. In
addition, it is imperative that the non-cabinet based small
systems engineering co-locate because the next terminals behave
as small systems, providing user programmability. This would
provide excellent co-location possibilities with your main users,
such as standalone word processing and the retail products
group... but this is a detail.

Ken has declared that we are not going to consider the division
question at this time. Please work up the geographic proposal
and address the necessary organizational implications without
resorting to a division as the only solution. In fact, if the
site and breadth of markets is great enough a division probably
is less relevant.

What is an appropriate date for a proposal? Can we get together
with you and discuss this?

GB1.S2.51

"TO" DISTRIBUTION:

DICK CLAYTON	ART CAMPBELL	DICK ESTEN
@CLEM		

"CC" DISTRIBUTION:

KEN OLSEN	STAN OLSEN	WIN HINDLE
LARRY PORTNER	GEORGE CHAMBERLAIN	JOHN HOLMAN
JOHN F SMITH @CLEM		

TERMINALS HOME QUIZ

Name:___________________________

Number of hours/week spent at a terminal or personal computer? ___________

1. Define the term "DEC Speak"?

2. Why will a VT100...125 outsell an IBM 3101? _______________

an adm 3a? ____

the various HP terminals?___________________________________

3. Define the set of terminal performance and functional attributes and what terminals have what attributes.

4. Describe the current (and future) chips for video control.

5. What is unique about the most recent HP terminal and why would anyone want it?

6. When do you believe all video terminals will evolve to be intelligent? To be full blown personal computers with mass storage?

7. When will CRTs first start to be replaced by other technologies?

8. Describe each of the above technologies in 7.

9. Which terminal or personal computer would you buy?

10. What are the characteristics of Gigi-M alias Gigi II? Gigi 1.5? Suvax graphics? CT-100? VT200? The various CSS terminals? John Kirk's new CT/VT?

00 BURT DECGRAM ACCEPTED S 19539 O 01 23-MAR-81 00:52:40

****
* d i g i t a l *
****

TO: SI LYLE
DATE: SUN 22 MAR 1981 23:43 EST

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION

DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: RE: RE: MARKETING PLANS/TJ MEMO 3/13/81 ATTACHED

I strongly support widescale sales of these terminals and small systems using the approach of having the terminals product line take the lead in programming (hopefully in a hll) specific protocols (3270, tektronix graphics) and doing speciific block mode applications to make the smart terminals.

Could we take the vt101 etc and put the microsoft basic in it so as to be useable for programming these?

Let's start with the 101/131, 125, gigi, pdt, and 278 word processing terminal.

Could they also have programs, written in Fortran to support the terminals on ours and other systems? (In the case of the graphics terminals, visicalc, and plotting are really necessary to make them play.)

As an aside, I would like to get the support plans for the VT125 for our systems. I find NO ONE using them in our systems programming and this is crazy!

"CC" DISTRIBUTION:

TED JOHNSON DICK LOVELAND KEN OLSEN
BILL PICOTT

GB2.S5.21

00 BURT DECGRAM ACCEPTED S 2569 O 50 15-OCT-79 12:39:14
FROM: GORDON BELL DATE: MON 15 OCT 1979
12:38 PM EST
DEPT: OOD
EXT: 223-2236
TO: DON CROWTHER
cc: R.L. LANE
JOHN HOLMAN
BILL JOHNSON
BRUCE RYAN @CLEM

SUBJECT: OBSOLETE TERMINALS TO TPL AND RIO

GB0005/8/EMS

Will you please get a list of the unused obsolete terminals we have
including up to VT05's and LA30's? Then let's send them to TPL who in
turn can distribute them in the Rio office. I found DEC employees
fixing LA30 modules and heads.

I'm sure if we give them to TPL, they can figure out a way to sell or
distribute these terminals effectively. Please start today!

GB:swh

00 BURT DECGRAM ACCEPTED S 1058 O 15 15-JAN-80 21:01:48

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION DATE: TUE 15 JAN 1980 9:01 PM EST

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION DEPT: OOD

EXT: 223-2236

LOC/MAIL STOP: ML12-1 A51

SUBJECT: CHANGE IN TERMINALS PRODUCT DIRECTION!

I am excited about the discussion that we have scheduled which I hope will be long enough to get into product details. It has been hard to hide my agenda that our terminals product direction is not adequate. Fundamentally, I want us to divide the problem up into evolution based on the vt100 and products that will be more revolutionary following it. The more revolutionary products though maybe should be constrained to be compatible with the options advocated below.

The premise is that vt100 has attracted many competitors and imitators and there will be piles of competitors ready to do us one better. Given the $'s being spent to tool the 100, we had better do something quick to make it be unique. Fundamentally though, it is unique because it has extra power and space that we must capitalize on. Thus, the VT100 will be the Kernel for much future terminal expansion. The following 1 board options seem essential:

1. vt132-editing option board with block mode and some ability to do specials (possibly this would also support a tu58)
2. vt 162 forms entry with block mode ddcmp. Do not release the 162 as we know it cause we can't support or get the 100 capability in it! WE MUST HAVE COMPATIBILITY IN AN UPWARD FASHION. ALSO, GIVEN THE 162 is Fonz based, then we can also do a limited set of programmable functions...even though I don't know specifically what they are right this minute.
3. VT125- Graphics board.
4. vt278 processor with connector for remote floppy. This would have a built in modem, and serial port to support lqp, la34 or la120, and also support 2 floppies in a PDT case. Note, by plugging in this board we get wps! (Also, there is an RSX version of wps that does remote wps processing so that many users can tie into a large 11 for the lowest cost.

Here, it is desirable that the 278 board be in the 100. 3 and 4 would work together.
5. vt103 as announced already follows the philosophy of being an option.

Imagine being able to market a terminal (cabinet) with these capabilities? By the time we get the products ready, we'll have an ad on base of at least 1/4 million...and if each of these will only buy 500 worth of ad on. No one has done this. Let's do it...it also solves the multiple terminal problem cause one terminal could be dumb ala 100, with graphics 125 module; and have the forms entry board als 162 doing some special function. With the 162 board we could let css or Art's engineering really go after the medium volume

1k-50k specials by merely writing 11 programs (in Pascal, I hope). Julius, I hope you'll support this approach versus the special 162. Note, with the 125 and the 162 together we can easily build the highly specialized multi-font typeset terminals with a program.

I want to define these board architectures so they play together and we can do all these things. Also, some of the boards could be used in the LA's to get us specials. We have most of the work done for the modules, now let's look at this slight eco to make them play together!

"TO" DISTRIBUTION:

STAN OLSEN   DICK CLAYTON   BRUCE DELAGI
ART CAMPBELL   ART WILLIAMS   BILL PICOTT @MR16

"CC" DISTRIBUTION:

KEN OLSEN   ROGER CADY   JULIUS MARCUS
JACK GILMORE   BOB GLORIOSO

GB1.S2.19
00 BURT DECGRAM ACCEPTED S 10647 O 68 15-NOV-81 12:22:38
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* d i g i t a l *
****

TO: see "TO" DISTRIBUTION   DATE: SUN 15 NOV 1981 12:19 PM EST
                                             FROM: GORDON BELL
cc: see "CC" DISTRIBUTION   DEPT: ENG STAFF
                                             EXT: 223-2236
                                             LOC/MAIL STOP: ML12-1/A51

SUBJECT: THOUGHTS ON TERMINALS FOR DUMB, WPS AND TECHNICAL USE

Ken just sent a note around based on the Frost and Sullivan data that says the full page wps now is 23% of the market and will decline to 13% in 85. The current WPS market is 2GB and will grow at 28% (doubling every 3 years) to 5GB. Hard copy only
units will decline to a few percent based on 13% now. These numbers are ALL UNITS, not dollar volumes. We need to decide what we want to go after.

In general, I don't really trust these surveys. However, it's
clear there will be a lot of minimal systems sold (I assume these
will be the cheapest system). Here, we must use the 278 really
aggressively to go after the typewriter replacement market! I
hope it is cheap enough. It is also possible that someone will
make a really good system and capture the whole thing. Note that
Sony has a full page which I am still receiving parts of, and I
believe that this will tell us something as to how much we can
believe the numbers. Note, the IBM Selectric dominated the market not due to cost, but due to quality. They got the market
not on price and maybe not even in terms of units, but they got
the $ market. In short, I believe technology and quality could
blow any market data like this all to hell!

Note, a new company has announced a $2500 full page alpha display. I think we have to look at what it would provide, before we base our work on Market surveys. Similarly, there is
much fundamental work going on in raising the TV standards to higher quality. I trust we have one on order!

QUARTER (THIRD OF TEXT) VERSUS HALF PAGE

For starters, I am very confused as to what a half page would do for us in the alphanumeric market, versus our 1/3 page. Note we have been calling this 1/4 now (for 240 lines) and 1/2 (for 480 lines) to give something like 33 lines of text. For starters, this interim display would give us some higher quality letters, but it would also give us decent resolution for our technical users who operate remotely. As a buyer now (with VENUS) I would like to give every engineer a VT125 that would have 480 lines (versus 240) so he could see his prints at home! Right now, I'd like to have something we can experiment with so as to find out what these different page sizes would provide.

Another cut at this would be to make the screen flicker by using
it non-interlaced. This would give the resolution at the price
of flicker. Here, let me speculate a really low cost, but potentially useful display. Make it just a 240 or 480 (non interlaced) display. As an alphanumeric, it would be a VT100, or
when operated in 480, it would be called Rough View Mode. With
this, one could VIEW 53 lines using 9 lines per character (7+2
spaces). This still doesn't get to a page, since most are 55 lines of the possible 66 lines and ? for European pages. When
used as a graphic display, then View mode mode give a much bigger
picture.

This doesn't mean we should hold off any plans to get a VT200!
It is critical to get a VT200 emulator to every development group
NOW (which should be easy, given the VT103), since we need to start off loading terminal handling Yesterday.

WHY WAIT FOR THE VT200 CHIPS BEFORE WE GET FULL PAGE TERMINALS?
Somehow, I don't believe this is going to happen. It feels

like
the Semiconductor industry is going to have chips before we do.
In talking with the NEC semi folks, those guys are committed to
get this market! Somehow, I think we'd be ahead to take their
chips and use them for our full page work then to totally base
our VT200 on our own chips. If full page is going to happen,
let's drive to get it out there now and not wait on our chips.
Note there are only 200 chips in the Stanford Workstation! We
could have this out on the market within a year, if we adopted
their design.

GETTING A DECENT HIGH QUALITY TERMINAL FOR VAX
I'm really concerned that we are doing so many really interim,
low quality redos etc. versus getting a high quality terminal out
there for VAX. We just can't get the big Suvax display out
there and we have no alternative for a production display for the
professional for VAX. I thought that CSS was going to market
this impressive terminal.

We also need something of Xerox Star quality (1 page, 960 lines)
that can plug into a Unibus and be used to give say 3 to 8 high
quality workstations on a 730 or 750. Note this gives the best
professional station in the industry at competitive prices. This
just has to get factored into the funding this go around. It is
much higher priority than say CAT, and a lower cost VT100. VAX
is both directly funding and indirectly funding terminals by

providing the ports for all the low end money losing
projects!

As we allocate resources during this budget pass, the above
are
some thoughts. I'd sure like to see some protos to help
decide!

"TO" DISTRIBUTION:

BILL AVERY   CATHY LEAROYD VIA AVERY GEORGE
CHAMPINE
SI LYLE   KEN OLSEN

"CC" DISTRIBUTION:

BILL DEMMER   SAM FULLER   BOB
GLORIOSO
WIN HINDLE   ANDY KNOWLES   JULIUS
MARCUS
BRUCE STEWART

GB3.S2.41
00 BURT DECGRAM ACCEPTED S 10825 O 131 30-JAN-82
23:29:33
****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION   DATE: SAT 30 JAN 1982
11:27 PM EST
                                        FROM: GORDON BELL
cc: SAM FULLER   DEPT: ENG STAFF
                                        EXT: 223-2236
                                        LOC/MAIL STOP: ML12-
1/A51

SUBJECT: GETTING THE ARCHITECTURE OF THESE TERMINALS
SPECIFIED

I believe there has been a suggestion around for several
years

as to how to specify terminal hardware architecture such as the
vt100 and 125. It may have trouble when the terminal gets more
complicated though.

Fundamentally, the specification has to be written in something
like ISP or the notation used in the SRM. It has to be organized
with the same kind of rigor:

State internal to the display
State that is visible Screen[0:23]<0:132> for example
The I/O ports and the sublety of any buffering in them, including
 the keyboard
The operations on the state when a character arrives in terms of
 what's displayed, the cursor, etc.

I don't see what is tough about this. I keep seeing these idiotic
tables of differences that assume an incredible knowledge about
the semantics of displays.

I haven't seen a decent manual yet on displays.

Bill Avery,
For months, I've requested that we really write a classic manual
that defines all our terminals and how they operate so we and our
users know what they are. Is there any chance we'll ever do this?

Since DECSIM has a really good way to describe systems like this,
what about using that language?

"TO" DISTRIBUTION:

BILL AVERY ALEX CONN BILL
STRECKER
JOHN WAGNER

GB3.S2.63

FROM: GORDON BELL DATE: TUE 23 OCT 1979
2:04 PM EST
DEPT: OOD
EXT: 223-2236
TO: BOB KUSIK
    LUTHER ABEL
    STEVE TEICHER
    CRAIG MUDGE
    STAN PEARSON
    JOE ZEH @CLEM

SUBJECT: COLOR TERMINALS AND THEIR USE IN CAD--FOLLOW-UP
11/2/79

GB0005/28/EMS

I count for color CRT's: LERAD, SWAVE, LCG A/D, and Personal VAX. Are they compatible? Complementary? Needed? Headed for Development?

Wouldn't we be better with one of two less and more product focus?

Now we are also looking at IC layout on: IC: LSEG, MSD, APOLLO, and Microproducts. PCB layout work at: IDEA, CALDEC, SWAVE. Are there others?

GB:swh
00 BURT DECGRAM ACCEPTED S 26802 O 89 12-SEP-81 18:47:29

****
* d i g i t a l *

****

TO: see "TO" DISTRIBUTION   DATE: SAT 12 SEP 1981
18:42 EST

FROM: GORDON BELL

cc: KEN OLSEN   DEPT: ENG STAFF

EXT: 223-2236

LOC/MAIL STOP: ML12-
1/A51

SUBJECT: GETTING VT'S,LA'S,ROBIN AND CT OUT FIRST, THEN WHAT?

I strongly support Bill and Si in this next product
direction.
We must have a terminal that can become a computing terminal.
The lineup now:

vt 1xx	500	should be cheaper and expandable to a ct
vt125	1000	
vt180	1450	
ct120	1450	
ct150	2500	

Desired:

vt	350	(expandable to a vt125 version cheaply and to a ct))
vt125'	500	
ctversion	800-1000	
ct120	,<1450	
ct150	2200	

If my hunch is correct, we are going to badly need a terminal
after the market responds with a very loud yawn with
the new vt 101,102, 131, 132. This has to be our famed, but
long awaited vt200. The question is whether we can
wait for a more expensive monitor.

We should proceed asap to get some data bout how to get
this next low cost vt/ct. The breadboards should include:
CAT

TRIAD as a way to get the expansion and 11 compatiblity
(by doing this designy, we have 2 options... it is the vt/ct we talk about above, or it can be a ROBIN type product that we put in a vt100
vt200 ... currently directed at being 1/2 page, but no monitor
and a very long schedule

At any rate, we ought to go like hell to get our current, very
full plate into production and into our customer's hands.
Recall, we are announcing or planning to deliver vt101...131,
la24, la12, vt125 (a hell of a task when you consider the
software), ROBIN (with the hope of it being an FA&T version
given that Xerox is delivering 7,000 per month!), ct120,
ct150. I
say we are crazy to be talking about introducing any more
products for the next year, if we want to do a quality
development, manufacturing and marketing job! Are we
committed
to quality????

Bottom line:
Get the products out. Get together and get several
breadboards going
that aim at the above (or you change it) target.

When can Si and I see the plan?

"TO" DISTRIBUTION:

BILL AVERY	ART CAMPBELL	BARRY JAMES FOLSOM
BOB GLORIOSO	SI LYLE	AVRAM MILLER

ATTACHED: MEMO;22 MEMO;35

****
* d i g i t a l *
****

TO: BILL AVERY DATE: FRI 11 SEP 1981
16:05 EST

FROM: SI LYLE

cc: GORDON BELL DEPT: <CPG>
ART CAMPBELL EXT: <264-5001>
AVRAM MILLER LOC/MAIL STOP: <MK1-
2>/<2C36>

SUBJECT: RE: VT 180 FOLLOW ON/BILL AVERY 8-31-81

The follow on product must be a terminal that becomes a personal
computer. If we build a box that is independent of the terminal
then it is just another CP/M box and there are many of those. So
we loose every bit of pizzaz and end up just one of the crowd and
might even confuse the CT message.

Si

ATTACHED: MEMO;35

****
* d i g i t a l *
****

TO: BARRY JAMES FOLSOM DATE: MON 31 AUG 1981
15:52 EDT

FROM: BILL AVERY

cc: see "CC" DISTRIBUTION DEPT: LDP DEVELOPMENT
EXT: 231-6805
LOC/MAIL STOP: MR2-4/E79

SUBJECT: VT180 FOLLOW-ON

We need to establish a hard set of goals for the VT180 follow-on.
It looks like the FCC standards may force us to put the processor

in the box with the floppies; we will also have the T-11 and hence a DEC SW strategy. This product will have much more of a personal computer flavor then the VT180; I believe it will be a corporate product and will be marketed by numerous groups. There are a number of engineering groups in a position to contribute, including CT, Small Systems Software, and the Video group.

I would like you to put down a preliminary set of product goals that we can review at my staff meeting on 8 September; we can then start to set expectations as to what will happen and who will be responsible for what.

31-AUG-81 17:36:53 S 34912 MLDP

"CC" DISTRIBUTION:

GORDON BELL ART CAMPBELL SI LYLE AVRAM MILLER

GB2.S8.26

GB1.S1.4

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i n t e r o f f i c e
m e m o r a n d u m

SUBJ: **Issues on Where Terminals are Heading**

TO: Ed Lazar, ML1-2/T29
Bill Picott, ML1-2/H26

Date: 1/18/80 Fri
From: Gordon Bell
Dept: OOD

CC: Roger Cady, MK1-1/E25 MS: ML12-1/A51 Ext: 223-2236
Art Campbell, MR2-2/M67 EMS: @CORE
Dick Clayton, ML12-2/E71
Bruce Delagi, MR2-1/M64
Bob Glorioso, ML3-2/E41
Stan Olsen, MK1-2/C36
Charle' Rupp, ML3-2/E41
Bob Savell, ML5-2/E50
Art Williams, ML1-3/E62

Subject: **Issues on Where Terminals are Heading**

Am glad you anticipated what would have just been this memo and allowed me a personal dump about the overall direction. There are 3 pages of comments with some appendices of earlier comments plus the Commercial Products Terminals request. I really care about terminals because they are what all our users see and interface to.

. I want to test all our Terminals at a time when they can be affected. Note, there is still something wrong in the Keyboard "feel" on our terminals. Mary Jane seems to think this problem is solved with the Hytek keyboard. Has it? (A. Note the attached comments on LA34.)

Architecture and Technical Direction

. Architectural control. Generally we have to have architectural control to avoid the plethora of point products we now have that are incompatible internally, and cannot be built on in an intelligent fashion. OR, in order to do the insanely large number of terminals we desire, we must have a common architecture. Let's get the combinatorial number of terminals x electrical interfaces x protocols x mass storage units x smart or intelligent part down to a arithmetic problem by having common interfaces. (C. Note the attached comments.)

.Graphics architecture, design and control. Graphics look like one essential mid-life kicker for VT100. I'm worried about when we are getting the 125 and how we are going to handle the

architectural evolution that is implicit in it. (D. Note my attached comments on graphics.) We also have to be able to print what we view. This terminal should fundamentally be considered to be a 2D Calculator (and it will evolve as such).

. Built-in modems and/or acoustic couplers. The physical interface plug and cable has to be right as noted about the WPS 200. Let's assume a telephone company will install cables for terminals. Can we assign one person to handle the cabling, plugs, modem and protocols work? Before the terminals group gets a marketing person to squelch it, let's consider the user and stockholder by building modems into all terminals! I fought this one several years ago. Hopefully, Ken will solve this one where I've failed.

Product Proliferation versus High Volume, Quality Products

. It seems like there are too many like crazy, given there is no architectural commonality. What new ones can we not have? How can we merge using common components such that we get all of them but by parts, not point products? I think that we have to change our direction as per the REDBOOK!

Evolution versus Revolution

. VT100 Evolution. Given that we have attracted a large competitor following with the 100, and given that it has extra power, cabinet and hooks for add ons, can we make lots of add-ons for it so as to drive the look-alikes bananas and get an even bigger market? (E. Note the attached comments on the VT100 mid-life kicker and EMS message of 1/15/80.)

. Revolutionary Gonzales' Modular Packaging. This has to be the way to go for all new terminals to give us the edge. Can we make all new terminals this way, and count on the above evolution of the 100 and the enhancements that Terminals group is doing to the hardcopy to hold us until we get the design under control.

Specific Product Issues

. Very Low Cost Hand Held Terminal (VLCHHT). How real is the very low cost terminal that R and D is doing, and why not do it rather than getting the evolutionary slight cost reductions (eg. 100L). Terminal costs are not the issue with a user...the terminal is a minor part of his total cost, functionality or reliability or speed wins every time when he looks at his costs. Let's also use VLCHHT for our computer and mass storage consoles. Should we get Sharp to build it to our specifications?

. Physical cable interconnects to terminals are inconsistent and need attention. Note comments to you and WPS on VT100/WPS200.

. Let's make the VT200, i.e. the VT100 follow-on 66 lines! If this is not the case, let me know immediately. Note: VT03 (12 lines); VT50 (12 lines, only upper case) and evolving rapidly under market pressure to VT52 (24 lines, both cases); VT100 (24 lines, better and both cases and foreign characters and 132 columns allowing 48 lines on a side by side basis); and VT200 (should be higher quality characters with a full page).

. Color. I suspect the best test will be with GIGI. Namely, color probably is only needed when video and pictures are used and that means graphics have to happen first. IBM has lead the way...will the customers follow? (Don't we have to be really prepared if they do?) (F. Note the attached comments on the color issue.)

. Noise is certainly an issue for most user environments.

Understanding and Advanced Development

. Understanding historical and depicting future of terminals by use of family trees. The Redbook usually has just the next few years with the various terminals plotted in a cost vs. time fashion. Given the plethora of new terminal products I think it would give us all a great deal of insight to have the family tree plotted clear back to the VT03 and LA30 (and ASR 33). These would be similar to those in Computer Engineering or the big DEC tree hanging in the museum. There's lots of information. Namely, when the project starts, the branch is put on the trunk and when it ships a node it is put on the branch and when we stop shipping, the branch is terminated. Enhancement models get extra nodes on the trunk. The insight I'd like is gestation period changes, width of the tree, what segments, etc.

Organizational and Interface Issues

. Poor connection especially with Campbell and Delagi re joint REALISTIC plans. Our projected revenues come from every segment of hard/soft copy, cheap/constant cost with increased capabiltiy, office environment/portable dumb/smart/intelligent, DEC/other vendor/custom, domestic/foreign combination. We can't design, build or support all these dreams. Besides the Terminals group doesn't have a coherent, documented plan.

. Better interface to commercial. (B. Note their attached comments on products requirements on terminals.)

. Better interface to WPS, Typeset.

. Better interface to MPG so we get saleable terminals there.

. Better interface to Small Systems (i.e. Shanzer) to let them use your extra cabinet space and power to make a complete system without a major redesign.

. Manager for Video? Let me know if I can help sell a recruit in this vital exciting job.

GB:swh

00 BURT DECGRAM ACCEPTED S 17572 O 71 21-FEB-81 18:05:08

****
* d i g i t a l *
****

TO: MARKETING COMM: DATE: SAT 21 FEB 1981 17:59 EST

FROM: GORDON BELL

cc: SI LYLE
AVRAM MILLER
BILL PICOTT

DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: UURGENT PROBLEM: RESPONSIBILITY FOR LOW COST SYSTEMS

For our disussion at GVPC:

Independent of whether I have be able to help build better low end personal computing terminals, historically we have tried and generally have done poorly (market share, profitability,quality).

PRODUCT HISTORY

The products arena, over the past 6 years and currently:

VT8/E (Reuters), VT14(originally GM for PDP-14)
VT30, 31, etc. by CSS for weaving, mimic diagrams, tv
VT15,GT40, GT60, Megatek (lab and engineering graphics)
VSV11 (Graphics and Image) LDP, now CSS
VT20,21,71,171, etc. for Typeset also Tektronix based
LA36/BSR, LA36/TU60, LA120/TU58 (AT&T), LA44, VT134
PDT130, PDT150 (for ADP)
Minc, Mini-Minc, TLC
Gigi, Gigi 1.5
VT103 (TPG)
DS315

WHY IT HAPPENS

Our structure and the basic P/L Bill of Rights (which I do not advocate changing), created the problem. Some of the forces:

.Customers specialized need (Caused 6)
.Perceived specialized market need (caused about 20)
.Perceived general purpose, high volume opportunity (5)
.The components are available, and it's about the only piece of hardware that a P/L can afford to engineer
.They are fun to start. It is the one product that can be built according to the classic model: marketing specifies and engineering builds it
.The market is perceived to be sufficiently different that no gp system can be built (Apple disproved this!) ... hence no common system was able to be defined
.The engineering budget was not large enough to cover this evolving part ... for example, the whole WPS P/L had to be started up to start the eng. investment
.Poor engineering leadership to recognize need, and propose it

SOLUTION

Now that we have recognized the problem, let's solve it.
        .Technology is changing making engineering cost higher,
         product costs lower, and unprofitabity clearer
        .We are doing a system to cover many of these areas
        .Near term, Engineering is taking responsibility for 278
        .Engineering will operate "modified Golden Rule":
         .Will operate with Business Plan and Phase Review
         .Will get an outside assessment of product viability

        .Review the current terminal and PC's ... there are
         lots more lurking losers. Put the $'s in low end PC's!

GB2.S4.34
00 BURT DECGRAM ACCEPTED S 36 O 01 13-JAN-80 10:50:10

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION   DATE: SUN 13 JAN 1980 10:43 AM EST
                                             FROM: GORDON BELL
cc: see "CC" DISTRIBUTION   DEPT: OOD
                                             EXT: 223-2236
                                             LOC/MAIL STOP: ML12-1 A51

SUBJECT: SOLID WIRE ON PEDESTAL 100'S AND THE WPS200

I can't believe that FS just connected a bunch of VT100's on movable pedestals to our WPS 200 system with solid wire. These are 20ma connections and they use a really poor connector. Why don't we use a standard modular jack such that standard phone cables, connectors and telephone installation procedures can be used?

What are the installation standards here? Who has this responsibility? Could you send me the standards we do use? I'd like your groups to get together and work out what we do use. The WPS200 wiring as demonstrated in our area is totally unacceptable as an office product in quality, wiring, reliablility, noise level and aesthetics. As a system, I think the WPS 200 system is fine, ignoring the fact that it is unsupported because it is a large 8. Will you convene and segment the problem and decide who's responsible for what? and what can be done?

For starters, switching the WPS200 to serial lines for both the Draft and LQP would help matters enormounsly. It would give us greater distance and get rid of the eyesore that can not be installed. It would also give us the needed increase in signal to noise ratio and help reliability...and even allow interchangeable use of fiber optics. In looking at the specs, I find that FS didn't need to use 20ma, but could have stayed with the EIA. This cost us in time and engineering at our floor site.   Here again, I want to get the number of configurations down a lot so that we can make what we do sell work! Having these infinite options and FS designs just complicates the already marginal software package...and in order for us to survive here we have to start limitin options on the 200!
Bob Gray it is clear you have the leadership here, and I'd like to know what and when we can expect simplification?

"TO" DISTRIBUTION:

DON BUSIEK   BOB GRAY   GEORGE
PLOWMAN
BILL PICOTT @MR16
"CC" DISTRIBUTION:

JACK SHIELDS   DICK CLAYTON   JACK
GILMORE
BOB DALEY   BOB TRAVIS   B
FTIZGERALD VIA DALEY

GB1.S2.18
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* d i g i t a l *

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TO: see "TO" DISTRIBUTION DATE: FRI 25 JUL 1980
5:15 PM EDT

FROM: GORDON BELL
cc: MARY JANE FORBES DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: WE NEED SOME CAPITATL FOR AVAILABLE, INTERNAL EQUIPMENT

Several of us are involved in building a small, terminals system. We have hardware in stock, although we have to order a few specials. We want 8 copies, at about 1.6K for PDT; .75 for Vt100, clocks outside at .4K, Modem proto at .5K (25.6K). There is some funding within the various projects which Bill Zimmer, who is co-ordinating the procurement, will tell you about. I'd like to find the difference and get all this stuff together by the time I get back so we can work rather than talk.

Please help.

"TO" DISTRIBUTION:

BILL ZIMMER AND FORBES MITCH KUR LARRY PORTNER

GB1.S6.17
00 BURT DECGRAM ACCEPTED S 24722 O 05 15-JUN-80 19:55:00

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* d i g i t a l *
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TO: BILL PICOTT DATE: SUN 15 JUN 1980
12:52 PM EDT

FROM: GORDON BELL
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-

1/A51

SUBJECT: RE: RE: WE REALLY DO NEED LOTS OF ARCHITECTURE IN TERMINALS

Great. I am busily rethinking the great terminal. I just visited Allen Newell and looked at his use... another atypical
user, but found in addition to calculator nearby (we would show it on the screen, plus the registers of it plus past results
(ie the tape)), I found a clock, and possilbly an alarm clock that should be built in. The way to do these is to have about 4 virtual terminals there with a nice, quick action, eg.
like a telephone extension switch to move among them and the ability to generally do virttual circuit switching so that they
could all be used in an independent way.

We would put a rom in the terminal that would get the user the
various capabilities which he'd pay for as options. Now, I see them as: the telephone management connection (with phone
dialer and ability to put in numbers to recall for dialling); the
calculator-timer-clock option; the BASIC option; the paper option-
where we store all the scraps of paper that a user needs as a reminder
to keep his terminal in operation. All these would be independent
of the host.

Is there anything patentable here? How do we keep it from getting out and getting in other terminals before weget to the
market ?

Can you get me a person to help define and write the software for

these (ie the VT100) so we can see how they work? (I only want
one person in and R (A/D) role. Note, we can use these as Midlife
Kickers to the 100 too.   How are we going to plug in the option
roms?   I would build them on a PDT first to really get them
refined. When can I get the help?

GB1.S5.6
00 BURT DECGRAM ACCEPTED S 26689 O 40 29-MAR-81 20:58:30

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TO: see "TO" DISTRIBUTION   DATE: SUN 29 MAR 1981 20:57 EST

FROM: GORDON BELL

cc: KEN OLSEN   DEPT: ENG STAFF

EXT: 223-2236

LOC/MAIL STOP: ML12-1/A51

SUBJECT: WINNING COMPUTING TERMINALS AND TERMINAL STRATEGY

Avram has proposed how we should focus our product development in the
computing terminals and terminals effort. Given we have the strength
and creativity of the groups who have been doing product engineering
in RPG, and TPG together with a unifying product direction we should
be able to put together a product set that would ship in August 82.
The product set:

. Black and white monitors to be used across all products
. LA24 ro printer and possible LA12 ro if the cost is there
. modules for the ct100 that can be used in the lower cost

versions
     including: rom, floppy, telephone management, and modems.
   . ct-wini with >2K product cost
   . ct-floppy with 1.3K cost
   . vk gigi 1.5 with 600$ + Monitor product cost with the ability to
     use the ct modules
   . a really low cost dumb or small computing terminal in a VK, with
     a product cost target of 200. Hopefully it would take the
     modules, but its goal would be cost and the only important
     modules that it need use would be the modem.

I think this is the right product direction. We can and should do it.

How can we proceed?

"TO" DISTRIBUTION:

SI LYLE   AVRAM MILLER   STAN OLSEN
BILL PICOTT

GB2.S5.32

this is a test this is a test this is a test
THIS IS A TEST FOR THIS TERMINAL
THIS IS A TEST FOR THIS TERMINAL

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Subject: **Why I Believe The Tewksbury Group Should Have the Highest Morale**

To: Bill Demmer, TW/D19

Date: 4/9/79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

CC: OOD
Brian Croxon, TW/C04
Dave Cutler, TW/D08
Bill Heffner, TW/C10
Bernie Lacroute, TW/A08
George Plowman, ML5-5/E97
Dave Rodgers, TW/C04
Bill Strecker, TW/A08

At a meeting in Tewksbury with the Venus Developers, who I all hope will move to Marlboro to continue their work, a question came up in regard to morale and future work. The question was why is Tewksbury being persecuted by having projects (cpu's) killed (70 CIS, 68) or moved (Venus)? The answer is quite simple and must be communicated there:

1. We did not continue the 70 CIS and 68 because you were so successful in building VAX! This seems like a paradox, because it means the harder everyone there works on VAX, the less products (actually just basic systems) we'll have. I don't believe the group understands that at the same time, we are moving toward a much more diminishing role for the 36-bit line. In fact, the attached statement gives the direction for this product line. Note that by stopping Dolphin, we have redirected 2 years of work that would have otherwise gone ahead had VAX been less successful.

2. Venus was moved because it was in such good shape as a project team in terms of focus and definition. There is expertise for ECL-based systems in Marlboro and rather than closing down this engineering center, I want to see it work on mainline products in a lower price range.

3. Tewksbury must become the architectural center for the Homogeneous Distributed Systems as given in the strategy. The base software is done there now and it is the place where this total architecture, and much of the implementation will be carried out! I want you to take over this global interconnect/network function and establish the appropriate links and controls with the Small Systems/Terminals group, DECnet/Comm and to the relevant Product Lines so that

the Corporate Product Strategy is implemented in a much more focussed, timely fashion.

Although I and the rest of DEC have commended the 780 and VMS team many times for a great system just as our customers are now by buying them, the ultimate satisfaction must come from knowing that your product is the base for DEC's computers for the next 10 years! Now I want you to build the structure that interconnects these machines together and to other computers in a as yet undefined totally novel (and good) homogeneous environment.

GB:ljp
Attachment

D I G I T A L INTEROFFICE MEMORANDUM

DIST: Dick Clayton ML12-2/E71 Jim Cudmore ML1-5/E30
Bill Demmer TW/D19 Ulf Fagerquist MR1-2/E78
Bill Johnson ML3-5/H33 John Kevill ML3-6/E94
John Meyer ML12-1/A11 Larry Portner ML12-3/A62
Bob Puffer ML12-2/E38 George Plowman ML5-5/E97

Brian Croxon TW/C04 Dave Cutler TW/D08
Bill Heffner TW/C10 Bernie Lacroute TW/A08
Dave Rodgers TW/C04 Bill Strecker TW/A08

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ID#365

Subject: **Using Tan Epsilon Chi (TEX) As The Base For All DEC's New Typesetting Systems And A Quality TEX T Scope**

To: OOD
Ed Fauvre, MK1-2/E06
Jack Gilmore, MK1-1/J14
Len Halio, ML1-2/H26
Bob Lane, MK1-2/B11
Jim Milton, MK1-1/D11
Roy Moffa, ML5-2/E93

Date: 27 NOV 78
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

Stan Olsen, MK1-2/C36
Bill Segal, ML3-5/E82
Tom Stockebrand, AB
Bob Travis, MK1-1/J14 follow up 12/11/78

Don Knuth's Tan Epsilon Chi (TEX) computer typesetting system is probably the major contribution to typesetting in this century. It may rank somewhere near the Guttenburg press in terms of importance. Don Knuth, as usual, has "put it all together" by understanding typesetting very, very deeply and has posited a system which:

a. understands typesetting and allows a user to prepare text on <u>any</u> typewriter, word processor or editing system, or directly;

b. as distributed with the current macros (and described in the manual AIM-317 or STAN CS-78-675 by the Computer Science Department) can typeset major books in science, engineering and mathematics;

c. can be tailored, by a set of simple macros to virtually all typesetting applications.

Fundamentally, I want us to get distribution rights for the program so that we can use it now and build all subsequent typesetting systems on it! Now it runs on the 10, is written in about 10K lines of SAIL, but will be re-written in PASCAL. As a high-quality typesetting machine, the 5,000 pts/inch laser scan Alphatype Corporation product, for $25K is the best.

<u>High Precision Alphanumeric Scope</u>

Forest Baskett wants to build a high precision alpha scope for high quality word processing (including typesetting) using the new Motorola $500, M4408, 50 Mhz monitor. It would have a 8 x 10-1/2 page-oriented viewing area and 768 x 1024 pixels each with two brightness levels. It would use 32-64 Kchips to give 256 Kbytes and the whole design would be about 100 chips. The power is 5V, 5A; 55 volts 1.2 A (I said use Fonz).

I want simply:

a. us to supply the parts and constraints;

b. him to consult on this (Forest is very impressive with experience, accomplishments and energy);

c. us to get it into manufacturing, making sure it's buildable; and

d. distribute Don Knuth's Tan Epsilon Chi typesetting software.

GB:ljp

D I G I T A L   INTEROFFICE MEMORANDUM

DIST:

Dick Clayton	ML12-2/E71	Jim Cudmore	ML1-5/E30
Bill Demmer	TW/D19	Ulf Fagerquist	MR1-2/E78
Bill Johnson	ML21-3/E87	John Kevill	ML1-3/E58
John Meyer	ML12-1/A11	Larry Portner	ML12-3/A62
Bob Puffer	ML12-2/E38		
Ed Fauvre	MK1-2/E06	Jack Gilmore	MK1-1/J14
Len Halio	ML1-2/H26	Bob Lane	MK1-2/B11
Jim Milton	MK1-1/D11	Roy Moffa	ML5-2/E93
Stan Olsen	MK1-2/C36	Bill Segal	ML3-5/E82
Tom Stockebrand	AB	Bob Travis	MK1-1/J14

March 10, 1980

Harvey G. Cragon
Texas Instruments
Semiconductor Group
P.O. Box 225012
Dallas, Texas 75265

Dear Harvey:

I would be delighted to have a column of ASC. Could we also have a few photos, manuals, and papers too? Thanks for the prompt reply.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:swh
GB1.S2.48

FROM: GORDON BELL DATE: TUE 23 OCT 1979
2:24 PM EST
DEPT: OOD
EXT: 223-2236
TO: J.W. FORD
cc: STAN OLSEN
R.L. LANE
BOB DALEY
GEORGE BERRY

SUBJECT: STRATEGY ON THE TEX TYPESET SYSTEM-FOLLOW-UP: 11/2/79

GB0005/29/EMS

Subject: Confirming your Strategy on the TEX Typeset System --

I'm glad you've decided on supporting TEX in your first version of SCRIBE.

I'd like to have a copy of the SCRIBE business plan and also talk with the person responsible for this part of the plan. Will you please send me the plan? and name?

GB:swh

GB0004/35

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Subject: Let's Build A Product and Internal Typesetting Strategy on T_EX

To: Distribution

Date: 8/20/79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

George Berry's memo sums it up. We need to make a strong commitment to T_EX.
Joe, get us together to decide.

If we get organized, we can have a most significant product very rapidly. My feelings about T_EX are covered in the attached draft of a foreward for Knuth's book to be published soon by Digital Press. The activities we need to engage in are:

0. Make a commitment to an overall program (like this one).

1. Move the 10/20 version (in SAIL) in-house now to get the experience of the use and of the language. Be prepared to sell 10/20 if people want them. Distribute T_EX through DECUS if Knuth wants us to.

2. Move T_EX to VAX as it becomes available in PASCAL. Help Stanford make the conversion. Get it to be strictly compatible so that the learning and text in the 10/20 version are transferrable.

3. Use it now in Educational Services, for publications including Digital Press. Publish Knuth's book ASAP.

4. Extend the use for SWS, SWE,

CIS, Hardware Manuals and Products Promotion Group.

5. Get the necessary training courses set up based on the first course that Stanford ran, and build on their material. Eventually extend them outside when we offer it as a product.

6. Proceed to make it a product now as the highest priority, first commercial typesetting product. Move to put front ends and back ends on it based on SCRIBE, making SCRIBE fit it, rather than visa versa. (T_EX was there first, and if it becomes a standard (which I hope it does) then we will have to make the compatibility later.)

Attachments - 2

Distribution: Jim Bailey, Heidi Baldus, George Berry, Chuck Bradley, Bob Daley, Don Elias, Joe Ford, Sam Fuller, John Griffin, Jack Gilmore, Per Hjerppe, Bill Johnson, Bob Lane, Marcie Kenah, Del Lippert, Fred Mueller, John Morgan, Stan Olsen, Bill Segal, Jerry Witmore, Bill Zimmer

SIMPLE COMPUTER SIMULATION

Memory capacity: 24 3-digit cells

The Computer's Working Registers:

IR Instruction Register - holds the instruction selected by the PC

PC Program Counter - selects the memory cell for the next instruction

AC Accumulator - arithmetic register where results are accumulated

Instruction repertoire:

INP - 7 - INPut a number from the keyboard to a memory cell

OUT - 8 - OUTput a number from a memory cell to the typewriter

LDA - 1 - LoaD a number from the memory cell to the Accumulator

ADD - 3 - ADD a number from a memory cell to the accumulator

STA - 2 - STore Accumulator in a memory cell

STP - 0 - SToP! Do not perform any more operations

THE PROGRAM TO ADD TWO, 3-DIGIT, TYPED NUMBERS AND PRINT THEM ON TYPEWRITER

MEMORY CELL		NUMERIC VALUE	MEANING
00	INP 12	712	INPut a number from the keyboard to memory cell 12
01	INP 13	713	INPut a number from the keyboard to memory cell 13
02	LDA 12	112	LoaD the number in memory cell 12 to Accumulator
03	ADD 13	313	ADD the number in memory cell 13 to accumulator
04	STA 14	214	STore the number in accumulator in memory cell 14
05	OUT 14	814	OUTput the number in memory cell 14 on the printer
06	STP	000	SToP! Perform no more operations.
07			
12			Memory cell to hold the first number to be added
13			Memory cell for the addend
14			Memory cell for the sum
23			last cell of the computer's memory

HOW TO OPERATE THIS PROGRAM

WHICH "SIMULATES" A SIMPLE COMPUTER PROGRAM

THAT RUNS A PROGRAM TO ADD TWO NUMBERS (FROM THE KEYBOARD) AND PRINTS THEM

ACTION KEYS:

SPACEBAR (the long key) - makes the "simulated" computer go from instruction to instruction

0-9 digits - allows a 3-digit number to be typed. Any number more than 3 digits will cause an error and the program has to be restarted.

RETURN - terminates the string of typed numbers

If the program is stoped, it can be restarted by typing:

```
    LOAD "*",8
RUN
```

September 10, 1981

Stanislow Budkowski
Associate Professor
Warsaw Technical University

Dear Stanislow:

Thank you for your letter. Enclosed are some handbooks on the

LSI-11 including the Writable Control Store Option.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:mal
ID#GB3.S2.3

ENCLOSURES:

WRITABLE CONTROL STORE (WCS) - BROCHURE
MICROCOMPUTER INTERFACES HANDBOOK - BOOK
MICROCOMPUTER AND MEMORIES - BOOK

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SUBJ: Thank You

TO: Gladys Pannell

Date: 1/22/80
From: Gordon Bell
Dept: OOD
MS: ML12-1/A51 Ext:
223-2236
EMS: @CORE

Your Underwood Typewriter is a welcome addition to our collection. Sometime in the future we hope to have an exhibit of typewriters through the years--yours will be an important part of that exhibit.

In the short term, Mary Jane is putting together for the ML12 lobby showcase equipment the office used in the 1910 to 1930 era, and she plans to use this typewriter.

Thank you for contributing to this project.

GB0003/44

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Subject: **Thank You Lunch**

To: DECNET Program Contributors
(See Distribution)

Date: June 5, 1979
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

Date: June 20, 1979

Place: Engineering Conference Room ML12-1

Time: 12:00

RSVP - Mary Jane Forbes
223-2237

GB:swh

Distribution:

Kami Ajgaonkar, ML5-5/E97
Mary Breslin, ML5-5/E97
George Conant, ML5-5/E97
Bill Daley, ML5-5/E97
Scott Davis, TW/D08

Alan Eldridge, TW/E97
Mike Fein, ML5-5/E39
John Forecast, ML5-5/E97
Rod Gamache, ML5-5/E97
B. Anne Greene, ML5-5/E97
Steve Johnson, ML5-5/E97
Jim Krycka, TW/D08
Thomas Lofgren, MR1-2/E89
Henry Lowe, ML5-5/E97
Doug MacKenzie, ML5-5/E97
Jim Miller, MK1-2/L02
Peter Nesbeda, ML5-5/E97
Allan Peckham, MR1-2/E89
George Plowman, ML5-5/E97
Jeff Schriesheim, ML5-5/E97
Steve Seufert, ML5-5/E97
Chuck Stein, ML5-5/E97
Bob Stewart, ML5-5/E97
Lee Webber, MR1-2/E89
Mike Weinstein, ML5-5/E97
Rich Witek, MK1-2/L02

CC: Larry Portner, ML12-1/T32

D I G I T A L   INTEROFFICE MEMORANDUM

DIST:

Kami Ajgaonkar	ML5-5/E97	Mary Breslin	ML5-5/E97
George Conant	ML5-5/E97	Bill Daley	ML5-5/E97
Scott Davis	TW/D08	Alan Eldridge	TW/E97
John Forecast	ML5-5/E97	Rod Gamache	ML5-5/E97
B. Anne Greene	ML5-5/E97	Steve Johnson	ML5-5/E97
Henry Lowe	ML5-5/E97	Doug MacKenzie	ML5-5/E97
Jim Miller	MK1-2/L02	Peter Nesbeda	ML5-5/E97
George Plowman	ML5-5/E97	Larry Portner	ML12-1/T32
Jeff Schriesheim	ML5-5/E97	Steve Seufert	ML5-5/E97
Chuck Stein	ML5-5/E97	Bob Stewart	ML5-5/E97
Mike Weinstein	ML5-5/E97	Rich Witek	MK1-2/L02

2 June 1983

Mr. Bruce Delagi
60 Peter Coutts Circle
Stanford, CA 94305

Dear Bruce:

It was good to do my final recovery in Palo Alto. After 3 days in Colorado Springs last weekend, I think I've recovered from the recovery.

Given your involvement in writing a proposal to work on AI Architecture for 3 years, how does this fit in with your plan for spending one more year at Stanford? (I still believe CMU's doing the best system's level work on parallelism and AI.)

I don't understand your own role as student? researcher? or manager?

Is it in AI (architecture? analysis? applications? systems implementations? etc.) Japanese Scholar? or designer of VLSIable hardware? or manager of our total PPA program there to understand how one applies it to ALL applications?

Believe there are very interesting possibilities as the person who works across all areas using PPA. (This is much safer and useful to work on in terms of getting results versus what may be an insurmountable problem of non-parallelism given the commitment to LISP) LISP parallelism may not be expressable or implementable except at AGE, MRS and application levels.

I hope you'll take a quick look at implementing Titan in Trilogy technology. It might provide an opportunity to mend fences with WRL.

I plan to propose a Bay Area Engineering/Manufacturing group and facility that would do joint ventures with various concerns -- especially start-ups.

Sincerely,

Gordon

GB5.53

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Subject: **Thanks for Stratton Mountain IV**

To: Peter Christy, ML12-3/A62
Lorrin Gale, TW/D19
Dave Hunt, ML1-4/A97
George Plowman, ML5-5/E97
Stan Pearson, ML12-2/E71
Phil Tays, ML11-4/E53

Date: 6/2/79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

CC: OOD

The public thanks were real. The presentations were great, and I look forward to viewing and interacting with the videotapes.

It feels like even more people could attend and still have it interactive. It may be worth keeping it down to only 3 days however. Stan Pearson has suggested Profession Based Systems as the topic for next year. I'm sure there will be other topics...eg. with all the focus on products, maybe we should just go after the development process and all the parts that support it. This seems like an interesting way of focusing on the importance of all that money we spend below the line.

Thanks again, and you too Dick for supporting the effort. Who's going to do it next year? Bill, are you volunteering?

GB:swh

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Peter Christy ML12-3/A62 Lorrin Gale TW/D19
Dave Hunt ML1-4/A97 George Plowman ML5-5/E97
Stan Pearson ML12-2/E71 Phil Tays ML11-4/E53

Dick Clayton ML12-2/E71 Jim Cudmore Ml1-5/E30
Bill Demmer TW/D19 Ulf Fagerquist MR1-2/E78
Bill Johnson ML12-3/A62 John Meyer ML12-1/A11
Larry Portner ML12-1/T32 Bob Puffer ML12-2/E38

ID#312

| d | i | g | i | t | a | l | **i n t e r o f f i c e m e m o r a n d u m**

Subject: **Thanks for Talk**

To: Peter Jansen, PK3-1/M40
Bob Trochi, PK3-1/M40
Jerry Witmore, PK3-1/M40

Date: 24 OCT 78
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

Pete Jansen and Bob Trochi did a very credible job in putting the slide talk together which I presented at SIGUCC in Boston on Monday, October 16. Even though this is per our agreement, thanks anyway.

I hope the talk helps the Edu Image with SIGUCC. If I can ever help in selling, let me know.

GB:ljp
February 12, 1982

Mr. Carver Mead
Department of Computer Science
California Institute of Technology
Pasadena, CA 91125

Dear Carver:

It was really a great pleasure to be in your course last week. On behalf of Digital, let me express my thanks for a stimulating experience. The talk on Friday to various people outside of engineering, including several of my peers was also very worthwhile.

As one who tries to understand the future out of the past, I appreciate the analogy with the mechanical industry. We're only just beginning to understand the vastness of the various forms the information processing industry will take and the mechanism is probably the broadest analogy. The effort at the museum is another way I try to get at this. Here, I'm firmly convinced that PMS is a good taxonomic framework to hold all past artifacts (including programs). It's unclear how well it will hold up in the future. About two years ago, I gave a talk at Stanford on the lessons (about 45 now) we've learned from generating the computer generations. The RCA example and need for free resources that Gordon Moore talked about are already in them in some form. Gwen and I are trying to get these into a book.

I was glad we were able to spend some time together on Friday afternoon and discuss our product/technology dilema. Given your teaching, it is more than ever clear that the design work has to be done via people versed in programming who can think creatively about the programs necessary to do the design automatically! Anytime you have ways on how we can provide more effective products, I'd sure like to talk about them... on the phone, here, there or wherever. I'd like to visit Cal Tech when there is another opportunity. Look forward to more on the chip compiler.

Again, thanks for spending the week with us.

Sincerely,

Gordon Bell
Vice President of Engineering

CC:
Lee Williams
Steve Teicher
Del Thorndike

GB3.S2.14

October 19, 1981

Dr. John M. Murray
Assistant Professor of Electrical Engineering
University of Colorado
Colorado Springs, Colorado 80907

Dear Professor Murray:

I really appreciate your teaching of VLSI here and in Colorado Springs and hope to eventually take the course.

Do you and your students use our facilities for various these in this area?

Please consider us when you do your technical and managerial sabbaticals.

Sincerely yours,

Gordon Bell
Vice President
Engineering

cc: Lee Williams
GB3.S1.6

Note: My appologies for the recent mixup in letters and thank you for bringing it to my attention.
Mary Jane Forbes, Secretary to Gordon Bell

June 15, 1979

Robert L. Boylestad, Assistant Dean
Thayer School of Engineering
Dartmouth College
Hanover, New Hampshire 03755

Dear Mr. Boylestad:

Enclosed is the edited version of my talk - "Innovation in Japan--A Lesson For Us?"

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:swh
GB0003/55

In order to effectively identify, design, produce, and distribute products to what appears to be a nearly infinite marketplace, an effective segmentation scheme is needed. The marketplace is so large because the computer is fundamentally used as a supplement and substitute for human and other information processing systems.

Furthermore, most information processing can be done in various modes ranging from a totally distributed, decentralized fashion with small computers to a single centralized, shared, very general purpose computer. While conventional market segmentation schemes must apply, the dynamic range of the product (in terms of price, technology, and function) makes a simple product segmentation scheme (1 dimension) useless. The set of producers for a small segment of the market can be segmented using a product based scheme...and then within the set more conventional segmentation can be used.

This essay is fundamentally a taxonomy of marketplace segmentation dimensions. The dimensions are presented in three clusters: product and producer-based (e.g., function, price, size, technology, level-of-integration); the distribution channel (e.g., direct versus multiple suppliers) and consumer-based (e.g., location, organizational size, demographic). Table Marketplace gives all the dimensions according to the three clusters.

Table: **Marketplace Segmentation Dimensions**

Product Based

Function (vs. Structure)
Discipline-Environment Based Functions
Structure i.e., PMS (vs. Function)
Computer Structure Performance
  Hardware
  Operating System Scheduling Urgency
  Languages
  Use Generality (fixed...or programmable)
Price (and Range)
  Memory Size (-price derived)

Reliability, Availability,
  Maintainability

Distribution Channel Based

Price/Unit
Price of Sale
Terms, Conditions and Service
Rent vs. Buy
Capability as CS
Selling form (personal vs. catalog)
Third party involvement

User Based

Geography
Standard Industry Classification (SIC)
  for coding organization

SIC Independent/Generic Information
  Processing Activities

Intellectual Disciplines (and their
  Homogenity)

Demographic Factors

Organizational Structure
  Size
  Ownership
  Degree of Centrality (and Locations)
  Division vs. Function
  Locus of Decision Making

User (Consumer)
  Producer - Applications
  Participating level-of-integration
  Capability at level-of-integration

Cost, Disk, and Benefit
Application TEchnology
Time and
  Real Time
Shared vs. Distributed
  (# Applic./System)

Applications Problem Locality

One unique aspect of computing is that the consumer is very often the entity which writes the final application program...hence the consumer is also his own producer for a large fraction of the product. Also, the producers form opinions based on their own needs and consumers. Producers mistakenly dismiss the notion of applying a computer as simply "an application". "An application", is fundamentally "the product"...and this usually implies a significant amount of software. For example, a lawn mower is "applied" (or used) to cut grass. Producing motors, wheels, tubing for the frame and handles, some sort of blades that could be used to cut grass would hardly constitute being a lawn mower supplier...nor would consumers of these parts (without assembly plans) regard the parts as lawn mowers, ready for application even though occasionally the parts had been assembled into lawn mowers (also tractors, wagons and other motorized vehicles).

In a recent seminar held within DEC a number of sales, marketing and product development people were asked (in groups) to give various ways the computer marketplace is segmented. Table MS shows this segmentation in a form which has been rearranged into the three groups which will be used in the remainder of this essay.

Table MS: Market Segment Dimensions Listed by Group

Dimension	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Product-based								
application		x	x	x	x		x	
product=#application=generality			x	x	x			
price		x		x		x	x	
tech. change		x		x		x		
physical size		x						
terms & condition/service			x	x	x		x	
single vs. multiple purchase			x	x			x	
finance/rent/full payment lease/buy						x	x	
The Channel								
direct/reseller	x	x	x		x	x	x	x
User								
geography		x	x	x	x	x	x	x
SIC-code	x	x	?	x	x	x	x	x
size=spending power?	x						x	
demography				x				
buying attitudes			x	x				
cognitative dissonance				x				
psycho-graphics				x				
self sufficiency		x			x		x	
level of expertise	x	x	x			x		

x
spending power x
industrial versus consumer x
risk
x
justification basis
x

The basic computer hardware, an operating system specialized to a specific task (or highly general), an applications subprogram library, and the specific application based in part or wholly from the library, all determine the end use of a computer system within an organization. This network of parts is shown in Fig. Net as a flow, it corresponds to the original model and to the levels of integration. There are a large number of hardware models, h, each of which provide a certain range of performance at varying prices, on which, b, basic operating systems, and language-sets operate...giving what might be a large as h x b basic systems. By having a set of applications programs, a, each of which can operate on all of the systems (which is a desirable, optimistic, though unrealistic assumption), at "n" at a time, the number of unique systems is so large that all systems, are essentially unique. The number of unique systems increases since many of the systems will be used for more than 1 application over the machine's lifetime, or at a given time. A given application will usually find widest use based on fundamental activities within the organization, although it may be necessary to specialize the application to the particular organization. These applications correspond roughly to certain professional and intellectual discipline needs (e.g., electrical engineering--filter design, patent searching, statistical analysis of sales, inventory control) or across a set of more basic generic activities (e.g., word processing/typing, filing, message switching, plant security).

Distributed Product Design and Marketing

To further obscure the definition and responsibility for a system, a set of third party suppliers often participate in the design and manufacture by selling direct to the end user, or to the manufacturer for resale; assisting in the sale, application, installation, education and ultimately modification of the system. In the case of communications-based equipment, a common carrier is also involved. Alternatively, the end user may choose to apply the system at any of the multiple levels-of-integration.

Figure Mkt. shows the size of the market to be proportional to the amount each supplier is willing to participate in the definition and solution of the user's problem. Furthermore, the market often appears to be completely elastic with price, for a given application. Here we measure the cumulative degree of participation as being a 100% on the outer periphery of the onion (when a final application is supplied), and nearly 0% when only supplying the core (only the hardware). Whether a supplier can simultaneously sell at multiple levels-of-integration is a separate issue. Hence, it is possible that part of the market is unavailable because a seller only sells final solutions...and doesn't sell components on an ala carte basis. Very often, the degree of participation is highly correlated with the users sophistication in computing. A highly sophisticated user can indeed work with a only computer hardware, and proceed to write operating systems, languages, and applications programs with no further support. Also note that the price of the system increases rapidly as one supplies more of the system.

The metric for measuring market maturity is somewhat elusive, because it's so highly variable among markets and applications. Within a university the researcher is the first to use a computer for experiment control...yet the controller is last to use a computer for payroll or for inventory control. The application of a computer to a particular discipline follows the basic model shown in the first figure of the first essay...here, the computer or a particular program represents the basic research to be injected in the pipeline process. Just as we measure a given technology in terms of shipments of the product to a user, critical events (times) measure the market maturity.

THE THIRD PARTY MARKETPLACE SUPPLY

This marketplace has grown up around several activities:

1. Hardware is supplied initially to computer manufacturers for incorporation in systems, and as the user's understanding increases, these suppliers sell direct (as indicated in Fig. Mkt. in an add-on fashion). A separate,

independent add-on market not predicated on selling to computer manufacturers develops some time after initial sales and depends on knowledgeable users who are willing to take the risks commensurate with the lower costs.

2.Basic Operating Systems and Languages is by comparison quite a small market, and almost limited to special products (e.g., languages for simulation, data base management) on an add-on basis. These occasionally provide a degree of standardization among computer manufacturers. They take advantage of functional or performance limitations in the general, manufacturer supplied software.

3.Applications libraries have been the domain of the third party software suppliers. By becoming expert in an applications domain, written in a given language and operating on either a very specific configuration or a wide range of computer systems, a supplier is able to become expert in a marketplace, and hence dominate it. This is based on the fact that a computer manufacturer can not develop all applications, or the fact that a user is not in a business of applying and then selling back his application to other users.

Although this software is one of the purposes of a given manufacturer's users organization, it's voluntary, and usually non-profit, hence a limited supplier. The lack of protection (e.g., patents, copyrights) further deters there being a more well-defined marketplace surrounding user-supplied software. Ultimately, this will exist as programming cost continues to dominate hardware ownership costs. Such a marketplace will exist and be most similar to today's publishers; in fact, the publication of programs (algorithms) could ultimately supplant static text publication.

4.Applying/Installing/Training are also activities of third party suppliers. The final application, given a basic application library is a significant activity which implies a deep understanding of the organization which is to use the computer. For most cases this implies changing the program to fit the organization...or conversely changing the habits of an organization. There is still significant training involved to use a computer since it has a low tolerance for ambiguity, is generally inflexible, only adaptable up to a point, and can't learn. It should also be noted that a computer program in an organization is fundamentally a non-static entity and must constantly be changed and adapted to the organizational needs.

Figure Ch1. shows a complete diagram of the product flow via numerous channels based on one or more third parties which supply: complete systems, for which the computer is a minor part; an "added-on" part at any one of the levels-of-integration (including application, training, installation and service); or the final levels-of-integration based on taking lower level-of-integration parts from the manufacturer. In this diagram, there is a further separation between being a basic supplier as a main channel of flow (bottom to top of a box in the diagram) for the product (i.e., the channel handles the product), and being an "add-on" vendor (flow from the right in the diagram) to an existing product base with no handling of products. The diagram also shows the hardware, operating system and languages are further refined to the application even within the manufacturer's organization...rather than being totally general. For example, a factory data collection system has terminals that are specialized to the environment.

Often six organizations can be involved in a system: a third party supplier can supply disks to a manufacturer (and to the ultimate users on an "add-on" basis); the original manufacturer supplies hardware and software; a common carrier provides communications services; a third party develops basic applications library; another supplier installs, applies and trains the end user to operate the system; and finally the end user is provided a system which is ready to be operated, serviced and used.

The final user can also take on many of the roles of the third party or manufacturer by buying the system at a low level-of-integration and then adding appropriate applications knowledge, finally applying and using the computer.

Figure Ch2. shows a slightly more complete picture of the flow, yet simplifies the fact that multiple vendors can supply parts as third, fourth, etc. party vendors. In this figure, the extra boxes, of operating, servicing, and using the computer are added. Here, we have cases of both third party service and operations, (i.e., service bureaus or timesharing computer supply companies). In some instances, the manufacturer is also a supplier of a complete computation service (e.g., CDC). The original manufacturer supplies most service, and the end user organization operates the machine for his own use in most cases.

Figure Degree shows the product amount supplied for each of the three classes of organizations as a function of level-of-integration. The amount of basic supply varies for each manufacturer. In general, the larger the manufacturer, the more they supply directly without buying hardware from other vendors. (Also, the largest manufacturers attract the largest independent suppliers for add-on.) Operating systems and languages are mostly supplied by the manufacturer. The domain of application programs (i.e., the product) varies with the marketplace, customer size, etc. but has traditionally been handled by the (knowledgeable) user.

Basic Computer Function Dimensions

Each computer system carries out one or more information processing functions in a given environment. The section on the organization using the computer discusses the various intellectual disciplines as a way of segmenting use - although it doesn't specifically segment (list) them. These disciplines, rather than the associated environment, determine a computer's function more than any other factor since computers assist existing organizations in their information processing tasks. Alternatively, as computer designers, we feel that the structure (or form) determines the use. Thus, we can analyze the function or the form just as architects claim that "form follows function" or function follows form in some structures.

The second comment (warning) about function is that systems often take on multiple functions due to their inherent generality. In the section on operating systems we noted that all systems evolve to provide the same, general capabilities given enough evolutionary time. Thus we must also warn here of another rule of generality:

> All computer systems can be programmed to carry out the function of any other function...provided there is enough memory in the system, and that users will wait long enough for response and will spend the time to write the program.
>
> A consequence:
>
> Most computer systems carry out multiple functions, despite the fact that they were not originally installed for the secondary functions.
>
> A second consequence:
>
> Minicomputers (and other small computers including hand-held fixed and programmable calculators) are installed to handle limited functions that grow up around the highly general use of larger computers. (They are especially effective since the problem is now well defined.) The programmable, small computers begin to evolve at constant price and increasing generality. The well established, useful functions for a given discipline are placed in read only memory and become fixed functions. For example, the early scientific calculators evolved from just having logs, exponentials and transcendental functions to include statistical analysis, curve fitting, vectors and matrices.

The number of functions (i.e., applications) has increased significantly over the few decades of the computer's existence with the technology providing improved performance, cost/performance and cost for computation. Therefore, the classical functional segmentation used in the early days of computing are hardly applicable today. Table Fun1 gives two segmentation schemes: the classical one, and one which seemed adequate in 1971 (Bell and Newell, 1971). The classical (and IBM) segmentation divides the world up into three functional parts: Commercial--which is primarily record processing oriented and appears to be an extension of the card systems of the early 1900's; Scientific--which is predominately computation oriented using algorithms for processing numbers, symbols, graphs and consisting of scientists, mathematicians, engineers, and designers; and finally Industrial control (IBMeze for sensor based) is for real time control of mechanical processes which are directly connected to a computer.

The Bell and Newell (1971) scheme (column 2) added communications, file control, terminal and timesharing computers as functional categorizes.

Communications computers are special cases of real time control where the input-output interfaces are communications lines to terminals and to other computers. These have come into existence as: pre-processors to time multiplex a number of low speed lines onto a single line (the front end computer); message switching computers - replacing torn-tape telegraph; telephone switching control; and store and forward switches for computer networks. Computers are scheduled as in demand to the characters and messages on the various communications lines - hence are not real time. They differ from the highly general computers by not having general purpose peripheral equipment such as printers and substantial secondary memory. They usually operate with only a single program as opposed to being multiprogrammed.

File control computers were used in the control of disk memories and we expected them to evolve to become complete file and data base management systems (the so-called back end computer)...these are still yet to materialize as separate functional entities.

Terminal computers have evolved to a much higher degree than we expected.

These have materialized because the control for terminals (e.g., calculators) are done with microprocessors (i.e., processor-on-a-chip) and every terminal includes a stored program computer. Given this generality, it is a small matter to provide the terminal user with facilities to write programs.

Timeshared computers were shown as separate functional entities. These are probably a misnomer, but simply represent the ultimate generality for a computer.

Table Fun1: Simple Functional Segmentation Schemes

Classical Functions	**Bell-Newell Functions**
EDP (batch and rje oriented)	Business

Scientific (batch, timesharing for computation)	Scientific
Industrial control=sensor-based (real time discrete and continuous control)	Control
	Communications
	File Control
	Terminal
	Timesharing

Discipline-Environment Based Functional Segmentation

Table FunDisc gives a detailed segmentation scheme based on the intellectual disciplines and generic environment (e.g., home based) using and developing the computer systems. This scheme is given in substantially more detail than the two previous schemes, but is quite similar to the classical segmentation scheme. It also shows the evolving structures in each of the disciplines...hence, one can see that nearly all the environments evolve to provide some form of direct, interactive use in a multiprogrammed environment. The structures that interconnect to mechanical processes are predominately for manufacturing control. Other environments, such as transportation, are also basically real time control. Another feature of discipline-based functional segmentation is the fact that each of the disciplines operate on different symbols.

Commercial (or financial control) based environments hold records of identifier names for entities (e.g., part number) and numbers which are values for the entity (e.g., cost, number in inventory).

Table FunDisc: Discipline/Environment Based Functional Segmentation Scheme

Commercial environment [financial control for all
industry, retail/wholesale
distribution=BICARS]
=records storage and processing
traditional batch transaction
processing against data base business

analysis (includes calculators)*

Scientific*, engineering and design based environment
=numbers, algorithms, symbols, text, graphs storage and processing
traditional batch computation*
data acquisition*
interactive problem solving*
real time (includes calculators and text processing)
signal and image processing*
data base [notebooks and records]

Manufacturing environment
=record storage and processing
batch*
data logging and alarm checking
continuous real time control
discrete real time control
machine based
people/parts flow

Communications and Message Based
(Message/Text transmission switching, storage and processing)
message switching
front end processing
store and forward
networks
speech input/output
word processing
terminals and systems

Network (e.g., highway)
network flow control (excludes comm. nets)
on-board control

Education-based (Computer Assisted Instruction)
=algorithms, symbols, text storage and processing
drill and practice
library storage

Home-based using TV set
(entertainment, record keepint, instruction)

*Implies continuous program development

The scientific, engineering and design based disciplines use various algorithms for deriving symbols or evaluating values. Text, graphs, and diagrams are the major ways of representing objects, and have to be processed. For these environments, we have seen the computer change from a calculator (as it was initially funded to do calculations for ballistic weapons) to a sophisticated notebook for keeping specifications, designs and scientific records. It has also evolved for direct recording and analysis of time varying signals and images. Initially the computer was only used as a transducer to collect data from physical phenomena to be analyzed later on larger machines with some preprocessing (encoding). Eventually, the computer was used in direct analysis and control. Now, many transducers have (or will have) computers embedded in them in order to encode information at a high level so that its output does not have to be processed by another computer. These will invariably be connected to other larger computers in a network fashion to handle notebook graphical display and control functions. This corresponds to the intelligent terminal that is prevalent in the human interactive systems where processing is done at the lowest possible level and only the meaning of symbol is transmitted not the values of individual, time varying samples.

Manufacturing environment computers have evolved from a simple record keeping function which is quite similar to records in the commercial environment to direct on-line human control in a way identical to the other financial control-based disciplines.

Process-control computers have evolved from their initial use as assisting human operators (controllers) with data logging and alarm condition monitoring to full control of processes with either human or a second computer backup. The structure of the computer and the control task varies widely depending on whether it be a continuous process (e.g., refinery, rolling mill) or a discrete process (e.g., warehouse, automotive, appliance manufacturing).

Transportation for aircraft, trains, and eventually automotive vehicles is a form of real time control that uses both discrete and continuous control. Control is carried out in two parts: on board the vehicle and the network (e.g., airspace, highway) that carries the vehicles. The transportation control function dictates three unique characteristics for the computer structure:

1. very high reliability. Society has placed such a high value on a single human life that all computers in this environment can not appreciably lower the likelihood of fatality.

2. very small size for on-board computers.

3.extreme operating and storage temperature range for on-board computers - especially for automotive vehicles.

Communications and message based computers have evolved from telephone switching control, message switching, and front ends to other computers to be the dominant part of a communications system. With these evolving systems, the communications links have changed from analog-based modulation representation and transmission to sampled-data, digital transmission. By using all-digital transmission, data and voice (and video) can ultimately be used in the same system. Voice transducers enable speech communications with the computer.

Word processing (i.e., creation, editing, and reproduction) together with the long term storage and retrieval, and transmission to other sites (i.e., electronic mail) have evolved from several systems:

1. Conventional torn-tape message switching (e.g., TWX, Western Union, Telex).

2. Terminals with local storage and editing (i.e., flexowriters, teletype ASR's, magnetic card/magnetic tape automatic typewriters, and the evolving standalone word processing terminals.

3. Large, shared text preparation systems for centralized documentation preparation, newspaper publication, etc.

4. Large, systems with central filing and transmission (distribution). These will negate need for substantial hard copy. With these systems, text can be prepared either centrally with the system,, or with local intelligent word processing systems.

The education-based environment implies a system which is a combination of transaction processing (for the human interaction part), scientific computation as the computer is required to simulate real world conditions (i.e., physical/natural phenonmena) and information retrieval from a data base. These systems are evolving from the simple drill and practice systems which can be represented by a small, simple algorithm; through simulation of particular real world phenomena; to knowledge-based systems which have a limited but useful natural language communications capability.

Home based computers are beginning to emerge. The dominant use to date is in providing entertainment in the form of games that model simple real world phenomena (e.g., ping-pong). Appliances are beginning to have embedded computers that have particular knowledge for their environments. For example, computer-controlled ranges can cook particular food in fairly standard ways. Alternatively, cooking can be controlled by embedded temperature sensors.

Simple calculators to record checkbooks have existed for quite some time. These will soon evolve to provide written transactions for recording and control purpose. Many domestic activities are in essence scaled-down versions of commercial, scientific, education, and message environments.

PMS Structure Based Functional Segmentation

Table FunPMS presents a segmentation scheme that is based first, on the function the information processing system components are carrying out and second, on the disciplines and environments. Thus function follows form.

It should be noted that on evolution, each computer ultimately has a significant amount of computation, memory for data-base storage, transducers to connect with people, mechanical processes, and connects to other computers. Initially, one can characterize use by a simple information processing component. For example, the early card based equipment included only transducers, simple data-operators (+, -) a few words of memory, and plugboard switches. The evolution:

1. Keypunches: transducing alphanumeric records to a card deck record.

2. Verifiers: transducer/data-operator to transduce same record and to compare for identity.

3. Card interpretter: transducer to print characters on card for each column of holes.

4. Card reproducer: transducer to reproduce an identical, or column transposed copy of card deck.

5. Card lister: transducer to list each card as a line on paper.

6. Card sorter: data-operator to rearrange card deck in ascending/descending order according to column record values.

7. Printing calculator: transducer/data-operator to read and

store (in limited internal memory) values from a set of cards, to carry out simple operations on the stored values, and listing read, stored, and calculated values. Processing is fundamentally on a one pass basis.

Table FunPMS: PMS Structure Based Functional Segmentation Scheme

C:=Computers S:=Switching

- Business control (records)
  - batch
  - transaction processing
  - timesharing for development
    - modellings analysis*
- Scientific*, engineering, design (numbers, text, algorithms, and graphics)
  - batch
  - data acq.
  - interaction problem solving
  - real time signal and image processing
- Manufacturing control (people based - records)
  - batch
  - transaction processing
  - timesharing for development, modelling, analysis*
- Manufacturing Real Time Control
  - data acquisition and sensing (mechanical process variables and control algorithms)
  - discrete control

- Control for comm. nets
  - front end multiplexors
  - store and forward
    - torn tape message
    - computer-computer

T:=Terminal/Transducer

- personal standalone
  - fixed function arithmetic
    - calcualtors
  - discipline-oriented, fixed
    - function calculators
  - small, programmable
    - calculators*
- personal computer-based
  - dumb
    - text
    - graphics
  - text/word processing
  - fixed function (e.g., data
    - entry)
  - programmable
    - single, remote load
- personal rje station*

continuous control independent with single
discrete/continuous testing language*
general purpose - see C*
Transportation control shared
remote job entry stations
Home (records and entertainment) special printers
COM
Education (algorithms, symbols) speech i/o
sensor based front end

M:=Memory

Back end data base

*implies continuous program development

In this scheme, nearly all the environments of the previous scheme have been classified as computers (with full generality). Most of the functions for the communications category of the previous scheme are characterized as switching. Terminals occupy a significant segment reflecting both the cost and the perception that the terminal is now the computation facility (with embedded processing and memory). For very small systems, such as calculators, the keyboard, lights, housing and power supply (i.e., those parts that appear to be the terminal) dominate the cost and size. Here we have included the calculator as the most elementary terminal. The complete set of terminals is given in order of increasing size (and cost) and intelligence (i.e., amount of processing and memory).

Terminals, like computers, evolve to be fully general purpose with the capability to represent most of the information forms users need including text, graphs and figures. The terminal entitled the personal remote job entry station is such a terminal--it would have substantial secondary memory to store a user's personal files, processing to attend to a fairly large number of tasks, and programs to carry out text and program preparation functions in a standalone fashion.

Although the last two schemes appear to be different, they are fundamentally about the same. The first is organized basically on the discipline, and then by the evolutionary values correspond to the features of the structure (form) which provide the function. The second segmentation includes the discipline segmentation (function) as a secondary segmentation for each structural (form) given -- hence is a more detailed segmentation variant of the first scheme.

BASIC COMPUTER STRUCTURE PERFORMANCE DIMENSIONS

The simplest, yet still effective product segmentation is on the structure and performance of the basic computer hardware. There is a tacit assumption that sufficient software exists to exploit the structure, and that the transformation from this basic, lowest level hardware machine (here the macro machine) to the user machine (as provided by a language such as COBOL or FORTRAN) is relatively constant across various hardware (architecture). As each level is crossed, a transformation takes place requiring computational work. The form of the work with compiled languages is via the computer and run time support and with interpreted languages is via constant interpretation of the program. At the lowest level, the internal micro machine provides the architectural facade, the ISP, for the macro machine and operates at roughly 10 times the later's speed. Thus a machine executing 1 million instructions per second may have an effective microcycle time of 100 nanoseconds, permitting 10 million micro instructions/sec. execution. In turn, this implies that a conventional macro machine (ISP) executing 1 million instructions per second, is capable of perhaps 250,000 higher level FORTRAN language statements (instructions) per second depending on the mix of built-in functions and external functions called. To give constant ratios across levels of integration is a poor simplifying assumption when comparing machines of differing classes (e.g., micro to super) because there is not a consistency of data-types (i.e., micros currently have no built-in real arithmetic, whereas minis do). However, for machines within a class (e.g., mini) it's probably all right, provided the two machines have about the same data-types. Hence a count of the data-type is one of the more significant performance indicators, whether it be for a micro machine, macro machine or a language machine. This count must reflect the utilization of built-in operators for the data-type.

In a subsequent section we will show the transformation on performance starting with the highest level machine (language) requirements, down through the operating systems (which absorbs processing capability) and on to the basic hardware macro level machine.

The PMS structure, with the corresponding performance attributes for various components provides the basis for understanding machines and comparing them with each other. Figure BPMS gives a PMS diagram of a basic computer, with the parameters that are relevant to model computing structures adequately for this first set of essays. The diagram shows the key structural and corresponding performance parameters of each component as they provide a total computing environment. Alternatively, one might use a more descriptive, or tabular form, but the goal here is to provide a structural/performance basis for parameterization, comparison, and specifying the finite resources of the computer.

It's imperative to consider the resource constraints, and the effect of their interaction as each next layer of a machine is designed. For example, a certain line printer requires buffer space (Mp. size) and processing time (Pc. speed) which is then unavailable at the next machine level (e.g., FORTRAN).

In fact, Allen Newell and I once argued that we could describe a machine (at any level) with any number of parameters. Recall the first essay postulated a single performance indicator, the product of memory size x processor-access/second was adequate. Newell and I carried out the exercise for up to 5 parameters:

Number of parameters allowed:	1	2	3	4	5
1	Pc(i.rate)	-	-	Pc(op.rate)	
2		Mp(size)	-		-
3			Ms(size)	-	-
4				Pc(i.width)	-
5					No. of terminals

We did not allow ourselves any product indicators such as the product term of processor speed x memory size to indicate basic computational performance which we used in the first essay.

The first parameter Newell and I used was information.rate between the processor and memory, instead of the more conventional instructions per second. The following example of 3 different architectures (with 2 implementations of a stack architecture; one with the stack in the primary memory, Mp, and the other with the stack in the processor, Pc, using fast registers) show the difference in the various measures in what should fundamentally be about the same performance for a given problem.

The simple expression with the two operations, + and := A := B + C.

	Stack <u>(top in Mp)</u>	Stack <u>(top in Pc)</u>	1-address or <u>general reg.</u>	<u>3-</u> <u>address</u>
Program B,C,A	push B push C add pop A	push B push C add pop A	load B add C store A	add
No. of Instns.	4	4	3	1
Accesses	4op'+3a+6d 1op"+3a+3d	4op'+3a+3d	3op+3a+3d	
Program size (bits*)	64	64	72	60
Bits accessed	16+48+192 12+48+96 =266	16+48+96 =160	24+48+96 =168	 =156
Time to execute** (microseconds)	0.5+1.5+6 .37+1.5+3 =8 =4.87	0.5+1.5+3 =5	.75+1.5+3 =5.25	
Statement exec. rate(actual performance)	1/8 = .125m 1/4.87 =.21m	1/5 = .2m	1/5.25	=.19m
Oper.rate	2/8 = .25m 2/4.87 =.42m	2/5 = .4m	2/5.25 =	.38m
Inst. rate	4/8 = .5m 1/4.87 = .21m	4/5 = .8m	3/5.25 =	.57m
Pc(i.rate)/ = 1m word length	32m = 1m	32m = 1m	32m = 1m	32m

*assumes: address/a = 16b; data/d = 32b; op = 8b; op' = 4b; op" = 12b

**assumes a memory limited processor which can access 32b/microsecond

We have constrained the information rate between Pc and Mp to be the same in all cases, indicating roughly the same technology. The statement execution rate (the actual performance) is the highest for the 3-address machine, reflecting the highest performance whereas the conventional measure (instns/sec) shows it to have the lowest performance (by a factor of 4) over the fastest machine. A more subtle measure, operation-rate, is correlated with the true benchmark statement execution rate. It should be noted, (ignoring the first machine, a stack machine with stack in Mp) that the information-rate is a good performance indicator - versus the conventional, but poor, instruction-rate measure. For more unconventional machines, instructions/sec. tends to become a significantly poorer measure. The various vector/array machines (e.g., ILLIAC IV, CDC STAR, CRAY-1) have single instructions to operate on at least 64 operands per instruction.

Alternatively various programmable calculators have single instructions such as Sin, Polar to Cartesian co-ordinate conversion. Accesses/sec. will be used as a Pc performance measure.

For multi-processors the number of processors x the memory accesses/sec. roughly gives the total Pc.rate. Pc.rate can be computed more precisely by using the number of primary memory modules, Mp, and their data-rate. For a system where the memory access time, and the memory rewrite time equal the time for a Pc to operate on a word, the performance (Strecker, 1970) is roughly:

$$\text{Pc.speed (in accesses/sec.)} = (m/t.\text{access}) \times (1 - (1 - 1/m)^{p})$$

where m = # of Mp modules, and p = # of Pc's

Note that when p = m = large, the performance reaches an assymtope:

$$= m/tc \times (1/e)$$

In the case of multiprogramming systems (e.g., real time, transaction, and timesharing), the time to switch from job to job is critical. This measure, process context switching rate is one of the main attributes since most computer systems operate with some form of multiprogramming.

The number of data-types in the Pc, or preferably data-types compatability give the performance measure when operated with a particular language.

The memory sizes (in bytes) for both primary and secondary memory gives memory capability. The memory transfer rates are needed as secondary measures, especially to compute memory interference when multiple processors are used. This measure also permits system performance to be computed by subtracting the secondary memory transfers and external interface transfers. For file systems which require multiple accesses to secondary memory for single items, the file access rate capability is needed in order to compute performance. Similarly, for multiprogrammed systems which use secondary memory to hold programs, the access rate is needed.

Communications capability with humans, other computers, and other electronic encoded processes are equally important structure and performance attributes. Each channel (e.g., a typewriter) has a certain data rate and direction (full duplex for simultaneous two way communication). Collectively, the data rates and the number of channels connected to each of the 3 different environments (people, computers, other electronically encoded processes) signify quite different styles of computing capability, structure and ultimately use. For example, having no communications connection to other computers implies a standalone system. Having only interconnection to mechanical processes via electronically encoded links implies a real time structure. Similarly only human intercommunication with multiple terminals denotes a timesharing or transaction-processing orientation. Figure PLOT uses a Kiviat graph to display the six main dimensions of processing, primary and secondary memory capacity, and the three communication channels in a single 6-d graph, with 3 additional dimensions. Each dimension is logarithmic over a factor of 1,000,000 with the value 0, denoting the absence of an attribute (e.g., there is not communication with external systems beyond human and standard comm.). Various secondary measures and unit quantities are denoted by separate numbers by each dimension. Unit quantities can either be multipliers, x (denoting the measure is for 1 unit such as a disk) or divisors, /, (denoting the measure is for all the combined units of the system). A number-sign, #, is equivalent to a multiplier, x, denoting the graph value is for just one unit. Additional attribute: values are plotted parallel to or as marks on a given dimensional scale. Occasionally dimensions are further specified (e.g., audio, video). Arrows denote directionality of information flow. Note that if the Pc speed is "balanced" with Mp size according to Amdahl's constant, then the value of the two should be about the same. (Here Pc is accessing 300,000 bytes/sec. corresponding to say 100,000 instructions/sec., with Mp of 100,000 bytes). The graph conventions include subtleties of showing fixed points (i.e., ROM or hardwired), and averages, range and overhead due to other resources.

The arrangement of the six dimensions allows easy recognition of a structure in terms of the relative mix of the resource/performance attributes. Figure BPMSR gives a diagram of a computer system in the same order as the graph's dimensions.

Figure EXAMPLES shows how the 6-d plot can be used to represent and differentiate various computing structures in which we're interested. The first two structures are keyboard i/o, i.e., a single information transducer we know as the typewriter which has half-duplex i/o at 10 characters (or bytes) per second. A 10 char./sec. teletype is formed by adding a line interface.

The simple, early fixed function hand-held calculator, e.g., the HP35, which has a fixed processing/memory structure with about 4 x 10 digits (or 20 bytes to be more precise, of primary memory and store, limited keyboard input and 10 light LED output at about 10 char/sec. The internal fixed program is stored in about 2,000 ROM bytes--hence there is a single, fixed point; and the operation-rate of the unit is fixed at about 100 accesses/sec. of the HP35's powerful data-types. The HP65 programmable calculator is shown next with various fixed functions being replaced by programs, and Mp and Ms are each 500 bytes. The functions in ROM, though still present are not apparent to the user, hence are removed.

The second line gives graphs of various terminal structures beginning with a fixed function operating at 10,000 accesses/sec. (or 100 usec) with about 1,000 bytes of local memory and 2400 bits/sec. or 300 bytes/sec. access to a computer. The unit can be made programmable at 20,000 accesses/sec. by proving processing on a 4,000 byte primary memory. Mass storage, here a floppy disk, is also added in the second case--which also serves as a communication link. Communication to the external world is at 2,400 baud, or 300 bytes/sec. Output to the screen is at 2,400 bytes/sec. or 19,200 bits/sec. with input at 10 char/sec.

The next two systems are remote job entry stations, the first is fixed function and the second programmable. There are two i/o channels, one of 2,400 baud (i.e., 300 8-bit bytes/sec.) for the card reader and 4,800 baud (or 300 lines/min. = 5 lines/sec. at 120 bytes/line = 600 bytes/sec.) for the line printer connected via a 4,800 baud full duplex link. The second RJE terminal also includes a Pc at 50,000 accesses/sec. and an Mp of 16Kbytes. A tape unit of 50Kbytes/sec. which holds 300 Mbytes.

The next system is a programmable, store and forward system with 16 Kbytes, with a Pc which has an access rate of 100,000, with a context switching time of 1 millisecond. There are 32 lines of 10 to 150 bytes/sec. The four communication links to other computers operate at 600 or 1,200 bytes/sec. (or 4,800 or 9,600 baud). The next system is a fixed function, remote full duplex analog multiplexor with 16 channels operating at 16 x 100 bytes/sec. and multiplexed into a 1,200 byte/sec. (9,600 baud) line--hence the line limits the maximum sampling rate.

The next system is a programmable, remote, standalone process control system. Note the absence of any lines to communicate with other machines. A secondary memory system of 10 million bytes is used for communication with other
computers. Both gross and net Pc (2,000 accesses/sec.) (2,000 bytes) resources are given. Net capabilities are after the other resources are managed. One-hundred transducers are sampled each 10 milliseconds with 3 transducers connected to humans at a data-rate of 30 bytes/sec.

The last series of systems are, general purpose, multiprogrammed computers. The first is a batch system with card and line printer. The next is an 11/70 with 100 real time inputs, 60 terminals, and 2 connections to other computers. The KL10 is a large, multi-user (100) timesharing system. Finally the largest computer, the CRAY-1 is given, showing the dependence on external computers for Ms, and terminals.

Some comments can also be made about virtual machines!

OPERATING SYSTEM/LANGUAGE/APPLICATIONS DIMENSIONS

The outer three levels-of-integration operating system, language, and application structure dimensions determine the performance of a given computer. We know there is a fixed set of hardware resources--the basic hardware machine to which the various layers of software are applied...forming intermediate machines. At each level (machine), resources are used (taken away) to provide the next higher level (machine).

At the lowest level, the operating system provides control and management of the hardware, and permits it to be allocated to the multiple competing use requests. The multiple use requests may take the form of:

1. Single stream batch usually with overlapped input, compute, and output (i.e., spooling of input/output).

2. Multiple, concurrent batch streams.

3. Timesharing with independent user virtual machines.

4. Timesharing with shared concurrent processes for a single user.

5. Partitioned system with various batch and timesharing environments, each of which may have independent or shared tasks.

6. Real time with independent and/or shared processes.

7. Transaction processing with independent and/or shared processes for each terminal.

Although it's difficult to be completely precise about an operating system type, we will proceed to classify them simply along what appears to be the scheduling urgency dimension as: batch, timeshared, real time, or a hybrid combination of the three. The classification difficulty comes about because a computer is so general purpose and because:

"Every computer evolves to be fully general purpose, given enough time".

In batch mode, there is little urgency; the machine is scheduling its workload. The utilization of a batch oriented computer should be highest, since all the jobs are available to schedule, and there is no urgency to expedite particular jobs. One puts in a batch of work and then gets out reports for "management". (For management, these reports seem to have a problem due to their size, error prone, totally numeric, and uninteractable character. They are a way of presenting everybody with all the data and the user has to search through it, so it is putting all the onus on the user. Batch mode is straightforward in terms of urgency; you do not care when things come out. There is one exception, payroll, which everyone cares about...but it requires little new information to run for most environments since everyone is paid at about the same rate each week or month.)

Interactive mode, in the form of timesharing as we have known it, is essentially stochastically scheduled. People sit at terminals making demands on the system at random intervals. We know that a system must meet certain response time constraints in the order of 2 to 10 seconds, for very simple requests and can take longer--depending on the users' perception of how complex the job is. If one doesn't get the information back within the right time, they walk away--and the system is declared unusable.

The difference between batch and direct-interactive use is shown in Fig.___. With the batch system there is a long, error-prone set of links between the user and the computer which require several days. With a direct, interactive system of the form: timeshared or transaction-process based, the link is direct...or at the most human-human, with direct feedback to correct errors. It's important to differentiate between timesharing and transaction processing computers. In timesharing, each terminal (or possibly small set of users at terminals) has a single job (or virtual machine) assigned to them. The interaction takes the form of running that single job, with multiple implied phases in respone to the user's terminal request. The system is designed to permit all users to operate completely independent of one another. One (or a few) basic programs, and all users are constrained to operate within the set. The program is actually a set of interconnected processes, and information is passed from process to process depending on the requests (control) from a terminal. The structure is quite analogous to a job shop with multiple, specific machines (i.e., the process) and the work is passed from machine to machine. Figures __ and __ attempt to illustrate the difference between these two structures.

Real time implies an even more stringent scheduling function, typically in the range of 100 microseconds, up to about a second for a request. We will now use scheduling urgency as the basic criterion for deciding the basic function of a machine and to generate a taxonomy for all machines. From the model shown in the figures, it is easy to see that process structured operating system provides greater performance than a general purpose timesharing system when used for a single transaction processing application.

The next level above the operating system is the language level. This level gives rise to machine support of the language or multiple languages...language variability. That is, is there just one language or are there several? Are the languages fixed or is there a machine language and the ability to add more? That indicates the language generality of use for the particular machine.

The effect of multiple languages is to require larger memories to hold common compilers or interpretters and run time support software; hence either a single larger primary memory or high data transmission rates between primary and secondary memories. Similarly more generality is required to provide for the multiple user machine environments implicit in multiple higher level machines (i.e., the languages). The effect of being able to add languages is the need for protection/sharing mechanisms.

The final level is the application level. Here we must ask how many jobs are performing that function? One,...N different jobs? How many terminals? Is there sub-job structure within the job structure? Another criterion, which is particularly relevant to the notion of minicomputers vis a vis mainframes, is the degree of dedicatedness. Is the program fixed or is it variable? Then, within what timescale is the program fixed or variable; for example, is the program changed daily? The greater the variability, the greater the uncertainty as to the system's performance and the need for idle capacity to provide acceptable response.

Of course, this is a grossly simplified model of a computer system in that it predicts the lower bound on performance. By having a number of "compatible" jobs, which do not compete for the same resources at a given instant, more performance is possible.

The critical dimensions which are traded off against the fixed resources of a computer:

1. <u>Operating System Level</u>

Function = Scheduling Urgency:

Batch	Don't care	0 - hours
Timesharing	Stochastic	2 - 10 sec
Real Time/ Transaction Processing	Demand	0.1 ms. - 1 sec.

2. Language Level (number)

One, fixed
Multiple, fixed
Multiple with machine language access ability to add more

3. Application Level

Dedicatedness = fixed or variable (programmable)

4. Number of Jobs (dependent variable)

A given computer has a fixed set of resources which may be traded-off in varying ways to provide performance to its ultimate users. In essence--"you pay your money and take your choice" by trade-offs among scheduling urgency, whether the machine is dedicated to one or more tasks, using one or more languages, and the responsiveness for a given set of users.

Figure 4 shows these trade-offs. The surface of the triangle represents fixed resources, and as scheduling urgency increases, less resources are available for use (or conversely, increased scheduling urgency requires greater resources. If one wants to put more work on the system, the scheduling urgency must be decreased because you do not care when the work comes out. If one requires more variability in terms of different applications, one must pay the price in terms of decreased load (less jobs). One can trade off languages along the generality axis and applications along the variability axis; and applications for a larger number of jobs. In essence, if one knows what work has to be done, a system can be dedicated. Minicomputers are predicated on doing dedicated tasks which are usually specified at the time the system is ordered (and delivered); we do not try to do something for everybody.

OPERATING SYSTEM TAXONOMY BASED ON SCHEDULING URGENCY

We can also use the previous dimensions as attributes to form a taxonomy of the systems. Figure 5 shows a family tree of systems, with the first branch, operating system scheduling urgency: batch, interactive, real time. The next attribute is whether there is one or N basic streams (or tasks). The third discriminating attribute is whether tasks are fixed or variable (programmed).

All machines seem to start out as being "purely" designed for a particular function, in that they follow just one of the alternatives from the set of possibilities. For example, in the case of batch, one can see adding generality, moving from a constant work, fixed single stream batch system for purely production, through a programmer serviced batch system, then adding multiple batch streams. From there we go into multiprogramming; multiprogramming to do fixed work and multiprogramming for variable work. Then it is interesting to note that hybrid systems start evolving to give the benefits of both interaction and batch. A system is used for programming with N jobs, a number of batch streams, and somehow all jobs have to be done in that environment. We notice a whole class of remote job entry systems (or interactive) forming from batch systems but a way of varying the scheduling urgency while living within the batch mode. That is in fact an interactive, N job stream, fixed system: a hybrid of a pure, interactive system and a batch system. The hybridization is tacked on to get the programming work done at the location of the programmer. The hybrid systems are supported by partitioning the operating system into a number of separate machines but this is an indirect way of providing an interactive environment.

The second major branch (Fig. 5) is for "interactive" computing where humans have direct communication with the computer. In the early days of computing, before there were significant operating systems, one simply permitted a number of users to sign up for a given machine and directly interact with it, at its console in a solo fashion. That was a pleasant environment but it was inefficient in terms of machine utilization; it was desired to have a larger number of users for the machine and one knew we could do it if we simply put them in via a batch job stream. It should be noted that modern, programmable (e.g.,TI, HP, WANG, IBM 5100, DEC Classic/310) calculators are in essence a return to this style of direct, interactive use.

Timesharing grew up by providing virtual machines, by sharing a single physical machine for each user with control via a terminal--hence N users were involved, each given a capability to run any type (a variable) of job.

Transaction processing originated from batch and timesharing use with an attempt to fix the job mix in order to gain and predict efficiency. In fact, timesharing and transaction processing systems tend to evolve to look rather similar. It's most closely related to a real time system as we noted before.

With a transaction processing system, one might start with a fixed load and some idle capacity, to guarantee service. Batch is run in the background to utilize the idle capacity. Then one finds that the fixed load was not fixed anyway. For example, we might have a program doing a data entry application but the applications programmer starts on the next application and hence is doing program development on that same machine. In timesharing one starts with a variable load and then evolves to bind applications to have a fixed base load so that the stochastic load doesn't have to be provided for--hence efficiency is gained. Eventually variable batch load and possibly some real time capabilities are added.

The real time based system also ultimately provides a similar capability to that of transaction processing. A process monitoring application is designed and scheduled on the basis of knowledge of a particular processing structure and load. Message switching is an example of an application which can be designed as a fixed, single task. Laboratory environment where events are highly structured and the processing task is relatively simple, but highly variable from experiment to experiment is another real time based system. One can understand the interaction of events and begin to know how well the system will perform. Alternatively, we may start with a variable load; with, say, an experimenter who is working to create his system to carry out an experiment. When he has finalized his system, the variable load evolves to become fixed; the machine is sitting there, running 24 hours a day, collecting data and assisting in the laboratory. Whichever origin, an environment evolves to one of being able to develop the next program while that fixed program is running. This created a mode, we call foreground/background (to utilize the idle capacity and get work done) with a simple machine.

I hope it is clear that a system starts with basic hardware and then is applied (be it somewhat modified) in different ways; these different ways provide batch, interactive and real time utilization. Small computers have traditionally been applied in real time and interactive mode...but they are impressive with batch mode too.

The other way of looking at these structures is by their interface to the outside world. Even batch mode is really coupling computers to people, but through a key punch and it's associated human links (see Fig. __). For a non-human, real-time process the structure is quite similar to transaction processing--but with more demanding time constraints because the process can generally not be slowed down (i.e., there is inertia). I believe in the limit, all systems take on all functions given enough time. The market causes the evolution. Once one produces a system, the pressure is to evolve every machine to do everything and we tend to succumb to that, either in marketing machines or in doing applications. With the evolution, the supporting costs (service people) start climbing. If one doesn't succumb, there are many highly tailored machines...the origin of minis and now micros.

Price and the Range of Price (and Performance)

Price is the critical attribute of the system as it directly determines the applicability (buyers) for a system or set of systems. With the very first computers, each advance in technology caused a new computer to be designed to match its inehrent capabilities. For example, as the early vacuum tube computer packaging improved, resulting in the fabrication of larger computers, registers were added together with additional data types (e.g., floating point data). By the mid to late second generation it became clear that computers could not be changed rapidly to precisely track the technology because users wanted to preserve previously written software to run on the new computer (of higher performance or of lower price). Similarly, as users applied a given computer to a task and then outgrew the computer as the task expanded, they also wanted a range of compatible computers to choose from in order to migrate tasks among them. (While programming languages attempt to permit a substantial amount of machine independence, they don't entirely. Similarly the manufacturer who exploits the idiosyncrasies of the machine language level also requires compatible machines in order to build on a base software investment.)

Thus, as we build machines from new technology, there is always a constraint of past machine compatibility, and to provide machines across the widest price (and performance) range. The IBM System 360 utilized this principle more effectively than any other computer.

It is completely described in the literature (e.g., Bell and Newell, 1971) and by IBM. However, let's look at what the models provide in terms of price and performance.

According to the Telex papers IBM tried to provide model separation of a factor of 2 in price and 3 in performance. Hence, the relationship between performance and price should be:

$$\text{Performance} = K \times \text{Price}^{3/2}$$

which is not what Grosch's law calls for. Looking at the models range:

Models	**Price**	**Performance**
20 - 91	1 - 105 (mins)	1 - 300
	1 - 65 (arg)	
	1 - 125? (min of min to max of max)	

Here, the initial 7 models included: 20, 30, 40, 50, 65, 75, and 91.

And models: 25, 44, 85, and (a few) 95 were added.

Thus the original plan called for each machine to cover roughly a factor of 2 in price:

$$125 = 1.99^{7} ;$$

whereas, adding 3 models caused each machine to cover 1.6

$$125 = 1.6^{10}$$

Performance becomes:

$$65^{1.36} = 300$$

Gene Amdahl, head of Amdahl Computer Corporation, has pointed out (from the Telex papers) that the number of machines sold follows a completely elastic market. Also this corresponds identically to the revenue distribution of the world's corporations. Figure IBM shows the distribution function for the 360 (less model 91). Profitability is distributed differently with the smaller (and higher volume) machines having constant profitability versus lower profitability for the 168 which incurs greater development costs. (Amdahl also points out that the larger machines are at least as profitable as small machines when considering the lower support costs of the experienced user.)

For the current DEC PDP-11 family of machines:

Model(s)	Price Range (in K$)	[mid]	Performance (Scientific)
03	10 - 30	[15]	3
04	20 - 40		1
34	30 - 80		10?
45	45 - 150		40
55	60 - 200		70
70	95 - 300	[250]	65

Thus, the range 300/10 = 30 is covered on a per model basis of:

$$1.76^{6} = 30$$

or if we assume 04/34 and 45/55 as a single model then:

$$2.34^{4} = 30$$

The economy of scale factor performance using midpoint prices over the price range of 250/15 (16.67) is 1.51. I.e.,

$$70 = 16.67^{1.51}$$

Range Metrics

From the above discussion we can assess a set of computers in terms of the various price and performance metrics for each of the models (i.e., the range). Figure RM shows three hypothetical systems which are introduced at various times. The first 2 are introduced at a price range of 2 and then given enhancements to increase and decrease their price ranges to a factor of 4 and 8, respectively. The third system has a constant price range of 2 (between 32 and 64). The third graph shows the price range factor of 645 for the three systems and the fourth graph shows the effective price range factor of 32 for all three--reflecting the hole between 16 and 32. The fifth graph plots the % of holes and overlaps. The value of the effective price is used to compute the effective price range per system. (Note this is the metric that was used to evaluate the models of the 360 and PDP-11 above.

These metrics can be similarly applied to performance, memory size and other system attributes.

The goals for a complete, compatibile produce line (i.e., set of products) is to have:

1. the widest range of products in terms of price offering.

2. the largest economy of scale factor for performance that separates the models.

3. the smallest number of models to minimize costs of design, manufacture, selling and spares inventory.

4. the most cost-effective/competitive solutions for each price in the space.

Size (and Form Factor, i.e., Shape) Segmentation

Although computers have evolved to have a particular set of sizes and form factors (shapes), many computers are embedded in other systems--hence these take on the shape of the native system. The system price is roughly correlated with size and weight for most computers--although aerospace computers were initially priced inversely with size and weight.

For example, the very first hand-held calculators were implemented with small, stored program computers - hence the size and shape was that for personal convenience (e.g., portability). Now it's clear as hand-held calculators are made to be programmable that they are indeed stored program computers. Traditional minicomputers were successful in part because they were mounted in standard (9" equipment racks and as such "fit in" with other electronic control equipment.

Memory Size as Single System Size Metric

We have spent considerable effort describing the complexity of computer structures and why there are so many important dimensions in which to characterize a computer. Alternatively we now describe primary memory size as a single metric to characterize a computer system. This has arisen because: according to Amdahl's constant, processor speed, memory size and i/o bandwidth are all correlated; memory size is the dominate system price determinant; and with memory hierarchies, the total memory size is known given the primary memory size and processor speed. Alternatively by knowing the primary memory size, one can impute the type of use for the system...given a knowledge of the user environment. In this way, the cost for various systems can be projected (into the future).

The amount of memory for a given environment may also follow the distribution of organizational sizes.

Figure MemDis shows a wild guess at the memory distribution of various entities. The largest consentration of memory is centered around 7 digit numbers (e.g., phone #, the price of some object, street address, social security, a small number of time events). The next ditribution is based on a page of text. Note, the memory size is calibrated both in bytes and in terms of various physical memories that are worthwhile.

Examples of Segmentation Schemes

Authors, market surveyors, students of computer engineering, buyers and sellers must have some specific scheme for market segmenting. In this section, several of these schemes will be described.

Phister (Functional) Segmentation

Phister (1976) segments the use of machines by application area and then tracks this use for various sized systems. Figure Phister shows the use of minicomputers for:

Engineering and Scientific Computation
Process Control
Data Acquisition
Testing
Business

Note the middle three applications would have been characterized earlier as real time because they all interface to non-human, non-computer, external processes.

A Market Survey Functional Segmentation

One of the numerous market surveys also segmented computing in terms of functions performed. Then within each function, an estimate was given of market size and maturity. This functional segmentation (and corresponding PMS Computer Structure Components):

1. Communication - S, K, M

2. EDP Support - T

3. Business Data Processing - D, TD, TDM, TPM

4. Specialized Data and Word Processing - TM, TPM

5. Industrial Automation - T, TK, TPM

6. Specialized Data Acquisition - TM

7. Laboratory and Computation - DM, PM, TPM

8. Instructional - T, TM, TPM

The fine structural segmentation within the communications was:

1. Front end - S

2. Concentrator - S

3. Message Switch - S, SM

4. PABX - K, KM

5. Monitoring/control of central office - KPM

All the other segments are similarly broken up. Each subsegmented is also further segmented by price. The goal of this segmentation scheme was to have orthogonality among the segments (i.e., no overlap).

Size Based Market Survey Segmentation

One of the poorest segmentation schemes is a pure size based scheme because, at each size level, all applications are available. The values of the size basis:

1. Microprocessor (integrated into peripherals)

2. Modules destined for OEMs

3. Micro or mini capability for networks

4. Micro or mini specialized processing

5. Mini specialized packaging

6. Mini complex network computer

7. Mini used by novice

8. Mini top of range

9. Mini top of range, but integrated into nets

These 9 segments were then reduced to 4:

1. Micro - weak perf., variable complexity, functionally specialized

2. Micro + specialized average perf., weak computation, multi-Pc

3. Mini -, good perf., compatible, complex

4. Mini +, high perf., weak compatibility, multi-Pc, general purpose

DEC Segmentation

USER SEGMENTATION DIMENSIONS

The user-based segmentation dimensions of Table MARKETPLACE will be discussed in this section. The premise that a given application (product) is independent of the organization-based segmentation dimensions turns out to be totally false. There is a high degree of correlation between the product and the organization. The conventional, simple dimensions of location (geography), Standard Industry Classification code (what an organization does), the intellectual disciplines within the organization (e.g., accounting, engineering), and the size all dramatically affect the product (application) design. This section goes through the segmentation dimensions one at a time and discusses their effect on the product.

Geography (or location) is the simplest segmentation dimension because computers are complex enough to require salespersons. A given producer can only employ finite resources, and the rate of change of sales resources is fundamentally small. It's not necessary that geography be the dominate segmentation it is now. By drastically changing the intelligence of the computer, one could affect the dependence on personal selling. For example, the hand-held, desk, and small-programmable calculators have very little fixed intelligence...hence are understandable (and can be sold via mail and other non-people intensive channels). Similarly one could postulate a computer system with sufficient intelligence (not requiring the highly stylistic programming of today's computers) that could adapt to and provide information processing in a highly limited intellectual discipline (e.g., inventory control, message switching).

A further factor to complicate geography-based segmentation is that an organization (e.g., federal or state government, a state university, large corporation) is distributed over a large area...hence is unattended to by a single salesperson or area. Very often geography clearly impacts product design since various countries, states, and cities have differing regulations that affect information processing structures.

Although we currently poorly segment computer use by geography, it is reasonable to do so since areas vary widely in their willingness to take risk, spending for computation, and educational capability.

Standard Industry Classification (SIC) Code was devised in the 1930's by the Department of Commerce to classify the activity of an organization (see Table SIC).

Table SIC: Standard Industrial Classification Codes (first level)

A.	Agriculture, Forestry, Fishing
B.	Mining
C.	Construction
D.	Manufacturing
E.	Transportation, communications, electric, gas and sanitary services
F.	Wholesale trade
G.	Retail trade
H.	Finance, insurance and real estate
I.	Services
J.	Public administration

This segmentation dimension is probably the most widely used today even though a second level of refinement, the Intellectual Discipline, is necessary for products (i.e., to provide particular applications programs). The SIC code does not have a category which classifies various forms of consumers (e.g., personal, family). For example, all the categories have a set of activities that are independent of SIC code, reflecting the nature of an economy based/coontrolled organization. Some of these are shown below:

SIC Code Independent Generic Information Processing Activities

interpersonal communication
phone communication

text creation, copying, transmission and filing (includes TWX, message switching, intra/inter-office mail)

personnel record keeping (e.g., payroll, insurance)

legal

selling

general business
income management (billing, accounts receivable)
asset management (inventory, plant and facilities)
outgo management (orders, accounts payable)

These activities are really not totally independent of the SIC code, but rather depend on both the code and the intellectual discipline within the organization. For example, a payroll program which pays on the basis of skills for a hospital (e.g., various-typed doctors, nurses, administration, maintenance workers) would be considerably different than a payroll program for a construction company with different skills and control rules (e.g., unions, overtime).

Intellectual Disciplines (and Homogeneity)

A more fundamental, and more useful segmentation dimension that determines the product is the intellectual discipline (or activity) within an organization. since a computer is often supplementing these disciplines by helping with processing, holding information, capturing input data, presenting output, or doing control that would otherwise not be possible, it's natural the applications totally coincide with well established human, intellectual disciplines. Society (and universities) have segmented and codified this knowledge (often with algorithms) such that it can be applied by human information processors...and machines capable of interpretting the algorithms.

Demographic Factors

It's not clear that the use of a computer system within an organization is correlated with any of the standard, simple demographic factors (e.g., age, sex, nationality, eye color, education). Formal education in secondary schools and colleges, to the notion of algorithms, and computation probably aids in getting potential users to consider applying computers. Hence, use may be more highly correlated with recent education and therefore inversely proportional to age.

The more general intellectual capability measures (e.g., IQ) that transcends computer systems must also be considered as a segmentation dimension.

Organizational Structure

Many separate dimensions are needed to adequately characterize an organization structure as it relates to computers and information processing. It has been hypothesized that the structure of computers within an organization reflects the structure of the human organization. This should, in fact, be true if one accepts the conjectures that computers supplement/substitute for information processing of other forms (e.g., humans).

The simple metrics of size (measured by people, area, net worth, income profit, etc.) are often correlated with spending power - whether it be for buildings or computers. These metrics assume all organizations are identical, hence spend the same fraction for computing independent of what it does, where it is, or how its organized.

Clearly organizational ownership is also important, not as it affects products but by the way it buys machines. The alternatives range from the individual, through partnerships, co-operatives, corporations, non-profit corporations and the various levels of government. For example, in the case of the U. S. Federal Government, a strict centralized, approval mechanism is employed to insure that obsolete, low risk/lower benefit equipment is used. A small, privately owned organization can often make decisions rapidly since only one or two people are involved in the decision.

For large organizations, the geographical location of control (central versus decentral) is important. A geographically remote (decentralized) part of an organization may be completely centrally controlled, hence is merely a satellite subject to a central organization. In larger, strong centrally controlled organizations which use computers, IBM is the usual vendor. This phenomenon is fairly predictable because:

1. IBM was there first...10-20 years ago.

2. There is one main place to sell to, plus any general corporate selling. (IBM excels in this role.) There is no other way to enter the site.

3. There is the belief in Grosch's law...hence it's better to have one large computer than n smaller ones of 1/n power. Furthermore IBM doesn't provide small computers for distributed use.

4. A single computer is easier to control, hence easier on the organization.

Another organizational notion is the location of intellectual disciplines; the two extremes are the autonomous divisional organization and the functional organization. In the former, each division has its own intellectual disciplines...hence can be treated as independent, small entities.

The functional organization is based to independent skills centers; i.e., the intellectual disciplines, hence is easier to "sell to". Alternatively, unless a division is quite large, the functional organization will have a larger critical mass of skills to apply the computer (i.e., develop the product).

Conversely in a divisional organization, (unless there is some sort of mechanism for inter-group communications, and since divisions by their nature are set up to compete with one another) each division will tend to purchase and develop its own system! The matrix organization attempts to solve the problems inherent in the above two organizations by making each person part of two independent organizations: the function and the division (or project/product group). In this way the professional identity/management is retained; and the motivation associated with a product or project is added by assignment.

The locus of decision making (or theory X versus theory Y organization) is clearly important in both purchase and development of systems.

Each organization has a unique way in which systems are identified, proposed, approved, and implemented. It's essential that the people responsible for implementing a system recommend the system...otherwise there is a high likelihood it will fail to be applied properly. Unlike any other entity (including a new co-worker) entering an organization, a computer is fundamentally a part of an organization hence must have the approval of its co-workers.

User (Consumer) Capability as Computer System Producer - Applications

As we saw in the original diagram (Fig. Ch1) showing the network flow of products to use, any organization can serve as a producer. Most often, the final user (consumer) organization is also the developer (producer) for the applications programming, installation and training. This incestuous relationship does have a fundamental problem because there is not the normal check and balance relationship that exists in a producer-consumer (seller-buyer) pairing. Even though a clean interface exists in the form of a given language, there are a large set of non-orthogonal performance dimensions so as to thoroughly obscure fully characterizing the performance of a given computer system. Furthermore, in the initial design stage, a problem is very difficult to characterize in terms of the systems' performance dimensions.

A given organization may attempt a more complete design than it's capable of. For example, it may predicate a design on multiple third party hardware and software vendors, communications links from a common carrier, and have significant applications programming. Such an undertaking requires deep understanding at every level-of-integration.

A user organization then can be characterized by the following breadth and depth measures:

1. Participating levels-of-integration

2. Understanding, i.e., the capability at each level-of-integration (including the application)

Experience with other vendors is another important attribute-value pair. The most predominate value is the degree to which IBM supplies serviced equipment, software and other services. In fact, most IBM customers do not participate in a system design at the hardware, operating system and language levels-of-integration. Purchasing third party hardware is regarded as a high degree of participation in system design; and a user may still not have much understanding/capability at this level-of-integration.

Cost (and Risk)/Benefit

Ultimately, within our economy-based societies, all use of resources is tested with some sort of cost-benefit analysis.

Perhaps the easiest segmentation scheme is then a combined analysis of the cost, risk and benefit of applying computers to a given task. Presumably the producer has already done a preliminary benefit analysis for a given application before attempting to market his product. Since many applications are user originated (versus manufacturer originated) the cost-benefit analysis techniques are predominately done by the user. Note, a given new computer application may turn out to be economically infeasible after it's installation because the analysis techniques are not widely used by manufacturers or by many users.

The concept of computer equipment renting and leasing permits the cost and financial risk of a new application to be decreased. By this averaging process, each application is more expensive because it's paying for a share of the new applications.

Various characterizations of people can be used to further segment risk attitudes. Haley (1969) used these for a study on consumer marketing:

worriers
sociables
swingers/sensory-oriented/ego-centered
price-oriented (idependent)

If we characterize benefit and risk for a given application:

```
          benefit

risk          low               high
          -------------------------------
              !
low           !                     (easy decision)
              !     price -->  <-- worriers
              !
              !
              !
              !     (may be non-   (may involve
              !      existent)     research)
              !
              !                <-- swingers
high          ! ego-centered-->
              !
```

An organization's attitude toward risk taking is an essential ingredient, especially in the less mature application of computers. Nearly all computer installations have risk associated with them. For mature applications, there is even a risk that the biasses and mind set of an organization will cripple a computer and insure its failure. For new applications where there is clear benefit, the application development may not be possible at the required performance level and hence the cost will be too high.

An organization which does not have an R and D function, for example, is probably not familiar with the concept of risk...hence is likely to be either extremely early or late to use computers.

The simplest measure of risk is the cost of the application hardware and software measured in calendar time and human effort. It has been observed that cost and time increase exponentially with system size and that there is a maximum system size which can be built at a given technology time. Therefore risk increases with the system size.

Application Technology Time and Calendar Time

One might consider the timeliness (feasibility) of a given application to be part of the cost-benefit analysis. Alternatively, we should recall the time-evolution process model described in the first essay for all products (including the given application of a computer to a task). Here, an application product may go from basic research, to applied research, advanced development, development, production, product enhancement, maturity and ultimately die.

We must be careful to measure and separate the application time from the real time. At a given real time underlying technology or understanding may be such that basic research in a given area can not be conceived or even considered. Later, when the carrier technology has progressed, the necessary basic research may be carried out quite rapidly and progress to a production stage in only a few years. Figure Mat1 shows two hypothetical application base products that are increasing in use at different rates until they achieve saturation and then grow at a constant, slow rate. One application, the computer to understand speech, has been in the research phase from 1955 till 1975. Certain limited production use occurred in the mid '70's and as technology improves, we would expect this use to increase significantly. On the same figure, the number of hand held programmable calculators is plotted. Note that there is not a substantial front end phase with research, but rather the use occurs much earlier and lasts a shorter time before it saturates (at the number of people who are capable of programming or using a pre-programmed program.

Alternatively there is an effect which reflects the combined knowledge about the application as shown in Fig. Mat2. Here, by increasing the degree of participation a supplier can provide more systems than if the application (product) is developed by the user. Since many users are doing development at the same time there is no combined learning--hence the market matures more slowly than if there is development by the producer.

A secondary effect of technology time is to limit the maximum size system which can be build. Furthermore the time (and cost) vary exponentially with size times a technology building constant.
I believe we're at least starting to get some NI Servers/Stations started, which are predicated on Seaboard I and II unbounded Qbus based products, and then moving to bounded MicroVAX chip based products. The potential is just incredible, and certainly much greater than we had with the

original 11 with it's Unibus.

But alas, I fear we'll do what we did with CI clusters, making no one in charge of the overall structure to do the nurturing and pushing, followed by the ultimate product introduction of the concept and supporting the specific product intros. The result will be that the structure, as described below will take FIVE years to achieve, and by then, when we achieve it's full potential, it will be greeted by a chorous of yans.

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I want someone to take this overall resposiblity and to proceed to get the resources from the collection of junque we're doing it and then redirect it so that these critical projects are put in place to achieve the above distributed system dream.

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1. They have a basic product and very constrained architecture that lets us get BELOW the Multibus and Qbus based systems, yet is expandable enough to handle a reaonsable range. It is a factor of 2 or more below the HYDRA structure in cost with about the same performance for a minimal system. Apparently the product can be expanded to handle the Workstations case. Whether they could ever do portable or ECL or large servers is probably incidental. If the general bus is good, then they have a chance of making a very interesting low end product family (including our servers and gateways).

2. They have UNIX 4.1 running and are moving on to 4.2. They have Mr. 4.2 as part of the team. We need to have this expertise in order to reduce the risk and time to market for HYDRA to a reasonable level.

3. They are young, naive, enthusiastic, poorly led and don't understand the market. Furthermore they don't know how to get a product like this into high volume production. Hopefully, they are going to have a little trouble getting VC financing... and hence **may** be available to us.

THOUGHTS ON GETTING COMPANIES
I am quite distressed about our ability to find interesting companies to buy, buy product from or that approach us in startup mode.

BUYING PRODUCT
Traditional computer company metrics forces a make (not buy) mentality even though the ROI may be quite high. Virtually all of the discussions on buying products seem to start and end with conflict.

The DDE product was quite close and could have been quite profitable. Here, the compatibility, lack of UNIX commitement and understanding and conflict with HYDRA were the stumbling block.

Maybe a geographical distribution is the key. I know folks in Japan and the UK, but UNIX understanding and availability on the xxx32 is probably the bottleneck again.

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I don't think there are any that want to relinquish any form of control that would make them part of us. The only condition would be that they would relinquish equity or control seems to be unacceptable to us.

BUYING A TROUBLED COMPANY
These look poor ala Codata and Momentum.

START-UPS WHO COME TO US
I don't think we're going to get any start-ups who come to us unsollicited. Our standards are probably those of the VCs, and as such we simply are unattractive. I think start-ups want the independence and chance for the reward that they perceive we do not offer.

For the naive startups we have been unable to attract or hold them.

START-UPS WE FIND AND CREATE
This avenue ala lamP, Charle and what we may have to do in networks is going to take along time. The team has to form and we have to do a substantial part of the work. Also, we interfere with the natural selection process.

BOTTOM LINE
It would be wise to peg HYDRA somewhere around what Apollo and Masscomp did (start: 10/81; FCS: Nov. 82; Rev.83: 2.5M; Rev.84: 24M). Apollo was first, Masscomp followed 18 months later and HYDRA's 2 years behind Masscomp. This is significantly more aggressive than Sequent who will ship after 21 months, which is probably more realistic for a more complex (than Masscomp) product.

I don't see anything like a 30M year in our second year of operation UNLESS we get a company that would have product within 6 months, and that could deliver on the order of 20M next year. This could be obtained if the financial window opens for us and closes for the public offerings, which let the VC world dump their misFortunes and Wildcats on the public and replenish their money supply.

WHY SLUMBERGER SHOULD TAKE A SIGNIFICANT POSITION IN ECC

AS AN INVESTEMENT Clearly ...it passes their hurdles. But, they are used to buying bargains and we may not be perceived this way.

ECC AS THE CENTER OF THEIR INFORMATION PROCESSING BUSINESS. Ideally, they would some day own all of us. They really need ALL of ECC, to be a significant force in information processing because of our scope as a complete supplier. Currently they have semis, a plotter company and a CAD/CAM software company spotted across levels-of-integration. The paper on the structure of the industry shows how this CAD/CAM company is going to be evolved out of existence because of the migration to software only companies. Having us as a hardware, sales and service supplier would let them migrate these field people to our field company and let CAD/CAM company concentrate on software. Having a Systems company would also have a major-effect on the product direction of Fairchild. (It's important that they really understand the notion of the levels of integration model.)

Their size and structure inhibits doing this. Ideally, we'd do this and then effect a merger at about the 1 billion level. (Here, we have to be a bit careful in describing this, because it could help them tune and build their empire.)

We give them the critical mass through our field marketing organization where the only economy of scale exists. AND we give them a wonderful product line on which to base all their Fairchild, CAD/CAM and drilling work on.

SYNERGY WITH THE MAINLINE LOGGING BUSINESS Maybe they could just be a buyer, but it would be great if they had a much better source of supply than DEC... who they are worried about.

Our emphasis is on performance, moving into AI when appropriate and hence the synergy. In addition to the focus on parallelism, we want to build on the work of HT Kung at CMU which is completely targeted at signal processing, the mainstay of logging analysis. Kung has a real edge and we are talking now about how to establish and exploit this.

SYNERGY WITH FAIRCHILD AS A CUSTOMER
They are trying to be a source to the National 32032; this is critical. We certainly can help them focus on being a customer. We also use the Fast logic in our work.

SYNERGY WITH FAIRCHILD AS A SUPPLIER
Getting serious on the National part means having a source of software for the OEM we could be this!

Their tester needs HYDRA and perhaps Kung's machine since it processes data (signatures) at such a high speed.

Their AI effort clearly needs a host. Hydra is it.

SYNERGY WITH FAIRCHILD AS A JOINT PARTNER IN ESTABLISHING COMPANIES
Their AI effort is not spectacular due to lack of focus and their misunderstanding of the traditional model of research. The current behavior of researchers is to "use" a research environment to build a product or establish a set of customers (eg military) and then to break away and exploit this at your own company. Even if there was a product, there is no vechicle to sell an AI product. Their only rationale is for internal use, and this is nonsense because their problems are too hard for AI. Furthermore the people they have working for them are AI scientists NOT engineers; hence there won't be a product anyway.

AI COMPANY could be established asap. I might instead want to buy one jointly with them. My favorite would be Smart Systems Technology.

A SIGNFICANT ARCHITECTURE TO GET THEM INTO THE MICRO BUSINESS. We need a partner to fabricate and distribute MIPS! We supply the architecture, software and strategy. They sell the chip and possibly board products through the traditional channels. We're ready to move on this! There is an effort inside of Fairchild that should probably be scrapped!!!!! They have been a total failure in this area, but need to succeed to be a significant semicomptuter company.

A HIGH PERFORMANCE COMPUTER WHICH WOULD PUT PRODUCT FOCUS ON THEIR HIGH END TECHNOLOGY. My feeling is that Fairchild shoud get out of one of their businesses and concentrate say just on ECL and CMOS, but don't know. A joint development effort implementing either MIPS or the 32032 in ECL would be a winning product.

A WINDOW ON PEOPLE VIA ENTREPRENEURIAL ENERGY.
ECC CAN DO THIS. SCHLUMBERGER CAN'T.

BOTTOM LINE:
WE COULD OFFER THEM A BETTER VIEW OF THE FUTURE COULPLED WITH INTERESTING ALTERNATIVES FOR BUILDING NEW BUSINESSES
... IF THEY'RE INTERESTED IN PLAYING IN THE INFORMATION

PROCESSING

MULTIPROCESSOR COMPUTER STRUCTURES

COMPUTER NETWORKS

COMPUTERS LOOSELY COUPLED VIA COMMUNICATION LINKS

COMPUTER MODULES

TIGHTLY COUPLED COMPUTERS SHARING COMMON MEMORY AND/OR ADDRESS SPACE

MULTIPROCESSOR COMPUTER

A NUMBER OF PROCESSORS SHARING A COMMON PRIMARY MEMORY

PARALLELISM   RELIABILITY   PERFORMANCE
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BUYING A TROUBLED COMPANY
These look poor ala Codata and Momentum.

START-UPS WHO COME TO US
I don't think we're going to get any start-ups who come to us unsollicited. Our standards are probably those of the VCs,

and as such we simply are unattractive. I think start-ups want the independence and chance for the reward that they perceive we do not offer.

For the naive startups we have been unable to attract or hold them.

START-UPS WE FIND AND CREATE
This avenue ala lamP, Charle and what we may have to do in networks is going to take along time. The team has to form and we have to do a substantial part of the work. Also, we interfere with the natural selection process.

BOTTOM LINE
It would be wise to peg HYDRA somewhere around what Apollo and Masscomp did (start: 10/81; FCS: Nov. 82; Rev.83: 2.5M; Rev.84: 24M). Apollo was first, Masscomp followed 18 months later and HYDRA's 2 years behind Masscomp. This is significantly more aggressive than Sequent who will ship after 21 months, which is probably more realistic for a more complex (than Masscomp) product.

I don't see anything like a 30M year in our second year of operation UNLESS we get a company that would have product within 6 months, and that could deliver on the order of 20M next year. This could be obtained if the financial window opens for us and closes for the public offerings, which let the VC world dump their misFortunes and Wildcats on the public and replenish their money supply.

WHY SLUMBERGER SHOULD TAKE A SIGNIFICANT POSITION IN ECC

AS AN INVESTEMENT Clearly ...it passes their hurdles. But, they are used to buying bargains and we may not be perceived this way.

ECC AS THE CENTER OF THEIR INFORMATION PROCESSING BUSINESS. Ideally, they would some day own all of us. They really need ALL of ECC, to be a significant force in information processing because of our scope as a complete supplier. Currently they have semis, a plotter company and a CAD/CAM software company spotted across levels-of-integration. The paper on the structure of the industry shows how this CAD/CAM company is going to be evolved out of existence because of the migration to software only companies. Having us as a hardware, sales and service supplier would let them migrate these field people to our field company and let CAD/CAM company concentrate on software. Having a Systems company would also have a major-effect on the product direction of Fairchild. (It's important that they really understand the notion of the levels of integration model.)

Their size and structure inhibits doing this. Ideally, we'd do this and then effect a merger at about the 1 billion level. (Here, we have to be a bit careful in describing this, because it could help them tune and build their empire.)

We give them the critical mass through our field marketing organization where the only economy of scale exists. AND we give them a wonderful product line on which to base all their Fairchild, CAD/CAM and drilling work on.

SYNERGY WITH THE MAINLINE LOGGING BUSINESS Maybe they could just be a buyer, but it would be great if they had a much better source of supply than DEC... who they are worried about.

Our emphasis is on performance, moving into AI when appropriate and hence the synergy. In addition to the focus on parallelism, we want to build on the work of HT Kung at CMU which is completely targeted at signal processing, the mainstay of logging analysis. Kung has a real edge and we are talking now about how to establish and exploit this.

SYNERGY WITH FAIRCHILD AS A CUSTOMER
They are trying to be a source to the National 32032; this is critical. We certainly can help them focus on being a customer. We also use the Fast logic in our work.

SYNERGY WITH FAIRCHILD AS A SUPPLIER
Getting serious on the National part means having a source of software for the OEM we could be this!

Their tester needs HYDRA and perhaps Kung's machine since it processes data (signatures) at such a high speed.

Their AI effort clearly needs a host. Hydra is it.

SYNERGY WITH FAIRCHILD AS A JOINT PARTNER IN ESTABLISHING COMPANIES
Their AI effort is not spectacular due to lack of focus and their misunderstanding of the traditional model of research. The current behavior of researchers is to "use" a research environment to build a product or establish a set of customers (eg military) and then to break away and exploit this at your own company. Even if there was a product, there is no vechicle to sell an AI product. Their only rationale is for internal use, and this is nonsense because their problems are too hard for AI. Furthermore the people they have working for them are AI scientists NOT engineers; hence there won't be a product anyway.

AI COMPANY could be established asap. I might instead want to buy one jointly with them. My favorite would be Smart Systems Technology.

A SIGNFICANT ARCHITECTURE TO GET THEM INTO THE MICRO BUSINESS. We need a partner to fabricate and distribute MIPS! We supply the architecture, software and strategy. They sell the chip and possibly board products through the traditional channels. We're ready to move on this! There is an effort inside of Fairchild that should probably be scrapped!!!!! They have been a total failure in this area, but need to succeed to be a significant semicomptuter company.

A HIGH PERFORMANCE COMPUTER WHICH WOULD PUT PRODUCT FOCUS ON THEIR HIGH END TECHNOLOGY.   My feeling is that Fairchild shoud get out of one of their businesses and concentrate say just on ECL and CMOS, but don't know. A joint development effort implementing either MIPS or the 32032 in ECL would be a winning product.

A WINDOW ON PEOPLE VIA ENTREPRENEURIAL ENERGY.
ECC CAN DO THIS. SCHLUMBERGER CAN'T.

BOTTOM LINE:
WE COULD OFFER THEM A BETTER VIEW OF THE FUTURE COULPLED WITH INTERESTING ALTERNATIVES FOR BUILDING NEW BUSINESSES
... IF THEY'RE INTERESTED IN PLAYING IN THE INFORMATION PROCESSING

MULTIPROCESSOR COMPUTER STRUCTURES

COMPUTER NETWORKS

COMPUTERS LOOSELY COUPLED VIA COMMUNICATION LINKS

COMPUTER MODULES

TIGHTLY COUPLED COMPUTERS SHARING COMMON MEMORY AND/OR ADDRESS SPACE

MULTIPROCESSOR COMPUTER

A NUMBER OF PROCESSORS SHARING A COMMON PRIMARY MEMORY

PARALLELISM RELIABILITY PERFORMANCE

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION DATE: FRI 18 JAN 1980
11:20 AM FROM: GORDON BELL DEPT: OOD
EXT: 2236
LOC/MAIL STOP: ML12-1
A51

SUBJECT: THE 3 RIVERS PER Q - A THREAT, TREND? FOLLOW UP:
2/1/80

Every university I've talked to recently (Newcastle, CMU, Purdue, U. of Washington) have commented that they intend to get a number of PER Q's. Also MIT's building their own.

Why haven't the folks in marketing asked about this?

When will we have a Nebula mock-up or a breadboard, working software for this product? When could we get it to the market?

GB:swh
GB1.S1.25

"TO" DISTRIBUTION:

LARRY PORTNER	DICK CLAYTON	ULF FAGERQUIST
JIM BELL	ANDY KNOWLES	BILL JOHNSON
BILL DEMMER	SAM FULLER	WAYNE ROSING
JERRY WITMORE @MR16	JOEL SCHWARTZ @MR16	

THE END

Digital **Interoffice Memo**

Subject: **Time Scale for 16K Intel RAM**

To: OOD
Brian Croxon
Lorrin Gale
Bill Green

Date: 22 SEP 76
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

I got these points at a conference in France from their applications engineer.

4/74	Process technology begins
7/74	Initial 16K design
10/74	Layout
2/75	First functioning unit
6/75	64 devices operating in 1Mb memory
9/75	Compatible TTL version
12/75	Customer sampling of 2116

His data present in terms of # elements/chip = 2**(t-1959) versus my # bits/chip = 2**(t-1962) give a 3 year delay...or x8 elements/bit.

GB:ljp

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****************
* d i g i t a l *
****************
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TO: see "TO" DISTRIBUTION DATE: MON 12 JAN 1981
11:55 AM EST

FROM: GORDON BELL
cc: see "CC" DISTRIBUTION DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: SELLING TINY--ESPECIALLY WITHIN DEC

It feels like we need an aggressive internal campaign to sell and use Tiny. I see systems being built around the 8085 that should be Tiny. I also see work not being done that should be based on Tiny. Can we get this moving somehow? Some of the recent applications: getting all our line printers to have serial interfaces by using a Tiny in them, building a generalized protocol converter that converts SNA, etc. to DNA, consoles for our large systems. Your demo system is fine, but we need a bigger effort and we need more of them.

It seems like we need two kinds of systems: the 64Kbyte system you are demoing; and the 2 x 65Kbyte one where there is a controller space, leaving the 65Kbytes for an application (eg. communications). Let's have demos (build more Crickets) for each of the groups.

On the second type, can't we take the control algorithm out of the TU58 and put it in Tiny? Then we can use just the TU58 mechanism and get the cost down for what is essentially a ROM cartridge in the low volume applications where the code is likely to change or there are likely to be lots of variants (eg. the protocol converters).

Also, it has to be clear what the software alternatives that we
recommend using to write applications. Here, I would hope we could start pushing Pascal as a HLL, along with the various alternatives for the Operating System: S, RT, SSC, etc. It is
important that the users don't have to write their own, as we found out in using S as the basis for the VT200 controller! However, when we start using the TU58 or a comm. line for down
line loading of the system, the whole thing has to hang together
and be supported.

What systems are we planning to sell and support?

Who is responsible for the various systems (hardware and software)?

GB2.S1.14

"TO" DISTRIBUTION:

SI LYLE	JACK MACKEEN	ROY MOFFA
HERB SHANZER	STEVE TEICHER	JOE ZEH

"CC" DISTRIBUTION:

GERALD V BUTLER	BILL DEMMER	ULF FAGERQUIST
MARY JANE FORBES	FU 1/23	SAM FULLER
BILL JOHNSON	ANDY KNOWLES	ALAN KOTOK
MARY BRESLIN @MLXX	STAN PEARSON	GRANT SAVIERS
GIL STEIL		

+---------------------------+ GB0004/29
| | | | | | | |
|**d**|**i**|**g**|**i**|**t**|**a**|**l**| **i n t e r o f f i c e m e m o r a n d u m**
| | | | | | | |

+----------------------------+

Subject: **Some possible titles for Larry Portner**

To: Ken Olsen

Date: 8/4/79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

You are probably right: Associate Head, Vice President of Engineering isn't right.

Note Dick's title is:

Vice President, Computer Systems Development

Puffer's old title was:

Vice President, Engineering Operations

my title is:

Vice President, Engineering

In the organization chart, I simply put (Associate head or Associate) when both of us were in a box. It could be used like this if were simply always confined to the writing down on an organzation chart. Some alternatives:

Vice President, Engineering

Vice President (Associate), Engineering

Vice President, Engineering Operations

Vice President, Engineering (Associate)

Other possibilites, but maybe incompatible with other DEC titles:

Associate Vice President, Engineering

Assistant Vice President, Engineering
00 BURT DECGRAM ACCEPTED S 8831 O 19 08-FEB-81 15:37:39

****
* d i g i t a l *
****

TO: BILL AVERY DATE: SUN 8 FEB 1981
15:36 EST

FROM: GORDON BELL
cc: ANDY KNOWLES DEPT: OOD
BILL PICOTT EXT: 223-2236
JOEL SCHWARTZ LOC/MAIL STOP: ML12-
1/A51

SUBJECT: TLC DEMO MAR 9

I was delighted to get the information on the TLC.
It is a very impressive terminal, and looks like a good way to shake down the definition of the VT200. Here, I'd hope the 200 would do virtually all that TLC is going to do, but be low cost... and hence further out in time. TLC looks to me to be essential to hold our technical base. Frankly, at 5K it looks like a bargain! (Also, I see it as backup for the
VT200 approach.) Also, it's the first terminal that I think I could be very happy with as a user.

If you are prepared, could it be a real dog and pony show for some of the other people working on terminals?
VT12200-Picott, forrester, james, don haney
Suvax-nat parke and don north
gigi 2 graphics-stony ballard
terminals architectur- tom McIntire

It would seem that this might be an alternative to doing the Suvax display if we make any reasonable number of suvax's forrr
Nebula. Also, it would be a clear winner as a typeset terminal

given the page size (I assume the way to program other
character
sets really works... which technical users thrive on). The
high
baud rate also looks good.

All in all, the specs made by day. Now, assuming you can
deliver on the terminal, it can really help keep us in the
terminal market. Am looking forward to the demo! (I hope
you are really pushing on the terminals engineering group
to get a high resolution monitor.)

GB2.S4.19
****
* d i g i t a l *
****

TO: AVRAM MILLER   DATE: SUN 4 APR 1982
6:09 PM EST
                                                FROM: GORDON BELL
                                                DEPT: ENG STAFF
                                                EXT: 223-2236
                                                LOC/MAIL STOP: ML12-
1/A51

SUBJECT: TMS

Let's get together and talk about where TMS is headed. I'm
certainly excited about it and especially the many types of
software that it'll spawn. I'd like to get Walt Tetschner
into
the discussion too because he's off doing a voice interface
to a synthesizer, so large systems can build things like
EMS voice mail systems that read memos to you. Also, the
Klatt algorithm should be put in TMS. There is room for
all kinds fo products and misunderstanding and I don't want
to contribute to them.

Also, assuming the TMS is all it was spec'd, the reward
should be to keep the team together to do it again.

Can you get with Walt first and find out what's going on

there
and then let's get together?

(My part in getting the speech thing going under Walt was that we'd spent lots and got nothing. I wanted them to build what amounted to a type and talk that all sorts of systems could use to start building products.)

Bruce Delagi and I also speculated about a party line or group
kind of conference facility under the control of 2 CT's. It would also be nice to have a cheap, low resolution ccd camera for sending snapshots of the meeting. The voice could either go over the line encoded or on a seperate line. The ct's would
control what was put on the screen (ie the slides that would have been sent ahead of time and that would exist in every ct).

GB3.S4.42

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+---------------------------+                               ID#388
|   |   |   |   |   |   |   |
| d | i | g | i | t | a | l |   i n t e r o f f i c e   m e m o r a n d u m
|   |   |   |   |   |   |   |
+---------------------------+
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Subject: **Enhance the Q-bus Modules and Build the Commercial Terminal--Don't build Toby**

To: Dick Clayton, ML12-2/E71

Date: 12/9/78
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

CC:	Buzz Brooks	MK1-2/H32	Ed Kramer	MR2-2/A67
	Steve Coleman	ML12-1/F41	Jack MacKeen	MR2-2/M65
	Bruce Delagi	MR2-1/M64	Roy Moffa	ML5-

2/E93

Ed Fauvre	MK1-2/E06	Stan Pearson	ML12-2/E71
Don Gaubatz	ML3-2/E41	Mike Titelbaum	ML1-2/E65
Bob Glorioso	ML3-2/E41	Mike Tomasic	ML12-2/E71
Andy Knowles	ML10-2/A52		

<u>WHAT</u>

Since I am the culprit in suggesting no TOBY, I want to be constructive and say what I think we should do:

1. Build the appropriate Commercial Processor module with CIS, putting as much as possible on a Quad to connect to Q-bus.

2. Configure a system out of the Q-bussed modules to be functionally equivalent to the Commercial VT-100 terminal that was being built to hold TOBY. Do the documentation so as to see that it is not FA and T'd. (There is no way you can convince me that by building a new set of 5 modules that plug together without a green block versus using a few other modules that use a green block, we have to have no FA and T or not.) We might call this phenomenon the Green Block's Disease, if true.

3. Configure the modules and build a really great bounded system based on the RL02 that is suitable for TRAX, using the VT162 et al so that we have something that is functionally equivalent to the 8100 for transaction processing, but is 1/2 the 8100 cost. It would also run SCS and be used with a configuration to give HP 45 and HP 300 functionality. Stylistically, it ought to be designed for a terminal user/operator too.

4. Use the VT162 (Fonz-based system) as the true low-end 11 bounded system by running an applications there too by basing the design on SCS (with the terminal running in the foreground) just as the Advanced

Development program that Sebern carried out for you indicated. Do the packaging to get clean ROM pluggable options so that we can make many different terminals in a fixed fashion. This gets us a really low cost system.

WHY

We can carry out these designs for the cost of the TOBY terminal and the VT162 (which we are already doing) projects, yet we have a better base. The reasons for this approach are:

0. We get the RL02-based and low-cost 11-terminals products too.

1. Let's invest in a base (Q-bus) which can be used to track any changes that we may encounter in the marketplace. This gets us volume and cost. Furthermore it gives us a base for putting all future systems together. (Observe that the micros are even standardizing on the Intel Multibus!)

2. We will have to have hardware and software for SDLC, X25, DDCMP and our new high speed multidrop interconnect network. Although TOBY can be modified to track these changes, I ask why bother, when they must be done on the Q-bus 11 base already.

3. The system must surely interface to RL02, and I don't see making another interconnect structure which this will imply when using a bounded system.

4. Although the cost differential of 20% (as an outside high) sounds like a lot, I think it is small compared with our ability to get volume quicker (i.e., a short time to market), the ability to have different, unique systems if and when necessary, enhancing the modules base so that we can build a cabinet based RL02 system which we badly need to compete with IBM and HP. I can't get anyone to say that this market is that price senisitive, or they are that sure of the configurations.

5. I really can't stand the idea of starting a new, distributed bus (MUSH BUS) around those 5 modules for what is a negligible cost difference!

OTHER THINGS TO INVEST IN

Overall, it seems like there are more important basic options and software to invest in that will give us a bigger bang for the same buck that I believe will be deadended. Some ideas and significantly higher priority than a 20% cost reduction effort:

1. Communications/Interconnect- see above plus modem, acoustic coupler, IEEE bus, speech output

2. Hard copy- FAX and connection to LAs for hard copy. We also need graphics output, Letter-like quality, and Letter Quality. Communicating LAs.

3. Basic Q-bus Options- more LSI for lower cost (eg SQUID), PUSART, Tiny, the packaging for a good solid state memory for program distribution.

4. Basic, new Processors- Here, we have to get >256KB quick...note what all the other 16-bit micros can do.

5. LSI VAX, though low in expenditures to explore now, takes talent.

6. CRTs- high resolution for WP and Typeset. Graphics. Color. Hard copy output is needed with them all.

7. Special Transducers-- Speech output, Wand input, BADGE/Turn-around document input, ability to have special consoles (ie. keyboards) for different applications. Card reader, enabling an RJE to be configured and built.

8. Low cost terminals, especially if we go after mass market doing transaction processing on this kind of system where the goal is A TERMINAL FOR EVERYONE (sound familiar?). This includes the CRT and the small alphanumeric that Savell's group has breadboarded.

9. Other systems. Getting above 256KB is essential in light of 16-bit micro. Jack MacKeen and Ed certainly support the multiprocessor (see attached). We have a lot of understanding here on it and we can build on this or we can wait for the competition which we see coming.

10. Software systems. Communications support to the various other systems. RJE station emulation. 3270...et al emulation for various use as a general terminal. Concentrators for clustering and emulating VT162's with multiple VT100s. MINI-TRAX that will support more users on 256KB. Graphics support, given we get some hardware.

Overall, I think TOBY is dull and dead end, but given the customer interest in PDT, we'll probably sell some. However, given the same resources, I believe the products I have outlined in the first section will get us more product and functionality, a hell of a lot more revenue and a better product base.

Are we doing all the above now which I consider higher priority?

Attachment

D I G I T A L INTEROFFICE MEMORANDUM

TO:	Dick Clayton	ML12-2/E71		
CC:	Buzz Brooks	MK1-2/H32	Ed Kramer	MR2-2/A67
	Steve Coleman	ML12-1/F41	Jack MacKeen	MR2-2/M65
	Bruce Delagi	MR2-1/M64	Roy Moffa	ML5-2/E93
	Ed Fauvre	MK1-2/E06	Stan Pearson	ML12-2/E71
	Don Gaubatz	ML3-2/E41	Mike Titelbaum	ML1-2/E65
	Bob Glorioso	ML3-2/E41	Mike Tomasic	ML12-2/E71
	Andy Knowles	ML10-2/A52		

August 23, 1982

Tom E. Fortune
4344 No. Anna
Fresno, California 93726

Dear Mr. Fortune:

Ken Olsen forwarded your letter regarding "citizen-government communications" to me.

Thank you for thinking of Digital but we have no area of mutual interest at this time and no interest in having further discussion.

Sincerely yours,

Gordon Bell

Vice President,
Engineering

CC: Ken Olsen
GB3.S7.16
June 2, 1982

Tom Kimble
MK1-2/C02

Dear Mr. Kimble:

On behalf of Central Engineering, I would like to personally thank you for your contribution to the success of the Central Engineering Booth at the DECUS Meeting in Atlanta.

Very positive feedback has been received from our customers that were in attendance. Thank you for the effort you expended to support their needs. Your enthusiasm and endless energy in the preparation and execution of the booth is recognized as a key factor in our success.

I wish you continued success in the future and look forward to future activities that demonstrate the abilities of our products and our people.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:mal
GB3.S5.14

cc Jim Miller

Bob Daley

ID#363

d i g i t a l **interoffice memorandum**

Subject: **Tom McWilliams and VAX-on-a-Chip**

To: Bob Kusik, ML21-4

Date: 27 NOV 78
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

follow up 12/11/78

Tom McWilliams is graduating finally. What's the chance of getting him to come here and work on the VAX-on-a-chip? Also, I've asked him to look at making an emulation mode of VAX on the next version of the S-1. I'm trying to get Forest Baskett to try to build a VAX-on-a-chip at Stanford as a chip to test their capability. He might want to do this if we can get him interested in extending the VAX architecture.

Can we import the Widdoes/McWilliams CAD system? What part of it can we use as is?

GB:ljp

CC: Jim Bell, ML3-2/E41
Dick Clayton, ML12-2/E71
Bill Demmer, TW/D19

Sam Fuller, TW/A08
Chuck Kaman, TW/A08
Roy Moffa, ML5-2/E93
Bill Strecker, TW/A08
Mike Titelbaum, ML1-2/E65

D I G I T A L INTEROFFICE MEMORANDUM

DIST:	Jim Bell	ML3-2/E41	Dick Clayton	ML12-2/E71
	Bill Demmer	TW/D19	Sam Fuller	TW/A08
	Chuck Kaman	TW/A08	Bob Kusik	ML21-4
	Roy Moffa	ML5-2/E93	Bill Strecker	TW/A08
	Mike Titelbaum	ML1-2/E65		

Mr. Anthony Slocum
Lucid
1090 E. Meadow Circle
Palo Alto, California, 94303

Dear Tony:

I enjoyed the discussion with you and your team last Tuesday. Enclosed is a non-disclosure agreement which I promised.

After the meeting, I talked with John McCarthy's group regarding a Queue-based Lisp. I hope that we can satisfy the group that we have the right approach. John is intending to visit us soon.

I have already asked John Payne of National to contact you regarding their support in a Common Lisp. Also, I will call both Larry Walker at Sperry and Joe Watson at TI to enquire of their interest.

We would like to get an idea of the cost of implementing a compiler.

Sincerely,

Gordon Bell
Chief Technical Officer

Enclosure

CC:
Henry Burkhardt
Dick Gabriel
00 BURT DECGRAM ACCEPTED S 14217 O 91 15-JAN-82 12:49:18
****
* d i g i t a l *
****

TO: WILLIAM KELLY DATE: THU 14 JAN 1982
5:39 PM EST
PETER SMITH FROM: GORDON BELL
cc: ROGER CADY DEPT: ENG STAFF
WIN HINDLE EXT: 223-2236
JULIUS MARCUS LOC/MAIL STOP: ML12-
1/A51

SUBJECT: TI (DEAN TOOMBE) PHONE CALL 1/14/82

Here's what we said:

GB: I'm calling because our marketing people told me what a mess
they'd made of describing VAx. We had the wrong group talking to
you and didn't get into the critical product areas.

DT: Last week we decided to go to IBM for their cad/cam. We need IBM
net interfacing and hi performance color and B/W graphics. We
visited you in December and didn't think you were in this area.

GB: What about having a smaller parallel path using VAX?

Could you
come visit us and look at our very impressive workstation plans?
Or can we start by visiting you and describing this?

DT: Come here immediately! I'll be at DEC within 2 weeks to sell you
a Silicon foundry and could see the demos then.

You're at the 11th hour.

GB: I though you were at the 25th hour.

DT: No, it's 11:59 and the window's closing. Come sell.

GB: Ok. we'll be there asap.

Can you guys not make a liar of me? Why do we do such crappy selling/marketing vis a vis charters?

GB3.S2.56

ID#369

| d | i | g | i | t | a | l | **i n t e r o f f i c e m e m o r a n d u m**

Subject: **Using the Tops 20, 30-bit Address**

To: Norma Abel, MR1-2/E37
Tom Eggers, MR1-2/E47
Ulf Fagerquist, MR1-2/E78
Sam Fuller, TW/A08
Bill Johnson, ML 21-3/E87
Alan Kotok, MR1-2/E47
Dan Murphy, MR1-2
Dick Snyder, MR1-2/E37

Date: 28 NOV 78
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

follow up 12/12/78

Forest Baskett suggests that the most cost effective way to use the 30-bit address on the 20 is to put in the pipes mechanism of UNIX and to keep the individual process less than 256 Kwords. The operating system would manage a set of processes in a 30-bit environment together and the switching among them would be almost instantaneous and by mapping. This would allow nearly all the problems to be solved that a large address environment would provide except a single large array access. By going to 30-bits everywhere I fear not only the massive development cost, but more likely that the machine will not perform well. Hence, a simple explicit mechanism may be better than having 30-bits everywhere.

What do you think?

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST: Norma Abel MR1-2/E37 Tom Eggers MR1-2/E47
Ulf Fagerquist MR1-2/E78 Sam Fuller TW/A08
Bill Johnson ML21-3/E98 Alan Kotok MR1-2/E47
Dan Murphy MR1-2 Dick Snyder MR1-2/E37

+---------------+ ID#0166
! d i g i t a l ! i n t e r o f f i c e m e m o r a n d u m
+---------------+

Subject: **University of Toronto Programming System for Teaching**

To: John Leng, Ron Spinek,
Jerry Witmore

Date: 10 JULY 78
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

I ran onto a system where programming is really taught effectively and cheaply. You might do it/sell it other places. They use their language SP/k, a subset of PL/1, and the students use mark sense cards with the SP/k language. The system is wheeled into class and programs are run. For cost/job you probably can't beat it.

They'd be happy to have you use it, sell it, see it, etc.

GB:ljp

****
* d i g i t a l *
****

TO: BILL JOHNSON DATE: MON 18 FEB 1980
5:09 PM EST
PETER CHRISTY FROM: GORDON BELL
cc: ALAN KOTOK DEPT: OOD
ARTHUR DEAN EXT: 223-2236
LOC/MAIL STOP: ML12-1
A51

SUBJECT: RE: MORE ON TOUCH TONE

I agree. I can't understand why we are doing it. Having worked with 300, 1200 and 2400 baud on the ems system, I am going to advocate we abolish 300 baud on all terminals too! We have to start thinking of our people and their feelings about getting work done and wasting time in talking with these cursed machines we provide them.

Why can't those poor folks have fast modems and touchtones?

GB1.S2.29

FROM: GORDON BELL DATE: WED 24 OCT 1979
3:19 PM EST
DEPT: OOD
EXT: 223-2236
TO: BOB DALEY
cc: LARRY PORTNER
ROGER CADY
JULIUS MARCUS
ANDY KNOWLES
BILL JOHNSON

SUBJECT: YOUR TPS PRESENTATION

GB0005/31/EMS

Congratulations on your presentation of the Commercial Products Plan Alternatives. It was clear and cogent.

Given the input from the various Product Lines and Commercial Marketing, it seems like all we have to do is decide. Let's get the decision made and get on with implementation.

Gordon & Larry

GB:swh

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+---------------------------+                    GB3.S8.27
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| D | I | G | I | T | A | L |         I N T E R O F F I C
E
|   |   |   |   |   |   |   |         M E M O R A N D U M
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TO: PEG
EMC
Sheila Pidgeon
Sharon Keillor
Ext: 3-2236
Del Thorndike

Date: 26 OCT 1982
From: GORDON BELL
Dept: Engineering
MS: MLO12-1/A51
EMS: @CORE

SUBJ: Over 40 Engineers

I got this message from one of our "over 40 engineers."

"During the last six(6) months, I've had the experience of bringing a bunch of fresh college grads & Senior people into a group simultaneously. The contrast between the recent grads & the senior people was really striking to me.

The recent college grads:

Have an abundance of common sense & maturity.

Are optimistic & enthusiastic- don't know that it can't be done.

Are positive & constructive.

Are creative.

Are disciplined, smart workers.

Are flexible & adaptable.

Are crisp, clean, ego-less communicators.

In contrast, the senior people I've found to be lacking in each of the categories. The junior people are an absolute delight to manage & the senior people require the most help. The senior people also happen to be highly educated & have a strong pattern of formal re-training.

I'm certainly for making it easier for our engineers to obtain formal training but I do believe that it's a minor part of the problem & thinking that it's anything more is a cop-out.

Note that none of the areas that were identified above would be effected by technical training programs & yet they are essential ingrediants for having a first-class engineering function.

The problem of "Engineer deterioration" is created by a set of industrial managing priorities that simply don't have the technologist high on the list. The fresh engineer isn't aware of this situation. As they see the lack of appreciation/importance that we place on their work, they start the deterioration process."

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+---------------------------+                               <>
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|   |   |   |   |   |   |   |                m e m o r a n d u m
+---------------------------+
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SUBJ: Training: Eng. Obsolescence

TO: Distribution

CC: Operations Committee

Date: 26 OCT 1982
From: Gordon Bell
Dept: Eng. Staff
MS: ML12-1/A51   Ext:
223-2236
EMS: @CORE

We must break the viscious cycle: poor education causes poor products and longer schedules, with no time for education!

Very long projects don't allow for education, nor is Continuing Education part of our Individual Development Program evaluation. Close in projects (mid-life kickers) teach nothing!

A continuing education program is vital, given our demographics and lower growth which filters out young (teaching) engineers.

Gordon

DISTRIBUTION:
EMC
PEG
Mfg. Staff
RAD
TMC
Sheila Pidgeon
Del Thorndike
Sharon Keilor
Del Lippert

00 CORE DECGRAM ACCEPTED S 006201 O 328 13-JUN-83 18:21:21

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!   !   !   !   !   !   !   !
! d ! i ! g ! i ! t ! a ! l !        I n t e r o f f i c e  M e m o
!___!___!___!___!___!___!___!
```

TO: EMC:

DATE: MON 13 JUN 1983 2:28 PM DST

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

cc: FU 6/17
WIN HINDLE

MESSAGE ID: 5202828273

SUBJECT: ENGINEERING SKILLS=PROJECT/PRODUCT PERFORMANCE

GB6.2

In this year's strategy update, I identified developing our skills as #2 in the top 10 list, just below sorting out what work we have to do and who does it.

During the last few weeks I've been exposed to several projects which are mainstays of the product strategy, and find:

THERE'S NO WAY WE CAN IMPLEMENT CRITICAL PRODUCTS IN THE PRODUCT STRATEGY WITHOUT SIGNIFICANT ON-THE-FLY TRAINING OF ENGINEERS AND THEIR MANAGERS!

Frankly, I'm stumped, and think we have a stalemate and are not addressing training. EMC members seem to want no part of education for two reasons:

- your people are adequately trained for the current work, and your particular work environments are actually quite nice. Hudson and Marlboro fall in this category. Littleton's improving. I don't know of other acceptable environments.
- the situation is hopeless, and you're hoping the problem will go away. Pockets of the mill, some A/D, and Tewksbury are typical

WHAT IBM DOES
Erich Bloch, VP who built and operated Fishkill for many years, is in charge of their education. They just have to have an edge because:

- technical people take about 4 weeks per year in new courses
- managers take 3 weeks per year including one week of required technical education

EMC AGENDA ITEM
I'd like to discuss this critical item for a few minutes at EMC because the number of poor projects has reached epidemic

proportions
as measured by our performance against schedules (measured in being
1-2 years late) and simply by looking at the projects (and feeling my
gut).

A long awaited task force report is in process, but it is not aggressive enough in time, effort or direction.

Mostly, I want several projects very badly, but I don't believe they
are possible with the current people as trained and managed.

25 October 1982

Mr. Edward A. Reynolds
Quality Assurance Consultant
Mattituck, Long Island, N.Y.11952

Dear Mr. Reynolds:

Thank you for your letter and your concern about DIGITAL and the issue of Engineering Obsolescence. I appreciate your candid assessment of one sample of our Quality and Reliability Engineering. Since I don't know the plant or discipline, I won't comment except to say that Digital has grown more rapidly than any other company in history. The emphasis may have been on getting an organization in place rapidly, and perhaps less on technical skills. Therefore, you might find that we have an exceptional personnel department in our plant; we do have very good employee relations. As you properly point out, high technology is based on technical skills.

If you look at the officers of Digital, the majority come from an engineering background and a few have additional MBAs. Ken Olsen, our president, practiced engineering for many years and is still active in product design. There are a few companies who have a stronger engineering foundation in the officers than Digital. NEC has an amazingly large collection of engineers who have made contributions as officers. IBM appears to be an anomoly; it is strongly supportive of science, engineering and education, (and even the arts) yet it's top managers are from the field and marketing organization who have become professional managers. Watson has commented that he never understood why their great engineers never became the company's top managers. (I believe I understand why, but that's another topic.)

The problem of Continuing Education has become acute for us for many reasons, which I won't describe here. For example, the performance ratings of engineers entering their 40's shows a drop. We need a whole range of educational activities:

all forms of education within our research and advanced development organizations where industry (and I) expect new ideas and the assimilation of scientific knowledge necessary for high technology products;
continuing education aimed at the M.S. for all engineers who intend to practice engineering on a lifelong basis;
continuing education to update the skills of all engineers simply to track engineering knowledge;
updating our technical managers with technical courses at least on a two weeks per year basis so they are literate in the technologies they manage; and
degree programs for technicians.

Technical managers represent a special problem since there's a growing body of management knowledge. Therefore, those who practice it must also go through continuing management education instead of regarding management as a static field or "art". I often think that some engineering managers went there because they got tired of engineering and having to keep up technically. We simply can't have managers who are there because they are not good enough to engineer.

Right now, we have many courses and degree programs (including the popular MBA, unfortunately) within Digital, yet I'm uncomfortable that we are doing enough. The discomfort comes from visiting engineering sites only feet or minutes away from one another and finding a range of: bright young and older engineers who are stimulating and productive; and rapidly obsolescing young and obsolete older engineers. This leads me to think it's solely management and projects that most determine the excellence and mental age of its engineering and its products. We're trying to understand these factors in order to change.

Thanks for asking: What is DEC doing to improve this? The short answer is not enough. We're leaving too much to the individual, while at the same time pushing for short schedules and excellent projects based on no new skills. Clearly we have to change.

Sincerely,

Gordon Bell
Vice President, Engineering

GB3.S8.24
00 BURT DECGRAM ACCEPTED S 26809 O 602 23-MAR-81 19:18:38

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION   DATE: MON 23 MAR 1981 18:54 EST

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: ENROLLMENT IN THE VLSI COURSE, HUDSON

It is absolutely crucial that this course be attended by our designers outside of the Hudson group. Based on some cursory figures, our VLSI content in products is nil. We must upgrade our skills, by getting our consulting engineers taking these.

I would hope to see people like Kotok and Stewart in these courses, for example.

It is difficult to imagine that any of our projects would slip perceptibly by having one designer in these courses. On the other hand, it is difficult to believe that we can build decent products without using this technology. Also,

based on our long lead times for PWB's, it would seem possible
that VLSI is a way to get reduced design times while also getting lower costs.

Therefore, I would like each of the engineering staff to get a plan together to attend this next, and subsequent courses.

gordon

"TO" DISTRIBUTION:

BRIAN CROXON	ENG STAFF:	BERNIE LACROUTE
JIM MARSHALL	ROY MOFFA	BILL PICOTT
BOB SAVELL	HERB SHANZER	STEVE TEICHER
JOE ZEH		

GB2.S5.24
00 BURT DECGRAM ACCEPTED S 22535 O 188 21-APR-81 14:07:31

****
* d i g i t a l *
****

TO: ENG STAFF:

DATE: TUE 21 APR 1981 12:43 EST

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

cc: ROY MOFFA
STEVE TEICHER
JOE ZEH

SUBJECT: VLSI COURSES

We probably have to have a goal that states EVERY hardware engineer and manager takes this course within the next two years!

Gordon

GB2.S6.6

TRANSISTOR GENERATION

"What is a Transistor?

Transistors are made from silicon by the introduction of minute quantities of impurities that determine the electrical properties of the host material. By precisely controlling both the location and the concentration of impurities (called dopants), engineers can build up the transistor structure.

Doping impurities come in two types. The first adds free electrons to the silicon, coverting it from a near insulator to a conductor of electricity (although the conductivity is much less than that of a metal). The second type removes electrons from the bonds keeping the silicon atoms in the solid, leaving behind electron vacancies or 'holes'. The holes behave like positively charged carriers of electricity and thus the second type of dopant also raises silicon's electrical conductivity. Silicon that conducts electricity by way of free electrons is called n-type, whereas material that conducts by the way of holes is called p-type.

Transistors consist of three segments of doped silicon back to back, as it were. The sequence of segments is important; the allowed orders are n-type-p-type-n-type and p-type-n-type-p-type. There are two general classes of transistors, but both can have either the n-p-n or p-n-p sequence of doped silicon segments. The historic first transistor built at Bell Laboratories in 1948 is called a bipolar transistor because electrical current flowing through the device from one end to the other passes through both n- and p-type silicon and both electrons and holes contribute to the current. Bipolar transistors are also called current controlled because a small electrical current entering the device through the center segment controls whether the device as a whole conducts electricity. A voltage applied only to the two end segments will not cause the transistor to conduct electricity. Viewing the transistor as a switch, one says that the current into the center segment turns the switch on or off.

The second class of transistor is the insulated gate field effect transistor. In this type of device, a thin insulating layer (usually silicon dioxide) is placed between the central segment and its electrode. A voltage applied to the electrode creates an electric field which converts the region of the central segment just under the electrode from one conductivity type to the other (n- to p-type of vice versa). Thus, field effect transistors differ from bipolar devices in two ways: they are actuated by a voltage applied to the central segment rather than by a current, and all the current is carried by one type of carrier in three segments of the same conductivity type.

With the invention of the integrated circuit in the late 1950s, it became clear that the field effect transistor offered distinct advantages because fewer processing steps were needed to make this type of device and because it took up less space in the silicon. The type of field effect transistor called metal-oxide-semiconductor (MOS) has become the dominant form of commercial integrated circuit. The biggest advantage of the bipolar device is switching speed. Thus, for those applications requiring this capability, such as high-speed logic circuits in computers, bipolar is widely used. Moreover, new forms of bipolar circuits that are more amenable to miniaturization than the older types are being investigated and may well turn out to be important as MOS microcircuits in the next generation of microelectronics, the VLSI era." (Robinson, 1980)

By 1960 transistors had replaced tubes as the technological base for computers. Their properties, lending themselves to automated design and manufacture no longer meant that the innovative machines would come from handcrafted projects in laboratories and universities, but from industrial research and development. The end of the fifties saw the last spurt of laboratory built machines: Lincoln Lab's TX-0 (Transistor Experimental project), MANIAC 2, Bell Labs Leprachaun and ILLIAC II. In 1959, a Siemens 2002 was delivered to the Technical University of Aachen. The same year IBM introduced their fully-transistorized 7030, the 7090, and the 1401. In 1960,the CDC 1604 and 160, and Digital Equipment Corporation's PDP-1, the IBM 1620, and the UNIVAC 1105 were announced. The full range of computers were then available for purchase: ranging from business to scientific, and from small to super, i.e., from $100,000 to $10,000,000.

The early sixties brought the space race creating new computing needs in science and education. This generated new demands for computing power that, once available, led the first generation of "hackers" to enhance the machines into super toys. The Gemini flight inspired a group in Cambridge to use the computer scope to simulate space flight and space wars. Active communication between users from coast to coast rapidly developed into a computer game culture. The children of the first hackers started to college in the eighties and are as distinctive as the so-called tv generation since they grew up with computers as playmates.

Simultaneously, business was beginning to define a need based on computing versus tabulating and sorting. Champine (80) has listed the phases that characterize the development of commercial applications. As early as 1955, the full range of business uses were envisioned that are continuing to create a need for larger and faster business computers. But he notes that only the leading edge users were implementing the intermediate level functions in the late fifties. Thus, business data processing only began to drive the development of computers with second generation machines.

<u>ANALOG CALCULA</u>

COMPLEX

LEVEL REFERENCE

Auto-
pilot

Hawk

<u>Missile-auto-pilot</u>, Raytheon, 1960, Gift of Joe Kuprevich (D144.80).

<u>DIGITAL CALCULA</u>

3-4 REGISTER

<u>Anita</u>

<u>Electronic Calculator</u>, ANITA, Gift of Leonard Woodall (D209.80).

PROGRAMMABLE

<u>Clary</u>

<u>DE-600</u>

<u>COMPUTER</u>

<u>Atlas Computer</u>

-

Atlas 1 PCB, Ferranti Corp., 1959-63, Gift of Professor Sumner (D1.75).

-

Atlas Digits, Ferranti Corp., 1959-1963, Gift of Professor Sumner (D2.74).

-

Atlas I Computer PCB, Ferranti, 1962, Gift of Robert Hopgood, Rutherford Laboratories (D128.80).

-

Atlas I Fixed Memory, Ferranti, 1962, Gift of Robert Hopgood, Rutherford Laboratories (D129.80).

-

Atlas I Memory "THE SUPERVISOR", Ferranti, 1962, Gift of Robert Hopgood, Rutherford Laboratories (D130.80).

-

Atlas I Computer Form Flash Plates, General

Dynamics 1972, Gift of Robert Hopgood, Rutherford Laboratories (D131.80).

CDC 6600

Word Length: 60 bits for the Main Processor and 12 bits for the 10 Peripheral and Control Processors (PCP)

Memory Size: 131,072 words in 32 banks of 5 4096 12-bit word modules and 4096 12-bit words for the PCPs.

Speed: 250 million bits per second; 2 million instructions per second for the Main Processor and .5 million instructions per second for each of the PCPs.

Clock Rate: 10mhz (4 25 nanosecond phases)

Arithmetic element: Main cpu contained 10 functional units that could operate in parallel on the 16 word general register array.

Instruction format: 15 bit (operations on registers) and 30-bit (memory access)

Technology: All transistor logic; 6700 modules with 64 transistors in a 2.5 x 2.5 x 0.8 inch module, "cordwood package"

Number produced: 10 by the engineering group at Chippewa Falls

Price: approximately $3 Million.

Project start: Summer 1960

First delivery: September 1964 to Lawrence Livermore Laboratory

Software: COS (Chippewa Operating System) and FORTRAN

Project leaders: Seymour Cray with James Thronton

Predescessor: CDC 1604 and 3600

Successor: CDC 6400, 6500 and 7600

Use: Batch processing and shared use in large scientific computing centers

Achievements:

* 6600 and 7600 were the fastest supercomputers until the Cray I was introduced.

* Development of freon-cooled, "cordwood" packages proving a ten-fold increase in logic density.

* Fine multiplexed control for Peripheral and Control Processors.

* Independent parallel, functional units for high speed with tag control.

<u>IBM 7030 "THE STRETCH"</u> IBM, 1961, Gift of Computer Service, Brigham Young University (D250.81).

Word Length: 64 bits plus 8 bits for parity and error checking

Memory Size: 1 to 8 16k core memory stacks, self-contained each with its own clock, addressing circuits, data registers and checking circuits, addressing of up to 256k word locations.

Data Transfer Rate: Addressing of memories and transfer of information from and to memories by a memory bus permits new addresses, information, or both to pass through the bus every 220 musec.

Central Processor: The processor consists of the instruction unit, the look-ahead unit, a parallel arithmetic unit and a serial arithmetic unit.

Multi-programming through program interruption and address monitoring, and overlapped or parallel execution of instructions is possible.

Instruction Format: Halfword formats accommodate indexing and floating-point instructions. Fullword formats are usedby variable-field-length instructions. Five instruction sets and 765 different types of instructions are used.

Technology: Standard Modular System Transistor Cards. Used 150,000 high speed drift transistors, and provided interleaved magnetic core memory with 2.18 usec access cycle.

Number Produced: 9

Price: $6-8 Million

Project Start: 1954

Project Leaders: S.W. Dunwell; Gene Amdahl, John Backus, Werner Buchholz, B. O. Evans, Jerrier Haddad, Lloyd Hunter, Ralph Palmer, and John Sheldon

First Delivery: April 1961 to the Los Alamos Scientific Laboratory

Software: Algebraic and Fortran compiler

Use: Large scale scientific research, for example: nuclear reactor design, hydrodynamic problems, problems in nuclear physics.

Innovations (Adapted from Hurd, 1981)

* The drift transistor, a fast, diffused-base, alloyed-emitter transistor, improving quality, consistency, and speed.

* A

logic circuit design called transistor current switching permitting faster operation.

*

Two microsecond memory access time (compared with 6 microseconds).

*

Memory interleaving of up to four 2-microsecond memories, permitting average memory access time of one-half microsecond.

*

"Lookahead" reading instructions three levels ahead of the one being performed, determining memory references and allocations for instructions.

*

Advanced interrupt system.

*

Multiprogramming incorporating a system of memory protection.

*

Disk drive with a set of parallel read/write arms contained in a single mechanism with access ability of more than one-two million word disks with a data rate of several million bits per second per channel.

*

TRACTOR, a mass storage device using tape cartridges with exceptionally high speeds.

*

Error-correcting codes for memory.

*

Computer-aided design.

*

Automated assembly and testing of printed circuit boards.

*

Elimination of distinction between character, decimal and binary machines, fixed and variable word length machines, and fixed and variable record machines. Werner Bucholz coined the word "byte" to define variable-sized parts of words.

"Stretch: The Technological Link Between Yesterday AndTomorrow", Brigham Young University, 1981, Color, 3/4" videotape, 15 min. running time (V16.81).

The "Stretch", IBM's 7030, was the supercomputer of 1961. The system's innovations, including lookahead, array processing, and error correction codes, are highlighted in interviews with former users and footage of the machine in operation.

<u>LINC Computer</u>, Lincoln Lab, 1961, (D118.79)

Word Length: 12 bits

Memory Size: 2048 words

Speed: Approximately 125,00 single address instructions per second

Clock Rate: 500 khz using dec 4000 series modules

Arithmetic Element: Six 12-bit registers

Instruction Format: single and double operand, multi-mode

Technology: Discrete transistor using dec 4000 series modules

Power Consumption: 1000 watts

Size: 69"x32"x32", plus separate tape, keyboard, console, and interconnection boxes.

Price: $43,600

Project Leaders: Wesley Clark and Charles Molnar

Project Start: 1961

First

Shipment: March, 1962

Withdrawn: December, 1969

Number Built: 50 total, 21 by DEC

Successors: DEC LINC, LINC-8, PDP-12

Achievements:

*

Laboratory system to accept analog and digital inputs directly from experiments and to provide signals for control.

*

First truly personal computer with automatic file system via two LINC tapes, interactive program editing, development and control via crt.

LINC-8, Digital Equipment Corp, 1965, (D119.80).

Word Length: 12 bits

Speed: Approximatley 667,000 memory accesses per second

Clock Rate: 1 Mhz (same as PDP-8)

Instruction Set Processor: Both LINC and PDP-8

Arithmetic Element: Four PDP-8, six LINC 12-bit registers

Instruction Format: Single and double operand, multi-mode, 12 bit instructions

Technology: DEC "Flip Chip" R-series general purpose modules. (Discrete components)

Power consumption: 2,000 watts

Size: 69"x32"x33"

Price: $38,500

Project start: 1965

First shipment: August, 1966

Withdrawn: December, 1969

Predecessor: LINC

Successor: PDP-12

Achievements:

* System where both processors could operate in parallel.

* Utilized either LINC or PDP-8 software.

PDP-1, Digital Equipment Corp, 1960, Gift of Inforonics Corp (D116.79).

Word length: 18 bits

Speed: 100,000 single address instructions per second

Clock rate: 5 Mhz and 500 Khz for input-output

Arithmetic element: Accummulator and input-output

Instruction format: Single address 5 bit op code, 1 indirect bit, 12 address bits. Extended field with 15 address bits.

Technology: Early second generation Digital 1000 series 5 Mhz and 4000 series 500 Khz systems modules

Power consumption: 2160 watts

Size: 69"x88"x28"

Price:

$120,000

Project leader: Benjamin Gurley

Project Start: Summer 1959

First Shipment: Bolt, Beranek and Newman, November 1960

Number built: 50

Achievements:

* First commercial computer with graphics display.
* Operation as time shared computer, BBN, September 1962.
* Original space war program by Steve Russell at MIT.

PDP-7, Digital Equipment Corp, 1964, Gift of Computer Science Department, Worcester Polytechnic (D143.80).

PDP-8, Digital Equipment Corp,

Word lenght: 12 bits;

Memory Size: 4096 words (expandable to 32,768 words);

Speed: 333,333 signle address instructions/second; 1.5 microsecond memory cycle time;

Clock rate: 1 Mhz;

Arithmetic element: accomulator and 8 auto-index registers in memory;

Instruction format: Sincle address 3 bit op code, indirect bit, 1 page bit and 7 page address; 32,768 word addressable memory;

Technology: Digital R-series logic;

Power consumption: 780 watts;

Size: 8 cubic feet;

Number poduced: approximately 5,000;

Price: $18,000 with 4096 word memory and teletype type 33ASR;

Project start: 1964;

First delivery: April 1965;

Predecessor: PDP-5;

Successors: PDP-8S, LINC-8, 8-I, 8-L, 8-F, 8/M, 8/A, VT78;

Software: PAL-8 assembler, Macro 8 assembler, Fortran II, DDT (Symbolic debugger), Editor, RT-8 and OS-8 operating stand-alone operation systems using Dectape and diskpaks;

Use: Real time control and data collection. First "OEM" computer. Data commmunication. Small business data processing. Timeshared computation for very low cost/terminal;

Achievements:

* Originated concept of minicomputer.

* Provided the lowest cost computation and performance/cost at the time.

* Producible in high volume manufactured using wire-wrap technology.

* Improved ease of interfacint (first DEC computer to use I/O bus structure).

* By

packaging, price and supply established the two tier supplier/OEM structure.

*

Lowest cost per terminal with TSS/8 (smallest scale timesharing system).

PDP-12, Digital Equipment Corp, 1967, (D156.80).

Word length: 12 bits

Speed: Approximately 667,000 memory-processor accesses per second

Clock rate: 1 Mhz (same as PDP-8)

Instruction Set Processor: Both LINC and PDP-8

Arithmetic element: Four PDP-8, six LINC 12-bit registers

Instruction Format: Single and double operand, multi-mode 12-bit instructions

Technology: DEC "Flip-Chip" general purpose modules. Discrete components.

Power Consumption: Less than 2000 watts

Size: 76"x35"x33"

Price: $28,000

Project Start: June, 1967

First Shipment: June, 1969

Withdrawn: June, 1975

Number built: 1,000

Predecessors: LINC, LINC-8

Achievements:
*
Improved price, price per performance and larger display.
*
Lowered LINC-8 cost by building a single physical processor to execute either LINC or PDP-8 instruction set.

Siemens 2002

TX-0 Computer, Lincoln Lab, 1956, (D154.75).
Word
Length: 18 bits
Memory
Size: 8192 words
Speed:
80,000 single address instructions per second
Clock
Rate: Variable, controlled by delay-line (max rate = 5 Mhz)

Arithmetic Element: Accumulator; In-Out Register for program-controlled Input-Output; Index Register

Instruction Format: Five bit op code, (2 bits initially used) + 13 bit address (16 bits for initial 65,536 word memory)

Technology: Discrete transistor circuits and core memory
Power
consumption: Approximately 5,400 watts
Air
Conditioning: 15 tons
Size:
Built into 9000 square foot room at MIT

Component Count: 3,600 surface-barrier transistors (SBT) of Philco type 2N240
Total
Hours: Approximately 50,000 hours with 12

transistor failures

Project Staffing: Lincoln Laboratory Division 6, Group 63; William Papian, head; Wesley Clark, logical design; Kenneth Olsen, circuit design and construction (followed by Benjamin Gurley) Richard Best and Jack Mitchell, memory design. John Clarke supervised construction.

Project start: Late 1955

Use: Research on electro-physiological signal processing; speech analysis and synthesis; picture processing; simulation of sensory aids for the blind; bubble chamber photograph analysis; handwriting analysis; interactive programming; symbolic program tracing and debugging.

Achievements:

* Tested transistorized circuitry for use in computers.
* Tested a large, 65,536 word (18 bit+ parity bit per word) vacuum tube driven core memory.
* Improved real-time interfacing.

"Tomorrow: The Thinking Machine", CBS, 1961, B&W, 3/4" videotape, Running time: 1 hr. (V6.81)

Artificial intelligence is the topic of "The Thinking Machine," a 1961 episode of the CBS News <u>Tomorrow</u> show, narrated by Jerome Weisner and David Wayne. Machine "learning" is compared with human and animal behavior. Highlights include an interview with Claude Shannon, a robot-sequence clip from the silent film classic "Metropolis", and three versions of a TV western written on MIT's TX-0 computer.

<u>WRITABLE OR READABLE MEMORY</u>

MAGNETIC

RANDOM

Rope

<u>Apollo Guidance Computer</u>, Read Only Rope Memory, Burroughs, 1963,Gift of Dr. Albert Hopkins, Draper Laboratories (D115.76).

? <u>Non-destructive Read-out</u>, RCA, 1965, Gift of Cliff Granger (D162.80).

<u>WRITABLE AND READABLE MEMORY</u>

WAVE STORAGE

CYCLIC

Magneto-strictive

Delay-line stores hold information as a series of impulses circulating continuously along a closed path. In a magnetostrictive delay-line electrical impulses signifying data are converted into stress waves which travel the length of the nickel wire. The application of a magnetic field to the wire causes it to change dimension thus converting electrical impulses to stress waves, or vice versa. Coils similar to those found in an electro-magnet are used for inserting and recovering digital information from the delay-line. The Elliott Brothers' Computers in England were the first to use the magnetostrictive principle for storage of data. (Lavington, 1980)

<u>Magneto-strictive Delay-line</u>, Ferranti, 1958, Gift of Oliver Strimple (D230.80).

ICT Sirius Computer had 10 decimal digits per word, with 1000-10,000 words stored on delay-lines. Compile-add time cycle of

250 usec, and storage cycle time of 4000 usec.

MAGNETIC FLUX

RANDOM

CORE

Cores are made of ferromagnetic material that is able to become strongly magnetic when subjected to relatively weak magnetic forces. A magnetic field is generated in the vicinity of any conductor that is carrying a current. The direction of the magnetic field is related to the direction of the current flow in such a way that reversing the direction of the current results in a reversal of the direction of the induced magnetic forces. Each core has four wires: two which write selecting the proper one in a co-incident (x-y) axis. A third wire reads and a fourth wire inhibits a build up of energy. A number of core planes are then piled into a core stack or cube and in the transistor and integrated circuit computer generations were the most prevalent type of primary memory.

Ferrite Memory Stack-experimental, Digital Equipment Corp, 1975, Gift of Cliff Granger (D160.80).

Experimental Ferrite Core Memory, RCA, 1964, Gift of Cliff Granger (D161.80).

Ferrite Core Memory Cube, RCA, 1960, Gift of Cliff Granger (D169.80).

Ferroxcube Core Memory, Ferroxcube Corp of America, 1968, (D195.80).

Ferrite Core Memory, Ferroxcube Corp of America, (D196.80).

Core Memory Board, RCA, (D197.80).

Core Memory, Digital Equipment Corp, (D200.80).

18 Mil Planar Memory (8k), Digital Equipment Corp, (D198.80).

DISK

Minuteman Missile Fixed Disk Memory, Autonetics, 1962, (D107.80).

Telex Disk, 3M CORP, 1962, 75 cm diameter, Copper, Metal, Gift of Don Sordillo (D80.80).

PLATED WIRE

Plated Wire Memory, Honeywell, (D114.80).

? MOBIDIC Memory Board, Sylvania, 1956-57, Gift of Frank Feigin (D192.80).

? Flip-chip Power Supply, Digital Equipment Corp, (D193.80).

? ILLIAC II Block Multiplexor Switch, University of Illinois, 1962, Chassis-interplay, Gift of Clifford Carter (D216.75).

? Illiac II 48bit Register, Mesa Transistor, University of Illinois, 1963, Gift of Dale Sparks, Los Alamos Scientific Laboratory (D120.80).

LINKS AND SWITCHES

Teletype Receiver and Transmitter Module, Digital Equipment Corp, 1963, System Building Block 4707, (D217.80).

First functional unit package for controlling telegraph line. Identifical forerunner of one-chip circuits known as UARTs, Universal Asynchronous Receiver and Transmitter.

TRANSDUCTION

Friden Paper Tape Reader, Friden, 1964, Model SP-2, Loaned by Ed Luwish (X9.80).

??COMPONENTS

LOGIC MODULES

Analex Logic Module, Analex, 1962, (D21.79).

System Logic Module, Digital Equipment Corp, 1958, Gift of Dick Best (D22.79).

Adder Module-NORC, IBM, Gift of Herbert Lechner, Stanford Research Institute (D27.80).

Delay Line Memory/Logic Module, Computer Controls Corp, 1958, (D108.80).

SMS Logic Module, IBM, 1960, (D113.80).

PDP-6 System Logic Module, Digital Equipment Corp, 1964, Gift of Don Vanada (D212.80).

PDP-6 Signed Photo, Digital Equipment Corp., 1967, (B70.67).

PDP-8 Flip-flop R201, Digital Equipment Corp., 1966, 1x15x7 cm, (B71.74).

Dec Flip-chip Modules, Digital Equipment Corp, 1965, (D213.80).

22XX Printer Buffer Array, IBM, 1971, (D132.80).

Bit Slice (Triple Flip-flop), Digital Equipment Corp, (D201.80).

Bendix Bit Slice, Bendix Computer, 1968, (D202.80).

System Building Block, Digital Equipment Corp, (D203.80).

Ferroxcube FF1, Phillips Mfg, (D204.80).

Decimal Counting Unit, Berkley Scientific Corp, (D205.80).

Bendix Bit Slice, Bendix, (D207.80).

DMCAT2.3

Digital **Interoffice Memo**

Subject: **Translation Between Standard 11 Macro Code, and VAX Macro Code (non-native)**

To: Bill Demmer
Date: 4 OCT 76
From: Gordon Bell
CC: Jim Bell, Peter Christy, Pete Conklin, Roger Gourd, Ron Ham, Bernie Lacroute, George Poonen, Larry Portner, Bill Strecker
Dept: OOD
Loc.: ML12-1
Ext.: 2236

F/U 10/11

The above product is probably absolutely mandatory when our users see VAX. It will also diffuse the compatibility issue. This translator would enable them to take standard 11 code and run on the VAX (not just the 11 environment). Honeywell did this for 1401 code for their 200 series.

Will you please get some of the relevant people together (or have someone else) to brainstorm the cost/performance of the above translator after we've disseminated some information so they can think about it?

The issue is not can it be done, but rather whether it is good enough to use and how much the human gets involved.

GB:ljp

May 2, 1978

Drs. Joe Traub and Allen Newell
Carnegie-Mellon University
Department of Computer Science
Schenley Park
Pittsburgh, PA 15213

Dear Joe and Allen:

As usual I enjoyed the interaction with you and the CMU faculty last week, although it was strained. Since I have been spending my spare time this year writing the Computer Engineering book, I have gotten into a habit of poor communication, unlike the other five years since I returned to DEC (this was the first time I visited since last Spring). Although there is quite a lot of interaction among individual members of the faculty and people at DEC, there is little visibility with you and I think it would be useful if Jim Bell met with you so that we are all aware of the exchanges that are taking place. Lloyd Dickman of our R&D group who works for Jim is the official liaison. (For example, last week he supplied the computer module project with soldered backplanes from our manufacturing plant, that was not accounted for or even seen in any of our discussions.) At the same visit I discussed the use of our semiconductor programs and facilities with several CS and EE faculty members. Already, some of these programs are in use there and we exchange information routinely -- unlike any organizations I'm aware of.

We have been careless in our hiring protocol. I have asked that we call CMU before an offer is extended to a CMU faculty or staff member. In the case of Mario, we offered him a job (in line with IBM, Xerox and BTL offers) when it was unclear as to whether he wanted to return to CMU because of his salary and status there. I agree that CMU should follow the same protocol with us.

I'm sorry that we went through a hassle as to CMU's use of APL, but am delighted that the local office did the right thing in making it available to you.

Our performance in getting the KL10 operational was really poor. I'm sorry about this, however I can understand how our own service personnel are less motivated about installing machines that they ultimately won't be responsible for. When there are future problems, I think we have to get the problems addressed more quickly. It's almost inconceivable that we went six months without getting simple problems like lost cables and the right diagnostics solved.

I am asking Baird to see that our Regional Field Service Manager visits Howard to see if we can't improve what still seems like an antagonistic relationship.

Although it may seem like we have a significant potential product edge by having the CM* work done on LSI-11s, a major effort is still required for it to flow to us as advanced development or as a product because of the operating system differences. Almost any company hiring a person from the CM* project would be in a better product position, even though we follow the research more closely.

I've asked Jim and Sam to try to improve this coupling with Richard Swan. Also, I still believe that our standard operating system, RSX-11/M is a reasonable base on which to build the research. (This has turned out to be true in the case of our own internal multiprocessor work.)

I'm truly sad that we have a much poorer relationship with Bill Wulf, for numerous reasons (the latest being our inability to help in the DOD language effort). I've enjoyed the interaction with him and hope this will return some day. Ron Brender will be spending next year there and this might start to re-establish the link.

Bill Strecker enjoyed the interaction with the faculty and students last week and sends his regards.

I am sorry that there is a feeling that we are taking CMU for granted. We certainly don't mean to be. We intend to help CMU remain at the forefront in hardware and systems research.

Sincerely,

Gordon Bell
Vice President,

Engineering

Professor, Computer

Science and

Electrical Engineering

Carnegie-Mellon
University, on leave

GB:ljp

CC: Jim Bell
Lloyd Dickman
Sam Fuller
Baird Lashley
John Meyer
Dan Siewiorek
Bill Wulf

+---------------+
! d i g i t a l !   i n t e r o f f i c e   m e m o r a n d u m
+---------------+

Subject: **Travel to Colorado/Teleconferencing/Electronic Mail**

To: Lon Beaupre, John Kevill,
Ken King, John McNamara
CC: Jim Bell, Al Crawford,
Bill Hanson, Alan Kotok,
Bob Puffer, Grant Saviers

Date: 28 JUNE 78
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

follow up 7/12/78

Although I see the need for communications with Colorado, it feels like there's too much travel -- taking time and wearing people down. Can you get a handle on how many trips we're taking and figure out how we might be more effective and travel less?

We still must have computer teleconferencing as per the attached proposal. I'd like to get a project started immediately with phone units! Let's get conference phones, fax, word processing, and electronic blackboards in dedicated rooms at both sites.

As a separate issue we need really good electronic mail so as to avoid the memos and enhance written communication! (Note that CMS should, but doesn't solve this problem because it is not widely available outside sales.)

Who's responsibility is it to propose such a plan?

GB:ljp

Attachment

D I G I T A L INTEROFFICE MEMORANDUM

DIST: Lon Beaupre ML1-5/B94 Jim Bell ML3-2/E41
Al Crawford PK3-2/F34 Bill Hanson ML1-4/P11
John Kevill ML1-3/E58 Ken King ML3-2/E41
Alan Kotok MR1-2/E47 John McNamara ML3-2/E41
Bob Puffer ML12-2/E38 Grant Saviers CX

FROM: GORDON BELL DATE: THU 1 NOV 1979 11:38 AM EST
DEPT: OOD
EXT: 223-2236
TO: BILL JOHNSON
JACK MILESKI
SI LYLE
BOB DALEY
JOHN MORGAN
cc: LARRY PORTNER
ROGER CADY
JULIUS MARCUS
GLENN REYER

SUBJECT: TRAX 1.5 PROPOSED DIRECTOR

GB0005/46/EMS

I want us (Engineering Management) to be very, very positive in managing Release 1.5 on TRAX. You have the responsibility! Larry and I will help and would like to talk with the development team ASAP to answer questions. Also, I believe Roger should come with us. We must go and build a great, reliable product in 1.5.

Our decision to not aggressively market TRAX now feels good to me.

If we do well in 1.5 I'm sure the market will materialize - and as a developer, I'm happy for us to take the risk and not push it to marketing by asking for a guarantee, independent of whether we produce a good product or not. My scenario would be to let demand build and have our customers tell us to put TRAX on 11/74 mP and M+_ but we shouldn't plan it, nor do we deserve this guarantee.

GB:swh

FROM: GORDON BELL DATE: MON 29 OCT 1979
1:51 PM EST
DEPT: OOD
EXT: 223-2236
TO: ROGER CADY
cc: LARRY PORTNER
JULIUS MARCUS
ANDY KNOWLES
BILL JOHNSON
JACK MILESKI
SI LYLE
BOB DALEY

SUBJECT: CONGRATULATIONS ON DECIDING TRAX 1.5-- FOLLOW UP:11/9/79

GB0005/35/EMS

Congratulations on deciding on TRAX 1.5. I assume this means: 1. VAX TRAX must follow; 2. VAX TRAX be compatible with 1.5; 3. We market the hell out of TRAX and guarantee its existence for eternity (ala RSTS, 10, 20, M, PDP-8.) Is this the plan?

GB:swh

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Subject: **TRAX Measurements**

To: Ed Fauvre, MK1-2/E06
Ron Ham, ML5-5/B35
Ed Hopey, MK1-2/J05
Bruce Hurwitz, MK1-2/C02

Date: 16 NOV 78
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

follow up 12/5/78

I just saw that Bruce presented data on TRAX measurement to the performance measurement workshop. Could I have a copy? More importantly, I keep getting static from the field on TRAX in terms of its performance and what it is.

TRAX is a very key, important product (selling more than RSTS, I would hope). Getting the field behind it now is essential, and I'll try to help here all I can, but the information has to be available.

The TRAX team is certainly to be congratulated in getting the product into the library last Thursday!

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GB0001/26

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Subject: TRAX

To: Ed Fauvre, MK1-2/E06
Larry Portner, ML12-3/A62

CC: Julius Marcus, MK1-2/C37

Date: 2/20/79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

Our credibility is certainly blown on this one. Julius is conveying his hurts rightfully. This one bothers me because in my gut I knew it wouldn't work and said so. The group got me in and sold me based on some experiments; however, the sickly feeling persisted...mainly because of Hopey, who I really didn't trust. I should have gotten back to you. Things like this will happen, and we'll have to learn, but it seems like right now we might:

1. Announce only after real field test.

2. Have your developers buy performance testing from the right group, rather than having the analyst be a single report into the organization. Bruce Horowitz was (is?) good, but he seemed to be totally under control of the group. Hence, wasn't objective.

3. Have a separate QA that reports through a different function.

4. Limit Hopey's future activities.

The rumour is that TRAX can't be fixed due to an M problem. Can't we fix it?

You're invited to Marketing Committee to educate us.

GB:ljp

June 7, 1984

Hank Tropp
Department of Mathematics
Humboldt State University
Arcata, CA 95521

Dear Hank:

Thanks for the comments and bibliography. Enclosed is the final copy. Given this negative review, I hope you solicit another more positive opinion.

I can assure you that there's nothing personal with Mr. Moreau since I've never met him.

Sincerely,

Gordon Bell
Chief Technical Officer

GB13

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Subject: **TS04**

To: John Kevill, ML1-3/E58

CC: OOD
Mass Storage Pots

Date: 3 NOV 78
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-

I believe the TS04 will turn out to be a good investment. We should note that the recently announced System 38 and 8100's have fixed disks and they use low cost Mag tapes and floppies for interchange, etc.

Ivan Sutherland relates the Xerox Park bad experience where a large system is used for filing and each personal computer has a 10 Mbyte removable disk. Namely, there are multiple copies of software that can't be updated. He says build systems (like Minnow and Nebula that are intended to interface to other computers) with fixed disks.

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Dick Clayton	ML12-2/E71	Jim Cudmore	ML1-5/E30
Bill Demmer	TW/D19	Ulf Fagerquist	MR1-2/E78
Bill Johnson	ML21-3/E87	John Kevill	ML1-3/E58
John Meyer	ML12-1/A11	Larry Portner	ML12-3/A62
Bob Puffer	ML12-2/E38		
Dave Best	TW/A08	John Buckley	MK1-2/K36
Tom Campbell	MR1-1/M74	Steve Coleman	PK3-1/M28
Mike Gutman	ML21-2/E32	Bob Jack	ML1-3/E58
Mike Mensh	MK1-1	Bill Munson	ML5-5/E76
Grant Saviers	CZ	Charlie Spector	ML5-2/M17

Comments on Tsongas Editorial and Speech

The Editorial of March 27, 1982 in the Boston Globe showed more thought and clarity than anyone else from government, with the possible exception of a report on the Japanese trade problem by the Comptroller General several years ago. A letter, commenting and correcting his report is enclosed. Please allow me to add to your position:

. Our high military expenditures versus Japan's give us ZERO productivity for a large segment of the economy; hence the more spending, the lower the productivity. Since the industrial economy pays for the military, how can we have this spending by importing everything?

. Independent of whether military spending is good or bad, it simply takes a large portion of our small engineering workforce out of circulation where we could be building products to compete with Japan, plus raises the demand and causes churning of the workforce. This is why I shudder each time Raytheon or GTE receive military contracts. Arguments that the side-effects of military spending aid the consumer economy are basically hollow.

. Military programs such as the VHSIC program are at most, 25% effective, say versus the Japanese MITI programs, because the recipients such as Westinghouse or Hughes are military body shops that do cost plus work. There is no one to transfer the results to for helping the commercial sector.

. Labor is not the problem in high technology, except that it isn't especially well managed and we have too much overhead and too little technical support. The keys to high technology are the product and how it is made! I suspect this is true of automobiles too.

. The Semiconductor Industry is probably lost forever because it went off shore for low labor cost instead of investing in automatic bonders as did Hitachi, et al so as to be able to keep their work nearby, thereby reducing work in process, having better control and producing more cheaply.

. Management is the key to American Industry whether it be low or high technology. Ken Olsen, our President, sent around an excellent editorial (Kenneth Eskey, 6/4/82) on this, say as compared to the Japanese which I've attached.

. American Managers are very poor when compared with Japanese Managers, whether they be in Government, Industry or Universities! Many factors have caused this situation, including having Business and Managment Schools where there is probably NOT a discipline. The Japanese Managers know every aspect of their business from the electrons up to the people who make products. Invariably, they have come up through the engineering ranks, and many have PhDs. The American Managers are superficial and rarely know the products, how they are designed, or even have a really good understanding of investments and return covering the gamut from research to "cash cow" products. American Managers can't derive or explain the notion of quality or how it relates to productivity! Usually the American Manager demands both without understanding either. The most important thing that could be done here is to eliminate all Business and Management Schools who only teach personnel, politics and how to bullshit a case study!

. Government is now nil and seems to have withdrawn under the Reagan administration. It still requires feeding and, like the military, is zero productivity ($ in, 0 out), but at least it doesn't compete for engineers. As one of the world's largest bureuacracies it is totally consumed arguing with itself.

. Your numbers on R and D spending are missleading because the Military R and D is so miss-directed. In one program, the Military will end up spending several billion dollars for their own computer when ANY commercial one would be better. Furthermore the Russians will use our computers and get the work done earlier, cheaper and better! Thus we lose two ways. (enclosure)

. The problem of not enough engineers is quite serious. While Digital can recruit engineers for product design, I think we need many more so that we have people with engineering training in many parts of the company just like the Japanese. We simply have too many people involved in designing, building, selling and helping the organization who know NOTHING about computers or how to build them.

. On the lack of engineers, make sure we do not cut off our supply of foreign engineers who come here for an undergraduate and graduate education and stay. While there is a real cost to educate engineers who may not stay in the U.S., it seems far cheaper than fixing the basic fabric of the U.S. which supplies people who have the understanding of science and mathematics and who love to create.

. Our primary and secondary education system, are exactly like the Business and Managment Schools. Teachers are trained to operate the education process, rather than to understand the subject matter. The incredibly low quality of the people who enter teaching, especially via the teacher's colleges, is the problem. Learning via computers may be the answer to circumvent the system.

Here are some comments on your speech on Meeting the Japanese Challenge, given on May 21, 1982 to the International Business Center of New England:

. The Japanese companies now HAVE the 256K RAM market. We have these chips from Japan at present.

. I think we have lost a substantial part of the computer market already:

.

NEC is now number 2 in Letter Quality Printers and I saw their first printers come off the line 4 years ago;

.

Japanese manufacturers supply most of the dot matrix printers;

.

Video components and video display units are now on the threshold of taking over in the U.S. They have the dominant technogy;

.

70% of the memories, as you point out, are Japanese;

.

The basic, lower level technologies (magnetics, optics, ceramic materials, video, silicon) are disappearing, given that we have lost the consumer market drive.

.

the large mainframe business is now totally IBM architecture based, with Fujitsu and Hitachi increasing their shipments into the U.S. base THROUGH U.S. MARKETING COMPANIES! (The same is true in the U.K., Germany, Australia, etc.);

.

robotics; we had a lead, but have given much of this up. They are effectively coupled into our research programs at MIT and CMU.

. We all believe reciprocity is distasteful! Japan got to it's current status by managing reciprocity and flow of technology to Japan! I believe we'll end up here in several more years of industrial decay.

. Something is wrong with our measures if you believe that our per capita productivity is greater! RECHECK!

. Comments on your proposals to meet the challenge:

Labor/management cooperation of all kinds might help a few percent. Greater ownership might get labor to more savings and hence a gut reason to "buy American".

2

I completely agree with you that far more is needed in research. This is a misunderstood and poorly managed segment of industry. In trying to stimulate R&D so far, the effects to date have been mostly negative because Venture Capital firms have started up Low Risk, mundane companies who offer nothing to society. (There are a couple exceptions, but not many; mostly this money simply churns the engineering workforce.) The Fifth Generation Research project of Japan, if successful, will give them an even bigger edge.

3

Agreed. We have a major engineering workforce problem. It is mandatory to get the universities to change too as they are forcing talented engineering professors into industry with their tenure policies, teaching loads and inability to allocate resources on the basis of demand and need!

4

Fortunately we don't get argue with the government much. A recent Federal Standard on I/O Equipment was designed to help the Japanese while penalyzing various U.S. vendors such as Honeywell, Burroughs, and Univac. The net effect of this standard will be very bad.

5

Agreed. More is needed to encourage investment. The problem I have is what would you recommend to an investor? U.S. Steel, GM, Kodak, Honeywell or Mitsubishi, Honda, Canon, NEC, Fujitsu, Sony?

6

Yes, expand exports. We're barely in Japan and it's been a struggle to get anywhere. To really make it there we have to give up control and get a Japanese partner who we know may take our products and ultimately incorporate the ideas into their products. The leader of the design of the high performance NEC machine has been in their Lexington sales office for the last three years. Our

Japanese office is headed by a marketing person with
minimal technical training.

Gordon Bell
8 June 1982
****
* d i g i t a l *
****

TO: GRANT SAVIERS DATE: THU 9 OCT 1980
9:08 PM EDT

FROM: GORDON BELL
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: RE: TU58

Bad products cost money to sell. We don't have a large number
of salesmen to waste here, so let's get rid of it. We do need
to talk cause I don't understand why it isn't obvious we
don't get rid of it. Have you looked at the inventory lately?
If we force the product lines and salesmen they can obviously
sell it to someone. But why? Let's just use it internally and
not propogate it on the world.
g

GB1.S7.44

GB1.S5.67

Rather than spending our precious sales efforts trying to
sell TU58's at high sales costs and requiring us to remain in
the business for a long time, thereby increasing the product
array, it has been recommended we remove it from the market!
Since only ASG and Micros sell them (unsuccessfully) this
should be easy to do, given that there are 9,000 in
inventory. Here, we can put them into future products

(11/44, COMET, NEBULA, etc.).

Could you please look at this plan in conjunction with the user P/L's? Also, could you look at how we're doing versus the business plan?

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i n t e r o f f i c e   m e m o r a n d u m

Subject: **TU59 Spec.**

To: John Kevill, ML3-6/E94

CC: Carl Blatchley, ML1-3/E58
Bob Jack, ML1-3/E58
Mike Leis, ML1-3/E63
Lloyd Powell, ML3-6/E94

Date: 24 JAN 79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

follow up 2/7/79

I'm worried that the CCD attachment is proposed <u>before</u> we understand the performance very well.

Are we at phase 0 yet with a breadboard?

Why is the project so expensive?

How does this project cost compare with TU58 (before and after)?

GB:ljp

ID#15/DOCNO8

D I G I T A L   INTEROFFICE MEMORANDUM

DIST: Carl Blatchley ML1-3/E58 Bob Jack ML1-3/E58
John Kevill ML3-6/E94 Mike Leis ML1-3/E63
Lloyd Powell ML3-6/E94

+---------------+   ID#: 0148
| d i g i t a l | **I N T E R O F F I C E M E M O**
+---------------+

SUBJ: Initial frustrations on the reliability and engineering of the typesetting (8000-type) and word processing interface

TO: Heidi Baldus, Ed Fauvre, Jack Gilmore, Bill Keating, Marcie Kenah, Bob Lane, Del Lippert, Larry Portner, Jack Shields

Date: 5 JULY 78
From: Gordon Bell
Dept: Office of Development
MS: ML12/A51 Ext: 2236

Although I'm really happy with the WT/78 (especially when we get a more cost effective solution to the communications among systems problem), I am frustrated by the interface between the Typeset 8000 and the word processing system. I would think we would have a unique and very large market in being able to offer both typesetting and word processing for in-house publications and for the publishing of manuscripts. Although we have a large book that would tax most systems, I don't think the demands are out of line compared with a reasonable system.

Six years ago we published a book that was completely typeset, laid out, indexed, and table of contents cross-referenced using a PDP-10 at Carnegie-Mellon. It was a joy to use, and we made changes right up to the last minute. By contrast, our internal systems don't have any of these capabilities and the human interface is abominable, plus many principles of good design are violated. For example, in order to get the many character codes that the word processor doesn't know that the typesetting system needs (like mu), one has to type an escape sequence of 5 characters which get printed...almost destroying any readability for the document. The coding isn't compatible with the printer codes that are used intermediately with the typeset 8000. There are many intermediate files in the whole process that are generated sequentially, so that when an error is corrected late in the production, it is down stream and not reflected in earlier files...which then become obsolete.

Last night I had to write a program to build an index because none exist. Ironically, in using the BASIC manual I spent five minutes searching because there was a poor index. It is inconceivable that a company which has so many writers, wouldn't have an indexing program. (I would have thought the writers would have written one.) Given the program, on the 10, there's no way to get the information back into the word processing or typesetting system. (Since the program's in BASIC, it doesn't have the right character set either).

The reliability of the 8000 in Tech. Doc. sure has been bad, and that also influences my attitude because it is necessary to have, given all the steps in the process. Are we selling those large systems without having better systems
diagnostics?

Somehow we have the potential of having a really great system. How can we turn it into one instead of a collection of components that some dedicated people have to suffer with to make compatible and move data at great pain?

GB:ljp

D I G I T A L   INTEROFFICE MEMORANDUM

DIST:	Heidi Baldus	BY	Ed Fauvre	MK2/C36
	Jack Gilmore	MK	Bill Keating	ML12-3/A62
	Marcie Kenah	BY	Bob Lane	MK
	Del Lippert	BU	Larry Portner	ML12-3/A62
	Jack Shields	PK3-2/A58		

September 13, 1982

Dr. Andy Herbert
Dr. Andy Hopper
Computer Laboratory
University of Cambridge
Corn Exchange Street
Cambridge CB2 3QG
ENGLAND

Dear Andy and Andy:

I thoroughly enjoyed the visit to Cambridge, seeing CAP, the Ring Computer, its distributed switch, the gate array design system and learning about the next high speed switch. It was interesting to see that a single computing system could be implemented reliably with such a large number of diverse computers and such a relatively slow switch. I understand the need for the bridge to increase the bandwidth. I'm interested in the new 100 Mbit switch because we have a need for a high speed, low latency switch. As you get results on it, please keep us informed. The CAD work based on MODULA extensions seemed very nice and again, we'd appreciate hearing more about it as results become available. In particular, when your staff is in the vicinity, we'd like to have them visit and give a seminar.

I so regret that we hadn't more time to discuss the fast ring and Mayflower. I'm delighted that Cambridge is getting interested in parallel computing. If you have a research plan on this, I'd enjoy reading it and commenting on it if you'd like, because we need fundamental work in this area. Also, I'd like to read books or papers on the current computer.

Thanks for the hospitality. I hope we (Cambridge, DEC and myself) can have more interaction.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

cc: Professor Roger Needbaum
Dr. Maurice Wilkes
Dieter Huttenberger
Dick Davies

GB3:S7.19

June 4, 1982

Peter W. McFadden
Dean of Engineering
University of Connecticut
Storrs, Connecticut 06268

Dear Dean McFadden:

I certainly understand and appreciate the dilemma and need for computer science and engineering faculty. Basically I'm sympathetic and would like to recommend to our Corporate Contribution Committee that they contribute to your university.

While I certainly support this, I'm very concerned with the behavior and policies of universities, including yours, that discourages computer science and engineering faculty and teaching. We have hired faculty members <u>after</u> they have made a decision to leave academia because of: high teaching loads; poor resource allocation in line with need, market and external income; tenure bias against experimental work in favor of theory; and general miss-treatment as compared with other professions (eg. law, medicine), self-proclaimed professions (eg. business), the established sciences (eg. chemistry, physics) and even dried-up parts of traditional engineering.

I have forwarded your request to George Chamberlain, our Treasurer, who heads the Corporate Contribution Committee in hopes that we can help.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:mal
GB3.S5.15

cc George Chamberlain
    Bob Glorioso
    Sam Fuller
    Dieter Huttenberger

<u>Customer Segment Letter</u> - <u>Sample Only</u>

Professor Peter Warter
Head, Department of Electrical Engineering

University of Delaware
Newark, Delaware 19711

Dear Pete,

I was glad to talk with you again in regard to the possibility of getting DEC computers for the University. The situation there with a large, but relatively ineffective, central computer and several distributed minis (including the two you have running UNIX, and the Series 1's) presents an interesting challenge. The dilemma now is whether to distribute completely, getting rid of the high rental burden or whether to switch to us and/or to IBM. Furthermore, you believe that the bulk of our subsequent development will be in the VAX and 11 areas, hence you are reluctant to be stuck with another non-IBM mainframe in the 10/20 that lacks the critical mass to survive into the 1990's.

First off, we are committed to supplying high end 10 and 20 system hardware and we are spending a great deal maintaining and evolving these systems. I should also point out that there are more 10's/20's than any of the other so called mainframe suppliers (Burroughs, CDC, Honeywell, Univac) and since there is a larger number of terminals and user base, we believe the invested software base is quite large.

My recommendation is simple:

1. Flush the large machine you have, its a drain and the software is pretty unimpressive for anything but the targetted commercial enivironment that it has led its sheltered life in.

2. Establish a network interconnection machine (something like the 11/34) so that the numerous machines you have and that I am recommending can be used in the most cost-effective configurations.

3. Start with a 2040 to handle the bulk of the esoteric languages and general purpose load. Alternatively, if this load turns out to be small, then several 2020's might be a better solution. (For example, give the CS Department

their own and let them run it...it'll teach them about real computers.)

4. Buy as many VAXs as the budget will allow, although I believe that two will give you much more computing than you have now with the central computer. Furthermore, this will save money. One would be used for the administrative part, running Cobol. The other one would be for general computing.

At any rate, these are the comments you asked for. They are clearly biassed, but I think they are right.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:ljp
GB0001/14

Brian Randall believes they have a fundamental idea or mechanism that can be implemented on any operating system that will allow the simplified construction of secure and/or highly reliable distributed systems. He claims the idea is very simple, say like paging, yet so far has not been discovered. It can be described in only a few sentences to someone who's been working in this area. It has been implemented on their Unix based distributed system in a short time and the resultant systems indeed do work as advertised. It doesn't require Unix.

They would like to offer it to us, on a non-disclosure basis. It has been disclosed to several companies. The National Research Development Corporation technically owns the rights, but Brian thinks they will revert to the university. They want the idea exploited. Their interests are therefore: 1. we would have an intellectual connection of co-operation with them; and 2. we would support the university financially.

I have a simple one page write-up urging us to go look. He says come ahead, but bring your non-disclosure. Could you guys get together and see who should go look and then contact Brian about a visit?

PS.
Brian just called and stated that he talked with Peter Lee, just arrived from Newcastle and working on Distributed Software, and found that it would be very advantageous to use their technique in building our new system.

May 3, 1982

Dr. Herb Woodson and Dean Gloyna
College of Engineering
Cockrell Hall 10.310
University of Texas at Austin
Austin, TX 78712

Dear Herb and Dean Gloyna:

I just visited Austin again for an architecture conference and heard of your efforts to make the school of engineering a professional school. By implication, engineers would then be professionals along with doctors, lawyers and business-persons(?)

If you could accomplish this important recognition, it might help to address the salary imbalance in universities and gain the popular recognition that would attract more people to the profession. The reason for all this is to improve the quantity and quality of our scientific and engineering talent so that we can effectively compete in the world marketplace. Our international competitors apear to be well ahead in both raw brain power and in pure numbers. We have to address this.

While this movement may be a little like the equal rights amendment, it would seem that Texas has a real opportunity to lead and I, therefore, applaud and support your effort. Let me know how I can help.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:mal
GB3.S4.9

June 4, 1979

Mr. Robert W. Ritchie
University of Washington
Department of Computer Science, FR-35
Seattle, Washington 98195

Dear Bob:

It was good to get your letter of May 10th. But first, let me congratulate you on what is appearing to be a first class Pascal.

I have forwarded your letter to Jerry Witmore, who heads the Education Products Group. However, it wasn't clear to me just what you had in mind with respect to getting our help.

The high quality printer is of concern to me and I'd be anxious to hear of work you are doing there. This interaction would be directly with Bob Glorioso who handles our Advanced Development of terminals and small systems, or it could be with Art Williams, head of Printer Development. We would, no doubt, be willing to discuss our direction and timing when you visit here next. This should be under the non-disclosure arrangement.

Again, I hope we can continue to work together.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:swh
GB0003/38

cc: Jerry Witmore
Bob Glorioso
Art Williams

April 20, 1979

Dr. Murray A. Thompson
Director, Physical Sciences Laboratory
University of Wisconsin-Madison
3725 Schneider Drive, Route 4
Stoughton, Wisconsin, 53589

Dear Murray,

Having received your letter summarizing our decision to stop the funding of PSL1, let me make some comments about the decision.
The PSL1 was completely successful as an advanced development program in that it led to a development program which we believe will be a successful product. I believe I can truthfully say that until your project was started there was little or no interest in building smaller VAX systems. Several ideas generated in your program have been used in our work and PSL1 was used as the benchmark for the cost and performance. Unfortunately, research and advanced development programs only lead to development, and successful ones, by definition, generally mean termination.

It is essential that we terminate the program in a professional manner. I hope that we can have a briefing here which presents the results of the work to date. We believe it is not useful to continue building the hardware, but the microcode should be simulated in order to verify that the cache works as predicted.

We would like to encourage you to publish this work within the next year, and if possible, concurrent with our product announcement. You may have access to our product data for your publication. Hopefully you and Bill might write something up jointly.

It is important that the team regard their work as completely successful, even though the physical machine is not being built.

Sincerely,

Gordon Bell
Vice President,
Engineering

CC: Bill Demmer, John Mucci, Ken Olsen, Bill Strecker
GB:swh
GB0002/9

GB0001/4

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i n t e r o f f i c e   m e m o r a n d u m

Subject: **University of Wisconsin**

To: John Mucci, MR2-4/M38

CC: Bill Demmer, TW/D19
John Leng, MR1-1/A65
Joel Schwartz, MR2-4/M51

Date: 30 JAN 79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

Bill Strecker, TW/A08

follow up 2/9/79

As we have been discussing for two months, we have to decide whether to stop or continue in our relationship with the University of Wisconsin. It is grossly unfair to them and it will ultimately damage our reputation -- especially as we prolong an unfavorable decision.

The responsibility is yours. When are you going to exercise it?

We'll help, but you must lead now.

GB:ljp

****
* d i g i t a l *
****

TO: BRIAN RANDELL @FORN
12:39 PM EDT

DATE: MON 15 SEP 1980

FROM: GORDON BELL
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: YOUR LETTER OF 28 AUG. 80

SEND TO:

BRIAN RANDELL
THE UNIVERSITY OF NEWCASTLE UPON TYNE
COMPUTING LABORATORY
CLAREMONT TOWER CLAREMONT ROAD
NEWCASTLE UPON TYNE NE1 7RU

ENGLAND

September 15, 1980

Dear Brian,

Things got changed around due to commitments in Maynard.

Will Monday, December 1 be okay?

Gwen and I would plan to fly to Newcastle on Sunday and would be
delighted to stay at your house. We are scheduled to leave on Monday,
at 5 PM.

Any ideas of where to hunt for calculators and automata in London?

Looking forward to seeing you.

Gordon

GB1.S6.38

For your information, our TWX Code is MMC2.

-- TWX/TELEX NUMBERS --

BRIAN RANDELL @FORN
UNIVERSITY OF NEWCASTLE

EMS 2-MAR-79

14:24:58 340 1
To: William Strecker, Bill Demmer

CC: Mary Jane Forbes
From: Gordon Bell
Date: FRI 2-MAR-79 14:24:58 EDT
Subject: Treating Wisconsin in a Human way

MJ: Pls send copy to John Leng, Joel Schwartz, John Mucci and Bill McBride.

Also send a copy to the Madison or Milwaukee office handling the account.

We have treated this customer absolutely shabbily. The deal was most likely
to be shut off in December, pending a review.   I got a letter of his dated
2/23 where he still has no hint that we might possibly want to stop it.

John Mucci has been handling this part of the interface and we can't go on!
Engineering is not going to put any more into the project unless you believe
now that we should.

I fail to understand why an organization such as LDP is totally incapable of
making a decision and getting a job done.

Unless you hear from John and LDP within a week, plese call Murray at
Wisconsin and tell him that we aren't going to continue support from an
engineering viewpoint, and you don't know about LDP. It isn't fair to treat
customers (in this case a future former one, no doubt) like do-dos.

Don't let us continue to go on in this destructive fashion.

Command:

EMS 12-JAN-79
10:17:02 090 1
To: William Strecker
From: Gordon Bell
Date: FRI 12-JAN-79 10:17:02 EDT
Subject: MURRAY THOMPSON

ALSO TO: JOHN MUCCI

You guys have to push Murray for a review. Given that you want to turn him off, we must do it NOW!

Could we get him to build a Nebula copy and work on microprogramming it and systems issues?

Command:

GB4.S1.23

On occasion some of you may have dealings with citizens of the People's Republic of China (PRC) or East Bloc countries (USSR, Poland, Romania, etc.). I want to advise and caution all of you that your dealings with such people may be subject to requirements under the U.S. Export Laws.

Those laws require the company to get an export license from the U.S. Department of Commerce before any technical data, as defined below, is furnished to a citizen of the above-mentioned countries. A license is required not only if the technical data were actually being sent to the East Bloc or PRC, but also if it is provided here in the United States to a citizen of the PRC or an East Bloc country.

Technical data is defined under the law as "information of any kind that can be used, or adapted for use, in the design, production, manufacture, utilization, or reconstruction of articles or materials. The data may take a tangible form, such as a model, prototype, blueprint, or an operating manual; or they may take an intangible form such as technical service." In addition to the obvious forms of technical data - engineering diagrams, process designs, etc. - this definition includes software and seminars, university lectures, training courses, plant tours and meetings at which technical data may be disclosed.

I am cautioning you about this at this time because the Reagan Administration in its concern for national security is putting an increased emphasis on the improper export of such technical data. A violation of these laws could result in harsh consequences for Digital and for any individuals involved.

In the event you wish to engage in an information exchange with a citizen of the PRC or an East Bloc country, or if you want advice on what is technical data, you should contact Tom Moran of our Export Services Group well in advance of the intended exchange, DTN 223-3102. Bob Steinbach in the Law Department is also available if you have questions, DTN 223-5523. In addition, you should contact GIA before having any discussions with PRC people because our marketing strategies for that country are still evolving.

Attached to this memo is a somewhat lengthier memo which more specifically spells out requirements which you, as an engineer at Digital, have under the U.S. Export Laws regarding the handling and communication of technical data. Please be sure to distribute this memo to your staff.

RMS:ejl.9
Attachment

ATTACHMENT

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TO: All Engineers

DATE: 1 JAN 1983
FROM: Tom Moran
DEPT: Export
Services
EXT: 223-3102
LOC/MAIL STOP: PKO3-
1/K77

SUBJECT: U.S. GOVERNMENT REGULATIONS ON RELEASE OF
TECHNICAL
DATA

The U.S. Government regulates the export and reexport of
U.S.
goods and technology. Since Digital Equipment Corporation
is a
U.S. based company, most Digital products, including
technical
data, software, quotes, specifications, training and
service are
subject to these regulations. The Export Services Group is
the
sole Digital interface in all export licensing matters with
the
U.S. Department of Commerce, which maintains jurisdiction
for
most exports.

The U.S. government needs the cooperation of all high
technology
companies in its efforts to limit the unauthorized flow of
equipment and technology. It is in the interest of Digital
to
ensure that our business activities are carried out within
the
law and thus to minimize the possibility of being saddled

with time-consuming and costly investigations, to say nothing of running the risk of lawsuits, fines, possible loss of the ability to export, and even imprisonment.

The Reagan administration is sensitive to the fact that the uncontrolled disclosure of such technical data to "restricted countries" (Warsaw Pact and People's Republic of China) can put our country at a military disadvantage. The Administration has recently taken a number of steps to limit such illegal activities, for example:

- The U.S. Customs Service has fielded some 200 additional inspectors in an effort, called "Operation Exodus", to monitor U.S. exports more closely.

- The U.S. Department of Commerce is strengthening its compliance activities by placing a Deputy Assistant Secretary in charge, adding personnel in Washington, D.C., and establishing two new branch compliance offices, one in San Francisco and the other in Los

Angeles.

- The FBI and CIA have increased their efforts to monitor the activities of nationals of unauthorized countries in the United States and to detect and prevent the clandestine acquisition or diversion of sensitive U.S. goods and technology.

- The U.S. State Department and other agencies of the U.S. Government are seeking to strengthen and enlarge the activities of COCOM, the international body coordinating the strategic control efforts of the NATO countries and Japan.

- The U.S. Department of Defense is concluding a massive effort to identify equipment and technologies in the civil sector which they deem to be militarily critical and, along with other U.S. government agencies, is using this information to evaluate export license applications.

The engineering community of Digital can be of assistance by making certain that all engineering personnel - whether they live abroad, travel abroad, transmit information abroad, or merely come in contact with foreign nationals visiting the United States - fully understand that the U.S. Government restricts the flow of technical data and know-how, whether it be written, oral or visual.

The U.S. technical data regulations are complex but, briefly stated, technical data is classified into two basic categories; restricted technical data and data generally available to the public. Under these regulations technical data that is generally available to the public in the United States can be exported or released freely abroad. "Generally available" means data released orally or visually at open conferences, lectures, or trade shows, and publications which are available at libraries open to the public or available without restriction by subscription or other means.

Other technical data requires either a validated export license (for "restricted countries" and their nationals) or a written assurance from the recipient stipulating that neither the U.S. technical data nor the direct product thereof will be shipped directly or indirectly to "unauthorized" destinations without first having received written authorization from the U.S. Department of Commerce. Such a written agreement allows U.S. firms to conduct commercial business in countries other than the "unauthorized" ones, including training people, transferring software and controlled technology, etc. This applies to foreign nationals from these countries who are covered by such a written agreement with a U.S. employer.

This does not apply to nationals from "restricted countries" who may only be shown commercial equipment and facilities which are freely and generally accessible in the United States. Only published and freely available commercial information may be disclosed - neither proprietary or not generally available.

If you have questions about whether certain information is technical data, whether it is generally available and whether a license is required, you should call Tom Moran of the Export Services Group at DTN 223-3102.

The Training & Education Department of Export Services Group provides a presentation on:

The U.S. Export Laws and Their Influences on Digital Business

Presentation topics include:

o Overview of U.S. export controls
o Types of licenses used to export DEC products
o Responsibilities for compliance with export laws
o The Export Hold

Each presentation offers attendees the opportunity to ask questions and discuss specific issues.

Since forty percent of Digital's business is international, knowledge of the export laws and the means for legal compliance are vital to many groups.

Please contact Export Services (DTN 223-3113) if you would like to arrange for a presentation for your group or attend one of the scheduled presentations.

March 11, 1980

Dr. Robert Morris
Mathematics Department
The Commonwealth of Massachusetts
University of Massachusetts - Boston
Harbor Campus
Boston, Massachusetts 02125

Dear Dr. Morris:

I've been trying to find a way to assist in the evaluation of your proposal as suggested in your February 12 letter.

Although I can't be a member of the evaluation team, Dr. Ronald Brender has volunteered and I suggest you contact him directly.

As a member of the AMS TEX group, I'm sure there may be some arrangement we might make to work together. Rick Friday is in charge of TEX here.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:swh
GB1.S2.47

CC: Ronald Brender, DEC
     Rick Friday, DEC
     Andy Knowles, DEC

****
* d i g i t a l *
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TO: BERNIE LACROUTE DATE: SAT 20 JUN 1981
13:12 EST
DAVE RODGERS FROM: GORDON BELL
BOB SAVELL DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: UNA IN A REASONABLE TIME

Want to get the list and then review. These come to mind:
The current one used in the demo, backed up by a DMR NIFE
based one...
has an unblemished record of no output. Switching to 1 Mhz
until we
get chips... blows it as a very good Ethernet standard with
Xerox, Intel MULTIBUS BOARD VESION, and build converters to
Unibus and Qbus
Start from scratch... hits market at same time as chips
(really don't
see this). Let the outside market supply the boards...if a
source. Use the Multibus or a Xerox design. Go to Japan to
someone like Fujitsu to get it fast Just wait, but use an
interim to do the software. (This would essentially give up
on NI as a std.)

It is really discouraging to find that we have nothing
compared
to Xerox and Intel. What is being done to improve our design
capability here?

Can we get the complete list of possiblities via EMS, then
get the first looks at the ones we think might have gold as
to feasibility? and then meet to brainstorm?

Something around the Multibus looks most promising as of this
second. Am meeting with Intel folks this week re other
topics, so would like to know how much to enquire or push?

Clearly, we should minimize our development resources as this
is interim. I would really like to see a measure within this

hardware
group as to quality, and productivity (which, aside from the Pluto design is virtually zero as far as I can see.) Here, at some time, I'd sure like to meet with the engineers to discuss the importance of getting a product.

WPS USERS - Leave HP mode and type <CR>

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Subject: **Unbundling Diagnostics**

To: Andy Knowles, ML10-2/A52

CC: Marketing Committee
OOD

Date: 15 NOV 78
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

With the National suit and all the plug compatibles coming on stronger, it would probably be worth while to make it clear and get a policy that we are only selling operating systems for hardware we sell. This would mean that we would charge for handlers and diagnostics, and also we might reserve the right to not sell them. I don't understand the legality of this, but we might include this software in the hardware cost so it is clear that we won't sell them separately.

As a separate isssue, we can probably build hardware that is more secure to DEC made peripherals. (This will be a by-product of some of the security work.) This would allow us to enforce the separate component sales.

Given that the government is successful at getting an IO Channel or Device standard, it is clear that the plug-compatible people must pay for some of the expenses of the system. Charging back where the costs are incurred would be a good start.

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Dick Clayton	ML12-2/E71	Jim Cudmore	ML1-5/E30
Bill Demmer	TW/D19	Ulf Fagerquist	MR1-2/E78
Win Hindle	ML10-2/A53	Bill Johnson	ML21-3/E87
Ted Johnson	PK3-2/A55	John Kevill	ML1-3/E58
Andy Knowles	ML10-2/A52	John Meyer	ML12-1/A11
Stan Olsen	MK1-2/A57	Larry Portner	ML12-3/A62
Bob Puffer	ML12-2/E38	Bill Thompson	ML12-1/F41

Digital **Interoffice Memo**

Subject: **Understanding the "Total DEC (and other)" Marketplace**

To: Marketing Committee
Bruce Delagi
Jerry Todd

Date: 30 NOV 76
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

CC: OOD, Ken Olsen

F/U 12/14

I'm writing some essays on computer structures. One part has four essays on overview, technology, organization, and marketplace. The essay I'm writing now is on the marketplace (especially segmentation schemes).

This section is on the distribution channel. Four figures (attached) might be of use to help specify the structure of the marketplace, and then begin to get measurements on the product flow. I feel we must ultimately understand this flow and the associated implicit model to use as an investment strategy.

The figures are:

1. Basic pieces of hardware taking on entirely different machine characteristics by various operating systems. One or more applications are added to match the ultimate single or multiple use in an organization.

2. At each level-of-integration and also for application & installation/train and service (including applications) DEC, a 3rd
3. party, or the ultimate user can be the supplier. Also multiple 3rd parties can participate. To really track, understand we must know something about the channel...i.e., what is ultimate use?

4. Shows data (hypothetical) for what the various groups do/supply. This particular data and the consequential understanding might be the basis of our market investment strategy. The particular plot should be done for: size
product lines

5. Shows market size (availability) with level-of-integration.

Overall, shouldn't we try to get a more proprietary position with a basic applications library such that we, franchise as OEMs or end users can get to the applications quicker?

GB:ljp

Attachments

MESSAGE

THE TRUE MINI.

MARKET

IMPLEMENTED (AT SYSTEMS LEVEL) OVER $10K - $250K.

Hardware/Software focussed to applications and providing the best cost/performance solution.

Also used as a "Limited solution" general purpose computer.

BASIC HARDWARE

Get to much stronger, long term hardware position.

. more memory in mid-range (11/44)

. commercial image with CIS (11/44 - 11/68)

. no pallatives to confuse field, add parts, training and support. (11/74, 11/74mP)

BASIC OPERATING SYSTEMS

Cap MUMPS, IAS, RT multi-user.

Provide user level RSTS

enhancements or get compatibility on another system.

Use: M for real time and communications

M+ for general purpose

SCS for general purpose commercial

RSTS? for general purpose commercial and technical timesharing.
(Accept continued development or plan replacement; plan migration to VAX for GP users.)

+---------------+ ID#0170
! d i g i t a l ! i n t e r o f f i c e m e m o r a n d u m
+---------------+

Subject: **The Unibus as the Standard Mini I/O**

To: Bill Johnson, Ken Sills

CC: Dick Clayton, Andy Knowles, Carl Noelcke, Don Vonada

Date: 12 JULY 78
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

follow up 7/26/78

Andy will sponsor the Unibus I/O effort and push the strategy.

· Write a letter for him to make the proposal. He'll get PPG to promote.

· Get some of our academic friends plus customers to get on the committee.
--> Alice Parker, CMU
--> ? NSA or CIA
(ask Sam for a recommendation)

· Get someone on the higher level ANSII I/O committee now, so we can push back if necessary.

· Get the issues of non-compliance addressed. (Vonada)

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST: Bill Johnson ML21-3/E87 Ken Sills ML1-3/E58

Dick Clayton ML12-2/E71 Andy Knowles MR2-2/A52

Carl Noelcke ML3-3/H14 Don Vonada ML3-3/E67

August 29, 1980

Mary E. Payer
1766 Willard St. N.W.
Washington, DC 20009

John A. Alic - Project
Office of Technology Assessment
United States Congress
Washington, DC 20510

Dear Ms. Payer and Mr. Alic:

Bill Keating said this might be useful to you.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:swh

GB1.S6.24

GB0002/36

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Subject: **MIT'S VIDEODISK WORK!**

To: Mike Riggle, ML1-3/E58

Date: April 23, 1979

CC: Bob Glorioso, ML3-2/E41
Ken King, ML3-2/E41
Stan Olsen, MK1-2/C36
Bill Zimmer, ML3-2/E41

From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

Given our work on the videodisk, let's take advantage of MIT's work. Professor Negroponte, of the MIT Architecture Department, is doing a great deal of work interfacing the Magnavox videodisk (they have 3). It would be worth getting their people and ideas into our work. (We could probably get them as consultants if need be - if they have any capabilities or students).

Ken, Bill, or Bob can you set up the liason for Mike?

GB:swh

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Bob Glorioso	ML3-2/E41	Ken King	ML3-2/E41
Stan Olsen	MK1-2/C36	Mike Riggle	ML1-3/E58
Bill Zimmer	ML3-2/E41		

May 17, 1979

Ugo Montanari, Professor of Computer Science
Universita' di Pisa
Corso Italia, 40 - 56100 PISA
Italy

Dear Prof. Montanari:

Gordon Bell is away from the office until June 4. However, in discussing your request with Jim Bell, Manager of Research and Development, he suggested you talk with Earl vanHorn. Earl will be attending the same workshop in Albany as you and will look you up.

It would be helpful if you could let Earl know what is happening technically and exactly what your interest is.

As engineering is holding a 4 day meeting (May 29 - June 1) and many engineering managers will be away, it is especially important and time saving for you to talk with Earl while you both are in Albany.

We hope you enjoy your visit to the states.

Sincerely,

Mary Jane Forbes
Secretary to Gordon Bell

GB:swh
GB0003/28

cc: Gordon Bell
Earl vanHorn

Prof. Montanari
c/o Professor Herbert Freeman
Electrical and Systems Engineering Dept.
Rensselaer Polytechnic Institute
Troy, N.Y. 12181

August 29, 1980

Roger Reynolds
University of California, San Diego
Department of Music B-026
La Jolla, CA 92093

Dear Roger:

Thank you for your request for funding the 11/55 front end computer for Real Time Computer Music Research at CME. I'm really impressed that you and Dick Moore have made so much progress with the VAX.

There are three methods we might have of funding the proposal, and I have sent your letter and proposal to each of them. They are:

1. A corporate contribution - George Chamberlain our treasurer, has this responsibility.

2. A product line contribution - Joel Schwartz, head of the Laboratory Data Products Group has this responsibility.

3. A joint DEC-UC/SO research proposed - Dick Eckhouse of our Corporate Research group has this responsibility. This requires that someone inside DEC jointly sponsor and monitor the work.

I hope your salesperson, Les Conklin, will help sponsor this work. Meanwhile, I'll collect their inputs and reply to you as soon as possible.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:swh
GB1.S6.26

CC: George Chamberlain
Les Conklin
Dick Eckhouse
Joel Schwartz

August 29, 1980

Arthur Luehrmann
University of California

Lawrence Hall of Science
Berkeley, CA 94720

Dear Arthur:

Thanks for your letter and materials sent in July. We've put you on the Museum mailing list and do hope you'll be able to see it some day.

Our concentration at the Museum and Digital Press has been directed to the existing market--the computer buff's bag - not an expanding market.

Intuitively I feel that the major breakthrough on computer literacy will be "subversive" via word-processing and not directly via learning programming. Users of word processing systems begin programming without knowing what they are engaging in such a mystical skill. I am in fact more optimistic than you about computer literacy approached in this way.

Thanks for letting us see your proposal.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:swh
GB1.S6.25
June 30, 1980

Professor Maurice Wilkes
University of Cambridge
Head of Computer Lab.

Corn Exchange Street
Cambridge CB2 3QG
ENGLAND

Dear Maurice,

I am glad we could get together on Friday and discuss various issues surrounding your coming to DEC. Anxiously await being able to interact with you on all the problems we have about future directions and research. I have asked Dave Rodgers to forward the Ethernet Specification to you and Bob Swarz to send the floating point information.

Enclosed is a copy of a Consumer Reports Magazine which gives information on automobiles in the U.S. Personally, I am not fond of the Chrysler products because of their designs and service. The GM small cars that are now emerging (the so called X-Car design) really don't suit me because they feel always on the verge of being out of control due to size and stiffness of steering. If you really want to become American, then these or something much bigger is the way to do it. You also might look at the American designed Fords.

We have a Ford Fiesta which we really like, but it is not clear whether Ford is going to continue it. If they don't, replacing it by a new American design, then the price may go down to unload the Fiestas. But on the other hand, the service may not be as good. Given the quality, however, I may get a second one if this happens, just to get rid of the big Dodge we have that no one here likes. The Fiesta is made in Germany and is like the VW Rabbit. I heartily recommend these. The thing about the VW or the Fiesta is that they are front wheel drives and with Radial tires, one doesn't need snow tires. Similarly, the Honda and Toyota are well engineered and a pleasure to drive.

Gwen's suggestion to get a small, good controlled German or Japanese car to drive plus a used, very cheap, old gas guzzler so as to blend in with the natives sounds like a good idea, that is assuming you will need a second car. Spending time on this is a typical American sport which you'll have to play. Over the past few years it has become increasingly difficult to buy these cars by phone, which is the way I like to play it.

Hope this has been helpful.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:swh
GB1.S5.14

Enclosure - Consumer Report Magazine
May 26, 1981

Dr. R. N. Kavanagh
University of Saskatchewan
Academic Computing Services
65 Arts Building
Saskatoon, Saskatchewan S7N 0W0
CANADA

Dear Dr. Kavanagh:

Thanks for the thoughtful letter on how we might provide a personal UNIX. I have distributed it to various persons here.

We are working on systems in this area and I would like to get other requests from you. Our biggest impediment is not having a micro with I and D space right now. How severe is this limitation? Also, what do you see as the secondary memory requirements? What priorities at the CRT? How many systems in the net? What functions do they perform? How does it link to your other systems? Pete Conklin is coordinating these inputs and he may also contact you.

I do hope we can help you and provide these systems in the future.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:swh
GB2.S6.18

CC: Peter Conklin
Bob Gates
Avram Miller

April 27, 1981

Dr. J. C. Browne
Professor, Department of Computer Sciences
T. S. Painter 3.28
The University of Texas
College of Natural Sciences
Austin, TX 78712

Dear Jim:

Thanks for the reports on TRAC and the proposal to continue now and evaluate TRAC. While I have not read the proposal carefully, I do believe that the work should be continued so as to get the understanding that comes with use of a new system. That is, it is not satisfactory to just build a machine; understanding comes from use!

In many respects, I hate to comment on Jack Lipovksi's promotion to full professor. When I was there, I asked Herb Woodson if my comments were too late, or needed and he stated that the promotion had been stalled on a simple administrative problem (which he explained, but I've since forgotten).

Overall, I believe Jack should be offered a full professorship. Furthermore, I believe he will be more effective at a university than in either industry or government, whether the task be development or research. This approval is given with some hesitancy though, because while he has progressed intellectually, I still detect that he has trouble in working with his peers.

The basis of my recommendation is that I assume he is at least an adequate teacher. I was quite impressed with the dedicated group of graduate students engaged in the research project that he headed. We need this sort of work in computer engineering, as there are enough people developing theory based on non-experimental results. He was effective at getting the design description language group started. Furthermore, he produces a steady stream of interesting ideas. While I don't believe any of the ideas have been applied yet, they are novel, and they do stimulate independent thought. (While it has never been a requirement for a professor to have either novel or useful ideas, I do think it is important.)

Good luck on building TRAC. Please keep me informed as it progresses.

Am looking forward to the book you are writing with Digital Press.

Sincerely,

Gordon Bell
Vice President of Engineering, Digital Equipment Corporation
Professor, on leave, Carnegie-Mellon University

CC: Herb Woodson

GB2.S5.41

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!   !   !   !   !   !   !   !
! d ! i ! g ! i ! t ! a ! l !          I n t e r o f f i c e
M e m o
!___!___!___!___!___!___!___!
```

TO: JACK SHIELDS   DATE: MON 8 NOV 1982
12:10 PM

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5181172914

SUBJECT: RE: RE: A MUCH MORE COMPETITIVE UNIX

At least two customers I've spoken with recently perceive that we are forcing them to choose UNIX because we don't have the adequate UNIX support on VMS so that they can buy a VAX, run UNIX + VMS, and then maybe never go totally to UNIX. Either way (UNIX + VMS, or VMS - chosen) we win.

My help is to get the UNIX effort on VMS to a point where it's much better than UNIX standalone. Now, this isn't the case.

GB3.S10.24

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.___.___.___.___.___.___.___.
!   !   !   !   !   !   !   !
! d ! i ! g ! i ! t ! a ! l !          I n t e r o f f i c e
M e m o
!___!___!___!___!___!___!___!
```

TO: BILL JOHNSON   DATE: MON 22 NOV 1982

11:32

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5182597469

SUBJECT: RE: RE: ATTACHED

I wrote it several times:

I want one hardware system that runs both UNIX and VMS. The goal is to let a user bring in UNIX-based software and run as though they were running on a stand-alone UNIX system. By coexisting this way, we want to encourage especially diehard UNIX users to start using VMS features.

00 CORE DECGRAM ACCEPTED S 003312 O 508 14-JUN-82 16:37:44

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION

DATE: MON 14 JUN 1982 3:44 PM EDT

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5166445018

SUBJECT: BRITISH POLICY ON UNIX STANDARDS AND PERQS

Brian Randall, told me the there are two policies that are pretty hard and fast these days:

For Research, SRC, the Science Research Council is pushing the 3 Rivers PERQ, made by ICL as THE research machine. The Perqs are to be interconnected via the Cambridge Ring, which is being made by various manufacturers. With it, the standards are Pascal and the unix interface.

The British Software Industry is pushing to standardize the software interface of UNIX complete with the file system, using several languages, not just C. There are apparently 4 levels of standards: the first is the shell, the second is what I mentioned, and the 4th is the whole programming environment and set of languages.

These came as a surprise to me. I hope everyone else knows about them. Bill, Dick did you know?

"TO" DISTRIBUTION:

JOE CARCHIDI	PATRICK COURTIN	DAVE CUTLER
EWART DAVIES	BILL HEFFNER	WIN HINDLE
DICK HUSTVEDT	ANDY KNOWLES	BERNIE LACROUTE
BILL LONG	JULIUS MARCUS	AVRAM MILLER
BILL MUNSON	KEN OLSEN	PEG:
DAVE RODGERS	JACK SHIELDS	RON SMART
JACK SMITH	BILL STRECKER	VOGON/DAVIES @CNS1
JIM WADE		

WPS USERS - Leave HP mode and type <CR>

****
* d i g i t a l *
****

TO: EMC: DATE: MON 31 MAY 1982
10:38 AM EDT
OPERATIONS COMMITTEE: FROM: GORDON BELL
cc: see "CC" DISTRIBUTION DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: UNIX SUPPORT

Pat has made a request to pick this up as a corporate product.
Engineering is not able to add to the product list now; in fact, we're trying to reduce the number of products we're having to engineer.

UNIX should be a clear money maker. It could be coupled to a stricly software business such that the funding and NOR could Joperate "in control". Alternatively, the path must be the continued tin cupping to keep it going.

Given the number of UNIXes we sell, it clearly has to be supported and developed.

What you folks think here?

"CC" DISTRIBUTION:

RICK CORBEN PATRICK COURTIN BILL MUNSON
JOE REILLY

ATTACHED: MEMO;30

****
* d i g i t a l *
****

TO: JOE REILLY DATE: FRI 28 MAY 1982

5:34 PM EST

FROM: PATRICK COURTIN

cc: see "CC" DISTRIBUTION

DEPT: TIG

EXT: 264-5048

LOC/MAIL STOP: TIG/MK1-1

D29

SUBJECT: RE: UNIX FUNDING FOR FY83

GORDON PLEASE HELP.
TIG cannot afford to fund 800k out of our present engineering budget
to support a corporate responsibility.We are carrying the ball on too
many projects already.any smart idea?

28-MAY-82 18:44:24 S 6594 EMMK
28-MAY-82 19:16:39 S 03742 EMMK
EMMK MESSAGE ID: 5164753147

"CC" DISTRIBUTION:

GORDON BELL RICK HILLS BILL HOWERTON
JULIUS MARCUS BILL MUNSON STEVE SMITH

GB3.S5.54

GB3.S10.3

00 CORE DECGRAM ACCEPTED S 003658 O 520 01-NOV-82 17:08:11

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.___.___.___.___.___.___.___.
!   !   !   !   !   !   !   !
! d ! i ! g ! i ! t ! a ! l !        I n t e r o f f i c e  M e m o
!___!___!___!___!___!___!___!
```

TO: see "TO" DISTRIBUTION

DATE: MON 1 NOV 1982 2:45 PM

FROM: GORDON BELL

cc: FOREST BASKETT

DEPT: ENG STAFF

SAM FULLER   EXT: 223-2236
OPERATIONS COMMITTEE: LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5180460815

SUBJECT: A MUCH MORE COMPETITIVE UNIX

It continues to be clear that we are not active enough with respect to UMX on UMS by merely having C(UNIX).

The effect is clear: people will either not buy VAX's or they will buy VAX's with Unix on them.

There are two outside packages that run on VMS and give a full UNIX system which we might market on VAX: UNIS, coming out of SRI originally, and UNITY, from Human Computer Resources, Toronto. Let's pick one.

In having full UNIX in a full co-existence on VMS, we give people the choice on a single system. In this way, I think we'll sell lots more VMS based products for people who demand UNIX.

Now we're really forcing a choice to UNIX, and this is crazy.

"TO" DISTRIBUTION:

PATRICK COURTIN   BILL DEMMER   BILL HEFFNER
BILL JOHNSON   BILL MUNSON   MAHENDRA PATEL
RICHARD HUSTVEDT @ZKXX
<sal>Allan
<member>father
<contribution>
<> <sal>Connie
<member>mother
<contribution>In accordance with your wishes, a donation has been made to the Primary Children's Medical Center in Salt

Lake City, Utah.
<> <sal>Carl
<member>father
<contribution>
<> <sal>Corrinne
<member>husband
<contribution>
<> <sal>Allan
<member>father
<contribution>
<>
<sal>Ann
<member>brother
<contribution>
<>
<sal>Ann
<member>sister
<contribution>
<>
<sal>Allison
<member>father
<contribution>
<>
<sal>Arthur
<member>father
<contribution>
<>
<sal>Barbara
<member>father
<contribution>
<>
<sal>Barbara
<member>father
<contribution>
<>
<sal>Bruce
<member>mother
<contribution>
<>
<sal>Connie
<member>mother
<contribution>In accordance with your wishes, a donation has

been made to the Primary Children's Medical Center in Salt Lake City, Utah.
<>
<sal>Carl
<member>father
<contribution>
<>
<sal>Corrinne
<member>husband
<contribution>
<>
<sal>Charles
<member>wife
<contribution>In accordance with your wishes, a donation has been made to the Cancer Society.
<>
<sal>Curtis
<member>mother
<contribution>
<>
<sal>Connie
<member>brother
<contribution>
<>
<sal>Clifford
<member>daughter
<contribution>In accordance with your wishes, a donation has been made to Children's Hospital.
<>
<sal>Clarence
<member>father
<contribution>
<>
<sal>Claire
<member>mother
<contribution>
<>
<sal>Craig
<member>father
<contribution>In accordance with your wishes, a donation has been made to the Renal Dialysis Unit at Berkshire Medical Center.

<>
<sal>David
<member>brother
<contribution>
<>
<sal>Donald
<member>mother
<contribution>
<>
<sal>David
<member>sister
<contribution>
<>
<sal>Denise
<member>husband
<contribution>In accordance with your wishes, a donation has been made to the Cancer Society.
<>
<sal>Darrel
<member>sister
<contribution>In accordance with your wishes, a donation has been made to the Cancer Society.
<>
<sal>David
<member>mother
<contribution>
<>
<sal>Dianna
<member>father
<contribution>
<>
<sal>Donna
<member>mother
<contribution>
<>
<sal>Dorothy
<member>father
<contribution>
<>
<sal>Dick
<member>sister
<contribution>In accordance with your wishes, a donation has

been made to the Cancer Society.
<>
<sal>Deborah
<member>father
<contribution>
<>
<sal>Denis
<member>mother
<contribution>
<>
<sal>Donna
<member>brother
<contribution>In accordance with your wishes, a donation has been made to the Children's Hospital.
<>
<sal>Evelyn
<member>father
<contribution>
<>
<sal>Edwina
<member>father
<contribution>
<>
<sal>Ed
<member>mother
<contribution>In accordance with your wishes, a donation has been made to the Heart Fund.
<>
<sal>Eliot
<member>mother
<contribution>In accordance with your wishes, a donation has been made to the Cancer Research Department of Lutheran General Hospital in Illinois.
<>
<sal>Elaine
<member>father
<contribution>In accordance with your wishes, a donation has been made to the Heart Association.
<>
<sal>Ed
<member>mother
<contribution>

<>
<sal>Edward
<member>father
<contribution>In accordance with your wishes, a donation has been made to the Heart Association.
<>
<sal>Eli
<member>father
<contribution>
<>
<sal>Family Members
<member>father
<contribution>
<>
<sal>Frank
<member>brother
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<>
<sal>Family Members
<member>James
<contribution>
<>
<sal>Gary
<member>father
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<>
<sal>Gerald
<member>father
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<>
<sal>Gary
<member>father
<contribution>In accordance with your wishes, a donation has been made to the Cancer Society.
<>
<sal>Gloria
<member>parents
<contribution>
<>
<sal>Helen
<member>mother
<contribution>

<>
<sal>James
<member>father
<contribution>In accordance with your wishes, a donation has been made to the Heart Fund.
<>
<sal>John
<member>father
<contribution>In accordance with your wishes, a donation has been made to the Dialysis Unit of St. Mary's Hospital in West Palm Beach, Florida.
<>
<sal>James
<member>brother
<contribution>In accordance with your wishes, a donation has been made to the American Cancer Society.
<>
<sal>Jane
<member>husband
<contribution>
<>
<sal>Jill
<member>mother
<contribution>In accordance with your wishes, a donation has been made to the Heart Fund.
<>
<sal>John
<member>father
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<>
<sal>Josephine
<member>brother
<contribution>
<>
<sal>John
<member>sister
<contribution>In accordance with your wishes, a donation has been made to the Heart Fund.
<>
<sal>James
<member>father
<contribution>In accordance with your wishes, a donation has

been made to the Cancer Society.
<>
<sal>Jay
<member>sister
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<>
<sal>John
<member>father
<contribution>
<>
<sal>Janet
<member>mother
<contribution>
<>
<sal>Kathleen
<member>father
<contribution>
<>
<sal>Kathy
<member>husband
<contribution>In accordance with your wishes, a donation has been made to the Downs Parents' Association in Nashville, Tennessee.
<>
<sal>Louise
<member>brother
<contribution>
<>
<sal>Loretta
<member>brother
<contribution>In accordance with your wishes, a donation has been made to the Heart Fund.
<>
<sal>Louise
<member>husband
<contribution>
<>
<sal>Leroy
<member>wife
<contribution>In accordance with your wishes, a donation has been made to Children's Hospital.
<>

<sal>Lynn
<member>father
<contribution>
<>
<sal>Linda
<member>grandmother
<contribution>
<>
<sal>Millie
<member>father
<contribution>
<>
<sal>Michael
<member>mother
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<>
<sal>Mabel
<member>husband
<contribution>
<>
<sal>Madeline
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<contribution>
<>
<sal>Martha
<member>father
<contribution>In accordance with your wishes, a donation has been made to the Heart Fund.
<>
<sal>Muriel
<member>husband
<contribution>
<>
<sal>Mrs. Martin
<member>son
<contribution>
<>
<sal>Mary
<member>brother
<contribution>
<>
<sal>Margaret

<member>father
<contribution>
<>
<sal>Mrs. Munroe
<member>husband
<contribution>In accordance with your wishes, a donation has been made to the Cancer Society.
<>
<sal>Margaret
<member>sister
<contribution>
<>
<sal>Mike
<member>father
<contribution>
<>
<sal>Marie
<member>mother
<contribution>
<>
<sal>Norm
<member>mother
<contribution>In accordance with your wishes, a donation has been made to the Cancer Society.
<>
<sal>Norman
<member>father
<contribution>
<>
<sal>Nancy
<member>father
<contribution>
<>
<sal>Patricia
<member>father
<contribution>In accordance with your wishes, a donation has been made to the Heart Fund.
<>
<sal>Pamela
<member>father
<contribution>
<>

<sal>Pat
<member>father
<contribution>
<>
<sal>Patricia
<member>father
<contribution>
<>
<sal>Pamela
<member>father
<contribution>
<>
<sal>Paul
<member>father
<contribution>
<>
<sal>Rose
<member>brother
<contribution>
<>
<sal>Robert
<member>mother
<contribution>
<>
<sal>Richard
<member>father
<contribution>In accordance with your wishes, a donation has been made to the Cancer Research Center, Stanford Medical Center in Palo Alto, California.
<>
<sal>Roslin
<member>mother
<contribution>In accordance with your wishes, a donation has been made to the Heart Fund.
<>
<sal>Roslyn
<member>brother
<contribution>
<>
<sal>Robert
<member>father
<contribution>

<>
<sal>Richard
<member>mother
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<>
<sal>Robert
<member>father
<contribution>
<>
<sal>Robert
<member>step-father
<contribution>
<>
<sal>Roger
<member>brother
<contribution>In accordance with your wishes, a donation has been made to the Heart Fund.
<>
<sal>Robert
<member>father
<contribution>In accordance with your wishes, a donation has been made to the Zion Lutheran Church.
<>
<sal>Rebecca
<member>husband
<contribution>
<>
<sal>Somsack
<member>father
<contribution>In accordance with your wishes, a donation has been made to the Cambodian Relief Fund.
<>
<sal>Steve
<member>father
<contribution>In accordance with your wishes, a donation has been made to the New Hampshire Youth Orchestra.
<>
<sal>Stephanie
<member>father
<contribution>
<>
<sal>Susan

<member>mother
<contribution>
<>
<sal>Stephen
<member>brother
<contribution>
<>
<sal>Stan
<member>mother
<contribution>In accordance with your wishes, a donation has been made to the Diabetes Foundation.
<>
<sal>Shirley
<member>brother
<contribution>
<>
<sal>Steve
<member>mother
<contribution>In accordance with your wishes, a donation has been made to the Heart Association.
<>
<sal>Taylor
<member>father
<contribution>In accordance with your wishes, a donation has been made to the South Shore Hospital Intensive Care Unit in Weymouth, Massachusetts.
<>
<sal>Theresa
<member>brother
<contribution>
<>
<sal>Thomas
<member>mother
<contribution>
<>
<sal>Thomas
<member>mother
<contribution>
<>
<sal>Thomas
<member>mother
<contribution>In accordance with your wishes, a donation has

been made to the Sidney Farber Cancer Institute.
<>
<sal>Allan
<member>father
<contribution>
<>

<sal>Ann
<member>brother
<contribution>
<>

<sal>Ann
<member>sister
<contribution>
<>

<sal>Allison
<member>father
<contribution>
<>

<sal>Arthur
<member>father
<contribution>
<>

COMM	=	COMM Staff
D10	=	DEC 10 & 20 Product Managers
10S	=	DEC 10 & 20 Staff
ENC	=	Engineering Committee
F&A	=	Finance Committee
HCE	=	Hardware Consulting Engineers
HDM	=	Hardware Development Managers
HDPM	=	Hardware Development Product Managers

HDSTF	=	Hardware Development Staff
MKT	=	Marketing Committee
MM	=	Memories Managers
MSM	=	Memories Staff Managers
OEG	=	Other Engineering Groups - Outside OOD
OOD	=	Office of Development
OPC	=	Operations Committee
OPR	=	OPC Rotating Members
PLM	=	Product Line Managers
SCE	=	Software Consulting Engineers
SDM	=	Software Development Managers
SDPM	=	Software Development Product Managers
SDSTF	=	Software Development Staff
SYDM	=	Systems Development Managers
SYPM	=	Systems Development Product Managers

12 May 1983

Margaret H. Hamilton, President
Higher Order Software, Inc.
955 Massachusetts Avenue
Cambridge, MA 02139

Dear Margaret:

It was a pleasure to visit HOS and see the demonstration of USE.IT. I'm enclosing an ISP description of the first computer (at Manchester) if you're interested in describing a real computer.

I hope we can move rapidly through evaluation to use USE.IT. Based on my first impression, I think we ought to start offering training courses through Education Services for both internal and external people. I'm delighted that Del Lippert and Sharon Keillor are working with you.

In addition, we should then start a number of trial projects. Specifically, I see it especially valuable for these areas:

- field written software for customers (Don Busiek)
- Distributed Information Systems Software (Jeff Tash, Al Crawford)
- Computer Aided Design programs (Tom Smith, John Manzo)
- training discipline in hierarchial design (John Manzo)
- tools which evolve rapidly (Bill Keating)
- a product to offer to our commercial (Anita Moeder) and technical customers (Bill Long, Bill Keating).

I believe all these groups are looking at possible use, but to really move aggressively, they're going to have to try it on real work. I hope we can spend time at your course or doing these critical experiments instead of getting repeated demos.

If I can be of any help in the selling within Digital, please let me know.

Sincerely,

Gordon Bell
Vice President, Engineering

GB5.37
Enclosure

cc: Bill Johnson	Bob Daley
Del Lippert	Sharon Keillor
Don Busiek	Jeff Tash
Al Crawford	Tom Smith
John Manzo	Bill Keating
Bill Long	Anita Moeder

HOW DOES A PROJECT GET TO BE A YEAR LATE?
..."ONE DAY AT A TIME." FRED BROOKS

BASIS OF BROOKS' LAW: "ADDING PEOPLE TO A LATE PROJECT MAKES IT LATER."

COMMUNICATION IS PROPORTIONAL TO PROJECT PERSONS SQUARED, THEREFORE:

REDUCE UNNECESSARY COMMUNICATION WITH THE DESIGNERS, EG., AVOID NON-TECHNICAL MEETINGS, ASK THE SUPERVISOR, OR LOOK IN THE SPECS;

REDUCE COMMUNICATION BY GROUP STRUCTURING;

STRUCTURE COMMUNICATIONS BY BATCHING AND BY MAIL;

STRUCTURE TO BE ABLE TO OFFLOAD WORK BY PARALLELISM EG., USE SECRETARIES TO EDIT.

WHY AM I WITH THE VENUS PROJECT?

I BELIEVE IN THE TEAM AND PROGRESS SINCE MAY, BUT AM WORRIED ABOUT

* LEVEL OF RESOURCES,
* SEGMENTATION AND SCHEDULING OF PROJECT, AND
* SIDE EFFECTS DUE TO COMPLEXITY.

KEN PERCEIVES THE IMPORTANCE OF THE NEXT 3-6 MONTHS ON VENUS.

AREN'T THERE OTHER IMPORTANT CORPORATE ISSUES, SUCH AS JAPAN?

* VENUS IS JAPAN (THEY DOMINATE HIGH END -- VENUS+
* VENUS IS THE CORNERSTONE OF CORPORATE STRATEGY REVENUE FOR THE 80'S

VENUS = $1B/YEAR OR $4M/DAY OR $500K/HOUR

VENUS = 12,500 JOBS/YEAR

* VENUS HAS MET THE TECHNOLOGY/COMPLEXITY ENEMY
* VENUS IS A LEADING EDGE LAB TESTING OUR ENGINEERING CAPABILITY

WHAT IS MY ROLE? (HELPER, PROBLEM SOLVER, TEAM MEMBER)

HELPING YOU AND YOUR LINE MANAGERS ... ENG. VP, ULF'S BOSS

GETTING RESOURCES SUBJECT TO BROOKS' LAW

LOOKING TO REPARTITION WORK TO GET PARALLELISM

REDUCING WORK AND ENTHROPY

LOOKING AT ALTERNATIVE WAYS TO DO THINGS

LEARNING ABOUT MANAGING WITH YOU (ESPECIALLY COMPLEXITY)

CONSULTING ON AND REVIEWING THE DESIGN FOR ALAN

HELPING YOU UNDERSTAND ME:
AS A TEAM MEMBER, I WILL MAKE LOTS OF COMMENTS. SOME COMMENTS WILL BE CRITICAL AND I EXPECT TO ARGUE IDEAS, COMMENTS ARE ON THE TASK NOT THE PERSON.

YOU REMIND ME HOW TO MAKE SUGGESTIONS THROUGH THE MANAGEMENT/SUPERVISORY CHAIN, I MAY OCCASIONALLY FORGET.
I MAY OCCASIONALLY "ASK" TO CHANGE SPECS OR SCHEDULE:
BUT ONLY FOLLOW THEM IF THESE "ASKS" ARE WRITTEN AND EXPLICIT; GENERALLY I WILL USE THE NORMAL DESIGN REVIEW PROCESSES.
LET'S BE ALL BE OPEN. AS TEAM MEMBER, I CAN BE REACHED AT
BELL AT KL1031, ON EMS, OR
231-4650 OR 223-2236 OR 493-3525 (HOME)
MARY JANE FORBES OR PATTI WILKINSON WILL BE ABLE TO FIND ME.

LET'S HAVE FUN, LEARN, AND BUILD VENUS! G BELL, 11/20/81

+---------------+ ID#0163
| **d i g i t a l** | **I N T E R O F F I C E M E M O**
+---------------+

SUBJ: VAX&11 Systems Planning

To: Bill Demmer, Bill Johnson
Date: 7/10/78
From: Gordon Bell
Dept: Office of Development
MS: ML12/A51 Ext: 2236

CC: Joe Carchidi, Dick Clayton, Brian Croxon, Sam Fuller, Bill Keating, Bernie Lacroute, George Plowman, Bill Strecker, Pete vanRoekens

Having just spent a frustrating 2 hours with members of the VAX group talking about getting decent (easily supported, high performance handlers and diagnostics) I/O on VAX, I feel we are destined to fail. Although the architecture group is resposnible for recording the state of the system, Bill Demmer has the responsibility of planning what these systems will be and getting any of the suppliers and users to supply components to the interfaces/structures. The VAX organization feels decoupled from the 11 (its not coupled through me any longer), and the VAX group talks as if it has no responsibility for planning or desigining anything but CPUs. No wonder our customers complain about the lack of systems focus.

By September first I would like a plan for how systems are to be built (as distinct from CPUs with Unibuses sticking out of them with no diagnostics or handlers). This plan should include a hardware/software system support matrix of the busses we have and the ones we intend to have, the options connected to them, and the structures that can be built from them. It should start to couple with the communications groups so that we get some reasonably cost-effective interfaces for high speed lines so that much of the equipment can be supported remotely via standard lines and still not eat up the CPU for this support. This should involve less overhead than current Unibus devices as a goal say for a device such as a line printer. I would like this plan to include the current efforts (e.g. CIOB and ICCB) so as to get these resources oriented to a goal rather than to sustaining floundering projects.

I believe you have the resources, although it may require a bit of redirection of some of the CPU projects which are currently built to have no I/O. With this plan, we might have some faith that users will be able to get real time and any other I/O.

With this memo, let me rescend my support for the task I thought Lorrin Gale was doing (see attached), and put the responsibility and request squarely with its owner, the system manager.

gb

Attachment

D I G I T A L INTEROFFICE MEMORANDUM

DIST: Bill Demmer TW/D19 Bill Johnson ML21-
3/E87

Joe Carchidi ML3-4/E88 Dick Clayton ML12-
2/E71
Brian Croxon TW/C04 Sam Fuller
TW/A08
Bill Keating ML12-3/A62 Bernie Lacroute
TW/A08
George Plowman ML5-5/E97 Bill Strecker ML3-
2/E41
Pete vanRoekens ML12-2/E71

ollection 3/7/87 Sat

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75) EGLI & CO., "MILLIONAIRE" (B1.75)

Hutton, Charles, "Table of the Products and Numbers" (B2.76)

-376 (76) Chevalier
es Savier Thomas, "Arithmometer" (XB3.76)

6) ?, Gunter Rule (B4.76)

138 (76) Stanley, "Fuller's Spiral Slide Rule" (XB5.76)

76) J. Sang, "Platometer" (B6.76)

6) Burroughs, "Burroughs Model 5" (B7.76)

-10 (76) Burroughs,
oughs" (XB8.76)

6) Felt & Tarrant Manufacturing Co., "Comptometer" (B9.76)

6) "Monroe Electric Calculator No. 1" (B10.76)

6) Monroe Calculating Machine Co., "Monroematic" (B11.76)

6) Friden, "Friden Calculator Model D-8" (B12.76)

6) Monroe, "High Speed Adding Calculator" (B13.76)

6) Burroughs, "Burroughs Adding Machine Model A" (B14.76)

6) Underwood, "Standard Typewriter No. 5" (B15.76)

6) IBM, "IBM" (D16.76)

78) EGLI & CO., "Millionaire" (B17.78)

Stone, Edmund, "The Construction and Principal Uses
tical Instruments" (B18.78)

8) Drawing Instruments (B19.78)

8) W.H. Harling, Rolling Parallel Rule (B20.78)

78) Navigator's Sector (B21.78)

8) Burroughs Adding Machine Company, "Burroughs" (B22.78)

Friden, "Friden Model 132" (B23.78)

8) Parallel Rule (B24.78)

) DG Marketing Ltd, "International Metric Converter" (B25.78)

Soroban
.79)

(79) Napier's Bones (B27.79)

cal Rubber Publishing Co., <u>Handbook of Chemistry and Physics,</u> 31ST Ed"
.79)

)KEUFFEL & ESSER "Thatcher's Calculating Instrument 4012" (B29.77)

120 (77) L.&I.D., Timber Calculating Slide Rule (XB30.77)

) Selective Educational Equipment, "SEE CALCULATOR" (B31.79)

KEUFFEL & ESSER, "Slide Rule 689" (B32.52)

Casio, "Casio Mini Card Calculator" (XB33.)

Hewlett Packard, "HP-35" (XB34.79)

) Aluminum Housewares Co. Inc., "Fairgrove Adder" (B35.79)

"EXACTUS"
.79)

Foto-mem Inc., Slide Rule (B37.79)

sion Adding Machine Co. Inc., "Quixsum Adding Machine Model C" (B38.79)

a, Tokei, Keiki Co. Ltd., "Geigy Pedometer" (B39.79)

9) Monroe, "Monroe" Calculator (B40.79)

-22 (79) Gunter Rule (XB41.79)

0) Burroughs, "Burroughs" (B42.80)

0) Bing, "Bing No.2" (B43.80)

rton, Richard Stevens, "Handbook of Mathematical Tables and Formulas"
79)

Royal London Co Ltd, "Executive Thought Organizer" (B46.79)

9) Hoare, Charles, "The Slide Rule and How to Use It" (B47.79)

Rowning, J., "Directions for Making a Machine to

tions" (B48.79)

9) The A. Leitz Co., Planimeter (B49.79)

79) J.S.M., Navigator's Gunter Rule (B50.79)

79) Stanley, "Fuller's Spiral Slide Rule" (B51.79)

(79) Manlove, "Boucher's calculating circle" (B52.79)

80) Lowry Mfg. Co., "Lowry-bowyer Telemeter" (B53.80)

80) Navigator's Gunter Rule (B54.80)

80) Dring & Fage, Inland Revenue Slide Rule (B55.80)

)KEUFFEL & ESSER, "Thatcher's Calculating Instrument" (B56.80)

0) Felt & Tarrant Mfg Co., "Comptometer" (B57.80)

"RAILROAD TELEGRAPHER MAGAZINE" (B58.80)

80) Fowler & Co., "Fowler's Calculator" (B59.80)

"WESTERN UNION RULES AND INSTRUCTIONS" (B60.80)

0) J.R. Bunnell, Telegraph Key And Receiver (B61.80)

0) Marchant, "Marchant" (B62.80)

0) Corona, "Corona No. 3" (B63.80)

80) Burroughs, "Burroughs" (B64.80)

0) Molle Typewriter Co., "Molle No. 3" (B65.80)

0) Swift & Anderson Inc., Gunnery Level (B66.80)

Adler, "Favorit 2" (B67.80)

0) W & E Co., Telegraph Receiver and Relay (B68.80)

80) Heath and Co. Ltd., Sextant (B69.80)

Digital Equipment Corp., PDP-6 Signed Photo (B70.67)

Digital Equipment Corp., PDP-8 Flip-flop R201 (B71.74)

Vacuum Tube Logic Module M.D.Type 8 (B72.74)

0) Field Microscope (B73.80)

Cohen, Harold, "Amsterdam Suite" (B74.77)

0) MARX, "Dial Typewriter" (B75.80)

0) 8 (81) "BABY CALCULATOR" (B76.80)

Digital Equipment Corp., PDP-11/20 Module Artwork (B77.72)

0) A.B. Dick, "The Edison Mimeograph No. 1" (B78.80)

JJ&EF Johnson Co., Telegraph Key J-44 (B79.80)

Trinks-brunsviga, "Trinks-brunsviga" (B80.80)

-25 (80) Bell Punch Co.
"Plus" (XB81.80)

(80) C & E Layton, "Tates Arithmometer" (B82.80)

0) Metallograph Corp., "Musketry Rule of 1918" (B83.80)

-50 (79) Thales, "Thales Patent Calculator" (XB84.79)

Reliable Typewriter & Adding Machine Corp.,

" (XB85.78)

9) Olivetti, "Olivetti" (B86.79)

Contina Ag Mauren, "Curta" (B87.79)

80) Wales Co., "Wales Visible Adding Machine" (B88.80)

0) Allen-wales, "Allen-wales Printing Adding Machine" (B89.80)

6) Monroe Calculating Machine Co., "Monroe No. 1" (B90.79)

000 (79) Hans W. Egli, "Millionaire" (XB91.76)

80) Drafting Set (B92.80)

-50 (80) Abacus
.80)

0) Soroban (B94.80)

) Abacus (B95.80)

Reliable Typewriter and Adding Machine Corp., "Addometer" (B96.80)

0) KEUFFEL AND ESSER, "E.A. Sperry's Calculator" (B97.80)

0) Navigator's Gunter Rule (B98.80)

) 21(80) Stanley Rule & Level Co., Timber Slide Rule (B99.80)

7) J. B. Carroll Co., Computer Altitude

Type AN-5837-I (XB100.87)

0) MARX, "Junior Typewriter" (B101.80)

0) Navigator's Sector (B102.80)

0) Welch, Teaching Slide Rule (B103.80)

0) T.S. & J.D. Negus, Parallel Rule (B104.80)

0) Rolling Parallel Rule (105.80)

80) Drawing Instruments (B106.80)

-43 (80)"Thomlinson's Equivalent Paper Slide Scale" (XB107.80)

0) Dring and Fage, "Leadbetter Slide Rule" (B108.80)

0) Slide Rule (B109.80)

216 (80) J.F. Fuller, "Palmer's Improved By

puting Scale" (XB110.80)

60 (80) Fowler & Co,
er's Textile Calculator" (XB112.80)

) Lewis & Tylor, Limited, "Hydralculator" (B113.80)

-5 (80) "Circular
se Slide Rule" (XB114.80)

) Music Box (B115.80)

80) Blickensderfer, "Featherweight Blickensderfer" (B116.80)

(80) Jacquard Loom Mechanism (B117.80)

80) L.M. Ericsson & Co., Printing Telegraph Receiver (B118.80)

0) Navigator's Sector (B119.80)

0) C.W. Dizey, Proportional Rule and Protractor (B120.80)

United Chemical Engraving Co. Ltd., Proportional

rotractor (B121.80)

0) Parallel Rule (B122.80)

0) R. Waddington, Coventry, Lord's Calculator (B123.80)

0) Fowler's Ltd Sale, "Fowler's Calculator" (B124.80)

The Cleveland Twist Drill Co., Circular Slide Rule (B125.80)

2 (80) "Johnson

ical Light Exposure Calculator" (B126.80)

) Thorens, Musical Disk (B127.80)

0) Morris, "Morris's Measuring Instrument" (B128.80)

Tacro Inc., Map Measure and Compass (B129.80)

0) Drawing Instruments (B130.80)

80) ADDI-COSMOS, "B.U.G Calculator" (B131.80)

0) Drawing Instruments (132.80)

80) Drawing Instruments (B133.80)

80) Pantograph (B134.80)

0) Odhner, "Original Odhner" (B135.80)

81) W. Egli, "Millionaire" (B136.81)

50(81)American Can Company, "American Adding Machine" (B137.81)

1) Scale and Ruled Compass (B138.81)

) J. Good, "Measuring Made Easy" much Enlarg'd

nson, (B139.80)

1) Depose H.C., Map Mileage Reader (B140.80)

) Counting Beads (B141.80)

1) Bennett, Typewriter (B142.81)

81) Bunzel Mfg, Vienna, Thomas Arithmometer (B143.81)

Dietzgen Co., "Dietzgen multiphase style-m
ecimal trig type log log rule" (B144.81)

) Dietzgen, Slide Rule (B145.81)

) 30(82) Stanley Rule and Level Co., Coggeshall Rule (B146.81)

(81)Richardson and Co., Coggeshall Timber Slide Rule (B147.81)

) Spelling and Counting Board (B148.81)

7) "Every Man's Own Interest Calculator" (B149.87)

(81) Roberto Guatelli, Pascal Adder (B150.81)

1) Electric Specialty Mfg Co., Telegraph Key (B151.81)

) SELSI, Map mileage reader and compass (B152.81)

81) A & W Smith, Pantograph (B153.81)

) Corona Typewriter Co., Inc."CORONA FOUR" (B154.81)

) Burroughs, "Burroughs Calculator" (B155.81)

) Burroughs, "Burroughs Adding & Listing Machine" (B156.80)

1) Burroughs, "Burroughs Adding and Listing Machine" (B157.81)

1) J. Halden & Co., Ltd., "HALDEN CALCULEX" (B158.81)

Kentish, Thomas "A Treatise on a Box of
s and the Slide Rule for the Use of Guagers, Engineers, Seaman, and
nts," (B159.81)

81) R. & L.W. Leybourn, "TRIGONOMETRIA" (B160.81)

81) HANS W. EGLI CO., "MILLIONAIRE" (B161.81)

George B. Prescott "History, Theory, and Practice
ctric Telegraph" (B162.81)

) Michel Gloesener "Recherches sur La Telegraphie
" (B163.81)

Signal Electric Mfg. Co., "Signal Telegraph
" (XB164.81)

1) Simplex, "The New Simplex Typewriter No. 1" (B165.81)

Simplex, "Simplex Portable Typewriter Special

ed Model S" (B166.81)

-10 (81) Wolverine Co.,
ng Machine" (XB167.81)

1) Navigator's Sector (B168.81)

1) Navigator's Sector (B169.81)

1) Coggeshall Slide Rule (B170.81)

) Pickett & Eckel, Inc., Slide Rule (B172.81)

1) Burroughs, "Burroughs" (B173.81)

81) Felt & Tarrant Mfg Co., "Comptometer" (B174.81)

80) Siemens Brothers & Co., Printing Telegraph (B175.80)

(81) Sector (B176.80)

1) Dorabjee Hormusjee, The Oriental Calculator (B177.81)

1) Counting Beads (B178.81)

-28 (81) Reliable, "Addometer" (XB179.81)

87) Morin, H. de, Les Appareils De'Integration (B180.87)

1) Abacus (B181.81)

) 3 (81) Burroughs,
oughs Calculator" (B182.81)

) 4 (81) SELSI, Map
ge reader and compass (B183.81)

Digital Equipment Corporation, 2 PM Flip Flop (B184.81)

Data Products, Core Memory (B185.81)

Cal Research Computer, Tube and circuit (B186.81)

) Abdank-Abakanowicz, Les Integraphes La Courbe

et ses application; (B187.81)

1) "Precise" (B188.81)

4) A W Faber, Slide Rule (B189.81)

) Ideas Unlimited, "Horse-meter" (B190.81)

Molesworth, G L, Pocket-book of Useful Formulae a for Civil and Mechanical Engineers (B191.81)

81) Section of the first Atlantic Telephone Cable (B192.81)

81) A. Massim, Paris, Music Box (B193.81)

(81) Aaron Palmer, Boston, "Palmer's Pocket Scale" (B194.81)

1) Excise slide rule (B195.81)

Cooper, Henry O. Instruction for the use of A.W.

tell" Precision Calculating Rules, (B196.81)

"Enigma" (B197.81)

"Enigma" (B198.81)

82) "Everard" slide rule (B199.82)

2) Mileage reader (B200.82)

82) Chambon & Baye, "TACHYLEMME" (B201.82)

) "The MP Handy Guide for Knitting and Crochet" (B202.82)

) 130 (84) Tavernier Gravet, slide rule (B203.82)

82) slide rule (B204.82)

82) Dring & Fage, Slide Rule (B205.82)

2) Duss, Slide rule (B206.82)

2) Loftus, Rule (B207.82)

2) Rule (B208.82)

2) T.O. Blake Ltd., Rule (B209.82)

82) Henrici Briggii 1620, Logarithmorum canonis (B210.82)

84)40(86) "Consul" Educated Monkey (B211.82)

2) Jehu Hatfield, Clock interest table (B212.82)

2) Ratchet Adder (B213.82)

(82) C. X. Thomas de Colmar, Arithmometer (B214.82)

2) Hamilton Watch Company, Map Mileage Reader (B215.82)

2) Planimeter (B216.82)

2) Arnof, Map Mileage Reader (B217.82)

2) Manloves, "Boucher's Calculator" (B218.82)

87) Wheatstone, The Harmonic Diagram (B219.87)

) Hoffman, Slide Rule (B220.82)

2) Addac, "Addac" (B221.82)

(82) NAPIER, Rabdologiae. (B222.82)

82) Babbage, Charles, Passages from the life of a philosopher, First edition
.82)

) Rivard, M. Trignometrie Rectiligne et Spherique (B224.82)

) Hawkins Hand Book of Calculations for Engineers and firemen (B225.82)

Flint, A System of Geometry & Trigonometry

eatise on Surveying in which the Principles of Rectangular Surveying without
ing are Explained (B226.82)

) "Biomate" (B227.82)

) Goody Co., "Goody Magic Multiplier Pencil Box" (B228.82)

) Walt Disney Productions, "Mickey Math" (B229.82)

2) L. Appoullot, "Cercle a clacul d"appoullot" (B230.82)

) Wolverine, "Modern Math Addition" (B231.82)

) A. M. Maurand, "Le Prompt Calculateur des arts

s et du commerce" (B233.84)

82) Stanley, "Boucher's Calculator" (B234.82)

82) Stanley, Slide rule for calculating annuities (B235.82)

82) Tavernier-Gravet, "Regle a Eclimetre" (B236.82)

) "Calculator" (B237.82)

Sharp, "ELSI MATE EL-835" (B238.82)

Panasonic, "CompuVoice" (B239.82)

82) Stanley, "Barnard's Coordinate Spiral Slide Rule" (B240.82)

82) Palatine Engineering, "Bryan's Patent Planimeter" (B241.82)

2) Oliver, "The Oliver Typewriter Model 9" (B242.82)

82) Ludwig Spitz & Co., "TIM Time is Money" (B243.82)

2) Dalton, Adding and listing machine (B244.82)

Hitachi, c-mos i c (B245.82)

82) Bigelow, Jacob <u>Elements</u> <u>of</u> <u>Technology</u> (B246.82)

) Boole, George, <u>A treatise on the calculus of</u>

<u>ferences,</u> (B247.82)

82) Patrick Adie, "Eidograph" (B248.82)

82) Protractor and T-square (B249.82)

(82) Trigonometer (B250.82)

82) Troughton, proportional compass (B251.82)

2) planimeter (B252.82)

Svoboda, Antonin, <u>Computing Mechanisms and Linkages</u>

Hubert M. James, (B253.82)

) Gardner, M. <u>Logic Machines and Diagrams</u> (B254.82)

<u>The Trachtenberg Speed Ssytem of Basic Mathematics</u>

Ann Cutler and Rudoph McShane, (B255.82)

Kojima, T., <u>THE JAPANESE ABACUS,</u> (B256.82)

Bowden, B. V., <u>Faster than Thought</u>, (B257.82)

2) <u>Blaise Pascal "auvergnat" la famillle a l'oeuvre,</u> (B258.82)

83) J. Archbutt, parallel rule, compass and rule (B259.83)

3) "The Lightning Adder" (B260.83)

3) Hartree, Douglas R. <u>Calculating</u> <u>Instruments</u> <u>and</u> <u>Machines</u>

(B261.83)

10 (87) Addiator, "Arithma" (B262.83)

3) Globe Ticket Company, Blotters (B263.83)

) Babbage, Charles, <u>On</u> <u>the</u> <u>Economy</u> <u>of</u> <u>Machinery</u> <u>and</u>

<u>es</u> (B264.83)

83) Planimeter (B265.83)

) 20 (81) Automatic Adding Co., "Golden Gem Adding Machine" (B266.83)

3) The Adding Pencil Co., The Adding Pencil, Model B (B267.83)

3) Eugene Dietzgen Co., Catalogue and Price List (B268.83)

3) Keuffel & Esser Co., Catalogue (B269.83)

) S.A. Main BSc, Ballistic Coefficient Slide Rule (B270.83)

83) DeMarre, Ballistic Slide Rule (B271.83)

83)A Toyes, Tables de Comparaison entre les Mesures Anciennes usitees dan le tement de L'Aube, et celles qui les remplacent dans le nouveau System que, (B272.83)

83)William Jones,(Edmund Gunter), The Description and Use of the Sector and instruments.(B274.83)

)Nystrom, J.W., A Treatise on Screw Propellers and A full Description of a lating Machine (B275.83)

3) Saxton, E., Saxton's Logs for Four-place Work. (B276.83)

(82) Briggs, Henry, Arthmetica Logarithimica (B277.82)

) Newton, John, Trigonometria Britanica and A Table

hms to 100,000 (B273.82)

83) Vlacq, Trigonometria artificialis (B279.83)

3) Good, J., Measuring made Easy: Coggeshall's Rule (B280.83)

83) Speidell, Euclid, Logarithmotechnia (B281.83)

s de Colmar, Instruction pour se servir de L'arithmometre,

calculer (B282.83)

Casio, Mini Card fx-48 Scientific Calculator (B283.78)

) Commodore US*14, Digital Calculator (B284.83)

ndustries, "Human Digital Calculator: Add'em up

hine" (B285.83)

Wilkes, D. J. Wheeler, and Stanley Gill, Programs for and Electronic Digital ter, (B286.70)

rd Stevens Burrington, Handbook of Mathematical Tables

as, (B287.55)

Wolverine, Adding Machine (B288.83)

) Designsense, Inc., Atlanta, Ga., "mileage minder" (B289.79)

Simplex, "Simplex Typewriter Model A" (B290.83)

Barron's Educational Services, "Metric Converter" (B291.83)

83) Typewriter (B292.83)

IBM, plug board for 911 (B293.83)

DEC, PDP-10 Cable connector (B294.83)

DEC, UART (B295.83)

DEC, Core plane (B296.83)

DEC, modules (B297.83)

George Fisher, Arithmetic in the Plainest and most

ethods Hitherto Extant, (B298.83)

0) Monroe, "Monroe" (B299.80)

) "SWIFT" HANDY CALCULATOR (B301.84)

(87) Pickworth, Charles N., Instructions for the use

ber's improved Calculating Role (B302.87)

84)Hine and Robertson Co., The Lippincopt Planimeter (B303.84)

84) Butterfield (1674-1722), Sector (B304.84)

) Hart, Walter, Book of Instructions for the Equationor,

sal Calculator, (B305.87)

)Marion & Co., London, Hurter & Driffield's Actinograph (B306.84)

7) Haulage Slide Rule (B307.87)

Philco, Circuit boards from the Philco 212 (B308.84)

4) Tasco, "Pocket Arithmometer" (B309.84)

) B. H. Day, Day's American Ready Reckoner, (B310.84)

4) ? (86) Otis King, Calculator (B311.84)

84) Brevete, (B312.84)

4) Keuffel & Esser Co, radial planimeter (B313.84)

) Abacus (B314.84)

0 (84) Iacobus Matinensis, sector (B315.84)

) Jason, Slide Rule (B316.84)

) Keuffel & Esser Co., Slide Rule (B317.84)

) Lawrence Engineering Service, Slide Rule (B318.84)

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) Kenyon Instrument Co., "The Kenyon Calculator" (B320.84)

Keuffel and Esser, "K & E Compensating Polar

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4) Keuffel & Esser, "Paragon protractor No. 1225" (B322.84)

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265 (87) Contina Ag Mauren, "Curta" Type II (B325.84)

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85) T. Heath fect, Gunter type sector (B338.85)

5) the Mechanical Engineer (B339.85)

35 (87) Todd Protectograph Co., "Star Adding Machine" (B340.85)

L. C. Stephier, Coggeshall rule (B341.85)

5) Hinged slide rule (B342.85)

) Wittnaur Watch Co., Map measure (B343.85)

) Kueffel & Esser Co., Map measure (B344.85)

85) Watkins, drawing instruments (B345.85)

85) W. L. Jones, pantograph (B346.85)

Integrator, 209478 (B347.85)

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) Jacobi, C.G.J., Canon Arithmeticus sive tabulae
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) "Unique", Log Log Slide Rule (B353.86)

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6) "Coggeshall" Slide Rule (B357.86)

6) Elliott Bros, Sector (B358.86)

86) J. Archbut, parallel rule, compass and rule (B359.86)

H. Huges Ltd., "Capt Field's Improved Parallel" (B360.86)

86) Charles Augustus Schmalcalder, Protractor (B361.86)

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87)Scheffellts, Michael, Pes Mechanicus Artificialis,(B373.86)

7)   Kempenich, H., "Prestolog" (B374.87)

7)   "Perfection Self-adding ruler" (B375.87)

7)   "Acu-math" (B376.87)

7)   Hemmi "Sun", Slide rule (B377.87)

7)   Acu-Math, "ACU-MATH No. 150" (B378.87)

7)   Keuffel & Esser Co., "Log Log Duplex Decitrig" (B379.87)

7)   Hemmi, Versalog geotec (B380.87)

7)   Pickett, "microline 120" (B381.87)

7)   Hemmi "Sun", "Universal" (B382.87)

7)   Aston and Mander Ltd., Slide Rule Mark IV (B384.87)

7)   Lawrence Engineering Serivce, Peru, Indiana, (B385.87)

0 (87)   Keuffel & Esser Co., Polyphase 4053-3 (B386.87)

0 (87)   Keuffel & Esser, Slide Rule (B387.87)

7)   Keuffel & Esser, "DECI-LON" (B388.87)

87)   D'Ocagne, Maurice, Traite de Nomographie; (B389.87)

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Subject: **Change in Reporting Structure**

To: Engineering Managers

Date: 3 JAN 79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-
2236

Effective immediately Pete vanRoekens, who heads the Hydra project, will report to Larry Portner.

GB:ljp

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+---------------------------+                          ID#0291
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Subject: **LLL Visit on the 4th**

To: Vatche Sogominian, OA

Date: 10 OCT 78
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-
2236

Thanks for setting up and running the stimulating visit to LLL on the 4th. I really enjoy interacting with and learning from bright people. The visit to the Shiva experiment was worth the trip alone.

I was most impressed with your rapport with the large customer base and the fine environment you provided by having the 25+ LLL staff and management to dinner at your house in Berkley. This was the finest, most tasteful, DEC soiree I've ever attended. All of us were at ease and it certainly helped build a better vendor-user interface. I'm sorry more of us can't (don't know the customers?) or don't (too lazy?) provide this level of hospitality. Of course, it is also nice to observe a competent professional at work.

Thanks also for the room and drive to the airport on Thursday morning. The Claremont Hotel was quite a nice place too.

GB:ljp

CC: Marketing Committee
    Wes Brown, OA
    Shel Davis, PK3-1/C21
    Gerry Moore, PK3-2/A66

D I G I T A L INTEROFFICE MEMORANDUM

DIST: Vatche Sogominian OA
Win Hindle ML5-2/A53 Ted Johnson PK3-2/A55
Andy Knowles ML5-2/A53 Stan Olsen MK1-2/A57
Bill Thompson ML12-1/F41

Wes Brown OA Shel Davis PK3-2/C21
Gerry Moore PK3-2/A66

GB3.S10.25

00 CORE DECGRAM ACCEPTED S 005375 O 515 24-NOV-82 17:54:21

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TO: BOB ROCKWELL DATE: WED 24 NOV 1982 1:07

FROM: GORDON BELL
cc: see "CC" DISTRIBUTION DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5182702747

SUBJECT: HELP ON IMPROVING VAX RIGHT NOW

As you know, the Venus slip is causing incredible competitive pressure by Interdata and SEL. IBM may also be close.

Could we get Hank Maurer to help on a project to look at the 780 microcode to speed up technical benchmarks? We would like to try several approaches:

1. Looking at a specific benchmark such as SPICE, understanding where the time is spent, and then putting various parts in microcode.

2. Looking at Vector Fortran and including some of these operations the architecture.

3. Speeding up specific, basic routines such as FFT, the scientific routines, etc. for inclusion into the architecture.

The goal is to provide the "performance oriented" 780 user a factor of 2 for his compute bound programs.

"CC" DISTRIBUTION:

DILEEP BHANDARKAR   WIN HINDLE   PETER JESSEL
BILL JOHNSON   BILL STRECKER   GEORGE THISSELL

GB0003/31

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i n t e r o f f i c e   m e m o r a n d u m

Subject: **Hi End Peripherals on VAX**

To: Bill Demmer, TW/D19 Date: May 29, 1979
Ulf Fagerquist, MR1-2/E78 From: Gordon Bell
Mike Gutman, ML3-6/E94 Dept: OOD
Per Hjerppe, MR1-2/E78 Loc: ML12-1/A51 Ext: 223-2236
Bill Johnson, ML12-3/A62
Bernie Lacroute, TW/A08
Dave Rodgers, TW/C04 Follow-Up: 6/15/79
Grant Saviers, CX

I think there is always going to be a thirst for high performance peripherals on VAX by certain OEM and LDP customers that we'll never be able to, or want to meet, by our mass storage offerings. These applications include: image and sound processing, geophysical processing, nuclear experiments and other data intensive use. Large computation center use is certainly in this category.

Shouldn't we breadboard an interface to the IBM channel so that special users could buy it and interface there own peripherals on a strictly advanced development basis?

Is the backplane interface the best way to get an IBM channel level compatible interface? Or is it SBI? ICCS? Or MASSBUS in the DX20?

We too have a good disk/tape direction in the RM05 and RP08 and I'm not proposing we deviate from this or re-open this question!

Now that the systems groups are to start behaving as systems groups it's clearly Tewksbury's job. Maybe Bill should talk with Ulf about how to build systems.

GB:swh

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Bill Demmer	TW/D19	Ulf Fagerquist	MR1-2/E78
Mike Gutman	ML3-6/E94	Per Hjerppe	MR1-2/E78
Bill Johnson	ML12-3/A62	Bernie Lacroute	TW/A08
Dave Rodgers	TW/C04	Grant Saviers	CX

00 CORE DECGRAM ACCEPTED S 004451 O 767 26-OCT-82 20:43:04

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* d i g i t a l *
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TO: BILL JOHNSON
DATE: TUE 26 OCT 1982
8:11 PM EDT

FROM: GORDON BELL
cc: see "CC" DISTRIBUTION
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5179851780

SUBJECT: RE PRODUCTS CHARTS AND REORGANIZING VAX AND PRIORITIES

It's hard to believe we aren't on to this one. The SEL machine was first shipped summer 81, and a major update last summer providing up to 17 times the throughput of VAX! They have multiprocessors and a modern compiler. The raw speed of 1 cpu is about 3 x a 780 at 200K. The PE machine is about the same.

Our problem is a complete paralysis in engineering that you must fix, including getting out of the focus on marketing and going back to a "balls out" form of engineering. Admitedly, the disaster is caused by having no VENUS (or having it 50% more expensive and what will be precisely 3 years late wrt SEL!). Therefore, in our planning it is essential to kiss VENUS off in anything resembling a strategic product. IT AIN'T! That's why the Nautilus and why we have to do all possible to get it in 2 years versus the 2.5... more in line with the 780.

The main point that many who attended the 32 bit review made was that our main business, VAX was run by people who had no awareness of the competitive issue.

BJ,
In asking the issue to a bunch of people who are asleep, you're simply passing the myth on that engineering doesn't understand. You must understand personally, and restructure the whole 32 bit area to form a competitive group.

We simply don't have time to go down through the ranks, asking the questions, hoping people will learn and getting them to change their priorities.

This is not a learning process ala DEC U. This is survival!!

g

Stand by for a message to be transmitted later tonite.

"CC" DISTRIBUTION:

DAVE CHANOUX	RICK CORBEN	BILL DEMMER
STEVE ROTHMAN	BRUCE A RYAN	JACK SMITH

GB3.S8.76

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Subject: **Array Processors and Vector Extensions to VAX and Fortran**

To: Distribution

Date: 28 NOV 78
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

follow up 12/12/78

I discussed the vector extensions to VAX with both Jacob Schwartz of NYU (SETL, compiler theorist, parallel algorithm writer) and Forest Baskett at Stanford. Forest would like to work on the extensions and I say let's give him a contract. He has the ideas and the experience with the two years on the Cray 1 at Los Alamos. Also, I'd like to have him work for us sometime. Since he may never come to the east, he's one of the people that would be worth having a west coast facility for.

Forest believes that the Burroughs Fortran extensions for vectors are good and that we should go ahead and put them into Fortran as a standard. He believes, as I do, that to get the full power of a machine, the language must contain the primitives. Compilers can go a long way to use parallel hardware, but the user can do better if given the access!

The Cray 2 is being discussed with users now and the consensus is that vectors are good and work well in the Cray 1, even though Cray was considering their elimination.

Cy Levinthal at Columbia asked when we are going to have an array processor. I was coy, knowing full well that we won't do anything until we start getting beat up in the marketplace!

GB:ljp

Distribution

Ron Brender	ML3-5/E82	Bill Johnson	ML21-3/E87
Joe Carchidi	TW/D08	Chuck Kaman	TW/A08
Peter Christy	ML12-3/A62	Bill Keating	ML12-3/A62
Dave Cutler	TW/D08	John Leng	MR1-1/A65
Ulf Fagerquist	MR1-2/E78	Bill McBride	MR2-3/E70
Sam Fuller	TW/A08	Tom Stockebrand	AB
Richard Grove	TW/C10	Bill Strecker	TW/A08

Dick Hustvedt TW/D08 Pat White ML12-
3/E51

D I G I T A L INTEROFFICE MEMORANDUM

DIST: Ron Brender ML3-5/E82 Bill Johnson ML21-
3/E87
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TW/A08
Peter Christy ML12-3/A62 Bill Keating ML12-
3/A62
Dave Cutler TW/D08 John Leng MR1-
1/A65
Ulf Fagerquist MR1-2/E78 Bill McBride MR2-
3/E70
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3/E51

00 CORE DECGRAM ACCEPTED S 000023 O 3 24-OCT-82 9:06:05

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TO: see "TO" DISTRIBUTION DATE: SUN 24 OCT 1982
8:55 AM EDT

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION

DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5179547527

SUBJECT: ARCHITECTURAL EXTENSIONS AND REDUCTIONS TO VAX

Jeff's note points out the problem in how we used to think about the VAX architecture prior to MicroVAX and the recent work we've started to enhance the ISP for better performance in AI and selected technical benchmarks (which remain to be seen).

Yesterday, I started a short note on why architecture has to change with time, including looking at directly executable subsets, and the short note is now 4 pages and growing, so I won't argue this motivational and understanding issue here now. Hopefully this'll be available this week because I want the feedback on it. Another note on RISC, somewhat longer is also in the works where I'm trying to get the basis for understanding it apart from the religious, moral and artistic ground it is now being framed on.

What we do now:
1. Jeff, tell us what we gain in time and cost by throwing out the 11 compatiblity mode.
2. Alan, you had the same concern on VENUS. Do we gain any time by throwing out the compatibility mode?
3. Dileep, your last answer as to why it had to remain in contained no data. Get the data that argues that it must remain in and at what cost to all and to special users. (We used to interpret 11's on 10's at about a 100:1 slow down and this was perfectly acceptable for the application.)

It's hard to argue that we want to kludge up all VAX boards by putting chip softcards on them, however, I would argue that say for Scorpio, we have a board option that would execute z80, 8086, 68000, 11, and 8 code, using the few chips that it would cost. The engineering market that sells to people who write software emulators really need this.

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ATTACHED: MEMO;126

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TO: GORDON BELL                      DATE: MON 18 OCT 1982 11:54 AM
EDT
                                     FROM: JEFF KALB
cc: see "CC" DISTRIBUTION            DEPT: <LSI ADMINISTRATION>
                                     EXT:  225-4025
                                     LOC/MAIL STOP: HL2-2/M11

                                     MESSAGE ID: 5179036158

SUBJECT: PDP11 COMPATIBILITY MODE IN VAX
```

While I recognize that there was recently a decision of VAXB regarding compatibility mode, I believe that it is time we changed our policy regarding its maintenance in the Vax architecture. We are forcing the inclusion of this capability into all our designs with the results of:

- o Increased Complexity
- o Higher costs, both of Engineering and Manufacturing
- o Longer development cycles
- o Risk to schedule

As just one point of reference, a detailed analysis of the impact on the V11 program indicated that elimination of the compatibility mode would have eliminated one quarter from the schedule. While it may be too late to gain back all this time now, consider that:

- One Quarter's activity on V11 is worth $1.6M in engineering expense

- One Quarter's pull-in on Scorpio systems is worth $100M or more of total lifetime systems revenue

Multiply this by the factor of 4 major Vax CPU's being developed in parallel and you get the point.

Well, what do we get by maintaining the compatibility mode? I'd argue - very little. The reality is:

- We do not support compatibility mode in a way which is really very useful to many of our customers

- This is at most, a transition strategy for a customer who has made the decision that he has outgrown his 11's

- We can effectively network "11's" and Vax's as a transition strategy and this is probably a better supported alternative than the compatibility mode (if it's an "11" program, ship it out to a cheap "11")

- o Nothing will change as far as our customers are concerned for 2 years. Even then, we already have three systems which support compatibility as well as it's ever going to be supported - Note we'd probably be better off giving away 750's to the guy making the transition (still charge for disk etc.) than continuing to carry this excess baggage from the past.

- o As MIP's go up, the likelihood that someone will be transporting an "11" application without also needing the memory addressing, gets less and less.

However, if we're still unconvinced that we can just drop compatibility mode, there are numerous other possible approaches which could be adopted which unburden the CPU design.

- o Complete software emulation - a true comparison is to provide only the same capability present in the emulation mode today - don't enhance it

  - Performance of 1/3 to 1/5 of base machine capability
  - Should take 256KB of memory as absolute worst case - including the 65KB for the program itself

- o Co-processor - either add a PDP11 processor into the base level design as a co-processor or use it as a "Softcard" type of add on like the PC's do. This could follow later than the basic CPU.

- o Write a translator from PDP11 code to VAX code. You made the comment the other day that someone almost had this working for PDP11 to 68000. This would have to be an easier problem than that one. Also, I've noted that there are already a couple of alternatives available in the market place.

- o Network an 11 and a VAX and have the VAX ship out the PDP11 problems.

Bottom line, we could significantly enhance the productivity of our engineering, shorten time to market, and have more cost effective CPU's if we can take what I think is a minor risk around a customer base which seems to be withering anyway. At least let's be a little more creative about how we implement compatibility features. It's an important business decision and can be Management's contribution to increased productivity.

I say we decide now and get on with the savings. I'll admit to not having hard data on how frequently compatibility mode is used, but unless someone has hard data which proves it would be a major loss of sales, I think we should press forward. There are plenty of alternatives, none of which would be needed in any case for 2 years (it's a mute point then).

JCK:met
8.73

"CC" DISTRIBUTION:

JIM CUDMORE
BILL JOHNSON
JACK SMITH
BILL STRECKER
STEVE TEICHER

GB3.S8.74

00 CORE DECGRAM ACCEPTED S 000308 O 45 10-OCT-82
16:28:03

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TO: see "TO" DISTRIBUTION DATE: SUN 10 OCT 1982
4:05 PM EDT

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

cc: see "CC" DISTRIBUTION

MESSAGE ID: 5178223306

SUBJECT: EXTENDING THE VAX ARCHITECTURE, CAN I HAVE A NAME

I would like someone assigned to explore extensions to the VAX architecture by adding instructions which do not increase the processor state and who are in line with the VAX complex instructions. I don't want to add vector registers or anything that would disturb the architecture of how instructions are executed. In the last few days, I've encountered several opportunities to extend VAX so as to extend it's life for particular applications and keep it alive.

The applications:
Signal Processing- Alan Oppenheimer, MIT lab, wants to explore this domain.

AI and LISP- The AI community are ignoring it and trying to get it to disappear by the LISP machines and by praying for a decent 10/20. Danny Hillis, MIT said he'd enquire as to whether we might find someone there to do this work. Alternatively, we might get it done at CMU.

GP scientific processing. There's a company in Illinois supplying these packages. We could probably contract the appropriate extension studies.

General microcode support (compiling into a fast, relatively riscy machine). Who's the company supplying this software?

Matrix and other operations for VLSI- Richard Newton, Berkley was receptive about doing this.

Possibly something that would accelerate the scheduling of simulation or the interpretation of these quasi-parallel data structures that occur in DECsim, etc.

One of the myths that I used to (till last week) believe, was that the 10 had a simple instruction set. Maybe it once did, but the plethora of new data types, funny pointers to access them, and the addition to get a big address space has made the
fast interpretation of the ISP very, very complex and difficult
so that now the 10 looks to be significantly more complex than
VAX. VAX does have many data types and operations, and as long as we do not add state, or require different data structures,

I want to capitalize on the fact that fast, larger microprogram
memories are here and are going to continue to be available over the machine's life. I want to get started with this effort
now!

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DILEEP BHANDARKAR BILL DEMMER SAM FULLER
BILL STRECKER

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BILL JOHNSON ALAN KOTOK

GB3.S8.63

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SUBJ: FOLLOW UP NOTICE   Date: 9 FEB 79
                                               From: Mary Jane Forbes
  TO: MARIO MUMMOLO, WA   Dept: OOD
                                                 MS: ML12-1/A51   Ext:
223-2237

Follow Up 2/16/79

Gordon would appreciate an answer to the attached memo.

mj

00 CORE DECGRAM ACCEPTED S 005153 O 919 19-OCT-82 22:04:12

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* d i g i t a l *
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TO: see "TO" DISTRIBUTION   DATE: TUE 19 OCT 1982
8:11 PM EDT
                                             FROM: GORDON BELL
cc: see "CC" DISTRIBUTION   DEPT: ENG STAFF
                                             EXT: 223-2236
                                             LOC/MAIL STOP: ML12-1/A51

                                             MESSAGE ID: 5179140047

SUBJECT: SPITBROOK VAX CENTER FOR PARALLELISM AND VAX EXTENSIONS

The attached center is moving ahead, albeit slowly. Similarly, Christy's Computation Center for Parallelism (CCCP) is also being put together. Now, I'd like to get a center in Spit Brook to be used for both architectural extensions to VAX for various languages so that the language group can use it; and for working on parallelism. This is why I'm advocating the pair of 782's that can be used as a 784. I also believe that if we do this work, we can get a factor of 1.5 out of the architecture and compilers (eg. Fortran and LISP (another memo to follow)).

Could you folks put together a similar center along with the other two and get postured to start the work in co-operation with the Technical Product Lines who are now losing business?

"TO" DISTRIBUTION:

JOE CARCHIDI	BILL HEFFNER	BILL JOHNSON
BILL KEATING	MAHENDRA PATEL	

"CC" DISTRIBUTION:

RON BRENDER	BILL DEMMER	SAM FULLER
TOM GANNON	BILL STRECKER	

GB3.S8.71

00 CORE DECGRAM ACCEPTED S 003241 O 342 28-JUL-82
14:37:10

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TO: see "TO" DISTRIBUTION DATE: WED 28 JUL 1982
1:56 PM EDT

FROM: GORDON BELL
cc: see "CC" DISTRIBUTION DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5170809470

SUBJECT: CRITICALITY OF VAX COMPETITIVENESS NOW AND IN THE FUTURE

GB3.S6.39
We must have higher performance systems at lower priced systems and at
the high end. Don't we have a crisis, because:

DEC IS NOT THE LEADER IN PERFORMANCE & PRICE/PERFORMANCE MINIS!
(Nor are we heading to be.)

BACKGROUND: SEL has made recent announcements in providing a 17M
whetstones machine. PE has one. Hitachi has a fast, VAX look-alike
that looks good enough to be able to run VAX assembly level software
by automatic translation... assuming they can get their hands on the
assembly listings of VMS, languages, et al. DG and Prime are close,
and IBM has lowered prices on 4341-2's. All these factors just have
to affect bookings to some degree.

We have to mount a task force level effort to assess our position and
then move to redirect resources to be competitive asap and in the
future.   Here's the options that come to mind:

SPECIALS	NON-VAX	VAX-UNI/DUAL PROCESSOR
CDC FORTRAN+Uvector	Titan	Venus
U accelerators	Titan-vector	Nautilus
VAX+FPS 164	Titan-mC	HyperVAX
VAX+2080		COMET-MCA
Qbus 11 mP	U-VAX, U-VAX-mC	Venus-Fujitsu

New P.vector (buyout in a joint venture)
CI+HSC+750(RDMS)

VAX MULTIPROCESSOR OR MULTICOMPUTER STRUCTURES

784 (4Pc, symmetrical 780 utilizing MA780), including 4 Pc.Venus
780's on Ethernet (many are available for experimentation, and
this structure will emerge, given Scorpios as PC's
780's on CI
Scorpio on BI (780 x n) on one BI

LARGE, MULTICOMPUTER/MULTIPROCESSORS
64 computer 16032 mapped into VAX address-space (see Strecker) with
a follow-on of Scorpio or MicroVAXs

I want your help in addressing this critical competitive problem.
What options do you see? What are the efforts and risks involved in

these? Who are the relevant people we need for task forcing? Let's
rendevouz by mail, meet briefly this month to decide on the approach
and then aim for a 2-3 day meeting in early September.

"TO" DISTRIBUTION:

FOREST BASKETT DAVE CUTLER SAM FULLER
BOB GLORIOSO DICK HUSTVEDT BILL STRECKER

"CC" DISTRIBUTION:

BILL DEMMER	ULF FAGERQUIST	WIN HINDLE
BILL JOHNSON	JOHN O'KEEFE	KEN OLSEN
JACK SHIELDS	JACK SMITH	

WPS USERS - Leave HP mode and type <CR>

We must have higher performance systems at lower priced systems and at the high end. Don't we have a crisis, because:

DEC IS NOT THE LEADER IN PERFORMANCE & PRICE/PERFORMANCE MINIS!
(Nor are we heading to be.)

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ID#335

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+---------------------------+
|   |   |   |   |   |   |   |
| d | i | g | i | t | a | l |   i n t e r o f f i c e   m e m o r a n d u m
|   |   |   |   |   |   |   |
+---------------------------+
```

Subject: **VAX DMT; When?**

To: Bill Demmer, TW/D19
Bernie Lacroute, TW/A08
Dave Rodgers, TW/C04
Bill Strecker, TW/A08

Date: 7 NOV 78
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

CC: John Leng, MR1-1/A65
Jack Shields, PK3-2/A58

follow up 11/21/78

John believes there are VAX problems that DMT would have found.

What's the story?

John also believes there are unreliable VAX systems in the field. How bad?

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST: Bill Demmer TW/D19 Bernie Lacroute
TW/A08
John Leng MR1-1/A65 Dave Rodgers
TW/C04
Jack Shields PK3-2/A58 Bill Strecker
TW/A08

00 CORE DECGRAM ACCEPTED S 000365 O 66 21-AUG-82 21:05:57

****
* d i g i t a l *
****

TO: SAM FULLER DATE: SAT 21 AUG 1982
9:02 PM EDT
BILL STRECKER FROM: GORDON BELL
cc: see "CC" DISTRIBUTION DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

MESSAGE ID: 5173246170

SUBJECT: DUCHAMP'S VECTOR INSTRUCTION WORK AND EXTENDING VAX

This talk is on the 26th at 1-2:30 in Mr2, 17c... pretty obscure place. I hope the work is good and let me recommend we take this
issue a lot more seriously.

Right now, I want VAX to survive and be a significant architecture in the 90's as I think it rightfully deserves. The situation is touch and go though as we are unable to implement it effectively.

I knew we were at risk with VAX when such a complex machine was architected in 75. A note written then on the issue of microprogramming and its use (or not) is in the mail.

I think we have to continue to extend VAX into microcode to get incremental performance while NOT extending the state which would in turn drastically increase the complexity of what has to be built in hardware. Unfortunately, we should have
made it possible to decrease the microcode too without changing the architecture as in microvax. This is in line with the fact that rams are getting bigger and bigger for microcode, and I don't see a way to add to the state of the processor without increasing complexity. Cohen's thesis which Richard Newton supervised is being sent around too because it illustrates the improvement of the HP1000 in matrices. I don't think we'll do anywhere as well because the HP was so bad to start with.

Maybe the VAX ISP can't be extended to give much greater performance without violating the constraint of increasing the hardware, but I'd like to know this too. To me, this means we'll consider the transcendentals, matrix and other operations (eg. FFT) as primitives. Also, we'll support a system of microprogramming.

We have a serious issue ahead to keep VAX number one.

"CC" DISTRIBUTION:

BILL DEMMER BOB GLORIOSO BILL JOHNSON
ALAN KOTOK

WPS USERS - Leave HP mode and type <CR>

```
*****************
* d i g i t a l *
*****************
```

TO: see "TO" DISTRIBUTION DATE: TUE 25 MAY 1982
4:05 PM EDT

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: MARKETING (AND DEVELOPING) VAX'S TO SAVE US

Data

1. Having just returned from visiting Cal Tech and seeing many distributed VAXs surround and overthrough the Cal Tech computation center, by adopting our strategy (complete with Ethernet), I'm appalled at our abysmal performance to sell VAXs, especially in Educational Institutions.

2. The System 38 is nowhere near a VAX, yet more have sold.

3. IBM's delivered more series 1's!

4. IBM now has a VAX force to STOP VAX. They needn't be worried.

5. HP has continued to grow with the 3000 despite its massive inferiority.

6. Who would buy a Prime when VAX (and a compatible Professional PC) are available?

7. With the 730 we should get computing down to very small groups of
2-8 for the best computing.

8. A 730 ad with no content!

9. OC time devotes no time to this critical area.

ACTION

1. We must immediately establish a techncial effort that only have a
VAX sales goal. Back to the Product (Product Line!)

2. There must be a strong, engineering effort for continued technical
market place needs.

This includes: real time, graphic support, better technical
languages, a relationed data base, high quality terminals and
personal computer support. (Here, aside from ESG, we have a
massive void coupled with poor incompetence!)

3. The commercial market for VAX is probably 10X the technical market
place. We have an excellent engineering group. We must now focus
on Commercial Marketing. Let's get the System 38! Let's discuss
at OC and set the buy in for focus and change.

4. We should market VAX commercial computing in Universities when we
have strong customer support.

"TO" DISTRIBUTION:

ROGER CADY BILL DEMMER WIN HINDLE

BILL JOHNSON R.L. LANE WARD MACKENZIE
JULIUS MARCUS KEN OLSEN JACK SHIELDS
RON SMART JACK SMITH

GB3.S5.50
D I G I T A L INTEROFFICE MEMORANDUM

DIST: VAX Marketing Group

Al Avery	ML3-5/E35	Paul Bauer	ML1-3/E38
Dave Best	ML5-2/M17	Frank Bicchieri	PK3-1/M28
Tom Campbell	MR1-1/M74	Janice Carnes	ML3-3/E71
Dan Goor	PK3-2/S10	Carol Hubler	PK2/A35
Bill Kelly	MR1-1/M42	Bernie Lacroute	ML3-5/E35
Mike Mensh	NT	John Mucci	MR2-4/M38
Stan Pearson	ML12-3/E13	Dick Rislove	PK3-1/M10
Leroy Rodgers	PK3-1/M33	Frank Sanjana	ML5-2/E71
Bob Trocchi	ML5-2/M40		

00 BURT DECGRAM ACCEPTED S 26048 O 556 06-JUN-80 20:55:25

****
* d i g i t a l *
****

TO: DICK ECKHOUSE
OOD:
cc: TERRY POTTER
BILL SVIRSKY

DATE: FRI 6 JUN 1980 9:01 PM EDT
FROM: GORDON BELL
DEPT: OOD
EXT: 223-2236

BILL THOMPSON LOC/MAIL STOP: ML12-1/A51

SUBJECT: BUYING ADD ON VAX MEMORY FROM OUTSIDE TO INCREASE PRODUCTIVITY

Given the state (hopefully in the past) of our needing extra memory for vax's, I have authorized the purchase of outside memory. This has created some concern in the Operations Committee. I may have assumed this to be a more general problem of need. Actually, I think that the users of VAX are underconfiguring it with memory, and I wanted to assure them that we would get the necessary memory so that they could get the necessary cycles out of the machine. Given the overall state of the equipment availability, I strongly support getting
significantly more memory to the tune of at least 4 MBytes per 780 so that we can get the most users on and have the least waiting time, hence the highest productivity for the users who are on.

Bottom line: equipment availability still seems to be a problem. If it is VAX, then get the memory size up asap (assuming you have the load). I'll support any means to getting this memory because the cost to buy it out is cheap(er
than inside), but the payoff in terms of productivyity is enormous.

ATTACHED: MEMO;18

****
* d i g i t a l *
****

TO: GORDON BELL DATE: MON 2 JUN 1980
8:15 PM EST

FROM: BILL THOMPSON
cc: MITCH KUR DEPT: CORPORATE
CONTROLLER
BILL SVIRSKY EXT: 223-3779

LOC/MAIL STOP: MS/C12

SUBJECT: IEG

BILL SVIRSKY HAS BEEN LOOKING FOR YOUR OUTSIDE EQUIPMENT NEEDS TO UNDERSTAND THE SIZE OF YOUR PROBLEM HE HAS NOT RECEIVED IT. DO YOU HAVE A REAL OR EMOTIONAL PROBLEM?
PS: HAVE YOU REALLY PERSONNALY SCRUBBED YOUR REQUEST?

GB1.S5.4

VAX PARTY EXPENSES -- 4/5/80

General

Band		500.00
Candles		16.07
Flowers - Tables		172.25
Fish		296.86
Flowers		446.00
(100 coursages @ $350; 2 centerpieces @ $35; Tax @ $26)		
Binders/Programs		13.70
Piano		150.00
Champaigne		666.00
Wine - 2nd time		134.50
Cheese		36.20
100 name tags + 24 # cards		40.00
Paperweights		1,075.00

	Sub	3,540.58

Tobin

Buffet - 200		1,074.00
Labor		795.00
Taylor Rental		929.66

	Sub	2,798.66

Grand Total 6,339.24 = 200 @ $31.70

GB1.S2.37

```
NAME                    MS       CONTRIBUTION
<!S>
<name>                  <ms>     <contribution>
<name>John Adams
<program>John and Patricia
<course1>Table 22 near the TX-0.
<course2>different seats at the same table.
<course3> Table l near LINC.
<sal>John
<ms>ML5-5/E97
<contribution>Marketing
<event>VAX 5-year Party
<rsvp>Y - no show
<guest>Patricia
<>

<name>Kerbey Altman
<program>Kerbey and Marjorie
<course1>Table 3 near the LINC.
<course2>Table l7 overlooking the dance floor.
<course3>Table 8 near the TX-0.
<sal>Kerbey
<ms>MK1-2/J05
<contribution>Software
<event>VAX 5-year Party
<rsvp>Y
<guest>Marjorie
<>

<name>Don Ames
<program>
<course1>
<course2>
<course3>
<sal>Don
<ms>CX
<contribution>Field Service
<event>VAX 5-year Party
<rsvp>N
<guest>
```

<>

<name>Patti Anklam
<program>Patti and Joe
<course1>Table 4 near VAX.
<course2>Table 16 overlooking the dance floor.
<course3>the long table (No. 23) around the corner.
<sal>Patti
<ms>TW/A14
<contribution>Training
<event>VAX 5-year Party
<rsvp>Y
<guest>Joe
<>

<name>Marilyn Arbuckle
<program>
<course1>
<course2>
<course3>
<sal>Marilyn
<ms>ML12-1/T32
<contribution>
<event>VAX 5-year Party
<rsvp>N
<guest>
<>

<name>Bob Armstrong
<program>Bob and Judy
<course1>Table 2 by the LINC.
<course2>Table 20 near Whirlwind.
<course3>Table 16 overlooking the dance floor.
<sal>Bob
<ms>TW/D06
<contribution>Hardware
<event>VAX 5-year Party
<rsvp>Y
<guest>Judy
<>

<name>Al Avery

<program>
<course1>
<course2>
<course3>
<sal>Al
<ms>TW/A08
<contribution>Product Management
<event>VAX 5-year Party
<rsvp>N
<guest>
<>

<name>Gordon Bell
<program>Gordon and Gwen
<course1>Table 1 near LINC.
<course2>the long table on the balcony-Number 23.
<course3>Table 8 near the PDP-1.
<sal>Gordon
<ms>ML12-1/A51
<contribution>Management-Host
<event>VAX 5-year Party
<rsvp>Y
<guest>Gwen
<>

<name>Joel Berman
<program>Joel and Frances
<course1>Table 12 near the classic 8.
<course2>Table 16 overlooking the dance floor.
<course3>Table 20 near Whirlwind.
<sal>Joel
<ms>TW/A02
<contribution>Field Service
<event>VAX 5-year Party
<rsvp>Y
<guest>Frances
<>

<name>Dick Berube
<program>Dick and Judy
<course1>the long table (23) on the balcony.
<course2>Table 9 near the console display.

<course3>right next door to Table l0.
<sal>Dick
<ms>PK3-2/M18
<contribution>Marketing
<event>VAX 5-year Party
<rsvp>N
<guest>Judy
<>

<name>Dileep Bhandarkar
<program>Dileep and Lou
<course1>the long table (23) on the balcony.
<course2>Table l3 on the balcony (behind TX-0).
<course3>Table 3 near VAX.
<sal>Dileep
<ms>TW/B05
<contribution>Hardware
<event>VAX 5-year Party
<rsvp>Y
<guest>Lou
<>

<name>Paul Binder
<program>Paul and Margaret
<course1>Table 8 near PDP-1.
<course2>Table 21 near the TX-O.
<course3>Table l5 overlooking the dance floor.
<sal>Paul
<ms>TW/D06
<contribution>Hardware
<event>VAX 5-year Party
<rsvp>Y
<guest>Margaret
<>

<name>Jack Bittner
<program>Jack and Claudia
<course1>Table 4 near VAX.
<course2>long table (23) on the balcony.
<course3>Table l7 overlooking the dance floor.
<sal>Jack
<ms>WZ2

<contribution>LSI Engineers
<event>VAX 5-year Party
<rsvp>Y
<guest>Claudia
<>

<name>Rodger Blair
<program>Rodger and Charlene
<course1>Table 1 near LINC.
<course2>Table 13 on the balcony.
<course3>Table l6 overlook the dance floor.
<sal>Rodger
<ms>MK1-2/J05
<contribution>Software
<event>VAX 5-year Party
<rsvp>Y
<guest>Charlene
<>

<name>Ron Brender
<program>
<course1>
<course2>
<course3>
<sal>Ron
<ms>ML3-2/E41
<contribution>Software
<event>VAX 5-year Party
<rsvp>N
<guest>
<>

<name>Mary Breslin
<program>
<course1>
<course2>
<course3>
<sal>Mary
<ms>ML5-5/E97
<contribution>
<event>VAX 5-year Party
<rsvp>N

<guest>
<>

<name>Roger Cady
<program>
<course1>
<course2>
<course3>
<sal>Roger
<ms>MK1-2/E25
<contribution>
<event>VAX 5-year Party
<rsvp>
<guest>
<>

<name>Dave Cane
<program>Dave and Aleta
<course1>the long table (23) on the balcony.
<course2>Table 5 near VAX.
<course3>Table 20 near TX-0.
<sal>Dave
<ms>TW/D06
<contribution>Hardware
<event>VAX 5-year Party
<rsvp>Y
<guest>Aleta
<>

<name>Joe Carchidi
<program>Joe Carchidi
<course1>Table 3 by VAX.
<course2>long Table 23 on the balcony.
<course3>Table 1 by LINC.
<sal>Joe
<ms>TW/D08
<contribution>Software
<event>VAX 5-year Party
<rsvp>Y
<guest>no guest
<>

<name>Rick Casabona
<program>Rick and Doreen
<course1>Table l by LINC.
<course2>Table 3 by VAX.
<course3>Table 22 by the TX-0.
<sal>Rick
<ms>TW/C04
<contribution>Hardware
<event>VAX 5-year Party
<rsvp>Y
<guest>Doreen
<>

<name>Dick Clayton
<program>Dick and Nancy
<course1>Table l6 overlooking the dance floor.
<course2>Table 22 by the TX-0.
<course3>Table 2 by your old friends -- LINC and 12.
<sal>Dick
<ms>ML12-2/E71
<contribution>Management
<event>VAX 5-year Party
<rsvp>Y
<guest>Nancy
<>

<name>Peter Conklin
<program>Peter and Donna
<course1>Table 2 by VAX.
<course2>Table l7 overlooking the dance floor.
<course3>Table 3 back to the VAX showcase.
<sal>Peter
<ms>TW/A08
<contribution>Product Management
<event>VAX 5-year Party
<rsvp>Y
<guest>Donna
<>

<name>Larry Coppenrath
<program>Larry and Paula
<course1>Table 9 at the console gallery.

<course2>Table l by LINC.
<course3>Table l9 overlooking the dance floor.
<sal>Larry
<ms>TW/D06
<contribution>Hardware
<event>VAX 5-year Party
<rsvp>Y
<guest>Paula
<>

<name>Brian Croxon
<program>Brian and Hazel
<course1>Table 3 by VAX.
<course2>Table 7 by the PDP-1.
<course3>Table l4 on the balcony.
<sal>Brian
<ms>TW/C04
<contribution>Management
<event>VAX 5-year Party
<rsvp>Y
<guest>Hazel
<>

<name>Dave Cutler
<program>Dave Cutler
<course1>Table 13 on the balcony.
<course2>over one to Table 14 -- and a better look at the back of TX-0.
<course3>Table 9 near the console gallery.
<sal>Dave
<ms>TW/D08
<contribution>Software
<event>VAX 5-year Party
<rsvp>Y - no show
<guest>
<>

<name>Bob Daley
<program>
<course1>
<course2>
<course3>

<sal>Bob
<ms>MK1-2/E06
<contribution>Management
<event>VAX 5-year Party
<rsvp>N
<guest>
<>

<name>Marion Dancy
<program>Marion and Jim
<course1>Table l3 on the balcony.
<course2>Table 8 near PDP-1.
<course3>Table 6 near PDP-12.
<sal>Marion
<ms>TW/A08
<contribution>Product Management
<event>VAX 5-year Party
<rsvp>Y
<guest>Jim
<>

<name>Scott Davis
<program>Scott and Dena
<course1>Table 7 near PDP-1.
<course2>Table 20 near Whirlwind.
<course3>Table 4 near VAX.
<sal>Scott
<ms>TW/C04
<contribution>Software
<event>VAX 5-year Party
<rsvp>Y
<guest>Dena
<>

<name>Shel Davis
<program> Shel and Nona
<course1>Table 22 near TX-0.
<course2>Table 6 near PDP-12.
<course3>Table 24, back up by TX-0.
<sal>
<ms>
<contribution>

<event>VAX 5-year Party
<rsvp>Y
<guest>Nona
<>

<name>Bruce Delagi
<program>
<course1>
<course2>
<course3>
<sal>Bruce
<ms>MR2-1/M64
<contribution>Management
<event>VAX 5-year Party
<rsvp>N
<guest>
<>

<name>Bill Demmer
<program>Bill and Marie
<course1>Table 8 near PDP-1.
<course2>Table l near LINC.
<course3>the long table (23) on the balcony.
<sal>Bill
<ms>TW/D19
<contribution>Management-Host
<event>VAX 5-year Party
<rsvp>Y
<guest>Marie
<>

<name>Charles Denny
<program>Charles Denny
<course1>Table 1 near LINC.
<course2>Table 21 near TX-0.
<course3>Table 4 near VAX.
<sal>Charles
<ms>MR1-1/A65
<contribution>Marketing
<event>VAX 5-year Party
<rsvp>Y
<guest>no guest

<>

<name>Sas Durvasula
<program>Sas and Laksmi
<course1>Table 12 near PDP-8.
<course2>Table 3 near VAX.
<course3>Table 21 near TX-0.
<sal>Sas
<ms>MR1-2/E47
<contribution>Hardware
<event>VAX 5-year Party
<rsvp>Y
<guest>Lakshmi
<>

<name>Rony Elia-Shaoul
<program>
<course1>
<course2>
<course3>
<sal>Rony
<ms>WZ2
<contribution>LSI Engineers
<event>VAX 5-year Party
<rsvp>N
<guest>
<>

<name>Tom Ermolovich
<program>Tom and Elaine
<course1>Table 20 near Whirlwind.
<course2>Table 7 by PDP-1.
<course3>Table 9 by the console gallery.
<sal>Tom
<ms>TW/C04
<contribution>Hardware
<event>VAX 5-year Party
<rsvp>Y
<guest>Elaine
<>

<name>Ulf Fagerquist

<program>Ulf and Helene
<course1>Table 24 by TX-0.
<course2>Table 12 by the classic 8.
<course3>Table 7 by the PDP-1.
<sal>Ulf
<ms>MR1-2/E78
<contribution>Management
<event>VAX 5-year Party
<rsvp>Y
<guest>Helene
<>

<name>JoAnn Falco
<program>JoAnn
<course1>Table 6 near the PDP-12.
<course2>Table 2 near VAX.
<course3>Table 20 near Whirlwind.
<sal>JoAnn
<ms>HD
<contribution>Hardware
<event>VAX 5-year Party
<rsvp>Y
<guest>Wayne R.
<>

<name>Mary Jane Forbes
<program>Mary Jane and Jack
<course1>Table 2 - the center of the action.
<course2>the center of the action - right in the same place.
<course3>but not for you, just root right to those chairs.
<sal>Mary Jane
<ms>ML12-1/A51
<contribution>Management
<event>VAX 5-year Party
<rsvp>Y
<guest>Jack
<>

<name>Sam Fuller
<program>Sam and Carol
<course1>Table 7 near PDP-1.
<course2>Table 24 near TX-0 (even though it was before your

time.)
<course3>Table 12 by the classic 8.
<sal>Sam
<ms>ML3-5/H33
<contribution>Management
<event>VAX 5-year Party
<rsvp>Y
<guest>Carol
<>

<name>Sue Gault
<program>
<course1>
<course2>
<course3>
<sal>Sue
<ms>TW/A14
<contribution>Writers
<event>VAX 5-year Party
<rsvp>N
<guest>
<>

<name>Ruth Goldenberg
<program>
<course1>
<course2>
<course3>
<sal>Ruth
<ms>PK2/M21
<contribution>Field Service
<event>VAX 5-year Party
<rsvp>N
<guest>
<>

<name>Andy Goldstein
<program>Andy Goldstein
<course1>Table 10 near the console gallery.
<course2>Table l by LINC.
<course3>Table 12 near the classic 8.
<sal>Andy

<ms>TW/D08
<contribution>Software
<event>VAX 5-year Party
<rsvp>Y
<guest>no guest
<>

<name>Rich Grove
<program>Rich and Karen
<course1>Table 8 near the console gallery.
<course2>Table 20 by Whirlwind.
<course3>other seats at the same table.
<sal>Rich
<ms>TW/C10
<contribution>Software
<event>VAX 5-year Party
<rsvp>Y
<guest>Karen
<>

<name>Ron Ham
<program>Ron Ham and T.T. Yang
<course1>Table 2 by the VAX.
<course2>Table 13 on the balcony.
<course3>Table 15 overlooking the dance floor.
<sal>Ron
<ms>ML12-3/A62
<contribution>Software
<event>VAX 5-year Party
<rsvp>Y
<guest>T.T.Yang
<>

<name>Tom Harris
<program>Tom and Sue
<course1>the long table (23) on the balcony.
<course2>Table 3 by VAX.
<course3>next door to Table 4.
<sal>Tom
<ms>MK1-2/J05
<contribution>Software
<event>VAX 5-year Party

<rsvp>Y
<guest>Sue
<>

<name>Frank Hassett
<program>Frank and Adelaide
<course1>Table 9 near the console gallery.
<course2>Table 12 by the classic 8.
<course3>Table 22 by TX-0.
<sal>Frank
<ms>TW/C10
<contribution>
<event>VAX 5-year Party
<rsvp>Y
<guest>Adelaide
<>

<name>Tom Hastings
<program>Tom and Bonnie
<course1>Table 12 by the classic 8.
<course2>Table 21 by the TX-0.
<course3>Table 3 by VAX.
<sal>Tom
<ms>MK1-2/J05
<contribution>Software
<event>VAX 5-year Party
<rsvp>Y
<guest>Bonnie
<>

<name>Bill Heffner
<program>Bill and Gerry
<course1>Table l5 overlooking the dance floor.
<course2>the long table (23) on the balcony.
<course3>Table 9 by the console gallery.
<sal>Bill
<ms>TW/E10
<contribution>Management
<event>VAX 5-year Party
<rsvp>Y
<guest>Gerry
<>

<name>Roger Heinen
<program>Roger and Marne
<course1>Table 24 by the TX-0.
<course2>Table 3 by VAX.
<course3>Table 17 overlooking the dance floor.
<sal>Roger
<ms>TW/D08
<contribution>Software
<event>VAX 5-year Party
<rsvp>Y
<guest>Marnie
<>

<name>Al Helenius
<program>Al and Suzan
<course1>Table 22 by TX-0.
<course2>Table 8 by the console gallery.
<course3>Table 5 by VAX.
<sal>Al
<ms>MR1-2/E47
<contribution>Hardware
<event>VAX 5-year Party
<rsvp>Y
<guest>Suzan
<>

<name>Win Hindle
<program>
<course1>
<course2>
<course3>
<sal>Win
<ms>ML10-2/A53
<contribution>Marketing
<event>VAX 5-year Party
<rsvp>N
<guest>
<>

<name>Dick Hustvedt
<program>Dick and Audrey

<course1>Table l6 overlooking the dance floor.
<course2>Table 2 by VAX.
<course3>Table 9 by the console gallery.
<sal>Dick
<ms>TW/D08
<contribution>Software
<event>VAX 5-year Party
<rsvp>Y
<guest>Audrey
<>

<name>Marty Jack
<program>Marty and Janet
<course1>the long table (23) on the balcony.
<course2>Table 4 by VAX.
<course3>Table 21 by TX-0.
<sal>Marty
<ms>MK1-2/J05
<contribution>Software
<event>VAX 5-year Party
<rsvp>Y
<guest>Janet Eagen
<>

<name>Peter Jancourtz
<program>Peter and Susan
<course1>Table 15 overlooking the dance floor.
<course2>Table 4 by VAX.
<course3>Table 1 by LINC.
<sal>Peter
<ms>PK3-2/M88
<contribution>Marketing
<event>VAX 5-year Party
<rsvp>Y
<guest>Susan
<>

<name>Steve Jenkins
<program>Steve and Sharon
<course1>Table 7 near PDP-1.
<course2>Table 4 near VAX.
<course3>Table 19 overlooking the dance floor.

<sal>Steve
<ms>TW/C04
<contribution>Hardware
<event>VAX 5-year Party
<rsvp>Y
<guest>Sharon Smith
<>

<name>Bill Johnson
<program>
<course1>
<course2>
<course3>
<sal>Bill
<ms>ML12-3/62
<contribution>Management
<event>VAX 5-year Party
<rsvp>N
<guest>
<>

<name>Kathy Johnson
<program>Kathy and Herluf
<course1>Table 11 near the console gallery.
<course2>Table 1 near the LINC.
<course3>Table 21 near TX-0.
<sal>Kathy
<ms>TW/D19
<contribution>
<event>VAX 5-year Party
<rsvp>Y
<guest>Herluf
<>

<name>Bob Johnston
<program>Bob and Debra
<course1>Table 7 near PDP-1.
<course2>Table l8 overlooking the dance floor.
<course3>Table l0 by the console gallery.
<sal>Bob
<ms>NI/K20
<contribution>Manufacturing

<event>VAX 5-year Party
<rsvp>Y
<guest>Debra
<>

<name>Judy Jurgens
<program>Judy Jurgens
<course1>Table 21 by the TX-0.
<course2>Table 12 by the PDP-8.
<course3>Table 4 by VAX.
<sal>Judy
<ms>TW/D04
<contribution>Field Service
<event>VAX 5-year Party
<rsvp>Y
<guest>no guest
<>

<name>Len Kawell
<program>Len and Jan
<course1>Table 5 by VAX.
<course2>Table 12 near the classic 8.
<course3>Table 14 on the balcony.
<sal>Len
<ms>TW/D08
<contribution>Software
<event>VAX 5-year Party
<rsvp>Y
<guest>Jan
<>

<name>Bill Keating
<program>Bill and Lenore
<course1>Table 22 near the TX-0.
<course2>Table l by LINC.
<course3>Table 21 back to the TX-0.
<sal>Bill
<ms>ML12-3/A62
<contribution>Software
<event>VAX 5-year Party
<rsvp>N

<guest>Lenore
<>

<name>Ed Kenney
<program>Ed and Fran
<course1>Table 4 near VAX.
<course2>Table l8 overlooking the dance floor.
<course3>Table l near LINC.
<sal>Ed
<ms>MR1-1/S35
<contribution>Diagnostics
<event>VAX 5-year Party
<rsvp>Y
<guest>Fran
<>

<name>Andy Knowles
<program>
<course1>
<course2>
<course3>
<sal>Andy
<ms>MR1-1/A65
<contribution>Marketing
<event>VAX 5-year Party
<rsvp>N
<guest>
<>

<name> Ed Kramer
<program> Ed and Debbie
<course1>Table 14 on the balcony.
<course2>Table 11 by VAX.
<course3>Table 6 by PDP-12.
<sal>
<ms>
<contribution>
<event>VAX 5-year Party
<rsvp>Y
<guest>Debbie
<>

<name>Nancy Kronenberg
<program>
<course1>
<course2>
<course3>
<sal>Nancy
<ms>TW/D08
<contribution>Software
<event>VAX 5-year Party
<rsvp>N
<guest>
<>

<name>Mitch Kur
<program>Mitch and Carol
<course1>Table 9 by the consoles.
<course2>The long table, 23, on the balcony.
<course3>Table 14 on the other side of the TX-0.
<sal>
<ms>
<contribution>
<event>
<rsvp>Y
<guest>Carol
<>

<name>Rita Lancaster
<program>Rita and Joe
<course1>Table 5 near VAX.
<course2>the long table (23) on the balcony.
<course3>Table 13 near the elevators.
<sal>Rita
<ms>MR2-3/E70
<contribution>Marketing
<event>VAX 5-year Party
<rsvp>Y
<guest>Joe Dzekevicjh
<>

<name>Bernie Lacroute
<program>Bernie and Ronni
<course1>Table 20 near the TX-0.

<course2>Table 5 near VAX.
<course3>Table 7 by the PDP-1.
<sal>Bernie
<ms>TW/A08
<contribution>Product Management
<event>VAX 5-year Party
<rsvp>Y
<guest>Ronni
<>

<name>Richy Lary
<program>Richy and Barbara
<course1>Table 11 by VAX's showcase.
<course2>the same seat.
<course3>to Table 13 on the balcony.
<sal>Richy
<ms>CX
<contribution>Software
<event>VAX 5-year Party
<rsvp>Y
<guest>Barbara
<>

<name>Leo Laverdure
<program>Leo and Martine
<course1>Table 20 near TX-0.
<course2>Table 8 at the console gallery.
<course3>Table 13 on the balcony.
<sal>Leo
<ms>MK1-2/J05
<contribution>Software
<event>VAX 5-year Party
<rsvp>Y
<guest>Martine
<>

<name>Jud Leonard
<program>Jud and Barbara
<course1>Table 5 by VAX.
<course2>Table 1 by LINC.
<course3>Table 14 on the balcony.
<sal>Jud

```
<ms>MR1-2/E47
<contribution>Hardware
<event>VAX 5-year Party
<rsvp>Y
<guest>Barbara  Sprout
<>

<name>Hank Levy
<program>Hank and Sandy
<course1>Table 10 near the console gallery.
<course2>Table 5 by VAX.
<course3>Table 24 by the TX-0.
<sal>Hank
<ms>TW/A08
<contribution>Software
<event>VAX 5-year Party
<rsvp>Y - now show
<guest>Sandy Kaplan
<>

<name>Peter Lipman
<program>Peter and Corinne
<course1>Table 21 near TX-0.
<course2>Table 7 near the PDP-1 (staying in chronological
order).
<course3>Table 5 -- to show off the latest number -- the VAX.
<sal>Peter
<ms>TW/C10
<contribution>Software
<event>VAX 5-year Party
<rsvp>Y
<guest>Corinne
<>

<name>Si Lyle
<program>Si and Joan
<course1>Table 12 near the classic 8.
<course2>Table 7 near the PDP-1.
<course3>Table 24 near the period room, "the TX-0".
<sal>Si
<ms>ML12-1/T39
<contribution>Marketing
```

<event>VAX 5-year Party
<rsvp>Y
<guest>Joan
<>

<name>Joe Mangiafico
<program>Joe and Serafina
<course1>Table 21 by the TX-0.
<course2>to the next table, number 22.
<course3>downstairs to Table 8, near the PDP-1.
<sal>Joe
<ms>HL
<contribution>LSI Engineers
<event>VAX 5-year Party
<rsvp>Y
<guest>Serafina
<>

<name>Ed Marison
<program>Ed and Trinita
<course1>Table 21 near the TX-0.
<course2>Table 9 near the console gallery.
<course3>Table 7 by PDP-1.
<sal>Ed
<ms>MK1-2/H03
<contribution>Software
<event>VAX 5-year Party
<rsvp>Y
<guest>Trinita
<>

<name>Don McInnis
<program>Don and Mary Jane
<course1>Table 5 by the PDP 12.
<course2>Table 24 by TX-O.
<course3>Table ll by the console gallery.
<sal>Don
<ms>TW/A08
<contribution>Product Management
<event>VAX 5-year Party
<rsvp>Y
<guest>Mary Jane

<>

<name>Bob McKenzie
<program>Bob and Sonja
<course1>Table 20 near Whirlwind.
<course2>Table 10 near the console gallery.
<course3>Table 2 by VAX.
<sal>Bob
<ms>MK1-2/J05
<contribution>Software
<event>VAX 5-year Party
<rsvp>Y
<guest>Sonja
<>

<name> John Meyer
<program> John and Jan
<course1>Table 6 near PDP-12.
<course2>the same seats -- with a change of guard.
<course3>Table 18 overlooking the dance floor.
<sal>
<ms>
<contribution>
<event>VAX 5-year Party
<rsvp>Y
<guest>Jan
<>

<name>Lee Mickle
<program>Lee and Tim
<course1>Table 10 near the console gallery.
<course2>Table 2 by VAX.
<course3>Table 13 on the balcony.
<sal>Lee
<ms>PK3-2/H20
<contribution>Field Service
<event>VAX 5-year Party
<rsvp>Y - no show
<guest>Tim
<>

<name>Chuck Monia

<program>Chuck and Joan
<course1>Table 11 near the console gallery.
<course2>Table 19 overlooking the dance floor.
<course3>the long table, 23, on the balcony.
<sal>Chuck
<ms>ML5-5/E76
<contribution>Software
<event>VAX 5-year Party
<rsvp>Y
<guest>Joan
<>

<name>Don Monroe
<program>Don Monroe
<course1>Table 12 near the classic 8.
<course2>Table 9 near the console gallery.
<course3>the long table, 23, on the balcony.
<sal>Don
<ms>TW/F17
<contribution>Diagnostics
<event>VAX 5-year Party
<rsvp>Y
<guest>no guest
<>

<name>Kathy Morse
<program>Kathy Morse
<course1>Table 10 near the console gallery.
<course2>the long table, 23, on the balcony.
<course3>Table 11.
<sal>Kathy
<ms>TW/D08
<contribution>Software
<event>VAX 5-year Party
<rsvp>Y
<guest>no guest
<>

<name>John Mucci
<program>John and Pat
<course1>Table 18 overlooking the dance floor.
<course2>Table 12 near the classic 8.

<course3>Table 5 near VAX.
<sal>John
<ms>MR2-4/M38
<contribution>Marketing
<event>VAX 5-year party
<rsvp>Y
<guest>Pat
<>

<name>Craig Mudge
<program>Craig and Maureen
<course1>Table 18 overlooking the dance floor.
<course2>Table 9 near the console gallery.
<course3>Table 7 near PDP-1 and the band.
<sal>Craig
<ms>ML4-3/T34
<contribution>Hardware
<event>VAX 5-year Party
<rsvp>Y
<guest>Maureen
<>

<name>Dick Murphy
<program>Dick and Lee
<course1>Table 19 overlooking the dance floor.
<course2>Table 14 (behind the TX-0).
<course3>Table 12 by the classic 8.
<sal>Dick
<ms>ML5-5/E45
<contribution>Writers
<event>VAX 5-year Party
<rsvp>Y
<guest>Lee
<>

<name>Kathy Norris
<program>Kathy Norris
<course1>Table 3 by VAX.
<course2>Table 21 by TX-0.
<course3>the long table, 23, on the balcony.
<sal>Kathy
<ms>TW/A08

<contribution>Product Management
<event>VAX 5-year Party
<rsvp>Y - no show
<guest>no guest
<>

<name>Tom Northrup
<program>Tom and Cindy
<course1>Table 3 near VAX.
<course2>Table 24 near TX-0.
<course3>over two to table twotwo...much.
<sal>Tom
<ms>WZ
<contribution>Hardware
<event>VAX 5-year Party
<rsvp>Y
<guest>Cindy
<>

<name>Ken Okin
<program>Ken and Laura
<course1>Table 22 near TX-0.
<course2>Table 4 near VAX.
<course3>Table 8 near the console gallery.
<sal>Ken
<ms>TW/C03
<contribution>Hardware
<event>VAX 5-year Party
<rsvp>Y
<guest>Laura
<>

<name>Ken Olsen
<program>
<course1>
<course2>
<course3>
<sal>Ken
<ms>ML10-2/A50
<contribution>Marketing
<event>VAX 5-year Party
<rsvp>N

<guest>
<>

<name>Joel Schwartz
<program> Joel and Sharon
<course1>Table 10 near the console gallery.
<course2>Table 21 near TX-o.
<course3>one table over to 22.
<sal>
<ms>
<contribution>
<event> Tax 5-year Party
<rsvp>
<guest>Sharon
<>

<name>Jamie Parker
<program> Jamie
<course1> the action -- and eat on your feet.
<course2> the unnumbered table with the boys from the band.
<course3> stay where you are and scurry about seeing that the champagne flows.
<sal>
<ms>
<contribution>
<event>
<rsvp>y
<guest>
<>

<name>Carol Peters
<program>Carol and Peter
<course1>Table l7 overlooking the balcony.
<course2>Table 24 near the TX-0.
<course3>Table 5 near VAX.
<sal>Carol
<ms>TW/D08
<contribution>Software
<event>VAX 5-year Party
<rsvp>Y
<guest>Peter Christy
<>

<name>Lou Philippon
<program>Lou and Claudette
<course1>Table 14 on the balcony.
<course2>Table 10 near the console gallery.
<course3>the long table, 23, on the balcony.
<sal>Lou
<ms>TW/A08
<contribution>Product Management
<event>VAX 5-year Party
<rsvp>Y
<guest>Claudette
<>

<name>George Plowman
<program>
<course1>
<course2>
<course3>
<sal>George
<ms>TW/C04
<contribution>
<event>VAX 5-year Party
<rsvp>N
<guest>
<>

<name>Trevor Porter
<program>Trevor and Rita
<course1>Table 6 near PDP-12.
<course2>Table 14 on the balcony.
<course3>Table 2 near VAX.
<sal>Trevor
<ms>TW/D08
<contribution>Software
<event>VAX 5-year Party
<rsvp>Y
<guest>Rita Sofka
<>

<name>Larry Portner
<program>Larry and Joan

<course1>the long table 23, on the balcony.
<course2>Table 8 along the memory lane of consoles.
<course3>Table l near LINC.
<sal>Larry
<ms>ML12-1/T32
<contribution>Management-Host
<event>VAX 5-year Party
<rsvp>Y
<guest>Joan
<>

<name>Dave Potter
<program>Dave and Janet
<course1>Table 11 near the classic 8.
<course2>next door to Table 10.
<course3>Table 24 near the TX-0.
<sal>Dave
<ms>TW/C04
<contribution>Hardware
<event>VAX 5-year Party
<rsvp>Y
<guest>Janet
<>

<name>Pete Rado
<program>Pete and Dorothy
<course1>Table 6 by the PDP-12.
<course2>Table 5 for a better view of VAX.
<course3>the long table, 23, on the balcony.
<sal>Pete
<ms>MR1-2/E47
<contribution>Hardware
<event>VAX 5-year Party
<rsvp>Y
<guest>Dorothy
<>

<name>Tom Rarich
<program>Tom and Anne
<course1>Table 24 by the TX-0.
<course2>Table 13 viewing TX-0 from the other direction.
<course3>Table 4 by VAX.

<sal>Tom
<ms>PK3-1/M56
<contribution>Product Management
<event>VAX 5-year Party
<rsvp>Y
<guest>Anne
<>

<name>Dave Rodgers
<program>Dave and Linda
<course1>Table 13 on the balcony.
<course2>Table 6 near the PDP-12.
<course3>the long table, 23, on the balcony.
<sal>Dave
<ms>TW/C04
<contribution>Hardware
<event>VAX 5-year Party
<rsvp>Y
<guest>Linda
<>

<name>Wayne Rosing
<program>Wayne Rosing
<course1>Table 6 near the PDP-12.
<course2>Table 2 near VAX.
<course3>Table 20 near Whirlwind.
<sal>Wayne
<ms>TW/C03
<contribution>Hardware
<event>VAX 5-year Party
<rsvp>Y
<guest>Joanne F.
<>

<name>Steve Rothman
<program>Steve and Millie
<course1>Table 14 on the balcony.
<course2>Table 6 by the PDP-12.
<course3>Table 12 by Classic 8.
<sal>Steve
<ms>TW/D06
<contribution>Hardware

<event>VAX 5-year Party
<rsvp>Y
<guest>Millie
<>

<name>Jeff Rudy
<program>Jeff and Ellen
<course1>Table 9 by the console gallery.
<course2>Table 22 by the TX-0.
<course3>Table 12 by the PDP 8.
<sal>Jeff
<ms>MK1-2/J05
<contribution>Software
<event>VAX 5-year Party
<rsvp>Y
<guest>Ellen
<>

<name>Jack Schneider
<program>Jack and Dorothy
<course1>Table 1 near LINC.
<course2>Table 20 near WHIRLWIND.
<course3>Table 3 near VAX.
<sal>Jack
<ms>WZ2
<contribution>LSI Engineers
<event>VAX 5-year Party
<rsvp>Y - no show
<guest>Dorothy
<>

<name>Jack Smith
<program>
<course1>
<course2>
<course3>
<sal>Jack
<ms>ML1-4/A54
<contribution>Manufacturing
<event>VAX 5-year Party
<rsvp>N
<guest>

<>

<name>Dick Snyder
<program>Dick and Sue
<course1>Table 13 on the balcony.
<course2>Table 10 near the console gallery.
<course3>over one - to Table ll.
<sal>Dick
<ms>MR1-2/E37
<contribution>
<event>VAX 5-year Party
<rsvp>Y
<guest>Sue
<>

<name>John Sofio
<program>John and Margaret
<course1>Table 9 by the console gallery.
<course2>the long table, 23, on the balcony.
<course3>Table 14 -- behind TX-0.
<sal>John
<ms>TW/D02
<contribution>Hardware
<event>VAX 5-year Party
<rsvp>N
<guest>Margaret
<>

<name>Bob Stewart
<program>Bob and Diane
<course1>Table 21 near TX-0.
<course2>Table 15 overlooking the dance floor.
<course3>Table 10 near the console gallery.
<sal>Bob
<ms>TW/C04
<contribution>Hardware
<event>VAX 5-year Party
<rsvp>Y
<guest>Diane
<>

<name>Bill Strecker

<program>Bill and Carole
<coursel>Table 4 by VAX.
<course2>Table l9 overlooking the dance floor.
<course3>Table 11 by the console gallery.
<sal>Bill
<ms>TW/B05
<contribution>Hardware
<event>VAX 5-year Party
<rsvp>Y
<guest>Carole
<>

<name>Barbara Thomson
<program>Barbara and George
<coursel>Table l7 overlooking the dance floor.
<course2>the long table, 23, on the balcony.
<course3>Table 10 by the console gallery.
<sal>Barbara
<ms>MK1-2/B11
<contribution>Writer
<event>VAX 5-year Party
<rsvp>Y
<guest>George Berry
<>

<name>Doug Towle
<program>Doug and Nancy
<coursel>the long table,23, on the balcony.
<course2>Table 11 by the Console Gallery.
<course3>Table l8 overlooking the dance floor.
<sal>Doug
<ms>MR1-1/M55
<contribution>Marketing
<event>VAX 5-year Party
<rsvp>Y
<guest>Nancy
<>

<name>Bob Trocchi
<program>Bob and Ginny
<coursel>Table 8 near PDP-1.
<course2>Table 15 on the balcony.

<course3>Table 21 by the TX-0.
<sal>Bob
<ms>MR1-1/M40
<contribution>Marketing
<event>VAX 5-year Party
<rsvp>Y
<guest>Ginny
<>

<name>Peter Van Roekens
<program>Peter and Nancy
<course1>Table 19 overlooking the dance floor.
<course2>Table 11 by VAX.
<course3>Table 10.
<sal>Peter
<ms>TW/D16
<contribution>
<event>VAX 5-year Party
<rsvp>Y
<guest>Nancy
<>

<name>Larry Wade
<program>Larry and Sherrie
<course1>Table 19 overlooking the dance floor.
<course2>Table 6 near PDP-12.
<course3>the same place (don't pass go).
<sal>Larry
<ms>PK3-1/M56
<contribution>Marketing
<event>VAX 5-year Party
<rsvp>N
<guest>Sherrie
<>

<name>George Wallace
<program>George and Rene
<course1>Table 14 on the balcony.
<course2>the same place - with new folks.
<course3>Table 6 by the PDP-12.
<sal>George
<ms>NI/C09

<contribution>Manufacturing
<event>VAX 5-year Party
<rsvp>Y
<guest>Rene
<>

<name>John Wanamaker
<program>John and Rhetta
<course1>the long table, 23, on the balcony.
<course2>Table 9 near the console gallery.
<course3>Table 6 by the PDP-12.
<sal>John
<ms>TW/D17
<contribution>
<event>VAX 5-year Party
<rsvp>Y
<guest>Rhetta
<>

<name>Jerry Witmore
<program>
<course1>
<course2>
<course3>
<sal>Jerry
<ms>MR1-1/M40
<contribution>Marketing
<event>VAX 5-year Party
<rsvp>N
<guest>
<>

HAPPY BIRTHDAY

VAX

AT FIVE

The personal program for:

<program>

Please be seated at <course1>
Help yourself to the first course:

Fresh New England Salmon & Bass
Garden Vegetables
Hollandaise and Mayonaise Verte

Cordonieu Champagne
Sparkling Poland Spring Water

8 P.M. The band starts up for your listening and dancing pleasure:

THE MUSICIANS

Alan Dawson -- on the drums
Member Dave Brubeck Quartet, 1948-1979, featured on "The Last Set at Newport," Atlantic Records, and many others. Currently can be heard at Lulu White's in Boston.

Artie Matthews -- at the piano
Taught at University of Massachusetts, Amherst. Can be heard on "IT'S EASY TO REMEMBER," Matra Records with Archie Shepp, Alan Dawson, Bill Pierce, Dizzy Reece and Charles Fambrough.

Whit Browne -- on the string bass
Instructor of string bass, Berklee College of Music. Recorded with Buddy DeFranco and Phil Wilson

Andy McGhee -- saxophonist
Member and arranger with Lionel Hampton and Woody Herman. Solo on Woody Herman's records, MY KIND OF BROADWAY, WOODY AT LAKE TAHOE, WOODY'S GOODIES, and Lionel Hampton's THE HAMP.

Jeff Stout -- trumpet
Solo trumpet with Buddy Rich.

8:15 - Proceed to <course2> (Remember to take along your glass.)

Serve yourself to -

Stuffed Cornish Game Hen
Cranberry Relish
Acorn Squash

More Cordonieu and Poland Springs

9:15 - Another move - with glass in hand to <course3>

Enjoy the Salad, Cheese and Fruit Buffet

Green salad and divers dressings

Brie

Bresse Bleu

Bel Paese

Gourmandese

Pears and Apples

Cordonieu and Poland Springs

10:30

THE VAX BIRTHDAY CAKE

Coffee

Dancing and Listening until
Midnight

Thanks for coming and contributing to
VAX

process record

00 CORE DECGRAM ACCEPTED S 000846 O 50 30-SEP-82 6:34:18

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION
DATE: THU 30 SEP 1982
6:23 AM EDT

FROM: GORDON BELL

cc: KEN OLSEN
    JACK SMITH

DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5177205260

SUBJECT: AN EFFORT TO IMPROVE VAX PERFORMANCE NOW (AND LONG TERM)

BACKGROUND

The competition with Sel, IBM, Interdata, etc. in the high end is supercritical. The long term solution is only solved by a faster machine. For the short term, we have to put together a significant program that will payoff in the next 6-12 months. Ironically, I think we have all the tools and answers, but we simply can't get the act together to do the work. The effort I had hoped to get moving within engineering is simply NOT moving fast enough because the people are already committed to a big workload to get the clusters out. We are proceeding slowly to get a computation center that could be used to work on speed up in Hudson... CCCP Christy's Computation Center for

Parallelism.

A TECHNICAL CENTER FOR SPEEDUP (Discussed with Bill Long)
E&S Displays are only connected to VAX. We need one here.
FPS164 (We have a 120, but don't know the limits or capabilities.
Microcode extensions to VAX (Customers do it, we don't want to touch it.)
4 Processor Multiprocessors for single jobs. Customers use it, we don't.
CI to interconnect machines. Customers are configuring systems now.

THE PROGRAM
Identify a team or two within engineering and the Product Lines who will get clear benchmarks and then drive to run these across the various configurations of relevance. We would do the earliest work with the 164 and microcode because these are there and more clearly understood.

THE TEAM
On monday when we discuss the VAX high end problem, I would like the names of candidates who can work here both to lead and do the performance analysis. This is a full time job for at least the next six months! Who are some capable volunteers and what do we lose by drafting them at this time?

We simply cannot wait for the next high end machines, nor do I believe the experimental machines that we are currently dreaming of are timely or sure enough to solve this problem.

"TO" DISTRIBUTION:

BILL DEMMER	SAM FULLER	WIN HINDLE
BILL JOHNSON	BILL LONG	PETER SMITH
BILL STRECKER	HARVEY WEISS	

WPS USERS - Leave HP mode and type <CR>

00 BURT DECGRAM ACCEPTED S 22796 O 557 05-NOV-81
14:54:39
****
* d i g i t a l *
****

TO: BILL DEMMER   DATE: THU 5 NOV 1981
9:49 AM EST
    BILL JOHNSON   FROM: GORDON BELL
cc: see "CC" DISTRIBUTION   DEPT: ENG STAFF
                                                 EXT: 223-2236
                                                 LOC/MAIL STOP: ML12-
1/A51

SUBJECT: PROMOTING VAX'S FOR PERSONAL COMPUTER SUPPORT
DEVELOPMENT

I just read a quote by Gary Kildall, President of CP/M:

"Everyone uses VAX for Development."

Surely we could make an "official" product to support PC's.
With
Nebula, the base will be even bigger! Given our PC offering
and given
people are doing it, can you find out which P/L's would sell
it? Can
we then encapsulate the product and promote it?

"CC" DISTRIBUTION:

BARRY JAMES FOLSOM   BILL KEATING   JOE MEANY
AVRAM MILLER   OPERATIONS COMMITTEE: PEG:
PETER SMITH

GB3.S2.31
00 BURT DECGRAM ACCEPTED S 19799 O 35 13-DEC-81
13:07:20
****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION DATE: SUN 13 DEC 1981
1:04 PM EST

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION DEPT: ENG STAFF

EXT: 223-2236

LOC/MAIL STOP: ML12-
1/A51

SUBJECT: WHAT WOULD A SIMPLER VAX ACCOMPLISH?

The point is: we are floundering about making any progress on defining the possiblity of a VAX subset, what it is in terms of
hardware and software, and what it might be used for.

By inaction, we're making a de facto decision to get out of the board business and to stay away from the chip business.

Furthermore, we are not getting the chips to make a cost-effective
personal computer and will be driven to the 68,000 for a good machine here on the next versions of CT.
F/J are less than optimum in: cost, performance, address size and
time to market (J-only). The 8086 loses in address size, performance and ability to be programmed easily.

In a similiar fashion we made a belated, explicit decion albeit
a sad, sloppy one to not get into the 16-bit chip business and to cap and gradually leave the 16-bit board business.
Just as I thought this decision was wrong, since 77, I know this
non-decision is equally wrong. Motorola will get better faster
than we will be able to provide competitive semiconductors for a
small system.

The result is clear: not only do we stay out of the 32-bit chip, and board business, BUT we are in significant jepordy in our mainline 32-bit business and emerging CT business.

"TO" DISTRIBUTION:

DAVE CUTLER	JACK MACKEEN	MIKE MOFFA
OPERATIONS COMMITTEE:	BILL STRECKER	

"CC" DISTRIBUTION:

JIM CUDMORE	BILL DEMMER	JEFF KALB
PEG:	STEVE TEICHER	

ATTACHED: MEMO;45

****
* d i g i t a l *
****

TO: GORDON BELL　　DATE: SAT 12 DEC 1981
8:17 AM EST

FROM: STEVE TEICHER
cc: see "CC" DISTRIBUTION　　DEPT: SEG
EXT: 225-4900
LOC/MAIL STOP: HL1-1/R02

SUBJECT: SOME THOUGHTS ON MICROVAX

A lot of people have been talking about a sub-SET VAX. I can now begin to articulate why I am uncomfortable with the term, sub-SET. It is not because I think that VAX should not be simplified. I think that it would be useful to make a modification of the VAX definition, to make it more viable, just as we have modified the definitions of past machines, i.e. the PDP-11.

However, I do not believe that the new-VAX, will be only interesting to the chip-and-board people. If new-VAX is to beat the 68000, then it is likely to be good enough to do most, if not all of today's VAX applications, just as many believe that the 68000 could do many if not all of the VAX applications. To me, understanding the purpose of new-VAX, is a key to understanding the nature of the simplification.

As an implimentation strategy, the goal would of course be to get the
device in one chip, with perhaps some off-board stuff, as is done in
the case of the 68000, for floating point and memory management. Another short term plan, might be to modify the microcode of Scorpio, using another design team. One might do this in addition to working on a single chip version, as the single chip version is likely to take longer to get, than Scorpio, at this point in time.

Have a good week.

/steve teicher

"CC" DISTRIBUTION:

JIM CUDMORE BILL DEMMER JEFF KALB
ROY MOFFA

GB3.S2.50

```
+---------------------------+                                 GB3.S8.49
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|   |   |   |   |   |   |   |            m e m o r a n d u m
+---------------------------+
```

SUBJ: On Implementing VAX: When Hardwired, When Microprogrammed

TO: PEG
EMC
RAD
TMC

Date: 15 NOV 1982
From: Gordon Bell
Dept: Eng. Staff
MS: ML12-1/A51 Ext: 223-2236
EMS: @CORE

Our inability to remove the 11 mode from VAX's now in design or add data-types for particular uses is symptomatic of our reactionary thinking about the timelessness of the VAX architecture, and the reaction to the fact that every 11 was a new architecture! Yet, the 11 may have been more successful because it changed all the time, even though it cost to have software track it. I know of no great architectures, certainly not those that are replicated in various technologies that remain static and yet maintain the greatness of the original implementation. Nearly all of the great Renaissance buildings have evolved over time; in fact, the greatness of an architecture is probably measured in its ability to be changed with time to both user needs and to technology. MicroVAX does show that we are willing to change for the sake of different needs and lower cost at a given technology. Given our ability to implement VAX's and yet our resistance to change it, VAX may have a short life.

We must act to keep what has become the greatest architecture I know.

A computer is determined by three variables, the first two of which are independent and somewhat exogenous:

1. The technology we build from.

2. The applications we run.

3. The architecture, or environment it provides to users.

THE TECHNOLOGY WE BUILD FROM

Memory and logic are all we use to build computers. The size and speed of memories, particularly with respect to logic determine the architecture more than any other factor. In the early days, we were memory speed bound, now we're much better matched. However, in microprogrammed machines, we're control bound.

The notion of Reduced Instruction Set Architectures(Direct Execution ISP), versus Complex Instruction Set Architectures (Microprogrammed Intepreted ISP) is totally driven by need and cost relationships AND NOT ON RELIGIOUS, ARTISTIC AND MORAL grounds! Why various architectures are "right" at various times, based on these relationships needs to be described historically, because I think we may learn from it... there's no mystery when you look at computers this way, and certainly no cause to say "but why were we so stupid?", and "why doesn't everyone build simple instruction sets like Cray versus IBM (or VAX)?". Several years ago, almost before there were fast, low cost memories suitable for microcode, everyone was sure that computers would be microprogrammed, to hold user programs and high level languages. Then it was "wrong or stupid" not to have user microprogrammability! Yet while microprogramming was provided, it only yielded a factor of 2-3 in performance.

THE APPLICATIONS WE RUN

There are gains to specialize the architecture to the application (or data type). The more specialized the data-type, requiring long sequences of instructions to interpret them, the higher the gain. Backus recalled the origin of building in floating point in the 704 based on the 701: "some customers were using the floating point interpreter and reducing the machine to 50 operations per second. ... in building it in, we got more than two orders of magnitude speed up ". No one builds a computer for <u>real time</u> technical applications use without floating point. Note that while the integer performance range for all the 11's is 40, the Whetstones range factor is 120; and for a more intensive floating point benchmark the range would probably be at least 500! The same is true for strings and Cobol. The trick is to decide what to build in:

basics- clearly these win benchmarks if you read Computer Architecture News. Since the Berkley RISC machine and most micros only understand integers, address integers and boolean vectors, then the benchmarks ignore all other data types

floating point- clearly necessary for the technical market

packed decimal and string represented numbers for COBOL. Again the impressive gains 10-20 like floating point. The tragedy, is that we really don't sell to this market, yet VAX paid dearly to build it in!

list structures for AI programs. This originally only meant addresses had to be handled well, but now it means dealing with typed data, and VAX is reduced to being run as an interpreter when fully typed data is used. Also, since LISP has a very elaborate and different procedure calling mechanism, many operations are required to implement it. Clearly LISP requires help.

string operations for text and database operations- VAX has these, but benchmarks really aren't available to show the gains. Furthermore, strings are really character vectors and unlike decimal strings, the operations are much simpler, hence the gain over a subroutine is only 2-3, since string ops are move, compare, concatenate, and search for sub-string, etc. which are 1 or 2 instructions in a loop. The real gains for text and database machines is probably going to be implementing searchs in parallel using special VLSI.

matrix operations- Here, the issue is how the data is stored and whether the processor has registers to hold the data (eg. CRAY 1) to speed up memory access. A vector in memory machine can be made to work as in the CDC STAR, the foregunner for the CDC 205, but the cost is high compared to vectors in registers. The gain in architecture is the reduction in eliminating the program access, and this may or may not reduce the execution time very much. Here, we should get a factor of 2-3 for a VAX depending on how the matrices are stored (eg. sparse).

vector operations for signal and image processing- The issue is whether we can gain much without special hardware, simply by building in various transforms (eg, FFT). This is less obvious since special hardware and chips will be used to process signals and give lower cost (eg. voice input data). A much better approach will be to build these in and measure the cost and speed-up. Here, writeable control store may be the best answer because it would allow speeding up arbitrary programs.

special data-structures for simulation- Are these operations which speed up scheduling events?

I/O- We could have added special operators for communications protocol handling. This is what CI provides. In a similar fashion, a special instruction was added to PDP-8 to allow it to handle Teletypes in a message concentrator application for 128 lines at reasonable speed! We've got to equal this, 15 years later on a 780!

ARCHITECTURE (AND IMPLEMENTATION)

Historically, processors have simply evolved by adding more processor state! The earliest processor had no state with all operations to memory, evolving to 1 AC, 1 AC + XR, multiple AC's,
sets of multiple AC's, and finally Cray's machines with vector registers. Thus, a RISC with many registers would fit the evolutionary pattern, however, it's easy to see that poor software could actually slow down a machine with many registers by having to save state across procedures. En route, the cache, AND microprogram memory had equally major implications on implementations.

THE 10/20 CASE. The issue with implementation is whether there's direct interpretation of the instruction at a speed the memory can deliver, or whether there's a seperate interpreter that probably won't keep the memory busy. The architecture of the 10 is an excellent case study: the early ISP (the 6) was extremely simple, a RISC (with hardwired floating point); now, the ISP has evolved to be more complex than VAX with more data-types, extended memory and many instruction formats to access and operate on all the data. Unfortunately, microprogramming was used in the KL implementation, thus starting the trend to a very complex, and messy ISP.

THE VAX CASE. GOAL G3 was compatiblity across a range (of 1000). The implications were that all machines had to implement all op codes using some technique (eg. microprogram, or software). Some machines might even implement some op codes directly in hardware. Finally, in microVAX we've developed the methodology that was first used in ATLAS Extracodes (circa 1960) to call VAX instructions in software. Also, like ATLAS, it would have been desireable to implement some instructions directly in hardwire. With VAX, the goal was to win Fortran, Pascal, PL/1, and Cobol benchmarks and have the data-types that VMS needed to run fast. VAX succeeded beautifully, but the bottom line is: because of compatiblity across a range and the target applications, VAX appears to require being implemented as a microprogram processor.
If we could directly execute the ISP, then the large factor might be attainable.

VAX+ Given, this background, the extensions we need to look at for VAX microprogrammed instructions extensions are:

AI languages

TEXT and DATABASE primitives

MATRIX and VECTOR operations for technical benchmarks. Here, the CDC Fortran primitives may be the best set. Unfortunately, there is not yet an ANSII fortran with Vectors. (Let's get one)

SIGNAL AND IMAGE PROCESSING- The MIT Signal Processing Lab and LDP and ESG should provide this guidance.

INTERPRETERS TO EMULATE OTHER ISP's. Given that we have the 11, it would seem more worthwhile to include more used ISP's such as the Z80, or the 8086 or 68,000 so users can debug these kind of programs at higher speed within the VAX environment. Also, they may execute Z80 code directly.

General tools to analyze and speed up particular problems. Here, JRS Research Indutries, Orange, California might help.

We can not in this look, extend the state of the processor, as this would increase the complexity of new implementations and make it incompatible with previous machines. Here, I only expect to gain a factor of 2-3 for particular domains such as LISP.

VAX- In a similar fashion, we can then decide on particular machines (eg. V-11, Nautilus, MicroVAX) to put parts of VAX in software and NOT microcode:

> 11 ISP- Jeff's point is throw it out of the ISP! (I think Jeff should propose to flush it and tell us what he'll save in cost and time to market.) Whether it's in microcode should be left to a particular user.
>
> FLOATING POINT- ala warm, only less warm since the interpreter would be in software
>
> STRING OPS- How many of our users care if COBOL runs fast?
>
> CLOCK AND TIMERS- used infrequently.
>
> OPERATORS to handle memory mapping exceptions

CAN WE MAKE FAST, ONE CHIP AND HI END VAX's?

It would seem to imply that we need to do more in hardware and less in microcode. Alternatively, if there's a shift in technology to have much higher speed memories for microprograms and caches so that microprogramming is more cost-effective, then the choice of VAX, say relative to a RISC may be fine for the future. I note that that GaAs is most likely to be first available as fast RAMs (eg. 1-2 ns)! Similarly there are 1 ns PLAs. Would these shift the method of doing logic back to microprogrammed processors? Strecker's project for faster VAX execution using microprogramming and hardwiring seems to be a way to have it both ways. If we were starting from scratch, this would clearly be the goal. The only question is can anything like a VAX instruction be executed rapidly and in a pipelined fashion? And can it be extended to other application domains? Right now, the indications seem to be that VAX, like the 370, can't be used for high performance implementations.

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+---------------------------+                              ID#0307
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| d | i | g | i | t | a | l |   i n t e r o f f i c e   m e m o r
a n d u m
|   |   |   |   |   |   |   |
+---------------------------+
```

Subject: **Objective Comparison of VAX and 10/20 Hardware and Software Architectures**

To: Bill Demmer, TW/D19
Ulf Fagerquist, MR1-2/E78

Date: 26 OCT 78
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

follow up 11/9/78

In talking with Bill Kiesewetter, I find he believes there is no fundamental difference among architectures, and therefore we can implement identical functions at the same price and performance for VAX's and 10's.

Could you get together a small team and quickly put this in perspective?

1. Just how do you characterize the architecture...can't we just use the government CFA measures? How did the 10 benchmark on the CFA examples?

2. Go through some benchmarks where we measure static and dynamic encoding for various kinds of problems. This should be in machine language, BLISS, COBOL and FORTRAN. (These are around because I have seen them for some BLISS and FORTRAN examples. Let's estimate the code for the 20 with 30-bit address.

3. Look at the cost to implement various processors and systems. Since VAX has more complexity

in its ISP, it probably costs more, and this had better result in a lower system cost because of the encoding.

4. On the other hand, won't the 10 be as expensive as the new floating point, new CIS, the VAX extension to give 30-bit addresses, are added? The two will then have the same data-types (the main component of cost). Do our customers need the extensions? Have we sold them? How much software will be converted to use CIS, extended floating point and 30-bits? Let's evaluate the cost of these, too.

5. At a system level both VAX and the 10/20 have some interesting problems and we need insight quick!

A. As a 20 owner, I can't get an understanding of the users or the help to get more out of a 20. If indeed 20 programs are bigger (say by a factor of 2) this means there is twice as much work involved in program swapping and in some case this means one half the users.

B. VAX has a small page size and it is possible that the management of these pages may totally consume it for large programs.

Can't we have a simple, closed form model that compares the two for a given load?

Please propose a quick, coherent plan.

GB:ljp

CC: Bill Johnson ML21-3/E87
Bill Keating ML12-3/A62
VAX-11

MESSAGE

The extended 11 for high performance and general purpose use for problems that have outgrown 11's.

MARKET

See message.

BASIC HARDWARE

1. Extend to lower base with COMET

2. Get HYDRA

3. Make DOLPHIN a 10/20/VAX at 780 price, more performance

4. Extend to lower price base

5. Single user, large address space

BASIC OPERATING SYSTEM

Enhance for HYDRA and COMMERCIAL

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+---------------------------+                                   ID#0303
|   |   |   |   |   |   |   |
| d | i | g | i | t | a | l |   i n t e r o f f i c e   m e m o r a n d u m
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Subject: **VAX-11 Compatibility**

To: Dave Cutler, TW/E88
Bill Demmer, TW/D19
Ed Fauvre, MK-2/E6
Bill Heffner, TW/C10
Bill Keating, ML12-3/A62
Bernie Lacroute, TW/A08
Larry Portner, ML12-3/A62
Dave Rodgers, TW/C04
Bill Strecker, TW/D19

Date: 18 OCT 78
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

follow up 11/1/78

Apparently we had poor communication on the above. You are all invited to discuss how we get back on the track*. We made a single O/S in VAX, to get a single O/S in the 11 land. This means a program written on M, TRAX, SCS, or M+ will run on VAX without reprogramming or any fuss!

I also want to discuss D/IAS compatibility and RSTS/E (I mean Basic+ only) compatibility. Please don't come to discuss why we haven't, but rather how SCS and M+ will be brought back into the fold. TRAX also has to be VAXed.

This is the only way we have a viable 11 --> VAX phaseover in our products. Also, it's the only way we can get any VAX commercial software. Let's get serious and think of our users -- I thought the anarchists had left.

GB:ljp

*Date: November 13
Place: Bill Demmer's CR, Tewksbury
Time: 8:30-10:30

RSVP -- If you can't make it.

D I G I T A L   INTEROFFICE MEMORANDUM

DIST: Dave Cutler, TW/E88   Bill
Demmer, TW/D19
                Ed Fauvre, MK-2/E6   Bill
Heffner, TW/C10
                Bill Keating, ML12-3/A62   Bernie Lacroute,
TW/A08
                Larry Portner, ML12-3/A62   Dave Rodgers, TW/C04
                Bill Strecker, TW/D19

****
* d i g i t a l *
****

TO: DAVE CUTLER   DATE: FRI 7 MAY 1982
10:23 AM EDT
                                         FROM: GORDON BELL
                                         DEPT: ENG STAFF
                                         EXT: 223-2236
                                         LOC/MAIL STOP: ML12-
1/A51

SUBJECT: RE: PERFORMANCE DATA ON VAX-11 C

Isn't there decent performance info on C?

ATTACHED: MEMO;36

****
* d i g i t a l *
****

TO: GORDON BELL   DATE: THU 6 MAY 1982
11:29 AM EDT
                                     FROM: JOHN ANDERSON

DEPT: COMMERCIAL ENG
EXT: 264-7783
LOC/MAIL STOP: MK1-2/D03

SUBJECT: PERFORMANCE DATA ON VAX-11 C

THE VAX-11 C DEVELOPMENT GROUP HAS BEEN GATHERING SOME DATA ON PERFORMANCE. ONE OF THE DEVELOPERS, CINDY HO, IS STARTING WORK ON GETTING THE BENCHMARK DATA THAT IS BOTH RELIABLE AND UNDERSTANDABLE. HER EFFORTS SHOULD BE READY FOR EXTERNAL USE IN ABOUT ONE MONTH.

AT THAT TIME, I WOULD LIKE TO SEE SALES UPDATE ARTICLE WRITTEN ON OUTPUT CODE QUALITY (COMPARING UNIX I/O V.S. VMS IS DIFFICULT AND COMPARES APPLES AND ORANGES).

THE RAW DATA SO FAR (COMPUTE-BOUND BENCHMARKS) SUGGEST:

O WE WILL DO "MUCH BETTER" THAN ISC.
O WE WILL EITHER LOSE TO UNIX (BY 15% FOR 20% OF THE TIME) OR WE WILL WIN BY 30% (OR EVEN MUCH MORE IN SOME CASES) THE OTHER 80% OF THE TIME.

THE VAX-11 C GROUP IS AWARE OF THE COMPLEXITIES OF BENCHMARKING AND IS WORKING TOWARD PROVIDING MORE MEANINGFUL DATA.

*****THIS EMS IS FROM ROSEANN MACLEAN*****

GB3.S5.59
2 November 1982

Dr. Dennis P. Geller, Director
Academic Computing Services
Babson College
Babson Park, Massachusetts 02157

Dear Dr. Geller:

Thank you for your letter. I'm delighted to see that we're educating people to have a healthy distrust of typeset material in general and programs in particular. This is something I learned many years ago too.

What we published was inexcusable. I'm now insisting that a program that is published as a listing should be run and reasonably well tested. Furthermore, all programs that appear in textbooks should be tested!

Thanks for pointing out the problem in our VAX-11 User's Guide AA-H869A-TE.

Sincerely,

Gordon Bell
Vice President, Engineering

cc: Bill Johnson
GB3.S8.31

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION   DATE: WED 1 OCT 1980 6:44 PM EDT

FROM: GORDON BELL
cc: BILL JOHNSON   DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: ANOTHER LOW END TOOL, VAX-11 PDP-11 ENVIRONMENT

Would like Gil and Maurice Marks to take a look at this. The idea of checking out 11 software for the single user on anything
other than vax is sounding less appealing. Could you folks look and then say what, how and how much? If we invest in the low end 11 software effort for stand alone, I want to do

it efficiently. This seems like the best way! (The time
saved
waiting for floppies or in just plain execution time savings
would be well worth it.) Can we look at it and dream abou it
before we flush it please??

"TO" DISTRIBUTION:

HEFFNER AND STEIL BILL HEFFNER BILL
KEATING

ATTACHED: MEMO;39

****
* d i g i t a l *
****

TO: GORDON BELL DATE: WED 1 OCT 1980
6:51 AM EDT

FROM: BOB TRAVIS
DEPT: OFIS ARCHITECTURE
EXT: 264-8178
LOC/MAIL STOP: ZK1-3/E11

SUBJECT: RE: PDP-11 PROGRAM ENVIRONMENT ON VMS

I think it could be a real help. There are two kinds of
savings
you can get from such an environment -- (1) the time saved by
NOT having to deal with the physical deficiencies of a target
machine while in the development mode and (2) the higher
inducement to retain common sources and use modern tools
throughout
the development process. (If it's quicker/easier to
recompile and
reload than to patch, more people will do it.)

As you point out, it's also just what you need for playing
with
the host/intelligent terminal boundaries sanely. Avoiding
whatever

tendency there might be to put stuff where it's easier to work with
rather than where it's best for performance.

Our experience with the RSTS/PDP8 development environment showed
up some plusses AND minuses, but I think mainly the minuses had to
do with clumsy procedures and CPU performance. I suggest whoever
looks into this more deeply talk to some of the WPS-8 people who
worked with it heavily, for suggestions/warnings.

Finally, I like it because it gets me closer to being able to do everything from the one terminal in my office! In that regard, I recommend that the "other" terminal, to monitor the environment, be only required in special circumstances, if that's
possible. For most things, I think ^Y checkpoint/restart from
the one terminal would be preferable.

GB1.S7.23

+---------------+
! **d i g i t a l** ! **i n t e r o f f i c e   m e m o r a n d u m**
+---------------+

Subject: **VAX-11 and 11's (and 10's) vs. 360/370**

To: Marketing Committee, OOD, Product Line Managers, Dick Berube, Peter Connell, Al Mullin

Date: 22 MAY 78
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

CC: Sam Fuller, Bill Strecker

follow up 6/5/78

I was under fire by a government customer as to why they should buy DEC when the future gets a 360/370 processor-on-a-chip (e.g., National's latest announcement).

My answer was:

1. The 370 software was optimized for large memory configurations (although there are small configuration systems) -- this gives us a cost advantage over IBM because of memory size and performance due to movement from disk.

2. IBM has commitments to many other architectures (e.g., Series 1, System 3-15, System 34, 3290, etc.).

3. Our encoding in VAX is better oriented to higher level than the 370. (Sam) Bill, can we start to compile data to prove this? (This gets us cheaper systems by the encoding amount.)

4. We have compatibility with the 11 for bounded applications, e.g., terminals. (They don't have this in their machines.)

They ask why we made a VAX vs. 10/20 and what to buy. I said:

1. The 10 software was implemented at high end.

2. The 10 had to be extended, it was out of address-space too.

3. We wanted more compatibility with the 11 than an emulate mode would have given. There's incompatibility (11-10) on: files and data-types that would have made incompatibility.

4. Buy 11's if bounded; VAX if software fits and compatibility with 11's needed; 10's if current base and software exists.

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST: Dick Berube PK3-2/M18 Peter Connell PK3-
2/M18
Sam Fuller TW/A08 Al Mullin PK3-
2/F40
Bill Strecker ML3-2/E41
Jim Bell ML3-2/E41 Roger Cady MK1/E25
Bill Chalmers MR2-2/M67 Dick Clayton ML12-
2/E71
Jim Cudmore ML1-5/E30 Bill Demmer TW/D19
Bruno Durr PK3-2/S56 Ulf Fagerquist MR1-
2/E78
John Fisher PK3-2/A93 Jack Gilmore MK
Win Hindle ML5-2/A53 John Holman PK3-
1/P84
Irwin Jacobs MK Ted Johnson PK3-
2/A55
John Kevill ML1-3/E58 Dave Knoll ML1-
4/P69
Andy Knowles MR2-2/A52 Ed Kramer MR2-
4/M16
Bob Lander PK3-2/F33 Bob Lane HD
John Leng MR1-1/F35 Bill Long PK3-
1/A60
Julius Marcus MK2/C37 John Meyer ML12-
1/A11
Gerry Moore PK3-2/A55 Stan Olsen MK
JC Peterschmitt GE Larry Portner ML12-
3/A62
Bob Puffer ML12-2/E38 Jack Shields PK3-
2/A58
Jack Smith ML1-4/F31 Charlie Spector ML5-
2/M40
Bill Thompson ML12-1/F41 Gerry Witmore ML5-
2/M40

+-----------------------------+ GB0002/38

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a n d u m
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+---------------------------+
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Subject: Getting Adequate VAX's This Fiscal Year

To: Bill Demmer, TW/D19
Ulf Fagerquist, MR1-2/E78
Bill Heffner, TW/E10
Per Hjerppe, MR1-2/E78
Bill Johnson, ML3-5/H33
Bob Kusik, ML3-5/H33
Larry Portner, ML12-3/A62
Bob Puffer, ML12-2/E38
Dick Snyder, MR1-2/E37

Date: April 25, 1979
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

Follow Up 5/15/79

Given the following:

1. We are (hopefully) under budget for FY79 and squeezed for FY80.

2. There are VAX's in inventory now, but the deliveries are going out.

3. There are 2020's in inventory.

4. We have a strategy that calls for building integrated systems of VAX's and 10/20's.

5. Our CAD work is up against the 10 address limit and we want to move to use VAX's there for putting data of the design and all the CAD programs in a single address space (if it makes sense).

6. Jerry Witmore is challenging us to breadboard (demonstrate) the combined VAX/10/20 system we are proposing at his October sales meeting.

7. We need configurations to test the HYDRA-type structures in software. This can be done using one of

the machines to simulate the behavior of Mercury and HSC. This would seem essential to get HYDRA and the Venus and the 2080 systems up and working. We would use this for traffic analysis so as to test the performance.

8. We are about to try to get the critical universities to get VAX's for VLSI - work (these mostly also have 10's and 20's).

BJ, Bob, and Larry could you please coordinate and drive getting a reasonably large number of VAX's and 2020's now to accomplish the above work. I'd like to see adequate systems of this type in MR, TW, WX, ML and MK. This would be 2, 2(CAD and development), 1(VLSI), 1(CAD), and 1...and a spare somewhere. The configuration should also include an interconnect at high speed, say using the PCL for now and ICCS when it is ready.

GB:swh

D I G I T A L INTEROFFICE MEMORANDUM

DIST:
Bill Demmer TW/D19 Ulf Fagerquist MR1-
2/E78
Bill Heffner TW/E10 Per Hjerppe MR1-
2/E78
Bill Johnson ML3-5/H33 Bob Kusik ML3-
5/H33
Larry Portner ML12-3/A62 Bob Puffer ML12-
2/E38
Dick Snyder MR1-2/E37

****
* d i g i t a l *
****

TO: ROGER CADY DATE: WED 13 FEB 1980
2:21 PM EST

FROM: GORDON BELL
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1
A51

SUBJECT: PERSONAL VAX PROJECT

FYI, please see below.

FROM: GORDON BELL DATE: SAT 9 FEB 1980 9:34
AM EST
DEPT: OOD

EXT: 223-2236
TO: GEORGE THISSELL
    JIM BELL
    BERNIE LACROUTE
    JACK MILESKI
    STAN PEARSON
    DICK SNYDER
    BILL HEFFNER
    BILL KEATING
    OOD:
    PEEBLES VIA J BELL

SUBJECT: GEORGE IS PROBABLY RIGHT

Somehow we have to get the personal VAX project going quickly in order to deal with this problem of one-ness and the built-in complexity that it might imply.   The intent of the single VMS is to be able to run a program at any level so as to preserve programs, and more importantly data across the various
systems. The thing that can vary is the user interface and the packaging of the system and the documentation to reflect the specific uses of the variations.

George is absolutely right on the evolution of a complex system.
It implies tons of manuals, and expensive system programmer experts, high support and massive overheads that only the CS depts can afford because the people are free and can deal with the complexity. Also, large organizations want them
to keep their staffs challenged.

Personally, I have had waged and lost all the battles in this regard by trying to get a manual written for a user (here,
I have wanted to try the simple experiment of putting all you need to know if all you know is APL, BASIC, PASCAL, or Fortan,
and simply want to login, create, run (with a library), and debug your program in a single manual). This would have made VAX simple for all who touch it in 95% of the cases. Alas, it

doesn't cover all the intricies of the file system, loader, debugging, writing macro programs, user defined commands, and administering the system. Not only have I lost the battle, but
I found out that we can't even get manuals like this written because the typesetting system and writers are not enough in control of their words that it is a 2+ year project...instead of simply moving a few files from previous manuals around. We
are somewhere in the early 1970's in our manual writing and typesetting capability it feels like.

Yes...we need some work here, and a plan. The systems organizations
as we have them now will never deal with this cause there are hundreds of other issues like Dock Merge that have to be dealt
with. Somehow it is in the domain of the Technical Director of
SW, and we need real leadership here to keep us from going down the current path that will inevitably mean a set of new systems to cope with the complexity.

PS
The IBM approach ain't right...cause it means no movement of computing styles, files, programs, and a mess in the complexity due to the fact that SNA won't be that good in solving the Interconnect problem. I still believe in the concept of where we could go, but it takes a belief and design to do it. The personal VAX is a start.
... assuming it starts someday. (The test is how big the manuals
are.)

George, I'm delighted you have bought some programs from the outside and potentially have saved us t to mkt and precious development resources.   Given that we share a common problem/
vision here, how can you in addition help guide us?

Anybody worried about this besides George and I?

ATTACHED: MEMO;76

TO: ROGER CADY DATE: FRI 8 FEB 1980
1:11 PM
EST

FROM: GEORGE THISSELL

cc: see "CC" DISTRIBUTION DEPT: SOFTWARE
ENGINEERING

EXT: 223-7698

LOC/MAIL STOP: ML12-3
A62

SUBJECT: RE. DEC UNIQUENESS

Read your note and will throw out a couple of comments-

Think we're striving for ease of use for our large customers by
expanding on the generality of the Operating System so as to minimize their training,networking, interchange, etc, problems.
Unfortunately a by-product of generality is to give up some of
the "approachable,friendly, and easy to use" characteristics that the single function user can have in 11 Land (single user
is RT-11, T/S is RSTS, multi programmed real time is RSX...)I suspect that a large part of this ease of use is in the manuals
which are describing a smaller functionality and are therefor easier to read....

It's worrisome in terms of the single function prospect that we're putting so many eggs into the one Operating System approach
which by definition is more complex than a system dedicated to a
subset of the universe. The system your data base prospect gets
will not only be able to run DBMS-32 but also Transaction

Processing, Real Time, Time Sharing, etc which is great for the
General Motors Programming Shop but complicates life for the single function guy. Maybe what's needed most is really good Tech
Writers who produce sets of single function system manuals?

It's even more worrisome that IBM seems to be trying to get where
we came from: the image of the S38 is Data Base; the 8100 is Real
Time; the 4300 is GP; etc. And they seem to feel that SNA will solve
all their compatibility problems? At any rate it seems intuitively
clear to me that whatever DB system you may develop on VMS just
has to be more complicated than say the S38 with its more narrow focus.Better manuals and prebuilt systems can help, but....

Maybe you've guessed by now that I question the one Operating System approach; you're right I do! On the other hand I don't advocate the chaos of the 11 Land where Operating Systems continue to proliferate, but rather a rigidly planned set of compatible, functional subsets of VMS. I would think this would
return "ease of use" to the single function user while VMS would
continue to be the GP system needed by the GM's of the world.

I'll also question the notion that 1 OS is easier to maintain than
several(when blaspheming why not go all the way). I'll argue that
there's a powerful synergism of complexity that more than makes up
for the extra drivers and manuals. In five years we're going to
need some pretty smart people to maintain VMS (Remember when OS370
went critical; ie fixing 1 bug was introducing 1.x bugs? or

when
the TOPS-10 solution was to throw away 1000 SPR reports?)

In sum then I'm suggesting that the multi function capability required by the one Operating System approach promotes ease of
use for our large customers at the corporate levels but has to
cost the single function user in terms of complexity. We can mitigate this to an extent with prebuilding systems and more precisely focusing our manuals but nothing's free;controlled additions to the O/S lineup could help on the ease of use axis.

Regards

"CC" DISTRIBUTION:

GORDON BELL* BILL JOHNSON JACK
MILESKI
RON HAM

GB1.S1.69--Attachment #

GB1.S2.26

<u>Data</u>

1. Having just returned from visiting Cal Tech and seeing many distributed VAXs surround and overthrough the Cal Tech computation center, by adopting our strategy (complete with Ethernet), I'm appalled at our abysmal performance to sell VAXs, especially in Educational Institutions.

2. The System 38 is nowhere near a VAX, yet more have sold.

3. IBM's delivered more series 1's!

4. IBM now has a VAX force to STOP VAX. They needn't be worried.

5. HP has continued to grow with the 3000 despite its massive inferiority.

6. Who would buy a Prime when VAX (and a compatible Professional PC) are available?

7. With the 730 we should get computing down to very small groups of 2-8 for the best computing.

8. A 730 ad with no content!

9. OC time devotes no time to this critical area.

ACTION

1. We must immediately establish a techncial effort that only have a VAX sales goal. Back to the Product (Product Line!)

2. There must be a strong, engineering effort for continued technical market place needs.

This includes: real time, graphic support, better technical languages, a relationed data base, high quality terminals and personal computer support. (Here, aside from ESG, we have a massive void coupled with poor incompetence!)

3. The commercial market for VAX is probably 10X the technical market place. We have an excellent engineering group. We must now focus on Commercial Marketing. Let's get the System 38! Let's discuss at OC and set the buy in for focus and change.

4. We should market VAX commercial computing in Universities when we have strong

customer support.

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Subject: **A Method of Segmenting and Seeing Whether and How 10/20 Customers Can Use VAX Now and In the Future**

To: Ulf Fagerquist, MR1-2/E78

CC: Per Hjerppe, MR1-2/E78
John Jorgensen, MR1-2/E78
Larry Portner, ML12-3/A62

Date: 2/14/79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

Follow up 3/2/79

The attached hypothetical letters to representative customers, based on the one started by John Jorgensen looks like an excellent way to attack this problem. It is the only way to really get at the problem definition, because it has to be done in detail, not just with a sweeping statement (e.g., all service businesses use 10's and have all their programming investment in Macro 10, hence we must supply hardware forever).

Also, given that we first do this at this level, we then have to go down to the next level of detail and really try it. I believe the in-house customer group is the right one to test. Note that we are talking to this group and it ought to be you, Larry and I so that we can get their concerns.

We need a project leader for first assessing the impact, and second, seeing how one would "migrate" use, although I think we must strike the word migration from our vocabulary. I don't think users want to spend any time doing this. They will write new applications on systems we provide as long as there's a reasonable way and cost-effective systems. When I wrote the letters I saw these ingredients:

1. Have a network so that work can be moved easily among machines. Here, this might be ICCS for very fast movement or the intermediate level (1 Mbit) link is probably adequate and preferred as it also permits the distributed location of machines.

2. Really specify what one has to do to write compatibly. I would also like to have utilities that would help (probably written in Snobol).

3. Only put new work on VAX. When programs exceed limit on 20's address (or exponent??), then move them on to VAX. Note, rather than doing extended range exponent for one promised customer, wouldn't it be cheaper to give the user a VAX? Therefore, work would gradually migrate as programs decrease in use, and a given customer could probably live within a given machine budget.

There will be similar rules for our internal development.

To assess the impact then, we would identify all customer classes at a significant level of detail, so the complete list is non-overlapping and 100%:

1. Engineering users with a significant number of 10's

2. New buyers of 20's in engineering

3. Take out all those who only run APL

4. ARPA (subtract it out of the universities part)

5. Universities with minis and deciding on a mainframe

6. Universities with 10's or 20's and running out of capacity

7. Service bureaus with significant investment in macro code

8. Service bureaus programming in standard HLL which can use large VAX as a way to off load their incoming job in a computing engine environment (here the 10 would do front and back end and switching, and VAX would compute.)

9. Other service bureau segments (probably at least two more).

10. Business users in COBOL and DBMS

11. CIS

12. Mfg. at DEC

etc.

The job would first segment the best we could and include enough dimensions so that the users were in separate classes. Then put numbers of installed base, and projected sales, separating add-on.

Further define each of the classes by exactly what they do and what programs they use by talking with them. This might get a few more classes. Write letters or describe the VAXination program to them in hypothetical letters like the ones we've done.

Do an experiment to show that it can work, etc. CMU would be ideal. Take a really hard one (probably the in-house ones) and work with a service bureau.

Who can lead us in this?

The hi end POT would probably have worthwhile comments on this approach.

GB:ljp

Attachments

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* d i g i t a l *
****

TO: see "TO" DISTRIBUTION DATE: FRI 27 JUN 1980 2:58 PM EDT

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION DEPT: OOD

EXT: 223-2236

LOC/MAIL STOP: ML12-1/A51

SUBJECT: SINGLE USERS VAX: WE NEED IT.

I believe we must move significantly faster to get to the market with a high powered, VAX personal computer. The VAX chip will then let us sell them in droves cheaply. THE LIMIT IS SOFTWARE - SO WE HAVE TO START. There are now these:

1. PERQ - orders for several hundred, CMU is using it for their

system with the goal of 150 @ 30K-50K in 2 years. Interactive Systems (Peter Weiner) is going to put UNIX on it.

2. Various Xerox machines - probably won't ever make it to market.

3. West Coast Semicomputer Company - (mid '81 with a 16-bit microprocessor with a reasonable address space).

4. MIT/ZENITH - Zenith's building the MIT Nu design of Professor Ward. Uses a 68000 and high resolution scope.

5. MIT LISP machine - MIT continues to make them. Apparently others are trying to buy them too. About 20 exist.

6. BBN Jerico - Rumour.

7. HP30 - proven dud so far.

8. Probably others. IBM proposed a modified 4331 to CMU for this.

What I'd like to see:

0. Get Ethernet/UNIBUS out NOW so users can build networks.

1. Get the display part and keep it independent of Nebula so that we can get breadboarding of system done on a 780 and COMET if we have trouble. Also, note both the larger machines, may be used in this mode.

2. Get the right interface to the canon printer so we can get LQP page output.

3. Build a significant number (100) of Nebula ASAP (by Jan. 1) for
us and several key customers including several universities.

4. Co-ordinate 3 so that we get the experimental work started.
Some of the universities will use UNIX, so we would use this
effort to co-ordinate the flow between VMS and UNIX. Sponsor
single user VMS though.

Who's in charge here?

GB:swh
GB1.S5.10

"TO" DISTRIBUTION:

ANDY KNOWLES JOEL SCHWARTZ PETER SMITH

"CC" DISTRIBUTION:

BILL MUNSON BILL DEMMER DICK ECKHOUSE
SAM FULLER BERNIE LACROUTE OOD:
LOU PHILIPPON WAYNE ROSING

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*****************
* d i g i t a l *
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TO: JOE CARCHIDI DATE: SAT 2 MAY 1981 15:29 EST
BILL DEMMER FROM: GORDON BELL
SAM FULLER DEPT: ENG STAFF
BILL HEFFNER EXT: 223-2236
BILL JOHNSON LOC/MAIL STOP: ML12-1/A51

SUBJECT: LOW COST VAX'S

We are having a hell of a problem in getting the 11's down in cost at the systems level because we are unable to take advantage
of the set of component chips available. The ii is an attempt at the hardware level to interface these.

There is a similar problem for software busing. These new peripheral chips are totally different and require new handlers and a way of interfacing to our operating system structures.

We are going to have to bring about some major changes in the way we cope with this hardware from the semi folks.

Currently, we can't use it. If we don't we are going to be uncompetitive.

VAX will have the same problem as Lloyd points out.

I want the BI rethought out. I don't see how we can use it. I would like to use IIndustry Standard
chips and provide an Industry Standard Board level bus such as the new, emerging 32 bit version of the Multibus that the IEEE is proposing. No way can we continue to ignore these standards.

ATTACHED: MEMO;62

****
* d i g i t a l *
****

TO: GORDON BELL
10:31 EDT
    SAM FULLER
cc: JACK MACKEEN
    TED SEMPLE

DATE: FRI 1 MAY 1981

FROM: LLOYD FUGATE
DEPT: MICROS
EXT: 231-5703
LOC/MAIL STOP: MR2-2/M65

SUBJECT: "11" AS A LOW-END 16-BIT ENGINE

```
*********************
* D I G I T A L     *            INTEROFFICE MEMORANDUM
*********************
```

TO: Gordon Bell   DATE: 28 April 1981
    Sam Fuller   FROM: Lloyd Fugate
CC: Jack MacKeen   DEPT: Micros Strategic
Planning
    Ted Semple   EXT: 231-5703
                                     LOC/MAIL STOP: MR2-2/M65

SUBJECT: LOW-END DEC ARCHITECTURES

"11" as a Low-End 16-Bit Engine

I believe we have encountered the following problems in using the
11 architecture for implementing low-end products:

1. DEC's early minicomputer implementation of a 16-Bit architecture has caused it to be an older generation architecture. Semiconductor vendors have benefited from five plus years of industry experience before doing their 16-Bit machine.

2. Our standards/software either limit or eliminate the opportunity to update the architecture to make it more competitive.

3. The "11" was not designed with LSI in mind. Most of today's
16-Bit machines from semiconductor vendors are designed specifically for easy implementation in LSI.

4. Transfer cost of DEC CPU's is higher than the market price of

16-Bit products from the semiconductor vendors (i.e. they are
not zero cost).

VAX as a Low-End 32-Bit Engine

It appears to me that these same problems in using the "11" as a
low-end 16-Bit engine today will apply to VAX as a low-end 32-bit
engine in 1986. Am I wrong?

01-MAY-81 10:35:50 S 9685 MLDP

GB2.S6.32

00 CORE DECGRAM ACCEPTED S 000342 O 52 10-OCT-82 18:29:06

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION   DATE: SUN 10 OCT 1982 6:23 PM EDT

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION   DEPT: ENG STAFF

EXT: 223-2236

LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5178223319

SUBJECT: MORE ON EXTENDING VAX VIA MICROPROGRAMMING

In the September '82 issue of Computer Architecture News (the one where the 80286 is benchmarked to be 2.6 x a 780), I noted
another article entitled: A comparison of Microcode, Assembly Code and High-Level Languages on the VAX-11 and RISC I.

The abstract:
"This paper compares the performance of a simplified pattern matching instruction. The fastest version was microprogrammed
on a 750, the next fastest the RISC, ... The paper presents the execution times ... ."

The example was taken from Yale Patt's introduction to the the
VAX-11/750 Microarchitecture. A microprogrammed 750 executed the string match at the following faster factors:

RISC	5-8.6
	using hand coded and c coded risc (@400ns cycle)
780	8.6-14
	using hand coded, c unix, c vms
750	14-28
	"

Namely, on the 750, you get a factor of 14 improvement over assembly language, a factor of 28 over Unix C and a factor of 18 over VMS C using a microprogram in the 750.

Such an example is probably the best case since the MatchP counts the number of occurrences of a 16 bit pattern in a string whose length is a multiple of 32 bits. MatchP takes 3 arguments: the patern, the stream addres, and the length of the the
string in bytes.

"TO" DISTRIBUTION:

DILEEP BHANDARKAR BILL DEMMER SAM FULLER
BILL STRECKER

"CC" DISTRIBUTION:

FRED ENGEL TOM GANNON DICK
HUSTVEDT
BILL JOHNSON ALAN KOTOK

GB3.S8.64

WE INTEND TO MAKE VAX/VMS THE COMPUTING ENVIRONMENT FOR THE 80'S AND 90'S, IMPLEMENTING 11'S IN THE TERMINAL AND REAL TIME FRONT END PRODUCT SPACE WHERE VAX IS TOO EXPENSIVE. THE EMPHASIS WILL BE ON ABSOLUTE COMPATIBILITY AMONG VMS AND THE ENVIRONMENT IT PROVIDES FOR M AND RSTS.

WE ARE ALSO DESIGNING COST-EFFECTIVE HARDWARE FOR 10/20 USERS AND INTEND TO PROVIDE AN ENVIRONMENT WITH INTERCONNECTION TO VAX USING COMMON COMPONENTS (E.G. FRONT ENDS). GROWTH FOR 10/20 USERS WILL ALSO BE PROVIDED THROUGH VARIOUS STYLES OF OFF LOADING (E.G., FRONT ENDING, SPECIAL PROCESSING) THROUGH THE VAX/VMS ENVIRONMENT IN A FASHION SO AS NOT TO REQUIRE SIGNIFICANT USER INVESTMENT.

****
* d i g i t a l *
****

TO: ORPHAN/ANKLAN @CNS1
DATE: WED 5 MAY 1982 2:48 PM EDT

FROM: GORDON BELL
DEPT: ENG STAFF

cc: see "CC" DISTRIBUTION

EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: VAX/VMS RELEASE 1 BOOK

It would be great to have a book that counters Soul of A New Machine.
My problem with it, other than the engineering, was that I don't think
the author liked the subjects at all, nor did he understand them.
Unfortunately, the book was successful as measured by the Pulitzer
Prize, and there is some expectation about what a project book might
look like. Fortunately, VAX and VMS didn't look like DG's project and
hence it really would appear dull by comparison. Also, copies of
books always turn out to be much less significant than the original.
(I sure like dull engineering projects versus the exciting ones say
like Venus.) Therefore, I am highly negative about Soul of VAX/VMS
because it has the markings of a copy, which unlike VAX/VMS was
original and which caused DG to have to have their project.

What I would really like to see is a companion book to COMPUTER
ENGINEERING, entitled COMPUTER ENGINEERING: A DEC VIEW OF SOFTWARE
ENGINEERING. Note that COMPUTER ENGINEERING has sold in the range of
20K copies the last time I looked, so I know there's an excellent
market. Bob Supnik had talked about such a book and we often talk
about this book along with the idea of a DEC Engineering Journal.

Others have talked about writing various articles. I have a tree that
Richy Lary drew that relates various versions of various Operating
Systems to one another, for example to give an overall perspective.

It would seem to me you would be the ideal person to write and edit
such a book. You would gather many articles that exist today plus you
would write the really definitive article or section (set of articles)
on VMS. The issues you raise in your outline could be addressed in a
section on VMS... or even a book on just the Engineering of VMS.

It seems to me you could proceed on a book, but really write it from a
technical perspective, although putting in the people parts, but the
audience is really Engineers (Software and Hardware and others) and
the emphasis is how to do it right. It isn't a book about a bunch of
kids trying to build something where the management is playing games.

What you think? Let's get together on this to brainstorm if you think
it has merit

"CC" DISTRIBUTION:

DAVE CUTLER BILL DEMMER BILL HEFFNER
BILL JOHNSON

GB3.S5.22
One of our vendors, related to the marketing domain, who is

at the top of his field in quality, gave me his impression of DEC as a customer. His view about the marketing space, comparing DEC with others:

Our reputation rests on a few good people but he has not seen them so he thinks their numbers must be small. Mostly, he's imputed that they must exist because we've done so well. He knows that we've hired people, presumeably because of the high growth, that NO ONE else would hire. It's easy to get in, we don't think excellence, and there's no way to get fired. He sees a lot of lazy and incompetent people. He can't understand how we're going to be able to continue with the magic, whatever it is, given these people.

He was as confused as our employees because of the matrix mystique. He postulates that we must have lots of stealing because of the fragmentation, fat and the kind of people. Everyone gets involved in everything. The result, lots of inefficiency, but mostly it is just very, very political with groups constantly bickering about each other and trying to stay away from other groups. The people talk openly about the politics.

Unlike one of his other customers, GCA, who he said was the best because of their understanding and caring about the products. We rank at the bottom in terms of understanding and caring about products.

Other companies: Honeywell's better, clearer, more professional in their interaction; Gillette, a company that everyone puts on their resume, people are professional, while they pass through; Polaroid, extremely poor management.

Engineering staff:
I think we have to have the same problems. During the overall review, I want to highlight our mediocre and incompetent parts and assign them to NOD (Nil Output Division).
October 10, 1981

Mr. Lee H. Schank
Vice President, General Manager
Rixon Incorporated
2120 Industrial Parkway
Silver Spring, Maryland 20904

Dear Mr. Schank:

Thank you for sending me the information on Rixon. I have sent the material to Bernie Lacroute, Group Engineering Manager for Distributed Systems. I have also sent a copy of the material to Bill Avery, Group Engineering Manager for our Terminals and Computing Terminals and to Al Crawford, head of our Corporate Information Processing Department, and finally to John Rose who is responsible for computing within engineering. Both Bernie and Bill are responsible for our product development and would focus on our use as an OEM, and Al and John are responsible for our internal corporate and engineering group needs.

The best way to start an interaction is by direct contact with the appropriate, direct users. Also, it would seem like Bernie and Al might host a general session where the products and possibilities could be explored. I would hope we could do a thorough evaluation of your products for these uses and possibly visit your main facility in Maryland, provided there is interest.

Thank you for calling your product to my attention. I hope there is some way for us to interact. Could you also send me a more complete catalog, including price list of your various products?

Sincerely,

Gordon Bell
Vice President, Engineering

CC:
Bill Avery

Al Crawford
Bernie Lacroute
John Rose
J. Bergmann

GB3.S1.24

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION DATE: WED 25 JUN 1980 10:06 PM EDT

FROM: GORDON BELL
cc: see "CC" DISTRIBUTION DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: 780/VENUS ARRAY PROCESSOR AND KAHAN AS A CONSULTANT

Kahan of Berkley
I talked with Kahan on Monday afternoon about his possibly consulting with CDC. Given that he had knowledge of Venus, he wondered how we felt about this. He stated that CDC was positioning a machine to be competitive with VAX. Given their knowledge of scientific computation, I am quite concerned.

Frankly, I think we need his help and understanding in tweaking Venus because of his knowledge of numerical, scientific computation and benchmarks. Through him we might make minor changes that would influence performance and accuracy greatly.

Who could interface with him? I promised that Sam or I would call him on this by Monday, so we must. Sam will you decide on this and talk with me?

780 and Venus Competitive Concerns
I am vitally concerned about our being too late with Venus and
the need for some interim like the Array Processor by FP Systems.
Initially, we would buy this and integrate it into the architecture as best as possible, but ultimately we may want to
build one and do a much better job of integrating it into VAX
and VMS. Thus, there is a range of alternatives, but I don't think we can do absolutely nothing, hoping FPS will save us.

Given that we now have such a significant part of our business in
this scientific domain though LDP, ESG, Government, and some in
EDU, we can't just let it go down the tubes. We have to get someone to frame the technical alternatives and costs rather quickly and then appraise the Technical Marketing folks so as to
get a direction. Who is going to do this?

"TO" DISTRIBUTION:

BILL DEMMER	ULF FAGERQUIST	SAM FULLER

"CC" DISTRIBUTION:

DILEEP BHANDARKAR	DAVE ORBITS	BOB FLYNN
MARY JANE FORBES	ANDY KNOWLES	JUD LEONARD
SI LYLE	MARY PAYNE	BILL STRECKER
TOM EGGERS		

GB1.S5.29
****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION DATE: TUE 19 MAY 1981
8:14 EST

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

cc: SAM FULLER
ALAN KOTOK

SUBJECT: VENUS AND ITS CONTINGENCIES

Given that Venus is really the cornerstone of the VAX strategy as the follow-on to the 780, the competitors, and my concern about its schedule, we should proceed as follows:

1. VENUS MUST COME IN AT THE SCHEDULED TIME
There is no option to stop work and to go back, get adequate CAD tools, do the design training, and staff such that we have a higher chance of winning. It is up to Ulf and George to do the necessary things to make it win! I intend to help lots here.

I'll discuss with Ken, and we should keep the Operations Committee informed if there are any changes.

2A 780 MID LIFE KICKERS
Are there any? What is the chance of running the clock faster? Using the new part we are talking to AMD about for the SUVAX display? Using an MCA data path?

2B 780 ENHANCEMENT USING TIGHT COUPLING TO FLOATING POINT SYSTEMS
They will be here this month with their VP of Engineering. We must co-ordinate with the persons hosting them to assure that their FPS box can be connected to VAX systems via the CI. This will give us the necessary coupling and experience for this type

of systems. Demmer, please get this cleared at GVPC so that we
can work with them freely when they come.

2C MULTI PROCESSORS VIA THE MA780
Here, we need measurements and help (experience is in MR) on symmetrical mP's, where we should go up to FOUR processors. Bill, let's get at least one four processor configuration and lots more memory for the VMS group so we can start this work.

2D HYDRA CLUSTERS
Anything here to do that's not being done?

2E NAUTILUS AS A BACKUP
Even though there are different persons, Nautilus may not be a
backup, given that it has about the same complexity. We must be
concerned with their lack of gate array design experience and tools, particularly when facing the Japanese competitive scene.

2F SCORPIO MULTIPROCESSORS AS A BACKUP
The team understands complexity and structured design, but does
it understand VAX adequately? Given the competitors are all multiprocessor based, and given our positive experience with the
11/74 MP, and given that we need more performance, can we get our
act together here to make a multiprocessor?

3 THE 2080 AS THE KEYSTONE OF THE HIGH END
We simply must now integrate the 20 into the VAX/VMS architecture. This means that work can be moved freely across
the two machines. The key parts are the languages and files, although we consistently get hung up with the command language!
(This can be limited to a few key languages such as Bliss, Cobol
and Fortran.)

We also need the 2080 as our main computation center machines
for
the foreseeable future. Within engineering, the CAD needs
are
quite clear, and we have to plan on it giving us the mips.

Ulf and Bill McBride must propose a significantly more
compatible
and integrated system plan.

ADDITIONAL QUESTIONS

Any other alternatives?

What are the priorities?

Is it clear who's doing what?

GB2.S5.58

"TO" DISTRIBUTION:

BILL DEMMER	ULF FAGERQUIST	GEORGE HOFF
BILL MCBRIDE	LARRY PORTNER	

****
* d i g i t a l *
****

TO: BILL DEMMER   DATE: SUN 14 JUN 1981
19:31 EST
    SAM FULLER   FROM: GORDON BELL
                                        DEPT: ENG STAFF
                                        EXT: 223-2236
                                        LOC/MAIL STOP: ML12-
1/A51

SUBJECT: BUILDING VENUS AND OTHER VAXES

I don't want to lose any time on getting this project
started.

We should have news shortly on the I-box. My greatest fear is that the I-box can't be proved to work, or will work so slowly that the performance will be something like a 780. The first estimates for the path are around 100 ns in the I box. I don't understand pipelining well enough to know what that means though.

Our problem here:
780 mid life kickers
Venus alternative
Nautilus
Staffing adequately to give Venus a fair shot
Cane, and a high performance machine
Scorpio, so it doesn't become a Venus

BJ is thinking of moving the office systems work to the UK. This would leave a team of very bright programmers without a project. They could be the basis of a system that would design the next machine, given a couple of good logicians and electrical engineers. The more I see us grunt away on logic, the clearer it is that it's not the way to do the job.

GB2.S6.68

The State of the Design
It seems like we have:

. text spec of entire machine, since the box names are incorrect, its unclear whether this has any validity
. text spec of boxes, together with some block diagrams, description doesn't reflect the design
. flow charts specifying behavior of a few parts
. behaviorial description, in TUMS of the boxes, non-operational as a complete system. Even if it operated as a complete system, it is unclear what it means due since the timing interaction of interconnect signals like stalls and micro-interrupts are so complex.
. 500 SUDS logic drawings specifying the machine
. 500 SUDS logic drawings for MCAs

. MCA physical layout, simulation description, test patterns, test data as to whether the MCAs meet their specs

What would be the IDEAL state of the Design?
A document describing all the documents and what the design ground rules are going to be. This would
It seems clear that we must have an accurate, structured design at all stages of the design.
Ideally, this design description is in machine readable form so that it can be checked as much as possible by machine.
Since the main design tool is SUDS, this implies SUDS compatilble software that must be written asap.

What would be the IDEAL design system?

0. Information only appears once and notification is made to users of information as it changes. Ideally a data base could do this, however, this has shown to be virtually unworkable using DBMS and the IDEA database. Alternatively, there must be batch update to flag changes.

1. Interactive, with access to any part, with protection of data as to the owner.

2. Report writing ability to get parts out as needed when there are large pieces that need to be looked at or put on the wall. No document should be more than 15 minutes away, with instant access to everything else, including access via SUDS terminals.

3. Overnite batch update of key part such as indexes, rule checking, etc. that is less frequently needed.

4. Calculator functions like the clock checker that operate on the data to give the designers quick access for making critical decisions.

5. Data base-like access of critical information that is structured in order of detail.

6. An index and on line access to all signals, giving:
.name, together with polarity, location, time generated, and the source drawing it is created on (derived from SUDS)

. a list of all the drawings it goes to and the time the pin expects to see the signal (derived from SUDS)

. a text description of the meaning of the signal (designer input, together with date created,

. a list of all the specifications that reference the signal

. a list of all the other documents that reference the signal

. a list of people who are interested in the name so that they can be informed of changes on some sort of periodic basis

A program would be run each period to update the index from SUDS or from a journal tape generated by SUDS. A program would be available to either automatically, or on demand report all the changes to names to the relevant persons.

7. Mail system so that designers can ask for information from one another and have an easy way of structuring the ambiguities.

GB2.S6.31

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a n d u m
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+---------------------------+
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Subject: DESIGNING AND PRODUCING A TIMELY, QUALITY VENUS ACTION ITEMS

To: Ulf Fagerquist, Alan Kotok, George Hoff, Sultan Zia, Roy Rezac, Bill Walton, Carl Gibson, Dave Copeland, Vehbi Tasar, Dick Beavan, Nick Cappello, Vic Ku, Tom Eggers, John Bloem, Tryggve Fossum, Bill Bruckert, Paul Guglielmi, Sue Nathan
CC: Bill Demmer

Date: 11/15/81
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51

After one week with Venus, it is clear that we have to change:

SCHEDULES MUST BE CLEAR AND WE MUST MEET THEM
We didn't get through the schedule reviews on the boxes, nor did we get around to reviewing the LSCAD and diagnostics parts on Thursday. Of those schedules we reviewed, it wasn't clear what the schedules were, nor how we were doing with them. It seemed like only Tryggve was meeting his schedules. This is awful, given we just replanned. We must have WEEKLY reviews. The focus will be both on the quality of the schedule and meeting them.

Good schedules have to be entered into the scheduling system.

I believe we have to have a totally on line system for looking at all tasks.

MORE RESOURCES
MCA DESIGN GROUP-The IBOX group has requested help in their design including one more logician and several logicians in February for MCAs. Getting their logician is very high priority and should be done this week. In addition, I hope to establish another group in MR1 who would only work on MCA design, test pattern generation and then testing when the MCAs return. They would be the providers of MCAs for the module and box designers. The goal is to free our box designers to design modules for the boxes.

TOP LEVEL DESIGNER AND LIBRARIAN-The top level design must be managed across the boxes, I believe by Alan. In addition, we must immediately obtain a technical librarian who maintains the documents and works at resolving the dangling loose ends by holding them. In programming, these correspond to the chief programmer and program librarian.

We have to explore other areas where more resources can be applied. Beware:
Brooks law states: "Adding resources to a late project delays the project."

HOW CAN WE REDUCE WORK?
I want to explore using the IO System of Jupiter, since it will have been built and debugged by the time Venus is built. Also, given the complexity of the machine, I would like to use an off the shelf 11 to get the bigger address space and be able to use an existing operating system. This would get us some extra breathing room in the program space. I can't conceive of writing the console program in anything like 65 Kbytes.

COURSE ON COMPLEX SYSTEM MANAGEMENT
All of us must take this course by John Monzo this week. Other courses may be required as we go along. I think we need something on the order of 1-2 days per month. One of these, out of necessity, may have to be on Saturday, so as to not impact our slipping schedules even more.

COURSE ON QUALITY
It is clear we also need a course on quality. The documentation of the machine I've seen so far is marginal. There are no conventions for names (eg. VA is used for Virtual Address register within Venus, whereas it is most generally used everywhere else to mean simply a virtual address), and there is inconsistent naming based on capitals, hyphens and abbreviations. I don't know how a computer can possibly equate 3 versions of what appear to be the same name in one paragraph and they certainly confused me. We have to have be perfect in every detail to get a working machine! We have to solve this problem.

FORMAL MEETINGS
We probably should minimize, stylize and streamline our meetings. This should get attended to this week.

OPEN COMMUNICATION AND SUGGESTIONS
It seems to me we are pretty open, but it is clear we have to be very open about things that may impede progress. Historically, we have been quite good about making these suggestions. In addition, there's already been good suggestions about computer operations

using a suggestion system. Although we don't have a suggestion system for the engineers, we must encourage suggestions from everyone on all fronts on: reducing work, being more effective with what we have to do, training and quality... here, we simply can not make any mistakes that requires any kind of rework (eg. eventually editing a document for naming consistency because the names were typed carelessly).

I propose we all be accessable for ideas and problem resolution via mail.

ADVANCED DEVELOPMENT
We need to carry out some aggressive high risk, very high payoff work concurrent with VENUS that could help in reducing future work and improving the quality.

BOTTOM LINE
Venus continues to be the most challenging project within DEC. It has to be a quality product and on schedule. Making it happen is our responsibility.

00 CORE DECGRAM ACCEPTED S 005541 O 535 16-NOV-82 20:20:04

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* d i g i t a l *
***************** GB3.S8.53

TO: see "TO" DISTRIBUTION

cc: see "CC" DISTRIBUTION

DATE: TUE 16 NOV 1982
1:23 PM EST
FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5181988022

SUBJECT: VENUS NEED, S1 (AND US), LLL MULTIPROCESSORS

VENUS

Having just returned from visiting a number of customers, the need for Venus is absolutely clear. We must take every opportunity for further inspection ala Cohen's Software Methodology in order to get it on time, and, if possible, ahead of schedule. The M-box in particular critical, and I wonder if an outside review would be useful too? Is there a chance here on the M-box? How?

The decision to use the SBI for Venus may turn out to be quite wise, even though it is costly. By using the SBI, customers can unplug options at various levels on Unibus and Massbus and attach them to Venus. This minimizes perturbation and saves files, etc. . . This also gives us a lot of 780's for sales somewhere. Possibly the 782 configuration might be useful in the transition.

I see a long life for Venus, independent of Nautilus, simply because of the SBI, and the lack of peripherals for BI initially.

THE LLL S1 (AND ITS PACKAGING)

I think it's important to build the S1, if for no other reason than because it's the most complex architecture that one can imagine and they've made a number of contributions in handling vectors and built-in functions. It is also a very tightly coupled mP(16 Pc's) with duplexed central memory and a switch like C.mmp. (Taylor series for transcendentals, FFT, digital filtering) There are only 25,000 100K chips in the processor . . . which is 4x the number in the FPS 164 and only 1/8 that of the Cray 1 at it's current 80ns clock which their verifier confirmed (50ns was the target before they laid it out in it's large form factor). Even though the Titan might actually outperform it for simple benchmarks, the novel handling of vectors, arrays, builtins functions and transcendentals should give it an edge
over the Cray for particular scientific processing, even though people will have to rethink their algorithms with very fast built-in transcendentals (10-50 x Cray when vectorized).

(HP's got some sort of fast FP processor too that has built-in transcendentals using a modified cordic algorithm.)

The machine is drawn on only 1000 A-sized prints -- (25 dips/A-size drawing) which really says hierarchical design works to surpress the redundant and the irrelevant. Note in SUDS, this would be on the order of 25,000 drawings! A count of the drawings should be the best indicator of complexity that designers have to deal with. Therefore, their machine is about as "complex" as Venus? Nautilus just has to work the print count and structure to hold down complexity.

The machine (S1-Mark IIA) is physically large because there are no card cages. It's in the shape of 3 "+" signs laid end-to-end so that all IC's are accessible. Power is totally bussed and fed from both ends. About 1/2 of the machine, the IBOX, has operated. It worked with a small number of design errors (principally the interface) a week after power-up!

S1 (Mark III)

This machine is to be the production version of the IIA, with no logic changes, and simply re-partitioned to get speed. It's to be laid out on 50 boards which have 250 x 2 IC's mounted on either side of the 15 x 15 PWB (4/6 mil spacing). Boards would be loaded against water-cooled plates on 1/2" centers. Thus the processor would be 15" x 15" x 25" package or 5725 cu. in. or .23"/flatpak. Note if we packaged Venus this way, with its 20 x 200 (4000 EIC's) could occupy a 10 x 10 x 10 cube! This would cut physical delays by more than x2, especially with edge connectors on both sides. They would be happy to share their packaging ideas and work with us. Joe Zeh ought to coordinate any visits.

They're planning a gigabyte of Mp---which only costs about $1M. This portends a problem in my lifetime . . . we only have about 30 bits for physical memory usually.

Also, I trust the already abominable addressing extension on the 10/20 will get extended again beyond its 30-bits in the next 10-20 years . . . please, please, please don't tell me when it happens.

It can emulate a 10 too probably, but won't since the only reason the proto did was for SUDS.

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BILL DEMMER ULF FAGERQUIST BOB GLORIOSO
BILL JOHNSON ALAN KOTOK

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BILL LONG DON MCINNIS BRUCE A RYAN
BILL STRECKER JOE ZEH

****
* d i g i t a l *
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TO: ULF FAGERQUIST DATE: WED 13 MAY 1981 6:27 EST

FROM: GORDON BELL
cc: BILL DEMMER DEPT: ENG STAFF
SAM FULLER EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: VENUS: NOW WHAT?

I basically don't think there's an option of letting a group or manager learn. Those folks are way in over their head and don't know it. I want to put together a set of people and do a set of analysis starting today. I'm in TW this morning and will discuss with Bill, then you guys might meet and then we could all meet at the mill.

Lots of thoughts:

What if we stopped it now? This would be the most humane and reasonable I'd believe. At any rate, we're going to have to face this, so I'd like to ask the question.

Who could manage the project at a detailed/design level to get the
job done? Fuller, Kotok, Stewart

How good are the various designers? (You've probably heard my theory of programmers wh do negative work.) How would you characterize them?

What formal methodology can you install that can allow the design to be verified or to even be converged or checked? Sam might have some ideas here. It might be done with some sort of ai program where the program is used to check the myriad of rules that need be checked. Here, we might get McDermott immediately to help us. The problem may be too big though!

Bill Demmer has got a real problem as it relates to 32-bits, however, I think the same issue is there. Namely, how do we build complex machines. Clearly this changes the emphasis on Nautilus and Scorpio and requires them... Nautilus has the same problem! (Although I have more confidence in the designers.) Their proposed schedule is the same as Venus and they propose the same techniques.

At 5, I'd like you and Bill to have pretty much scoped out where we stand and what kind of information we want to obtain about where we stand (as compared to Comet, KL, etc. along the lines of the design status.

Also, I'd like Bill to look at what whether there are any interesting alternatives vis a vis the 780. Could we realize it in 100K and get the same performance?

The bottom line:
I don't think there will ever be a machine there, given what I saw yesterday. A green, undisciplined, leaderless very large group is what I saw.

I think our thoughts ought to be confined to you, I, Sam, Allen, Bill and Larry for now. Hopefully we can all be at the meeting.

GB2.S6.42

00 CORE DECGRAM ACCEPTED S 000421 O 67 25-SEP-82 18:33:22

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* d i g i t a l *
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TO: see "TO" DISTRIBUTION DATE: SAT 25 SEP 1982 6:21 PM EDT

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION

DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5176595674

SUBJECT: CONGRATULATIONS ON VENUS PROJECT; NOW LET'S GO FOR CAD AND FACILITIES

Although it's hard to remember the fatal review in May 81, just 18 months ago, today's review of Venus was clearly two orders of magnitude different:
1. team versus collection of non-communicating gurus
2. anarchy versus a management structure with competent managers
3. everyone knowing what their job is and driving to do it
4. put something together versus design it right, check it and then build it. Quality Engineering!
5. seat of the pants versus science and engineering principles
6. a group going nowhere versus a basic spirit that VENUS will be a product, and there will be other follow-ons

Although things felt good with the project and the technology, we now have to go back and work like hell on::
1. The 10/20 network and operating system software that everyone

uses in Marlboro. Clearly these are unaccepatable
operationally to get VENUS and Jupiter finished!

2. Getting the CAD software working (AutoDly... timing verification
is essential I believe) AND

3. Getting the simulator, for the whole machine relible is also
even higher priority.

Am delighted that Jeff Singer is on the CAD software, but we need
to get Dave Copeland the resources to make the systems work.

All in all, even though there are problems, there's a group
who is now set up to solve them too.

"TO" DISTRIBUTION:

CARL GIBSON	BOB GLORIOSO	ALAN KOTOK
BILL WALTON	SULTAN ZIA	

"CC" DISTRIBUTION:

DAVE COPELAND	ULF FAGERQUIST	BILL JOHNSON
KEN OLSEN	JACK SMITH	

WPS USERS - Leave HP mode and type <CR>

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* d i g i t a l *
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TO: RANDI LOVE DATE: SUN 8 NOV 1981
3:12 PM EST

FROM: GORDON BELL
cc: see "CC" DISTRIBUTION DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: RE: GORDON BELL'S VISIT TO MARLBORO

Do intend to stay closer to VENUS than when I got involved
last
time. For the very short term, ie this week, I want to go
for
these things:
.get on loan a Xerox 9700 printer that can be directly
connected in order to get instant throughput of prints
(Ulf, contact Al Crawford on this. We would replace theirs
when you get yours. We do need this direct connection. I
want the 10/20 folks to get the network connection so as to
make your design network work.
.get a network in place that can handle all this
.get a job floor control system so as to get instant access
to
state of the design
Note these candidates: Albequrque, Colo Springs, Maynard
Modules,
someone else in MDC. Can you get the specs on all these
and any others and then lets decide which ones we are going
to use.
.get 3 designers from the UK or elsewhere (the call has gone
out)
Bernie says we can get 3 now for a year and he will take
them
into Distributed systems after they help Venus and get some
DEC training

I was particularly pleased with where we are on VENUS overall

as there has been so much progress. What I saw:
.A team of technical folks that are starting to behave as a
 team. You are all to be congratulated.
.Confidence that there is a good design basis.
.Equipment coming in to support the team so as to get
throughput
.The Quick Turn Around concept in all the modules and
services
.Buyin and understanding that we can and must seperate the
design
 so as to get parallelism and highest throughput (there needs
 to be MCA designers versus module designers ... Clem is the
 clearest on this point.
.Simulation is almost installed and I want to see how well it
is
 working.
.Structure in the design among the levels so we get a
 clear understanding at all times as to where we are in the
design
.timing verification has to be done, and we understand it's
need.
.Earl Van Horn's ISPS work really looks good. Whether we can
or
 or should use it remains to be seen. My feeling is that we
 could have either the dignosticians or simulator folks
 or microprogrammers do this as a check on the design.
 Note this was done at Intel on some of their recent machines
 except they used Simula for speed. In doing this, the goal
 would be to build the machine in ISPS at the box level in
 detail so that the clocked signals come out at the right
time.
 The goal here would be to get this done in sufficient
advance
 of the logic so that we would have a machine to run on.

We still need to work on a lot of things, including the
testor
to be used by the module and box designers.

Rather than working on process and teamness and resources, I
hope to get into the design asap so as to assess what we can
do

to simplify and get it sooner. Also, the closer look is necessary in order to see what we can do to aid the processes and
resources improvement.

"CC" DISTRIBUTION:

BILL DEMMER
ULF FAGERQUIST
ANDY KNOWLES
ALAN KOTOK
KEN OLSEN
LARRY PORTNER

GB3.S2.33

EMS 1-MAY-79 08:36:38 410 1

To: Bill Demmer
CC: George Hoff, Per Hjerppe
From: Gordon Bell
Date: TUE 1-MAY-79 08:36:38 EDT
Subject: Direction in Marlboro

Having heard the MCA review on Friday and seeing none of the people except
dave potter who are to be involved in venus and having it reiterated again
(at CMU) that we have been delivering marginal products in the 10 and that's
why everyone thinks we are moving to VAX, I would like you to get involved in
the definition of VENUS and especially in the staffing. The MCA really looks
marginal to me in terms of being expensive, most likely unreliable due to
low volume nature and my gut really says no. This movement of the project also
feels awful! The field service person on the 10's was present at the MCA
review and I don't want this group or the manufacturing people there involved
as they are not cost, or volume oriented, nor do they

understand quality
beyond having large organizations and this is not what the VENUS should be
all about.

Until Ulf gets back, I would like George Hoff to report to you.

Command:

EMS 2-MAY-79
15:29:49 290 1
To: Gordon Bell, Bill Demmer
CC: Per Hjerppe
From: George Hoff
Date: WED 2-MAY-79 15:29:49 EDT
Subject: EMS MESSAGE ON MCA/VENUS

The review this past Friday was planned to include MSD participation,
however, Ken's visit to Tewksbury created a conflict. I discussed this with
Dave Rogers and thought I relayed a message to you via Mary Jane - it was
decided to go ahead due to your crowded calendar. The key MSD issue in the
technology area is: we should trade-off the Siemens array with the MCA. We
committed to this trade-off at the meeting - Pat Sullivan met with Bob
Stewart before the meeting to insure that we understood his concerns. Bob, as
well as any other MSD engineer interested will be asked to be part of the
Venus technology trade-off review over the next four weeks.

I have reviewed staffing status with Bill today. We have 8 people identified
who will move to Marlboro this month. We expect to fill in the team with
Marlboro people this week.

The majority of the design team will be from MSD - including E BOX,
microcode, manager, floating point and systems architect.

MCA costs versus alternative technologies will be thoroughly reviewed. I will
set up a review of the plan for the technology trade-offs with Bill next
Friday.

The re-assignment of engineers form both Dolphin and Venus has been very
painful. My primary concern at this point is to re-establish momentum while
dealing with a review (and possible change) in the basic circuit technology
and packaging assumptions.

Command:

EMS 4-MAY-79
16:22:06 330 1
To: Gordon Bell
CC: Bill Demmer, Per Hjerppe
From: George Hoff
Date: FRI 4-MAY-79 16:22:06 EDT
Subject: YOUR EMS REGARDING MCA'S, VENUS & 2080'S AND RELIABILITY

I feel we have learned some painful lessons from the KL10 which are reflected
in the simplicity of both the 11/780 and the 2020. Simplicity is a key factor
in 2020 reliability plus a rigorous DMT/PMT process. The reliability of the

11/ 780 with a more complex structure is impressive. I believe that the
application of a mature technology and packaging approach were key factors in
the 11/780 along with DMT/PMT.

The application of any gate array technology to a medium scale processor
presents risks and complexity both in development and production which will be
reflected in time to market. If these risks and schedule impacts cannot be
justified in terms of life cycle operational cost and/or substantial
performance gains, they are clearly unjustified. The MCA technology will be
measured against more straight forward approaches for

Venus.

I believe we should apply a similar philosophy to the review of packaging
proposals i.e. if we add complexity and/or risk it should be clearly
justified in terms of payback to our customers in terms of time to market,
life cycle operational cost and performance.

Command:
00 BURT DECGRAM ACCEPTED S 13244 O 02 29-JUN-80 00:58:32

****
* d i g i t a l *
****

TO: ULF FAGERQUIST   DATE: SUN 29 JUN 1980 12:55 AM EDT
    GEORGE HOFF   FROM: GORDON BELL
cc: OOD: DEPT: OOD
    OPERATIONS COMMITTEE: EXT: 223-2236
                                          LOC/MAIL STOP: ML12-1/A51

SUBJECT: CONGRATULATIONS ON VENUS PROGRESS AND REPORT

The presentation, reports and work behind Venus really feels sound to me. The project is certainly about the largest we've
ever attempted and it is important that it be well run, just to keep from stumbling over its shoe laces.

Am delighted that we are over some of the big issues that were
holding us back at Motorola.

I was especially impressed with the sign-off and commitment that all the people and groups involved in both the task force
and the plan had. This is clearly essential and represents a significant management accomplishment already.

Keep it up. I look forward to the formal phase transition. Let
me know if there is anything I can do to help.

GB1.S5.39
00 BURT DECGRAM ACCEPTED S 22216 O 24 17-MAY-81 22:27:04

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION DATE: SUN 17 MAY 1981 22:19 EST

FROM: GORDON BELL
cc: ENG STAFF: DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: ONE WEEK TURN AROUND FOR VENUS AND EXTRA KL10'S THIS QUARTER

This is not optional. We have to have a plan in place to

attain this by the time the design, now on hold, comes
out.

Will,
I expect a major part of this to come from you. The need will hit probably at the end of this very short summer, I suspect.

The backplane is included too!

For starters, I would like to see if there are any KL10's we could add this quarter to help matters. Are there enough in Littleton? Marlboro? Tewksbury?

A task force, together with a clear leader should be formed no later than mid week to get this vital project under control.

"TO" DISTRIBUTION:

BILL DEMMER ULF FAGERQUIST GEORGE HOFF
WILL THOMPSON

ATTACHED: MEMO;35

****
* d i g i t a l *
****

TO: GORDON BELL DATE: FRI 15 MAY 1981
9:18 EST

FROM: PETER VAN ROEKENS
DEPT: OPERATIONS ANALYSIS
EXT: 223-1965
LOC/MAIL STOP: ML 12-
3/A62

SUBJECT: RE: RE:ONE WEEK PROTO BOARDS

I think this is the right approach. If we can take each of

the
elements of our process and tighten them up (or eliminate them)
we are bound to come out ahead. The how many angels on the head
of a pin discussions can wait till later. The Japanese don't
try to develop some entirely different approach as a first step.
They work on the individual steps. Later they look at the
overall flow and see whether larger parts or even the whole can
be replaced. And in these cases they do a proto type run of the
process before they scrap the old.

It is easy to fall into supporting the status quo. ie. it is not
really that much of a problem; prove it; the cost of fixing it
outweighs the benifits; etc.

Just as we want the output metrics for each of the PEG groups, we
need strong metrics for the supporting organizations. As they feel
they are being measured by their customers (PEG) for the amount they
simplify or complicate the job of producing quality products with a
quick time to market, we will see more of these good ideas.

PvR

GB2.S6.48

```
+---------------------------+                              GB0004/32
|   |   |   |   |   |   |   |
| d | i | g | i | t | a | l |   i n t e r o f f i c e   m e m o r a n d u m
|   |   |   |   |   |   |   |
+---------------------------+
```

Subject: **Teleconferencing System Proposal From Lake Systems**

To: Jim Bell, ML3-2/E41
Murray Copp, PK1/A10
Al Crawford, PK3-2/F34
Ralph Dement, PK1/A10
Jack Gilmore, MK1-1/J14
Rich Kalin, MK1-2/L02
Ken King, ML3-2/E41
Alan Kotok, ML3-5/H33
Ken Olsen, ML10-2/A50

Date: 8/4/79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

The equipment (TV and microware) looks good, but the whole operation needs to be much more flexible. The primary purpose is teleconferencing and not doing any fancy video recording or documentation. Given the amount that we move around in the Mill and the desirability of expansion of the system to other sites, such as Marlboro and Parker Street, we need to have a flexible (virtually portable) system, as Ken suggested, that can be installed in existing rooms with a minimum of difficulty. Given the equipment, a conferencing set up should be able to be installed in a room with a given set of appropriate parameters within a half day. To achieve this goal, I have the following recommendations:

1. The industrial design group with Bob Lotz should work to set the parameters for rooms that could be used for teleconferencing.
2. Lake Systems should be asked to put minimal "control room" facilities into a "box" that could exist in any room used for conferencing -- it can all hang out. The control room (box) would hold the viewgraph projecting area.
3. Neck mikes should be available to everyone in the conferencing situation. No desk mikes or anything that would get into peoples way and formalize the situation.
4. The first room, perhaps the big conference room across from my office, needs to be set up and used totally in an experimental fashion. (Dick Schneider is already thinking about this area in terms

of experiments as the office of the future...which we might call OOF.)

5. There would be cameras for audience (3), overall, overhead/top lighted viewing area, and presentation area (where a screen would also be pulled down and be used for slides). This might be both blackboard, whiteboard, and flip-chart area.

GB:swh

<title>
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<for>EBOD/PPC MEETING
<id#>27
<subject>PRODUCT STRATEGY'S VOTING RESULTS PRESENTED AT EBOD/PPC
<# of slides>6
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<title>OTHER PREMISES AND CONSIDERATIONS
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<wp#>3
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<date typed>78/09/12
<for>OC WOODS
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<wp#>2
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OVHD: Categories and slides in Overhead Books File

<u>Book 1</u>

Tech(t)

- tech rates for various techs
- tech tree of memories and logic
- Noyce's comp/ckt
- Toombs semi and bubble size, access, time
- autos vs computers

    Learning, tech forcst, and progress (fusfeld)
Memory (including core) evolution (t)
    memory categories size and access time general
Semiconductor evolution
Peripherals(t)
DEC C.cost, perf(t)
    All C's vs l-of-i
    8's; 8 $ vs perf; 8 and 11
    11 model char
    Whetstones for various machines
What total C environments will look like
    Switching cloud with various systems in background
    Turn-74
    J Bell's future implications
Can n micros=1 super?
    rates of bipolar, ecl and mos evolution
    cray, amdahl, ti9900 and comet
    Turn's forecst with lsi-11's added
    6600 and Cray 1 vs 8 and Lsi-11
Econ of scale, Grosch's law
    Total systems cost of 03...2050
    11 price and performance
    Whetstones of lots of machines
    vol of various 360's versus rental
    problem of range design
    Cox econ of scale
    Grosch's law
Memory model to predict all computers
Kiviat graph to respresent all machines
    Kiviat and its models of a basic computer
    multi-dimensional spaces of minis
The Unibus

Book 2

C ideas and evolution

- great ideas of hardware-cosers
- why computers evolve rapidly
- future challenge to DEC
- implications of technology
- wheel of reincarnatin
- effect of minis and maxis on each other
- product design guidelines

The pipelined development process

- overall environment (3, 1 simplified)
- behavior of engineers, sales, market, mfg.
- design styles vs size
- involvement of each group vs t
- running pipe for disks
- process for software, disks and cpu
- semi evolution vs disks
- how we win with managing process

Machine class formation

- producer consumer pairings in price bands
- new tech design options
- 3d price, perf and time (3 slides)

Level of integration, onions, n-space of process/size/arch/Lofi

- 4d
- disciplines dimensions
- a computer is not a tree
- lots of onions

Market segmentation

- schemes
- channels (2)
- dimensions
- functional seg
- applications evol (phister)
- PMS structure seg
- DEC's mkt seg
- size partition
- Mini and micro growth(t)
- mini applications origin
- SIC codes
- #users vs dedicatedness vs generality for a given perf.

taxonomy of system structure types
lang ops sys str dimensions
Engineering use of C's
generic activities of all eng.
electronic industry based
what i want from our tools
use of C within CAD(t)
Forecasts and Delphi process (quotable notes about future from
1969 perspective)

Book 3
DEC engineering
buy/seller model
picture of unlimited budget, enormous staff, etc.
level of i; 4d
organization
budget(time)
capital equipment spend(t) for a development
Mfg./Eng. Interface
Organizing around Level of Integ and managing tech. process
Micros
Brooks' deja vu
Challenge to CS educators
(Note there is a set of slides that I presented to SIG Comp Center directors that EPG has)

Bell, Mudge and McNamara Slides
Chapters 1, 2, and 3

GB0001/25
00 BURT DECGRAM ACCEPTED S 17839 O 28 10-MAY-81 17:39:44

****
* d i g i t a l *
****

TO: BILL JOHNSON DATE: SUN 10 MAY 1981 17:36 EST
OLLIE STONE FROM: GORDON BELL
cc: GVPC: DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: VISICALC ON VAX FOR INTERNAL (THEN EXTERNAL) USE.

I think we ought to get this product out as quick as possible, together with the necessary software that allows plotting on gigi and or the vt125.

We have a pile of these internally and we ought to take one that would get us the most points.

This would get after the personal computer folks by having lots of features that they couldn't compete with.

The version in ZK is really great: lots of extras plus really good math.

Let's meet with Andy on this, as it would seem to be most useful in the technical marketplace. However, Julius's troups are buying lots of Apples just for Visicalc.

We might start by taking the current VAX version and simply putting it on all systems together with the necessary plotting stuff using the vt125 and gigi... compatible with the Visiplot (plot package for Visicalc).

Why not get an approved version that could be run on our internal VAX's and see how people like it and what we can do to make it better and better?

Let's do this now!

GB2.S6.40

Digital **Interoffice Memo**

Subject: **Visit by DiGuino of IRCAM**

To: Bob Morris Date: 5 OCT 76

From: Gordon Bell

CC: Bill Avery Jim Bell Dept: OOD

John Bloem Bill Kiesewetter Loc : ML12-1

Ext.: 2236

Jesse Lipcon   Bill McBride
Bill Strecker   Al Wallack   F/U 10/12

Institute of Research - Acoustics and Music is a Paris based group, headed by Pierre Boulez. The Scientific Director is Max Mathews, also head of Speech and Acoustics research at Bell Labs, Murray Hill. They have a 10 generating music waveforms and doing analysis (in x100 real time), several 11's with GT's and disks for human interfacing.

They're visiting us on Monday and Tuesday, Nov. 1 and 2 to discuss the use of 11/34's as controllers for real time music synthesizers.

Bob Morris, will you take on the hosting, please? I would hope Bill McBride (or someone from LDP) could also co-host this, and at least attend as their supplier. I'd like as many of you to interact with them as want to. It should be worthwhile since their bus and signal processing requirements are so interesting, demanding, yet basic. They're going to do the design, but we can interact with them and get the benefit of their Advanced Development.

Please co-ordinate with Bob.

GB:ljp

C. GORDON BELL

Gordon Bell is Vice President of Engineering for Digital Equipment Corporation. The native of Kirksville, Missouri, earned his B.S. and M.S. degrees in Electrical Engineering at the Massachusetts Institute of Technology.

On leave as Professor of Electrical Engineering and Computer Science at Carnegie-Mellon University, Pittsburgh, he was previously Manager of Computer Design for Digital from 1960-1966. During that time he was responsible for DEC's PDP-4, -5, and -6 computers. He consulted for Digital in 1966-1972 while at CMU working on various computers and products including the PDP-11.

He has worked in the computer field on computer architecture, modularity of design, multi-processors, and applications. Publications include "Computer Structures" (McGraw Hill), co-authored with Allen Newell; "Designing Computers and Digital Systems, Using PDP-16 Register Transfer Modules" (Digital Press), with John Grason and Allen Newell; just published, "Computer Engineering: A DEC View of Hardware Systems Design" (Digital Press); and several papers.

In addition to his industrial interests, Bell has served the U.S. Government as a member of three COSINE committees of the National Academy of Sciences for computer engineering education, and the National Science Foundation, Office of Computing Activities. He was a department editor for the CACM, a Fellow of the Institute of Electrical and Electronics Engineers, and a member of the National Academy of Engineering.
00 BURT DECGRAM ACCEPTED S 8791 O 46 25-APR-81 16:22:55

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION DATE: SAT 25 APR 1981 15:55 EST

FROM: GORDON BELL
cc: JOE MEANY DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: VK100 FIX OR VMS (WITHOUT VK100). WHEN A TERMINALS ARCHITECT?

WE need two things:
.a terminals architect who irons out these specs a priori

.fix the VK100.

I claim that the VK was not designed, it was specified after we built something. The 2K sure doesn't bother me, nor do I think it would bother our customers who might, mind you

just
want to use it as a VT100 ... remember lots of our customers including the ECS ones do actually buy 100's and like them.

If a product goes on a VMS system, that is not up to a product
line! Whether we support a VK, is up to VMS. I'm sure there are lots of comprimises that could have been reached to get the product to be suitable, but with no extra cost. (Here, a subset might be a suitable one. The VMS issue is not
the 132 columns, but the control codes.)

Therefore, we have two immediate possiblities:
1. Make it clear that the VK is not supported on VMS! (any customer might really expect to use it since ECS is selling it. I'll be damned if I see us changing VMS and all the utilites
for another random subset that someone just havppened to feel like building one random day.)
2. Fix VK so it will work with the escape sequences, but not in 132 col. mode. This is undoubtedly possible, since 132 cols is usually at the discretion of user and not the system.

Bill,
Please get Don and Charlie Rose to get this fixed right now before we start getting the stupid hate letters from our customers telling us how dumb and unco-ordinated we are.

ps
I wouldn't feel so bad, if I hadn't seen the abysmal attitude we have to the incredible costs created in software by taking this compete laissez faire attitude toward standards by the terminals engineers. It also blows my mind that the VT125 and VK100 are such distint cousins to one another.

We have to start designing to standards, versus providing whatever we feel like!

"TO" DISTRIBUTION:

JOE CARCHIDI SAM FULLER SI LYLE
BILL PICOTT CHARLES A ROSE

ATTACHED: MEMO;149

****
* d i g i t a l *
****

TO: GORDON BELL DATE: FRI 24 APR 1981
10:06 EST

FROM: BILL PICOTT
cc: SI LYLE DEPT: TERMINALS
ENGINEERING
BILL PICOTT EXT: 223-8076
LOC/MAIL STOP: ML1-2/H26

SUBJECT: PLEASE SEE ATTACHED

****THIS MEMO IS FROM DON HANEY****

digital INTEROFFICE
MEMORANDUM
------- ------------------

TO: Gordon Bell DATE: 4/23/81 Thu
17:05:14

FROM: Don Haney
CC: Bill Picott DEPT: Video
Engineering
Si Lyle EXT: 223-9243
John Elsbree LOC/MAIL STOP:
ML1-2/H26

SUBJ: VK100 Incompatibilities with VMS

With respect to the VK100 incompatibility problem with VMS editors and VAX11-FMS, the product design of VK100 does meet its spec. The "hole" in the process is that it was never intended nor specified to be a full VT100 emulation or replacement. It was specified to have a text mode (ANSI), a graphics mode (REGIS), and a BASIC mode.

VK100 was designed, in conjunction with its associated software, to address a particular need in the ECS market, with potential applications elsewhere. Due to the existence of its graphics capability, the cost and performance implications of full VT100 compatibility, and the lack of a requirement for such a compatibility, it lacks certain VT100 functions. For example, implementation of split-screen would have required at least 2K more RAM and 132 column would have meant even more RAM plus really high-performance monitors. Since the ECS market did not need these, they are not incorporated.

It is entirely appropriate for VMS to not support VK100 as a generally supported device when using VMS editors and VAX11-FMS. If we now wish to change the VK100 requirements to include full VT100 emulation and support as a general-purpose terminal, in the sense of full software support on all systems, we need to put a new development activity in place.

It would seem that the crux of the problem is our need to address specific market opportunities with focussed products and the subsequent expectation that they can be extended to the general market space. Do we need to establish a policy such as described in the attached memo? (This is the first distribution of

the
attached memo.) At least it would raise the visibility level of
non-compatible developments. Comments?

digital INTEROFFICE MEMORANDUM
------- ----------------------

TO: Gordon Bell DATE: 22 APRIL 81
FROM: Don Haney
CC: Bill Picott DEPT: Video Engineering
EXT: 223-9243
LOC/MAIL STOP: ML1-2/H26

SUBJ: COMPATIBILITY OF NEW PRODUCTS

As one of the outcomes of the April 10 Video Architecture review, I believe a statement was made as to the compatibility of new products versus their predecessors or relatives. Specifically:

"Any new Video Terminal Product which is a descendant, or a relative, of an existing Product must include, as a minimum, all of the standard functionality of that existing product. All user and system interfaces must be uniform between the products."

As the result of the above statement, any product which purports to have VT100 functionality must include (but not be limited to):

24 lines
80/132 columns
Scroll
Split Screen
All VT100 Escape Sequences
Character Asynchronous Interface
7 LED's
82 Keys (or equivalent) labelled per VT100 and resulting in the same ASCII characters/strings BELL function Host Set-up (plus probably more I can't think of right now)

In general, all Video Terminal Products in a particular space shall be considered to be descendants or relatives of the then-current family until a new generation is released. Thus, all video products (VT101 family, GIGI, VT125, CT100, etc.) are considered a part of the VT100 family. In like manner, all graphics products (CT Graphics, GIGI-16, etc.) are part of the VT125 family. VT200 is a new family, but may have VT100 emulation.

The reason for this rule is to insure that Corporate and applications software and systems which are designed making use of various standard functions of a product generation can indeed be utilized by the descendants and relatives.

On the downside, adherance to this rule may seem to make it impossible to develop a "simpler" product than a general family might be. The appeal path to this dilemma is a secondary statement that:

"All deviations to this rule shall be made visible at the Phase O Review such that any new software, documentation, and systems requirements implied by the deviation may be planned during Phase 1."

On the subject of options --- since it is likely not smart to make the support software for a product family depend on the existence of particular options in the hardware configuration, I doubt if it is required that all descendants or relatives include (as standard or as options) all options of the base Product. However, "Standard or optional functions which might be considered as descendants or relatives of a base Video Terminal Product option must include, as a minimum, all of the standard functionality of that existing option."

Does this capture the essence of what we need to state? Comments?

24-APR-81 10:13:09 S 2952 MLDP

GB2.S6.14

December 14, 1983

VLSI DESIGN
CMP Publications
1054 Saratoga-Sunnyvale Road
San Jose, California 95129

Dear Jerry Weiner:

I enjoyed the dinner and interview with you, Roderic and Lorri. I'm sending you Mary Jane's book on word processing for the office, Computer Engineering which several of us wrote to describe Digital's computers, and a brief (auto)biography that was done for a Digital Equipment publication just before I left.

Also enclosed are several copies of the Museum Report and I'd like to urge you to write an article on it sometime.

If you send me your topical outline of the next years' VLSI Design, I'll comment on it.

Again, thanks for the hospitality.

Sincerely yours,

Gordon Bell
Chief Technical Officer
+---------------+
! **d i g i t a l ! i n t e r o f f i c e m e m o r a n d u m**
+---------------+

Subject: **VLSI RAD Project**

To: Bill Green, Len Hughes,
Bob Kusik, Le Nguyen

CC: RAD Committee

Date: 20 JUNE 78
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

follow up 7/5/78

I'd like to question this project and recommend that we take the same effort (modified to have adequate CAD support) and carry out a project that is oriented to a product and a significant standard, high volume design process.

1. The project would not explore CMOS, HMOS, SOS...use HMOS just as we've decided on! (Decide July 1 -- no travel)

2. Decide on either standard cell or gate arrays as the methods of design. NO CUSTOM DESIGNS! (due Sept. 1)

3. Code the gate array or standard cell library. (Nov. 1)

4. Decide on a test chip. (Nov. 1)

5. Design a product using the

technique (e.g., Pusart, Squid, some comm or CRT option)!
(April 1)

Can we discuss this soon?

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST:				
	Bob Armstrong	ML4-4/E91	Jim Bell	ML3-2/E41
	Peter Christy	ML12-3/A62	Lorrin Gale	TW/D19
	Bill Green	ML1-4/B34	Len Hughes	WZ
	Bill Keating	ML12-3/A62	Alan Kotok	MR1-2/E47
	Bob Kusik	WZ	Rich Lary	ML4-1/M58
	Jesse Lipcon	MR2-4/E79	Le Nguyen	WZ
	Stan Pearson	ML12-2/E38	Mike Riggle	ML4-1/B32
	Bob Swarz	PK3-2/S20	Art Williams	ML5-3/E12
	Joe Zeh	WB		

00 BURT DECGRAM ACCEPTED S 1043 O 18 04-FEB-80 22:12:46
FROM: GORDON BELL DATE: MON 4 FEB 1980 10:06 PM EST
DEPT: OOD
EXT: 223-2236
TO: DICK CLAYTON
ROY MOFFA
STEVE TEICHER
JOHN MEYER
cc: OOD:
OOD: @CLEM

SUBJECT: IDEA FOR KEEPING VLSI PEOPLE THROUGHOUT THE SCORPIO PROJECT

Dick Sites asked is there an way we might use stock to lock in these
circuit people who are always being bombarded and don't have

any real
commitment to stay on a project to completion.   Maybe a short term
5 year plan would help, or alternatively a stock plan that starts
when the project is finished. Our normal stock plan doesn't
deal with the reality of the people. On the other hand, I
really hate to think of going this way... as it opens up all
sorts of pandoras boxes throughout engineering. Any ideas?

GB1.S1.62

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TO: see "TO" DISTRIBUTION   DATE: TUE 3 MAY 1983 1:45 PM DST

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION

DEPT: ENG STAFF

EXT: 223-2236

LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5198760210

SUBJECT: VLSI: WE'VE GOT IT. WHAT TO DO WITH IT? (MICROSTRATTON)

GB5.25

Background
Jack came back from a visit to Hudson, excited because we have so much
design talent just finishing projects, and who are trained to do
projects in significantly less time than ever due to learning. On the

other hand, the problem now is what are we going to do next with these
very talented resources?

He suggested that we have a several day brainstorming session.

Sam,
Could you act as the host catalyst to set up a micro stratton type
meeting between the designers of VLSI and the potential users of it?

We ought to shoot for meeting in late June or early July at some out
of the way place, and bring 20-50 people together to learn about the
potential (i.e. some technology update) and look at the opportunities.
I'd also like to see us form some general policies on things we aren't
going to do. For example, why do any commodity, buyable controllers
for floppies, winis, communications (eg. pusart or octart)? We should
carefully evaluate whether we should bother with proprietary, vanity
controllers like Dragon, when the industry will beat us to the market.

It's clear we have opportunities for some exciting products:

1. PPA support VLSI to get higher performance and more processors
2. CMOS TITAN
3. A really low cost, integrated system (Commodore prices and
   functionality)
4. MDC's proposing a new, industrial bus, and this could (or
   should) require VLSI. Certainly the modules could use it.
5. The new world that will be possible with Digital PABX's in

terms of: voice, video (compression), terminals, store and
forwarding of voice/image, control (maybe the best way to wire
a manufacturing plant... certainly the bandwidth is there)

Probably the best way is to solicit a list of attendees from each of
the EMC members, and then ask the attendees to prepare some position
papers. What you say about the idea? attendees? VLSI products?

"TO" DISTRIBUTION:

JIM CUDMORE	BILL DEMMER	SAM FULLER
BILL JOHNSON	JEFF KALB	GRANT SAVIERS

"CC" DISTRIBUTION:

ANDY KNOWLES	JACK SMITH	BOB SUPNIK
STEVE TEICHER		

WPS USERS - Leave HP mode and type <CR>

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Subject: **AUSTRALIA -- Testing in the Load Determination of VMS**

To: Terry Potter

Date: 78 AUG 14
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

follow up 8/28/78

Could you please send a copy of how the testing is done in the load determination of VMS to Dr. Ian Jackson, Sydney University, Sydney, New South Wales, Australia? He's interested in how many terminals the machine will run and how we are going about testing it? Since this is sensitive as to future sales, you'd better let me see it first.

GB:ljp

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Subject: **VMS, the Strategy, and Hydra**

To: Joe Carchidi, TW/D08
Dave Cutler, TW/D08
Bill Demmer, TW/D19
Bill Johnson, ML21-3/E87
Bill Keating, ML12-3/A62
Bernie Lacroute, TW/A08

Date: 1/8/79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

Pete vanRoekens, TW/B10

Let me reiterate Friday's discussion with your groups:

VMS

It is a great product! Keep up the tradition on follow-ons. Our customers love and respect it, probably more than for any other first product.

Unfortunately, the product and subsequent hardware conjures up all kinds of embellishments desirable in follow-on releases. Don't let this pressure be demoralizing to us.

VMS and VAX are so good that we are entering a product development strategy based solely on them.

STRATEGY

Provide a set of homogeneous distributed computing system products (based on VAX/VMS) so a user can interface, store information and compute, without re-programming or extra work in many styles and sizes, as follows:

as a single, user personal computer with a terminal;
at a small, local shared computer for a group; and
via a large center computer within the network.

This implies emphasis on compatibility with VAX and bringing existing systems into the VAX framework. We will build 11 systems where VAX is not the lowest cost. We will also build 8's, 10's and 20's to protect user software investment and as point product market needs are apparent (eg. a lower than PDP-11 cost personal computer based on PDP-8 for the computer store).

Hydra will be the basis for much of this distributed computing environment.

HYDRA

Although Hydra is primarily targeted at high availability, it is also the structure for providing incrementally expandable capacity at a single site. Furthermore, as many of our customers have multiple VAX systems already, with more to come, it is the structure to provide for an apparently common system, including highly available filing.

VMS must be extended to provide the HYDRA capability.

MOVING AHEAD

The VMS extensions for the HYDRA capability must be done by the VMS group. Therefore, it is essential to figure out how this group can be expanded rapidly without losing control of product quality and the VMS architecture. The latest HYDRA specification represents a good first definition at the capability I believe the larger, central site distributed computing environments must provide. It is essential to begin the planning of these extensions and get agreement on the extensions. I see agreement on the structure and major parts of Hydra (e.g., the files system). Parts of HYDRA are contentious, as to their complexity, implementability, and need. The VMS and Hydra groups must resolve the differences by: discussion, by existence proofs (breadboarding and looking at non-DEC systems), benchmarking/demonstrating the need and by comprimise.

It is essential to get on with the HYDRA extensions now!

D I G I T A L INTEROFFICE MEMORANDUM

DIST: Joe Carchidi TW/D08 Dave Cutler TW/D08
Bill Demmer TW/D19 Bill Johnson ML21-3/E87
Bill Keating ML12-3/A62 Bernie Lacroute TW/A08
Pete vanRoekens TW/B10

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION DATE: FRI 25 JUL 1980 11:59 AM EDT

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: INFORMATIVE, IMPRESSIVE MORE SECURE VMS DEMO

Thanks. I hope the demo is given widely in Tewksbury, Marlboro, and Merrimack. Also, I would hope that the ideas and some of the group can migrate to VMS. This would help give us a continued leadership position.

Good work.

GB:swh
GB1.S5.62

"TO" DISTRIBUTION:

JIM HAMILTON JOE TARDO LLOYD
DICKMAN
PAUL KARGER

"CC" DISTRIBUTION:

JOE CARCHIDI PETER F. CONKLIN DAVE CUTLER
BOB DALEY BILL DEMMER DICK
HUSTVEDT
ULF FAGERQUIST BOB GLORIOSO BILL
HEFFNER
NIC JOHNSON BERNIE LACROUTE TOM
CHISSHOLM
HARVEY WEISS

GB0005/54

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i n t e r o f f i c e   m e m o r a n d u m

Subject: **Congratulations on Getting VMS Running on NEBULA**

To: Dick Barry, TW/C03
Nancy Kronenberg, TW/D08
Ken Okin, TW/C03
John Sofio, TW/D02

Date: 11/7/79 Wed
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236
EMS: @CORE

CC: Henry Crouse, ML1-5/B98
Bill Demmer, TW/D19
Bernie Lacroute, TW/A08
Si Lyle, ML12-1/T39
Lou Philippon, TW/A08
Larry Portner, ML12-1/T32
Wayne Rosing, TW/C03

I am delighted to hear the news about Nebula. It feels like it is likely to be the second VAX on the market. Let's keep the pressure up to get the PALs.

GB:swh

ID#357

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Subject: **Should Size Be A New Goal (of VMS) and Nebula?**

To: Joe Carchidi, TW/D08
Dick Hustvedt, TW/D08
Bernie Lacroute, TW/A08
Stan Pearson, ML12-2/E71

Date: 20 NOV 78
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

follow up 12/3/78

When Dave did M, he had stamps made with "Size Is The Goal". As a result, a small, fast O/S was built which hopefully has not been too eroded under customer pressure to do everything.

With VMS there weren't stamps, but there is now an impressive system that runs in 256 Kbytes that will support a few users.

0. We must hold kernel size <u>and</u> program/programmer interface so as to avoid need for non-compatible systems such as RSTS, RT-32, IAS, MUMPS, etc. The model has to be TOPS 10, where we built many engines to run the operating systems and user programs. Here, we must hold size erosion that TOPS 10 went through.

1. Nebula-RL02 must be

small and run with 2 RL02's (2 x 10 Mbytes) as a single (or 2-4) user system. This is the personal computer for the engineering users and CS researchers! (Here, note we need a great, graphics terminal.)

2. We must figure out a way to hold, and preferably decrease the O/S system size so as to head toward an LSI/VAX terminal version in January 1982.

Any problems?

Can we guard this?

GB:ljp

CC:	Roger Cady	MK1-2/E25	Peter Lipman	ML3-2/E82
	Dick Clayton	ML12-2/E71	Si Lyle	MR1-1/M42
	Dave Cutler	TW/D08	Julius Marcus	MK1-2/C37
	Bill Demmer	TW/D19	Bill McBride	MR2-3/E70
	Ulf Fagerquist	MR1-2/E78	Tom Northrup	TW/C04
	Sam Fuller	TW/A08	Larry Portner	ML12-3/A62
	Bill Heffner	TW/E10	Bill Strecker	TW/A08
	Bill Johnson	ML21-3/E87	George Thissell	MR2-4/M79
	Bill Keating	ML12-3/A62	Harvey Weiss	MR1-1/A65
	John Leng	MR1-1/A65	Jerry Witmore	PK3-1/M40

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Joe Carchidi	TW/D08	Dick Hustvedt	TW/D08
Bernie Lacroute	TW/A08	Stan Pearson	ML12-2/E71
Roger Cady	MK1-2/E25	Peter Lipman	ML3-2/E82
Dick Clayton	ML12-2/E71	Si Lyle	MR1-1/M42
Dave Cutler	TW/D08	Julius Marcus	MK1-2/C37
Bill Demmer	TW/D19	Bill McBride	MR2-3/E70
Ulf Fagerquist	MR1-2/E78	Tom Northrup	TW/C04
Sam Fuller	TW/A08	Larry Portner	ML12-3/A62
Bill Heffner	TW/E10	Bill Strecker	TW/A08
Bill Johnson	ML21-3/E87	George Thissell	MR2-4/M79
Bill Keating	ML12-3/A62	Harvey Weiss	MR1-1/A65
John Leng	MR1-1/A65	Jerry Witmore	PK3-1/M40

FROM: GORDON BELL DATE: WED 31 OCT 1979
10:07 AM EST
DEPT: OOD
EXT: 223-2236
TO: BILL JOHNSON
BILL HEFFNER
JOE CARCHIDI

cc: LARRY PORTNER
    JACK MILESKI
    BILL KEATING
    SAM FULLER

SUBJECT: DISTRIBUTING VMS DEVELOPMENT   FOLLOW UP: 11/16/79

GB0005/42/EMS

It seems clear to me we should have a strategy for the above. Clearly we want one main line VMS architecture and implementation group. With the demands we have on: fixes, supporting three machines; supporting other ames; all new devices, smaller capabilities ala diskless, better real time, multiprocessor via multiport, better commercial/DB, and reliability (Hydra). It seems clear that we can distribute all the functions where the architecture is clear and where there is an implementation instance. This lets us possibly distribute: VMS machine support to the hardware groups; device support to Mass Storage group and maintenance to SWS.

Can this be our policy? When can we start?

GB:swh

GB3.S10.18

00 CORE DECGRAM ACCEPTED S 000597 O 124 14-NOV-82 22:33:43

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TO: see "TO" DISTRIBUTION   DATE: SUN 14 NOV 1982 10:05

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION

DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-

1/A51

MESSAGE ID:
5181784640

SUBJECT: WHAT ABOUT A VOICE PLAYBACK/TRANSMITTER UNIT?

Having come back from a long trip and wanting to just call a bunch of people and leave some messages via voice, it occurred to me there's a possible, neat, useful product. I could have done the job if everyone had answer back units. Instead, I propose we convert the PC with TMS into a transmission/playback unit which would call people with various messages, and leave them under the receiver's control. That is, the user would record his own messages to transmit, and then specify the phone numbers and control flow (what to do if no one answers or if someone else answers). The PC would then make the calls and handle any answers back. In effect, its a voice mail system, but restricted to only point to point. A user could also leave it on, dial in leave a message and have the message sent to someone else.

Why don't we try this as a breadboard on the PC/TMS?
(I would have used it this weekend... so the market might have been finite.)

"TO" DISTRIBUTION:

BILL AVERY AVRAM MILLER WALT TETSCHNER

"CC" DISTRIBUTION:

SAM FULLER JULIUS MARCUS KEN OLSEN JACK SMITH

GB0004/13

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Subject: **VOTE and Sage Projects Together**

To: Sam Fuller, TW/A08
Bill Johnson, ML12-3/A62
Bob Kusik, ML3-5/H33

Date: 7/18/79 Wed
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

follow up 7/27/79

Will you and Pete Straka and Val Patel meet with me and tell me why we aren't getting VOTE and Sage projects together? I've read all the technical arguments and I say get them under 1 manager!

GB:swh

D I G I T A L INTEROFFICE MEMORANDUM

DIST:
Sam Fuller TW/A08 Bill Johnson ML12-3/A62
Bob Kusik ML3-5/H33

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Subject: **Ed Vrablik Replacement**

To: Jim Bell, ML3-2/E41
Ulf Fagerquist, MR1-2/E78
Ed Fauvre, MK1-2/E06
Bill Johnson, ML21-3/E87

Date: 22 NOV 78
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

follow up 12/6/78

I've not approved a replacement requisition for Ed Vrablik, who has been a corporate technology tracker within R and D. It seems to me that this function rightfully belongs within each group. Having Ed and Rowland Brandwein do this function is nice and necessary however, because when a group becomes lethargic, or overcommitted, or going down a wrong path, it is unwilling to take direction in the face of massive changes in technology and/or market.

Can Rowland play a more corporate role in this regard and make visible ideas for new technology?

GB:ljp

CC: OOD

D I G I T A L INTEROFFICE MEMORANDUM

DIST: Jim Bell ML3-2/E41 Ed Fauvre MK1-2/E06

Jim Bell	ML3-2/E41	Ed Fauvre	MK1-2/E06
Dick Clayton	ML12-2/E71	Jim Cudmore	ML1-5/E30
Bill Demmer	TW/D19	Ulf Fagerquist	MR1-2/E78
Bill Johnson	ML21-3/E87	John Kevill	ML1-3/E58
John Meyer	ML12-1/A11	Larry Portner	ML12-3/A62
Bob Puffer	ML12-2/E38		

00 BURT DECGRAM ACCEPTED S 21130 O 383 21-NOV-81 15:25:26

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* d i g i t a l *
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TO: WES BROWN

DATE: SAT 21 NOV 1981 3:20 PM EST

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION

DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: RE: VS11 --- SUDS AVAILABILITY

Congratulations!

Please go ahead with the project to put 4 on a 34. I'll fund it here as part of the Venus project. We would like to be a test site asap. Dave Copeland will get with you for a configuration.

We do need the extra terminals here like crazy. How does it work having just 1/2 the resolution of the gt? Can a designer
get the same amount of information up? What's the chance of using the same 34 to host multi vt125's for low cost, remote access... or would this be better to do directly into the 20. Why sweat the down line load? (Go ahead and put the floppy on it to boot it).

As an aside, am really impressed with the graphics on the ct since it is 240 lines by 1024 (and if they dropped non-interlace
could get 512 x 1024 which would be pretty close to the gt. Furthermore, this package has its own 5Mbytes for useful work too.

"CC" DISTRIBUTION:

BILL AVERY COPELAND VIA FAGERQUIST ULF FAGERQUIST
ANDY MATTHEWS DICK REILLY ROY REZAC
GRANT SAVIERS PETE STRAKA STEVE TEICHER
TOM BURNIECE @CSGV

GB3.S2.42

****
* d i g i t a l *
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TO: GEORGE CHAMPINE DATE: SAT 7 AUG 1982 12:35 PM EDT
BILL STRECKER FROM: GORDON BELL
cc: BILL DEMMER DEPT: ENG STAFF
BILL JOHNSON EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5171824786

SUBJECT: DISCUSSION RE VS100 AND PERSONAL NEBULA

During two seperate discussions with Bill and George, I think we've arrived at a solution which makes everybody happy and wins.

The VS100 and the Unibus interface to it would be laid out with a scheme that lets the fiber optic link be replaced with a null,
wire link adapter. The fiber optic link adapter would be held up
until we have the connector problem solved. But, we can still enter DMT with the wire adapter in place of the fiber optic link
adapter.

The Nebula would use the modules intact, but using the null adapter in place of the fiber optic adapter. In this way we don't have to spend mucho $'s in engineering, manufacturing and in the field for an extra set of spares, nor do we have to suffer the additional delay that historic with Nebula (we waited 2 years for Combo and the Integrated Disk adapter).

Thus, the integrated Nebula is now just a non-trivial packaging job to deal with heat and noise. Personally, I think this will
be somewhat limiting because no one wants an extra 500-750 watts
near them.

Also, this package is very neat for the professional where one system is integrated in the desk and there's a second slaveone connected via fiber optics. Mary Jane and I were really looking forward to putting the computer away from us (where neither of us have room for another desk) and getting just the vs100 on or near our current desks.

We must learn from the long history of the WS100 (the original PDP-8 about 10 years ago): All of us already have full offices and desks that we really like. The dolly and pedestal mounted 78 and 278 were better, but people really love personal computers of today because they are small and can be moved around a lot and don't intrude. We don't want to give up our desks or change things very much for another tube... especially if it radiates any noise or any heat (like 3 bodies... some of us don't have the airconditioning to handle the problem even). We want to change the furniture and office around a lot and big boxes are big constraints.

I'm really excited about the integrated nebula (above) and think others will be too... provided it doesn't take electrical

resources and is just packaging. I think others will like it too, provided they are naive and are attached to the idea that the computer must be with them. Ironically, the people who want this computer in their desk are those who'll probably not be happy with having a file server somewhere that belongs to someone else.

Hopefully, we'll sell lots... but Mary Jane and I will stick with our Nebula /VS100's as is with the computer in a closet and our own, protected files.

Let's get the work done so we can get Nautilus and the big multiprocessor and Scorpio and the BI and the fiber optic adapter (for the rest of us... and those who want to use a 750 as our cpu) done! Most of all, we can really get big bucks by making the VS100 available as a high quality terminal.

WPS USERS - Leave HP mode and type <CR>

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* d i g i t a l *
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TO: see "TO" DISTRIBUTION DATE: MON 24 MAY 1982
4:20 PM EDT

FROM: GORDON BELL
cc: GEORGE CHAMPINE DEPT: ENG STAFF
KEN OLSEN EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: VS100 AS THE FIRST VT200 (COULD IT BE VS200?)

It really feels clear to me that we should use the VS200, with
a serial port and suitable firmware as the first member of the
VT200 family.

If we push, I think we could sell 50,000/year at $7.5K.

Could we do some test marketing to get user reaction as a function of price? Personally this is the tube I've been waiting
for: landscape, high performance, 1 1/2 pages, and graphics. This product could be as big as VT100 if we market it! How can
we try?

"TO" DISTRIBUTION:

BOB HUETTNER @MLXX ART CAMPBELL CATHY
LEAROYD
JACK SMITH

GB3.S5.47

00 CORE DECGRAM ACCEPTED S 004596 O 702 02-AUG-82 21:38:45

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* d i g i t a l *
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TO: see "TO" DISTRIBUTION DATE: MON 2 AUG 1982 9:17 PM EDT

FROM: GORDON BELL
cc: see "CC" DISTRIBUTION DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5171316628

SUBJECT: GETTING THE COLOR VS200 DONE QUICKLY

With the encouragement of the market, it looks like VS100 is a real winner. Unfortunately, this really pushs us to have the color products. I think we ought to mount a big push to get the next color product asap. It is also that Appollo is now moving aggressively with their new color workstation that concerns me... this means we let a small company become a major competitor (the rumour is that their business plan is for 100M in 1-2 years)!

Why can't we prioritize the possibilities and get into a mode where we drive to get the low cost color workstation in a very rapid fashion?

"TO" DISTRIBUTION:

GERALD V BUTLER	GEORGE CHAMPINE	JACK SMITH

"CC" DISTRIBUTION:

SAM FULLER	KEN OLSEN	CHARLE' RUPP
PETER SMITH	BILL STRECKER	

WPS USERS - Leave HP mode and type <CR>

FROM: GORDON BELL DATE: WED 31 OCT 1979
4:44 PM EST
DEPT: OOD
EXT: 223-2236
TO: DICK CLAYTON
GRANT SAVIERS
BOB LOTZ
BOB PUFFER @CLEM
JOHN CLARKE
JOHN F SMITH @CLEM

SUBJECT: FAN IN VT78 FLOPPY

GB0005/50/EMS

I was shocked to find that Springfield ran out of fans in floppies and went out and bought real noisy ones.

The resultant noise is too high and clearly our customers aren't getting what they thought they bought, if they had a demo. In other cases, we are simply violating noise standards. How could this happen?

GB:swh

FROM: GORDON BELL DATE: THU 31 JAN 1980
12:10 PM EST
DEPT: OOD
EXT: 223-2236
TO: DICK CLAYTON
ART CAMPBELL
STAN PEARSON
EDWARD LAZAR
BILL PICOTT @MR16

SUBJECT: WINNING WITH THE VT100 FAMILY

With the Plessey PT100 announcement, we ought to get worried about how we're going to win against it. The answer is still clear to me: Put our major effort into really great enhancements - not cost reduction like the VT101 and VT131 where we go for piece! Let's leave these incremental improvements till the VT200 and a radical package.

We desperately need to come out with the enhancements that are implicit in the package space and extra power. These field upgradeable options are:

1. VT103 or PDT100 (why both??) - PDP-11 in the VT100.

2. VT125/Graphics.

3. VTXXX enhancements to do simple editing on DEC system.

4. System WPS278 (An 8 on a board to connect to a floppy).

5. Modems, hard copy, etc. and base for TPG Specials.

Our original plan - The VT100 would then be the VT100 Kernel Terminal or VT100 Terminal System...not just a terminal terminal. The ads are endless: Is your terminal terminal? The VT100 terminal is the base for terminals and small systems, not a terminal terminal. Etc.

GB:swh
GB1.S1.41

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+---------------------------+                      GB3.S1.16
|   |   |   |   |   |   |   |
| D | I | G | I | T | A | L |          I N T E R O F F I C E
|   |   |   |   |   |   |   |            M E M O R A N D U M
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TO: Ken Olsen

CC: Bill Avery
Dick Gonzales

Date: October 7, 1981
From: Gordon Bell
Dept: Engineering
MS: ML12-1/A51
Ext: 2236
EMS: @CORE

SUBJ: VT102 = CT05 REPLACEMENT PACKAGE

We must stay with the modular strategy we embarked on with CT because:

1. We want to design a set of modular components which the USER can mix and match to build dumb video terminals through computing terminals.

2. We're resource limited; modularity gives more products for less cost.

3. The modular approach lets us build several different monitors and let the customer buy according to needs of cost size, and package mounting (eg, desk, modular office, stand, wall, projection - TV).

4. We can build a really high quality set of monitors to add to the plethora of really yeechy-looking/engineered. Monitors should be a great market!

5. With the modular approach, there's much less desk clutter because there's only a cable to the monitor and to the keyboard. It gets rid of the cable to the line and to the printer.

6. Can we really get a 25-40W wall mounted PS that isn't just a separate box? (Why bother?)

7. We can offer a really low cost VT by offering it monitorless.

Note the attached sketch and table of alternatives.

We have at least four alternatives for repackaging the VT102:

Strategy	Integrated Smaller VT102 box (incl. modem)	Integrated Small VT102 box (excl. modem)	Point Product CRT Small monitor, separate box (for PS on wall)	Modular Smallest monitor Separate box (for PS, logic, modem)
# Boxes	2	2, (3)**	3, (4)	3
# Boxes w/printer	3	3, (4)	4, (5)	4
# Cables	3	3, (5)	3, (5)[4, (6)]***	4
# Cables w/printer	5	5, (7)	5, (7)[6, (8)***	6
Cost*	2	1, (5)	4, (5)	3
Size*	2	1, (5)	4, (5)	3
Size* on desk	3	4	2	1
Probs.	cabling on high, size, cooling if small	cabling on desk, size	cost cooling, P/S, cabling when modems and printers used. Power control, if printer and modem. especially with printer and modem.	cost

* 1 = best
** with modem
*** if P/S requires and AC cable

****
* d i g i t a l *
****

TO: BILL PICOTT   DATE: TUE 9 JUN 1981
9:15 EST

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION

DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: A STRONG VT125 GRAPHICS PRODUCT VERSUS CUTTING MANUFACTURING

Let's come on real hard with graphics by Jan. 1, 1982, instead of
cutting back 40M in our terminals manufacturing, and losing a great opportunity (and lots of manufacturing expertise we need).
Could you get together a task force of 3 persons representing the
marketing groups, one person from manufacturing, and two persons
from software engineering to see about the feasibility of making
a signficant announcement around the following hardware trio:

. VT125
. LA34/G for graphics output
. DF03, 1200 baud modem

In addition, we should press hard to get a color monitor of our
own into production so that we can take full advantage of all the
things the 125 can do vis a vis slave monitors. Also, this is
essential for the CT family and GIGI.

The software task would be to make sure we have a coherent set of

useful software, including getting a Visicalc that could convert
from tables to graphs, and at the same time, we could partially
stem the tide of Personal Computers bought because of VISICALC!
The Technical group has some of this software and there is a very
impressive program that allows a user to plot data extracted from
DATATRIEVE. Also, we must make sure languages basically support
the 125.

A moderate amount of teamwork here would get us a great deal of
revenue. Let's see what the potential is.

GB2.S6.30

"CC" DISTRIBUTION:

BILL AVERY	KENT BLACKETT	ART CAMPBELL
BOB DALEY	DICK ESTEN	DAVE FERNALD
GVPC:	BILL HEFFNER	BILL JOHNSON
BILL KEATING	SI LYLE	AVRAM MILLER
KEN OLSEN	CHARLES A ROSE	DICK SNYDER
BRUCE STEWART	OLLIE STONE	DICK STRAUSS

00 BURT DECGRAM ACCEPTED S 28256 O 506 28-AUG-81 22:49:28

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* d i g i t a l *
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TO: BILL AVERY   DATE: FRI 28 AUG 1981

22:46 EST
SI LYLE   FROM: GORDON BELL
cc: AVRAM MILLER   DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: BILL, THESE FOLKS WORK FOR YOU

What's the story???

I intend to see that this is stopped by the OC woods.
The 134 as I understand/understood it is idiotic.

Art Campbell will kill us yet. Given the impending disasters in the VT 101 ... 132 products, I will not be a party to anymore golden rule projects now will I let our resources (Barry reports to you) be diverted this way.

Please act.

ATTACHED: MEMO;18

****
* d i g i t a l *
****

TO: GORDON BELL   DATE: WED 26 AUG 1981
8:47 EST

FROM: AVRAM MILLER
DEPT: CT PROGRAM OFFICE
EXT: 223-9441
LOC/MAIL STOP: ML5-2/T53

SUBJECT: RE: RE: RE: RE: CT134

Gordon, I do not control the resources Art Campbell does. The
work is still going on.

GB2.S8.33
00 BURT DECGRAM ACCEPTED S 24669 O 505 21-APR-81
22:03:42

****
* d i g i t a l *
****

TO: AVRAM MILLER   DATE: TUE 21 APR 1981
22:03 EST

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION

DEPT: ENG STAFF

EXT: 223-2236

LOC/MAIL STOP: ML12-
1/A51

SUBJECT: BRIAN'S COMMENTS ON VT134

There are some clearly neat features here. We'll have to integrate them into CT.

Given that we have produced a string of about 30 losing (financially speaking) products in
this space, there is no way we are going to be building every product
that we can think of. We have two choices: ct or vt134. I want to
decide this damn quick and get us all headed in one direction.

I am tired of producing uncompetitive
products in this whole area. The company can't afford it much longer!

In general, my predjudice is to get the 134 integrated into the ct.

g.

"CC" DISTRIBUTION:

BRIAN FITZGERALD   BARRY JAMES FOLSOM   BILL

JOHNSON
SI LYLE BRUCE STEWART

ATTACHED: MEMO;17 MEMO;42

****
* d i g i t a l *
****

TO: GORDON BELL DATE: TUE 21 APR 1981
10:17 EST

FROM: BILL JOHNSON
DEPT: SOFTWARE DEV
EXT: 223-3982
LOC/MAIL STOP: ML12-3/A62

SUBJECT: FYI

Please see attached:

ATTACHED: MEMO;42

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION DATE: FRI 10 APR 1981
8:52 EST

FROM: BRIAN FITZGERALD
cc: BARRY JAMES FOLSOM DEPT: COM'L SYS & SUPPORT
BOB GRAY EXT: 264-5553
JIM MILTON @MK12 LOC/MAIL STOP: MK1-2/H32

SUBJECT: VT134

LAST WEEK, BARRY FOLSOM (TPG ENGR MGR) CAME TO MK AND GAVE A VERY IMPRESSIVE DEMO OF THE VT134. THAT WAS THE FIRST TIME I EVER SAW A COMPUTER OPERATE THE WAY REAL PEOPLE WORK. THE VERSATILITY AND

RESPONSIVENESS OF THE VT134 MADE ME BELIEVE THAT IT IS REALLY POSSIBLE TO DEVELOP AN ELECTRONIC EQUIVA- LENT OF PENCIL AND PAPER.

THE KEY TO THE VT134'S SUCCESS IS THE THOROUGH INTEGRATION OF THE HARDWARE AND SOFTWARE ARCHITECTURES. THE SYSTEM PERFORMS MANY TASKS SIMULTANEOUSLY AND ALLOWS THE USER TO SWITCH INSTANTANEOUSLY AMONG THE TASKS WITHOUT BEING BOTHERED BY HOW THE MACHINE WORKS INTERNALLY. THE VT134 SETS THE STANDARD FOR THE HUMAN INTERFACE TO A PERSONAL COMPUTER SYSTEM.

WE SHOULD SUPPORT THE VT134 AND PLAN TO USE IT IN THE OFFICE AND CCEG
PROGRAMS. I BELIEVE IT SHOULD BE POSITIONED AS THE HIGH PERFORMANCE (AT A HIGHER COST) MEMBER OF THE PERSONAL COMPUTER FAMILY WITH ENOUGH ROOM LEFT BELOW IT FOR THE CT PRODUCTS. IF WE ARE GOING TO GET SERIOUS ABOUT THE OF-FICE MARKETPLACE, WE ARE GOING TO NEED A FULL SPECTRUM OF PRODUCTS JUST LIKE WE HAVE ALWAYS HAD IN OUR MINICOMPUTER PRODUCT LINES.

REGARDS,

10-APR-81 08:54:34 S 2546 EMMK

"TO" DISTRIBUTION:

BOB DALEY BILL JOHNSON BRUCE STEWART

GB2.S6.7

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|   |   |   |   |   |   |   |
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Subject: **VT 162 and Friends**

To: Dick Clayton, ML12-2/E71
Len Halio, ML1-2/H26
Bill Johnson, ML21-3/E87

Date: 22 NOV 78
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

CC: Ed Fauvre, MK1-2/E06
Don Gaubatz, ML3-2/E41
Roy Moffa, ML5-2/E93
George Plowman, ML5-5/E97

follow up 12/6/78

What is this? Why isn't it just a PDT with a special ROM to make it a 62?

In the face of all the work we have to do, do we want any new part numbers added to the production and to inventory?

We must get a way to build terminals like this cheaply and easily. (Tiny should help too.)

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST: Dick Clayton ML12-2/E71 Ed Fauvre MK1-2/E06
Don Gaubatz ML3-2/E41 Len Halio ML1-2/H26
Bill Johnson ML21-3/E87 Roy Moffa ML5-2/E93
George Plowman ML5-5/E97

GB0001/22

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|   |   |   |   |   |   |   |
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SUBJ: VT162: A POSSIBLE MODULE FOR GATEWAYS AND FOR INTERFACING TO UNIT RECORD DEVICES AS PART OF THE INTERCONNECT STRATEGY

Date: 2/28/79 Wed
From: Gordon Bell
TO: Distribution
Dept: Office of Development
MS: ML12-1/A51 Ext: 223-2236

Follow up: 3/16/79

Is there a chance that the VT162 module could be used as a gateway? Given that it has 50KB capability and lots of protocol capability, it might be really good. Eg. what kind of board would be used to attach it to a UNIBUS for outboard preprocessing?

Also, it would be the module we could use to interconnect our multidrop bus to various unit record equipment. Here, things like line printers could be page, rather than line buffered. Note, this interconnect structure is a cornerstone of the strategy and while little visible progress is evident, it is essential and inevitable.

I am not suggesting that the VT162 be changed at all! I believe the possible users of it should look at how it can be used in this application. (It's attributes are pretty neat: a FONZ, RAM, ROM, lots of COMM port capability with protocol software.)

GB:mjf

Distribution

Dick Brewer, ML5-3/E12
Dick Clayton, ML12-2/E71
Roy Clites, ML5-5/E97
Bill Demmer, TW/D19
Sam Fuller, TW/A08
Len Halio, ML1-2/H26
Bill Johnson, ML3-5/H33
Jim Marshall, TW/A03
John McNamara, TW/E07
Roy Moffa, ML1-2/H26
George Plowman, ML5-5/E97
Wayne Rosing, TW/A03
Bob Savell, ML5-2/E50
Bill Strecker, TW/A08

00 CORE DECGRAM ACCEPTED S 003657 O 348 09-AUG-82 18:56:32

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* d i g i t a l *
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TO: BILL AVERY   DATE: MON 9 AUG 1982
3:25 PM EDT
    BOB HUETTNER   FROM: GORDON BELL
    KEN OLSEN   DEPT: ENG STAFF
    JACK SMITH   EXT: 223-2236
                                                      LOC/MAIL STOP: ML12-
1/A51

MESSAGE ID: 5172024905

SUBJECT: VT192

I didn't participate in the final stages of the proposal closing last
week...but I think they wanted to hold schedule and give up the modem
at FCS.

This makes me feel bad, but at least it is back from the position that
the terminals engineers took several weeks ago that we had no
modem...which caused me heart-burn and some sleeplessness. I'd like
to understand how the decision to drop it got made because I think
this may be at the root of a basic engineering marketing interface and
responsibility problem. (let's look at it to learn and not to
crucify). The point on the built-in modem is that we (Ken, Jack and
I) as ENGINEERS decided on the specs. There is no rational data that
can be presented that will disuade us (at least me) because we believe
that the world wants a clean design and we all want to sell a system.
Furthermore, we all want a unique, quality product, not a commodity me
too. We intend to change the hassled way the world buys and uses
terminals. We (3 of us) are assuming the risk, we would all listen to
reason, but we (I) believe that there can be no data because there are
no products like this on the market today, hence market data input is
irrelevant. This is identical to the non-negotiable position I took
on having great modems on the LA12...and the world's buying it.

As a separate issue, we're building modems into Rainbow and the

VT201.
Also, I hope DECmate II will get one. Rather than having 3 unique
boards, I say we can't blow our resources with 3 separate designs -
use one (think of the enginering, manufacturing and service costs)!
We really have to have an options architecture..

ATTACHED: MEMO;24

****
* d i g i t a l *
****

TO: GORDON BELL
JACK SHIELDS

DATE: THU 29 JUL 1982 2:08 PM EDT

FROM: KEN OLSEN
DEPT: ADMINISTRATION
EXT: 223-2301
LOC/MAIL STOP: ML10-2/A50

MESSAGE ID: 5170911454

SUBJECT: VT192

I just read Dick Yen's memo on decisions on the VT192. I thought
we decided we were going to have an integral modem in the first unit. Is this true?

KHO/ep
KO1:12.48

WPS USERS - Leave HP mode and type <CR>

00 CORE DECGRAM ACCEPTED S 001033 O 42 11-JUL-82
20:33:38

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION   DATE: SUN 11 JUL 1982
8:32 PM EDT

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

MESSAGE ID:
5169182952

SUBJECT: FINALIZING THE VT192 SPEC BEFORE WE SLIP THE
SCHEDULE

The engineering group under H. T. Cho is doing a great job. Characters are on the screen, the basic microcode is up and it looks as if they'll meet their aggressive schedule. The cost of 380, sans OCLI looks good.

We in Maynard are about to slow things down through lack of spec and worse yet, linking the spec to the VT200 series that ships 6 months after the 192. Given the sketchy spec and the fact that the setup has not yet been implemented, the project clearly will not be able to make the schedule or it is certain
to have to change when the spec is finalized when it has been implemented. Overall, this is crazy.

HT is going to be in town this week to finalize these 2 parts:
1. Ken's idea, which looks good, to have a 15" tube. HT will come with a cost and schedule impact. Maynard was to have breadboarded this so we can make a clear decision. Note, it

may not look good because the characters may be too thin.
2. The setup mode. Unless there's an iron clad spec that has been implemented, I say let's revert to the vt 100 spec but with some enhancement that writes the setup instructions on the screen so that the card isn't needed.

When HT leaves on Friday, it should be with firm spec. Jack Ken and I would like to meet to check on how he made out. Bob and Bill can you set this up?

We need the product. Let's all help get it.

"TO" DISTRIBUTION:

BILL AVERY	JERRY BOURQUE	DICK YEN
@TAIW		
JOHN ELSBREE	BOB HUETTNER	KEN OLSEN
JACK SMITH		

WPS USERS - Leave HP mode and type <CR>

00 CORE DECGRAM ACCEPTED S 001076 O 51 11-JUL-82 21:02:50

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* d i g i t a l *
****

TO: see "TO" DISTRIBUTION   DATE: SUN 11 JUL 1982
8:38 PM EDT

FROM: GORDON BELL

cc: KEN OLSEN

DEPT: ENG STAFF

EXT: 223-2236

LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5169182960

SUBJECT: PUTTING THE MODEM OPTION BACK IN THE VT192

This is a mess. At our earliest spec meeting we all agreed to put this in as an option. Now I find that Bob has the job of telling Ken and I that it's not going to be done.

This is in direct violation of what we agreed and I can't find out why it was taken out. Certainly the Taiwan folks believe the extra room and 3 watts can allow it.

I continue to see many VT100 look alikes and I want us to have a unique and great product. By putting the modem in, we are able to sell a very low cost vt100/modem combination that NO ONE can match and we're crazy if we don't take advantage of it.

Bob and Bill will you please get this back in?   It will not impact the slip schedule if we design for it.

(The LA12 is doing great with its built in modems and this will be even better if we do it right.

This must also be part of the spec that's carried back Friday.

"TO" DISTRIBUTION:

BILL AVERY BOB HUETTNER JACK SMITH

WPS USERS - Leave HP mode and type <CR>

****
* d i g i t a l *
****

TO: BILL AVERY DATE: THU 6 MAY 1982
12:59 PM EDT
BOB HUETTNER FROM: GORDON BELL
GEORGE CHAMPINE DEPT: ENG STAFF
JACK SMITH EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: WHY ISN'T OPAL THE VT200?

This message given out at today's meeting - for your files.

I'd like to get together and discuss our plans to get a high
quality
VT for our systems much more rapidly and in high volume.

Why can't the VT group take over the black and white CRT
being
announced at NCC and do the cost reduced follow-on for it and
the
color version?

Note, both of these could be operated with a conventional
serial link
if they had a UART.

We must produce these in high volume and attach them to
Nebula to get
the workstation price in line to compete with Appollo and 3
Rivers.
Here we ought to be at 20K or less/station.

The pipeline looks like this:

16 Ramtek -- --

8

4
Zebra Color --
2 Zebra \par
\par 1 VT125 -- -- Zebra'
\par .5 VT100's --
VT125' --
\par .25 -- -- VT100
& modem --

now 1/83 6/83 1/84

The cost reduction would be done in the factory (i.e. Taiwain) unless
there's significant chip work. Zebra' = VT200 and Zebra color =
Zebra x VT200.

Folks, I don't think we're going to make it the way we're headed.
Let's get our act down to 2 or 3 rings and then perform it!

GB3.S5.23
This message given out at today's meeting - for your files.

I'd like to get together and discuss our plans to get a high quality VT for our systems much more rapidly and in high volume.

Why can't the VT group take over the black and white CRT being announced at NCC and do the cost reduced follow-on for it and the color version?

Note, both of these could be operated with a conventional serial link if they had a UART.

We must produce these in high volume and attach them to Nebula to get the workstation price in line to compete with Appollo and 3 Rivers. Here we ought to be at 20K or less/station.

The pipeline looks like this:

16 Ramtek -- --

8

4

Zebra Color --

2 Zebra \par

\par 1

VT125 -- -- Zebra'

\par .5 VT100's

-- VT125' --

\par .25 --

-- VT100 & modem --

now 1/83 6/83 1/84

The cost reduction would be done in the factory (i.e. Taiwain) unless there's significant chip work. Zebra' = VT200 and Zebra color = Zebra x VT200.

Folks, I don't think we're going to make it the way we're headed. Let's get our act down to 2 or 3 rings and then perform it!

00 BURT DECGRAM ACCEPTED S 7437 O 663 25-AUG-81 22:32:02

****
* d i g i t a l *
****

TO: BILL AVERY DATE: TUE 25 AUG 1981 19:51 EST

FROM: GORDON BELL

cc: KEN OLSEN DEPT: ENG STAFF

EXT: 223-2236

LOC/MAIL STOP: ML12-1/A51

SUBJECT: KEN'S SUGGESTION ABOUT VT200

1. Construct the vt200 project under Bernie.
2. Bernie reports to Bill and is signed on for 3.5 weeks and we trust him ethically.
3. Set up a clear organization to get the work done very fast. In particular, there are 4 interfaces that could be troublesome that we have to deal with now:
   1. The spec on the controller and the crt.
   2. The Software support and needs.
   3. Getting the firmware team in place.
   4. Packaging (which we all agree we can defer on).

I suggest we make life simple, by admitting that the first release is only as a terminal, hence the user space issues don't become a majore problem. All we care about are the graphics and higher level editing primitives. This approach gets rid of items 1 and 2 for a long time.

GB2.S8.35

****
* d i g i t a l *
****

TO: KEN OLSEN DATE: FRI 12 SEP 1980
7:01 AM EDT

FROM: GORDON BELL

cc: DICK GONZALES DEPT: OOD
AVRAM MILLER EXT: 223-2236
STAN OLSEN LOC/MAIL STOP: ML12-1/A51

SUBJECT: RE: SMALL SYSTEMS

Just had some thoughts that might get us out of cost hole in the vt200 dumb version.

It seems to me the big thing we want to invest in is our library
of modules cause each one (a complicated one like a VT200 controller
or a cpu) represents a module start-up, sparing of one to

multi
megabucks. Given that we want to go for lower cost, then why not make a monitor package that would support the card we discussed
on Wed. morning. For power, we would have two options: a version that goes in the monitor, or one that hangs on the wall (I have a vadec 25w ps that does this). Alternatively we put the module and ps in the keyboard for the dumb version.

This would say we get a really good module size/mtg structure that would permit easy mobility to some or all these places as a means to get cost or ssmall size.
(Have just loved the 278 except if it had the mini floppies inside or if it had them in a small carryable box. It is right
size for desk and I carried it to SR easily. No heavier than a vt100)

Could the power system mount in the same way... so as to avoid
the ad hoc power supply systems that will evolve and not let us do this? Given all this, should the modules be the same size as T/E and Floppies?

GB1.S7.3
00 BURT DECGRAM ACCEPTED S 23558 O 33 26-OCT-80 19:49:33

****
* d i g i t a l *
****

TO: DICK CLAYTON   DATE: SUN 26 OCT 1980
7:45 PM EST
    AVRAM MILLER   FROM: GORDON BELL
    BILL PICOTT   DEPT: OOD
    ART WILLIAMS   EXT: 223-2236
                                         LOC/MAIL STOP: ML12-
1/A51

SUBJECT: SEPERATED YOU ARE GOING TO FAIL, TOGETHER THERE IS A CHANCE

It seems to me that the VT200 as it was going had a chance of being ok, provided that the Mass storage got integrated with it somehow. I never got an inkling of how this was planned from the requirements documents. Perhaps left alone, this would have happened. Somehow, we went too fast in terms of making a box, and it comprimised people's views as to what the 200 was to be.

As a user of a wps78 as both a dumb and intelligent terminal for at least 3 years, no way can I believe anyone should ever have a terminal that doesn't have mass storage. This may not occur as rapidly as I think, but it will be close. Even the fortune biggies are buying personal computers for this purpose.

Therefore, I will categorically state that within 3 years, the dumb terminal market will have peaked, and will be replaced by the personal computer as the terminal. We must get our act together now!

I expect that you folks will have an aggressive plan for building aggressively competitive programmable terminals with mass storage (also called personal computers) before our meeting on Wednesday, or tell me why my model is not valid and that we can and mus continue on the current course of building some sort of high quality dumb terminal and some boxed personal computer that appears to be making no progress.

Note that it has been 4 months since we agreed to this direction at Stratton and 2 months since the meeting with Ken. If you do not agree with this direction, I want it formally stated

by next monday at the llatest, so we can proceed with another plan and something that we all agree on in terms of terminals/
small system direction. (The current VT200 3 year plan is off by 1-1/2 years both in terms of gestation period and specs.)

GB1.S7.56
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* d i g i t a l *
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TO: BILL AVERY   DATE: MON 31 MAY 1982
11:24 AM EDT
                                            FROM: GORDON BELL
cc: JACK SMITH   DEPT: ENG STAFF
                                            EXT: 223-2236
                                            LOC/MAIL STOP: ML12-
1/A51

SUBJECT: VT201 AND VS100/VT200 SERIES: OPPORTUNITIES?

I don't think Cathy had looked at the issue of using Wim's design very carefully at all. Avram and Bob are now looking at this in detail. I asked YOU to look at this, not delegate it.
To my knowledge, Cathy has never designed or shipped a product,
so I wonder why you think she could make a very good analysis.

At least part of the issue of VT125 compatibility may turn out to be the old curse of the two planes (a VT100 and a graphics plane) which I ask you to fix. This is a kludge we do
not want to stop right now and not perpetuate. Certainly having
the same crew that gave us this kludgery do the cost reduction
makes all the numbers immediately suspect.

As you know, the terminals are really important. Bob's

only been here a short time, so I can't ask for much. In
order that we don't continue to fail, I hope you'll
spend time with him to get this area straightened out and
headed somewhere. We have far too many resources there,
given
the output... and it's clearly an area I want to see reduced.
It would seem that doing cost reductions on the VS100 offers
a really great alternative to the VT200, especially given
the incredible lead time for those chips.

Jack,
I don't believe that as peers, George and Bill/Bob, can
honestly
look at the issue of using the VS100 as a VT200 due to the
large
number of egos involved. I'd say let them start and then
let's
do an outside review of the thinking.

With the IBM, Wang and VS100 announcments and with the rumour
that Apple IV is full page, then there's going to be much
heat
on the terminals group to produce before '85. I don't see
why they need more than one year.

GB3.S5.56

FROM: GORDON BELL   DATE: THU 31 JAN 1980
12:16 PM EST
DEPT: OOD
EXT: 223-2236
TO: GARY COLE
cc: LARRY PORTNER
    DICK CLAYTON
    STAN PEARSON
    SI LYLE
    BRUCE STEWART
    BRIAN FITZGERALD

SUBJECT: VT278 BUSINESS PLAN

Could I see a copy of the VT78 Business plan with a comparison of how we've done against the plan? The 278 volume seems awfully high. What is coefficient that permits us to predict elasticity of this demand curve?

I certainly would like to see our system's plan and evolution based on the 378 and RLX78. Aren't you working on the wrong problem with the 378? When the cost is in the floppy, I thought, the projected cross-over of bubbles vs. floppy was in 84 or so? Are any P/L's driving to get us the large, PDP-8 system? Why not use the WS248 hardware we have right now, as it seems to be exactly what your proposing?

GB:swh
GB1.S1.43

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* d i g i t a l *
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TO: BOB DALEY
DATE: FRI 25 JUL 1980 2:41 PM EDT

FROM: GORDON BELL
cc: DICK CLAYTON
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: MORE 278 SLIP AND A NUDGE/OPPORTUNITY TO MOVE MORE TO THE 11

We keep having chip slips. We have PDT's in inventory. We have ideas on how to even get the performance of the PDT 150 up and unbottlenecked. We are aggressively building a PDT 50.
We have a WPS strategy that is 11 based. Given all this:

Can we move much more rapidly to get the 11 wps such that we do not need to market the 278 at all, given that it will be available at some future time? (We can really clean up in the market, I would hope with this approach).

Bob, can we discuss this on Monday? What a few of your troops
say?

GB1.S6.9
Congratuations on the 782
To: Dick Husvedt, Joe Carchidi, Brian Croxon, John Holz
CC: Operations Committee, BJ, Heff, Demmer, berube, lane

Although the announcement made the front page of several newspapers, I don't think it does justice to the significance of the 782. This is how we'll build all future machines most likely.

You are all to be congratulated on creating a really fine product, especially since VAX users need more performance. It really hits the mark.

Please convey my heartiest regards to the Hardware and VMS teams.

I'll be happy to sponsor or participate in any appropriate celebration of this important new branch on the VAX family tree.

Gordon
.

00 CORE DECGRAM ACCEPTED S 002733 O 259 14-SEP-82 7:30:57

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TO: BILL AVERY
BOB HUETTNER
JACK SMITH

DATE: MON 13 SEP 1982 4:39 PM EDT
FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-

1/A51

MESSAGE ID: 5175576717

SUBJECT: OVERFUNDING VT'S

The VT192 really makes me sick. The only thing it offers to the user appears to be less desk space and somewhat less cost. I think it follows the trend of a long series of marginal products that have succeeded the VT100. I hope you'll plot the overall cost pattern of the VT's since the VT100. My conjecture is that none of them were really required in terms of getting lower cost.

Moving the manufacturing to Taiwan was the only real cost savings. There's been no use of modern technology (eg. gate arrays) or no feature benefits. If TPG'd had no VAX, it would have been out of business. As a separate issue, I'd guess the VT201 is also a marginal improvement over the VT125 in terms of cost. Is it?

It's disturbing also to find that we were once going to build common options for VT's and PC's. Did we ever make a plan for options? Each modem is unique (i.e. CT, Rainbow) and still we don't build modems into terminals or Decmate like I thought we agreed to.

Basically I believe we're funding VT's too heavily as evidenced by lots of poor products.

GB3.S7.20

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TO: GERALD V BUTLER   DATE: TUE 4 JAN 1983
10:16 AM EST
    BERNIE LACROUTE   FROM: GORDON BELL
cc: see "CC" DISTRIBUTION   DEPT: ENG STAFF
                                            EXT: 223-2236
                                            LOC/MAIL STOP: ML12-
1/A51

                                            MESSAGE ID:
5186857147

SUBJECT: WANG: LOCAL AREA NETS, THEIR DIVISION, ETC.

GB4.S1.7

Jerry McDowell of Wang gave a sickening, hi-hype talk at a
LAN
conference in Sydney in which he described Wangnet, based on
well-proven CATV as the answer to combined voice, data and
video. He
said nothing about voice, but on questioning, this meant some
sort of
connection of Wang equipment with PABX plus the use of
headsets with
some data/voice channels for operator communication. He
urges us to
use two-cable for the Ethernet modems. Their promised 12
Mb/s CSMA/CD
is now 10 Mhg (Ethernet compatible?). My opinion still
stands: CATV
using frequency agile modems is a poor alternative to
Ethernet for

their several uses - terminals/workstations to their mainframes, at
9.6Kb-64Kb, as an Ethernet, etc. They have nothing in TV-based
products.

It's probably more significant that they have bought satellite
capacity and have established a completely separate company that uses
Wang engineering. The goal is to supply services and do wiring.

Our Sydney office is afraid of them, but yet doesn't know how our
products compare and compete with them, nor is there enough help
coming from the product lines regarding positioning. We need
aggressive benchmarking against them.

Bottom line:

They sell futures (typical date - end of 1984). They market
aggressively. They are getting organized to be even leaner and meaner
in network talk. We're one big fat, happy family with great products
and negligible ability to compete with them at the network level.

"CC" DISTRIBUTION:

HENRY ANCONA   BOB HUGHES   JULIUS MARCUS
OPERATIONS COMMITTEE: JACK SHIELDS

FROM: GORDON BELL   DATE: FRI 8 FEB 1980 10:34 AM EST
DEPT: OOD

EXT: 223-2236
TO: KEN OLSEN

SUBJECT: NOMINATING AN WANG FOR NAE

Jerrier Haddad (IBM) just called me on the above. He feels that from an external view Wang certainly seems deserving. It is IBM's unwritten policy I suspect to have a bunch of computer people outside on NAE just to keep the IBM visibility
down... in other words we are like their eeo program.

Someone is needed to either write the recommendation or to be a second nominator (2 or 3 are required). I've never met Wang, nor know of his work specifically.
Do you?
Would you be the main nominator if I got the data?
Would you be a second nominator, given that someone put the form together?
Do you think he ought to be in the NAE?
Who would be a good nominator who knows him (Forresor)?

GB1.S1.65

GB0003/40

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Subject: **Watching the Stratton and Strategy Videotapes**

To: Mary Jane Forbes, ML12-1/A51
John Meyer, ML12-1/A11

Date: 6/2/79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

These tapes turn out to be pretty neat. I want to make sure all the groups see them. Since you are keeping track of who is, let me know periodically. I intend to view them myself and interact with them.

GB:swh

D I G I T A L INTEROFFICE MEMORANDUM

DIST:
Mary Jane Forbes ML12-1/A51 John Meyer ML12-1/A11

GB3.S10.27

00 CORE DECGRAM ACCEPTED S 000699 O 188 04-DEC-82 9:34:31

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TO: see "TO" DISTRIBUTION

DATE: FRI 3 DEC 1982 4:06 PM

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

cc: MIKE GUTMAN
ANDY KNOWLES
JACK MACKEEN

MESSAGE ID: 5183614218

SUBJECT: WC FIELD (LASL WC11 COMPUTER)

Whether we do anything with the LASL machine is up to you guys!

LASL probably would love us to build and market it, but I doubt
if we could ever do it without ruining it (eg. making it non-

portable) or in a timely fashion.

I wanted out of this loop. My vote would be to sell T chips to anyone who wants them so that the computer could be built and marketed. It probably wouldn't compete with us and might even test whether a vanilla, RT11 can be sold. Later, we could follow, in our usual way!

"TO" DISTRIBUTION:

BILL AVERY | KEN OLSEN | JACK SMITH

ATTACHED: MEMO;53

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TO: GORDON BELL
11:24 AM EDT

cc: MIKE GUTMAN
DICK HEATON
RICHARD LEWAN

DATE: TUE 30 NOV 1982

FROM: JACK MACKEEN
DEPT: TVG MARKETING
EXT: 225-5600
LOC/MAIL STOP: HL02-1/L13

MESSAGE ID: 5183407720

SUBJECT: WC FIELD OPPORTUNITIES

Is there any interest or activity going on that you are aware of? Please advise.

(Gordon, please also note separate EMS I am forwarding on this subject.)

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TO: JACK MACKEEN   DATE: MON 8 NOV 1982 9:03
AM EDT

FROM: KENNETH B HEDBERG
DEPT: TVG BUS DEVLPMT GR
EXT: 231-7869
LOC/MAIL STOP: MRO3-3/G20

MESSAGE ID: 5181106176

SUBJECT: WC FIELD OPPORTUNITIES

THE WC FIELD SEEMS AN EXCELLENT OPPORTUNITY FOR US IN THE
SMALL END OF OUR SYSTEM STRATEGY. ARE YOU INTERESTED IN DOING
SOMETHING WITH IT FOR TVG, OR DO YOU KNOW OF ANY OTHER GROUP
THAT HAS AN INTEREST IN PRODUCING IT??
LANL IS WAITING FOR US TO INFORM THEM OF OUR INTEREST, OR
LACK
THEREOF, BEFORE MAKING IT AVAILABLE FOR ANYBODY ELSE. I HAVE
HAD
SOME INQUIRIES FROM OUTSIDE COMPANIES, NOTABLY CANBERRA IND
THAT WANT OUR PERMISSION TO PRODUCE THE WC FIELD.
PLEASE ADVISE AS TO HOW YOU WISH TO PROCEED.
REGARDS KH.

8-NOV-82 10:30:35 S 01443 MREM
MREM MESSAGE ID: 5181156024

1-DEC-82 4:22:49 S 00617 MR16
MR16 MESSAGE ID: 5183327101

Monsieur Jean-Jacques Servan-Schreiber
Centre Mondial
Informatique et Ressources Humaines
22.avenue Matignon
75008 Paris

September 13, 1982

Nicholas Negroponte
Jean-Jacques Servan-Schreiber
Centre Mondial
World Computer Center
22. Avenue Matignon
75005 Paris
FRANCE

Dear Nicholas and Jean-Jacques:

I thoroughly enjoyed the visit to Centre Mondial with you, Seymour and the rest of your colleagues. The enthusiasm, competence and direction were exciting and certainly contagious. Your aims and ideals are commendable.

Several of us have discussed ways we might be more tightly coupled and be part of your center. In addition to areas we'd like to monitor and use (eg. speech i/o, French command interfaces), I believe there are two <u>immediate</u> areas we might do jointly:

1. Support of personal computers by various small, centralized facilities-

   -such as te VAX 730. I believe that every 100 to 10,000 personal computers will require databases, specialized processing, software development, switching to each other and to other centers. I'd like to see us become actively involved in discovering these functions, importing them from other sites, developing them with you and then ultimately testing the system.

2. Proving the various complete Office Systems we're introducing on VAX to you on a test site basis so that we can work on human interfaces and explore the functional tradeoffs necessary when operating across various systems of centralized and personal computers. This is also related to the first point.

Also, other development opportunities will arise if we have people at the Centre.

Again, thanks for the interaction and good luck with the project.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

cc: Jean-Claude Peterschmitt
Claude Sournac
Dieter Huttenberger
Ken Olsen

GB3:S7.18

00 CORE DECGRAM ACCEPTED S 002041 O 192 14-SEP-82
6:18:03

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* d i g i t a l *
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TO: CLAUDE SOURNAC DATE: MON 13 SEP 1982
4:37 PM EDT

FROM: GORDON BELL
cc: see "CC" DISTRIBUTION DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

MESSAGE ID:
5175576623

SUBJECT: WORLD COMPUTER CENTER, AND WPS

I am very enthusiastic about the WCC and spoke with both Wade and
Davies about having engineers there to interface and explore opportunities arising from the presence:

1. Telecommunications around low cost terminals and low cost personal computers. Clearly we have to get into this somehow. As a minimum we need to "support" these via VAX's. For every n (say 1000) home micros, I believe there has to be at least one 730-780 class machine with database, program development, etc. supporting them and switching them.

I BELIEVE WE (France, Claude, Engineering) must take on this reponsibility to get such a product breadboard and it could very well emanate from WCC--clearly we all have to sell WCC on this structure and we have to be there and work with them to develop and understand it. Both Servan-Schreiber and Negroponte want us there, even though they probably don't yet see the need for this network of minis that I think will be necessary to support such an array of personal computers. I did write them explaining the need.

2. WCC should be a great test bed for the OFIS product interface work when we have something to release.

Again, I'd like to see WCC as the guinea pig for this using a VAX...together with the terminals. For now, I'd get them hooked on DECTEXT so we can get the learning. Since we have country folks doing the translation, let's put them at WCC and

GIVE WCC the whole thing: All-In-One, DECTEXT, EMS, etc. You
have the world's greatest showplace and potentially the
greatest DEC salespeople, and with a tiny bit of marketing,
you could have the greatest OA marketshare in France. (In
this regard, let me urge you to also market DECmate II as the
lowest cost WPS around and get the whole thing.)

We enjoyed having dinner with you, Christian and Georges last Sunday.
Our trip to Burgundy was great and we appreciated the information
about bicycles.

GB3.S7.23

"CC" DISTRIBUTION:

PATRICK COURTIN	DICK DAVIES @ACRE	SAM FULLER
DIETER HUTTENBERGER	BERNIE LACROUTE	JEAN-CLAUDE PETERSCHMITT
JACK SMITH	DAVID STONE	JIM WADE

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TO: FOREST BASKETT DATE: MON 6 JUN 1983
9:50 AM DST

FROM: GORDON BELL
cc: SAM FULLER DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5202114340

SUBJECT: THANKS FOR THE CAR AND HOSPITALITY

GB5.56

I thoroughly enjoyed the west coast visit and the time with you and
your co-workers. Susan's preparations and help all made it work too.
Each time I think about Titan, I get excited about the possibilities
of it becoming a multi-billion dollar product, but I'm concerned
whether we're moving as rapidly as possible. I'm encouraging Sam to
think about getting as much help there as you can manage because the
program is so urgent assuming it delivers the power you predict.

The interface with Stanford seems quite nice, and Ed wants me to be a
"consulting professor" that would visit and interact with their
research project from time to time.

I think it's going to be necessary to do this, assuming we're going to
try to get Stanford into the understanding of parallelism (via mP's).
I still believe the short run use (next 6 years) for PPA is going to
be in conventional and modified algorithm languages. We also want to

support Ed's effort on developing and understanding the use of parallelism for AI applications. I'm somewhat skeptical because I
didn't see an AI systems person. The immediate payoff will be to make
us a serious LISP machine supplier...I hope.

I'd like to find a way to help Bruce mend fences so he can get back
and be a useful member of the DEC community. He got quite excited at
the possibility of examining the Trilogy technology Titan. I'd be
quite happy to have a lor 2 module Titan at 3x Titan performance which
I think could easily be built for <$20K! (This would be damn near a
Cray for non-vector problems! Let me urge you to enlist him to come
look at this. The air heat exchanger is miniscule and would fit in a
19" x 19" no more than 20" of a 19" rack.) We're getting their designs for memory interfaces etc. so the work could be minimal.

Again, thanks -- and give my thanks to Gene for dinner and wines.

WPS USERS - Leave HP mode and type <CR>

Jack,

I think we need a major amount of help from you in regard to selling PRO and the CI Clusters. For starters, we really need an audit, by your committee about what's been going on. The goal is to make much more sales and PROFIT. My analysis follows.

CI CLUSTERS PROBLEM
A lack cluster announcement considering that we have a major product. I think the problem is that there's NO product manager for Clusters, and it simply gets done somewhere in the bowels of VAX base products marketing. Note clusters is:

. hardware options on the 750 and 780
.some cable and a connector (probably a Product Manager for it)
. VMS 3b.n, part of a release
. HSC which is clearly and seperately hyped

Note the absence of anyone who cares whether this works as a system, or that this collection can be sold as a significant system whose whole is greater than the sum of the parts. Rick Case's memo showed that we could promote it as the whole which is at least equal to the sum of its parts in terms of performance! Colorado recently just tried it all together. (There was no one there who took the system responsiblity.)

Fundamentally, we need your help to judge what so far is an non-existent act, and then help us get it together.

PRO PROBLEM (OPPORTUNITY)
PRO was late with its software, and it has been poorly advertised internally. Rumours abound. For example, it's incompatible with RSX and VMS, and there's a new PRO out soon on the Qbus. (This one hasn't been started yet.) All of these problems mean poor sales.

It's vital that we have a set of products that get customers onto DEC standards and files. PRO has great compatibility with Operating System interfaces and file systems with VMS and multi-user RSX. A great variety of programs from Fortran to third party software run compatibly across the PRO-RSX-VMS trio. No other system or vendor has the compatibility across PC's, team, group and mainframes like PRO does.   PRO will still ship about $100M this year, but is below plan and still needs more care and pulling.

Again, I think we need an audit, and help from your committee.
Please help.
Gordon
.

July 6, 1978

Office of EECS Graduate Student Matters
255 Cory Hall
University of California
Berkeley, California 94720

Dear Sir:

I am very enthusiastic about Stu Wecker visiting and teaching at Berkeley.

Let me take this opportunity to recommend him. He's bright, hard-working, and should do well there. His vitae accurately describes his work.

Sincerely,

Gordon Bell
Vice President,

Engineering

GB:ljp
ID#0154

00 BURT DECGRAM ACCEPTED S 13069 O 32 28-JUN-80 23:17:31

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* d i g i t a l *
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TO: OOD: DATE: SAT 28 JUN 1980
11:16 PM EDT

FROM: GORDON BELL
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

cc: DICK ECKHOUSE
BOB GLORIOSO
WAYNE ROSING

SUBJECT: CONCERNS FROM WEST COAST TRIP AND VIEWING MAYNARD FROM AFAR

Having spent a few days on the West coast talking to folks at Intel, Berley and Stanford where I gave a talk on 36 lessons to be learned from the computer generations, I was able to get some perspective of DEC engineering.

.Timeliness and competitiveness. We aren't hurrying enough. Intel is substantially ahead of where I though they would

.The University research is diverse and of really high quality.
My impression is that we should not be investing that much in research, but would be better putting really good advanced development in place and building really good coupling to the universities to leverage theirs.

.Our universities program is pretty good, but we aren't focussing on results. We spend the money and now need to follow up.

.Stanford has a Canon Printer interface that's pretty neat to do TEX typesetting. Left alone, we'll have something inferior in a couple of years. Theirs is really good and simple based on an Z8000. Is there a problem that we have a bunch of obsolete engineers or are we dumb or are we lazy or do we have so many people that they have to spend all their time talking instead of doing?

.All universities want to go all out with the high quality personal computer. At least 5 companies are trying to build it, because given the slightest imagination, one wants one. This criteria rules out the Product Line requests and Product management interests for such a product... but this is good too because. We have told too many people of our intent to build this product and as a result, we have stimulated a demand we can't fulfil. Also, we have selected the furtherest universities possible (Washington and Berkely) and one of the most open ones (Berkley) to place the product.

.Was impressed with Knuth's and Kahan's arguments why we should have used the proposed IEEE Standard for Floating Point. Clearly we made an expensive blunder here. Bill, will you go through the analysis of changing it to meet the standard. I think we need to do it. Can someone help me understand who is going to share in this blunder (Sam, Bill Demmer, Bernie Lacroute, me, Bill Strecker, Mary Payne, Dileep Bhandakar... please check any or all or anyone else.)

.CDC is supposedly trying to produce a machine to compete with VAX, given they lost business to it.

.780 isn't going to hold until Venus and even then, we are going to have to increase our ability to get more performance in this area. An array processor looks like the only short term possibility.

.Ed Feigenbaum at Stanford described his brother in laws role at a designer at Honda, in LA. They work every evening until 10 except Wednesday which is reserved for the family. Occasionally they test cars on Saturday. He won a design award and was decorated by the emperor. They are competing with 2 other groups in Toyko and Germany on their next car.

Given that TRW has just signed up to market Fujitsu, our options are dwindling. Sony and NEC already have their own distributorships.

Overall, I am concerned that our product cycle times are increasing at a time when we can not afford it. Also, the stuff we are planning just doesn't seem that good.

The pace is quickening at a time when we are getting big, old, tired and lazy. Also, the technology rules are changing and I see a bunch of engineers who can only design with standard IC's.

If we weren't so young (physically) we could go for early retirement. But barring this, I suggest we look at some of the other alternatives.

Any ideas?
Are we ready to discuss this?

GB1.S5.34
James Martin gave a very good talk on DP and DDP.

1. Engineering should sponsor a similar talk and learn.

2. We should review our CSW product direction regarding 4th generation languages. Some questions:

   a. Can we encourage SW houses to write these languages quickly AND have them be tightly integrated into the rest of VAX hardware? (This would give us a significant advantage over IBM.)

   b. Is our approach to parametized SW generally good? (The test should be the lack of COBOL programs.

   c. Should we do fixed applications programs at all? Should they only be based on 4th generation languages?

3. Relational Database is essential too. We should look at hardware to speed this up includng ICL's CAP.

4. He believes that users want 2 types of terminals:

   a. Executive - big, symbolic, color, high resolution, graphics, pointing, keyboard.

   b. Troop - cheap, B/W, graphics.

several wheelies
whole round of lan clusters
hsc, vsv, print server, and pluto are our nemesises vs uda..
what we learned,
vlsization

August 6, 1979

Dr. Karl Wildes
100 Memorial Drive
Cambridge, Massachusetts

Dear Dr. Wildes:

I recently learned that you were working on a historical report on Whirlwind. Since I am interested in the underlying history of our computers, I would very much like to get a copy. Also, Digital Equipment Corporation has a publishing group, Digital Press, which is starting a historical computing series and they might be interested in publishing your work.

Could you please send me any material you have on this subject?

Sincerely,

Gordon Bell
Vice President, Engineering
Professor, Computer Science and Electrical Engineering
Carnegie-Mellon University, on leave

GB:swh
GB0004/31

CC: Heidi Baldus, Digital Press

GB0002/47

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Subject: White Tornado Design for Word Proceesing, etc.

To: John Clarke, ML1-2/E60
Dick Clayton, ML12-2/E71
Jack Gilmore, MK1-1/J14
Bob Gray, MK1-1/J14
Stan Olsen, MK1-2/C36
Dick Schneider, ML11-4/E53
Phil Tays, ML11-4/E53

Date: 5/6/79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

Given the recent look at the repackaged printer for Word Processing, I would like to look at the following design ideas before it is too late to do anything about them. As a WPS 78 user, I have some predjudices, and would like a shot at seeing if we can do anything.

.less EMI in the FM band

.serial connections to the printer for ease of plugging/unplugging

.use of standard, serial terminals especially the LA34 to reduce the space.

.place for a modem or acoustic coupler

.less acoustic noise by getting floppies somewhere out of the way...let me urge us to consider TU58 and bubbles as an alternative for better convenience and for packaging and noise and really good performance when operated as an adjunct to a host processor.

.copy stand and place for papers if used as a terminal on a stand

.have the terminal mountable on a stand, but make the stand so that people can sit at it more comfortably.

.less static susceptiblity and better software to avoide loss of files.

.non-homely looking because we have the VT100 to start with

.easy to move around both in tethered (cabled) and by parts when it is necessary to carry it up and down stairs...make it so that one non Amazonian woman-type person can unpack, assemble and move it. Here, note the high payoff because all the WP Salespersons are women.

GB:swh

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

John Clarke	ML1-2/E60	Dick Clayton	ML12-2/E71
Jack Gilmore	MK1-1/J14	Bob Gray	MK1-1/J14
Stan Olsen	MK1-2/C36	Dick Schneider	ML11-4/E53
Phil Tays	ML11-4/E53		

GB0001/37

| d | i | g | i | t | a | l | i n t e r o f f i c e m e m o r a n d u m

Subject: Bubbles for White Tornado and White Tornado Versus New Editing Terminal

To: Distribution

Date: 3/6/79
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

Bubbles for White Tornado

Wouldn't bubbles make the WPS system connected to a large computer viable, whereas now it takes too much line and central capacity, and ends up performing poorly? With the 256Kbit bubble memory at costing less than a $100 interfaced, and giving about 8 pages of text, this would really be a hot system. I would assume that another bubble dip could cache most of the WPS program, which is the other component of response time.

Are we thinking about this?

Are we looking at using the TU58 as the main removable memory with the bubble as a cache for the lowest cost system?
Could we/ should we try it?

Using WPS as the Basis for the New Editing Terminal
Since I don't know what is being planned here, I have to ask a few simple questions:

Why can't we just use the White Tornado and WPS system? (Having just spent an hour doing 15 minutes work using the EMS editor, it seems to me we gain a lot using this editing terminal and creating this as a standard...which may even evolve with time.) Too expensive? Even used only as a page editor?

Is the text editing terminal compatible with anything we make or anyone else sells? or thinks they want?

My point is simple...let's make the DEC editing facilities those of WPS!

Jack are you pushing this?

GB:ljp

Distribution

Chuck Bickoff, MR2-1/M64	Bill Johnson, ML3-5/H33
Bill Chalmers, MR2-2/M67	Bill Keating, ML12-3/A62
Dick Clayton, ML12-2/E71	John Kevill, ML3-6/E94
Bruce Delagi, MR2-1/M64	John Kirk, ML1-2/E60
Jack Gilmore, MK1-1/J14	Mike Leis, ML1-3/E63
Bob Glorioso, ML3-2/E41	Roy Moffa, ML1-2/H26
Bob Gray, MK1-1/J14	Stan Olsen, MK1-2/C36
Mike Gutman, ML3-6/E94	Gil Steil, ML5-5/E76
Len Halio, ML1-2/H26	Bob Travis, MK1-1/J14
Bob Jack, ML1-3/E58	Pat White, ML12-3/E51

GB0004/47

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Subject: **Who has Charter for VAX and VMS Architecture?**

To: Jerry Butler, HD
Joe Carchidi, TW/D08
Dick Clayton, ML12-2/E71
Bill Demmer, TW/D19
Ulf Fagerquist, MR1-2/E47
Sam Fuller, ML3-5/H33
Dave Rodgers, TW/C04

Date: 9/11/79 Tue
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

Follow-Up: 9/21/79

CC: Pat Courtin, MK1-1/D29
OOD

Let's get this settled now. Pat Courtin has raised my concern especially as it relates to UNIX. Will different implementations (i.e. VLSI VAX, Nebula...,Nebula/BI, COMET, 780, and VENUS, all execute the same programs? Who's in charge here?

The same issue exists with VMS and P/L specific hardware/software. How can we keep system integrity when people add to it? Can someone from VMS consult/approve these extensions?

Also what about the interconnect space (e.g. BI, NI, CI)?

GB:swh

Dave Cutler recently talked with me about our now, seemingly over emphasis to processes, and the need for large staffs to do CAD tools.

We do need strong technical groups to build and integrate these tools. These people are critical to our survival, and they must design and implement an engineering enviroment where engineers get work done easily. It should be still noted that these people technically are only in the denominator of a productivity equation, when we make new hires.

What worries me most is our growing dependence on people who are hired specifically to operate facilitating processes that have nothing to do with the direct production of products or knowledge. Certainly we're used to personnel and finance as part of helping us operate an organization, but they are both constant or diminishing in size.

Again, we do need people to facilitate various processes (allocation of RAD, TMC, University Research, the budget). It is far better to use part-time people within engineering than to hire from without people who know absolutely nothing of the technology or products we build, and can only faciliate.

Subject: Marketing Software, etc.: Any Opportunities
To Dudley, kgf staff

We seemingly have an opportunity:

1 An idle salesforce that needs to be in the market to continue their learning and our interconnection to it
2 a need to learn about selling software, since there will come a time where software may be our main product and source of revenue
3 many companies here and abroad (eg. Australia and UK) who can give us exclusive distribution rights

Some possibilities:

0 Ally, of course
1MASS-11, the Wordprocessing package we run on VMS, and is compatible with the DECmate. This operates on the IBM PC and is being converted to run on the 370. They can also put it on UNIX. DEC is coming out with a competitor and will not recommend it as they do now when they're about to lose a sale. GM has standardized on Mass11. The group has no marketing effort!
2 Angusglow, UK, Leo Shiner, Pres. 101 Marlybone High Street, London W1, 486-0702 has two products to sell here:
  .DG CS Cobol that compiles for PDP-11's and will run soon on VMS. This exploits the fact that the PDP-11 has a poor Cobol. It allows DG OEMs to move to DEC and DEC OEMs on 11's to have a compiler.
  .An ISAM to replace the 11 RSX RMS that is faster and has more features.

Lots of people have contacted me about point products. I think we ought to look at these and figure out how to do them profitably.

<u>WHY COMPUTERS EVOLVE (RAPIDLY)</u>

. SCIENCE (KNOWLEDGE TO BUILD WITH)

. COMPONENT TECHNOLOGY (WHAT'S PROVIDED & WE CAUSE)

. DEVELOPMENT (WHAT WE PROVIDE)

. GOVERNMENT (BY NON-INTERFERENCE)

. USERS, e.g. (DEMAND & DEVELOPMENT)

(INFORMATION CARRIED BY ELECTIONS VERSUS MASS)

(MAXWELL VS NEWTON)

. CLEAR SEGMENTATION INTO LEVELS

. COMPUTERS ARE FUNDAMENTAL (AND VERY EASY TO UNDERSTAND)

. COMPUTER ENGINEERING (PROGRAMMING) EXISTS AS A WELL-DEFINED BODY OF KNOWLEDGE THAT CAN BE APPLIED

. INFINITE NUMBER OF APPLICATIONS

. ECONOMIC DRIVE TO COMPETE WITH (SUBSTITUTE FOR) OTHER INFORMATION

SWITCHERS, STORERS AND PROCESSORS

WHY MULTIPROCESSORS HAVEN'T EMERGED YET

. ENGINEERING CONSERVATIVE.

. THE MARKET DOESN'T DEMAND THEM.

. WE CAN ALWAYS BUILD A "BETTER" SINGLE, SPECIAL PROCESSOR.

. THERE ARE MORE DESIGNS FOR NEW PROCESSORS THAN WE CAN BUILD.

. PLANNING AND TECHNOLOGY ARE ASYNCHRONOUS.

. INCREMENTAL MARKET DEMANDS REQUIRE SPECIFIC NEW MACHINES.

. POINT PRODUCTS EVOLVE; A RANGE REQUIRES MUCH BETTER PLANNING

AND CONTROL.

. WE HAVEN'T BEEN ABLE TO PROGRAM THEM YET WITH A HIGH DEGREE OF

PARALLELISM.

I talked with Heidi Mason, of Acquity, who put us together with SST. She's convinced that we should merge and will help in the process. Acuity, is a company that consults in marketing strategy and got involved with them in trying to determine a more focussed strategy.

The points we might make to them are:

.Starting up is inherently risky... about 4%. A merger is the best case to hope for. This is argued in the paper I wrote on the industry and which they may have read. (She believes they have a .4 chance of making it for ? years without us. This is probably high.)

. We can make startup a sure thing due to capital, helpers, sales company. This means staff folks (K,G,H,R,R,J,J,K,S) plus several companies ready to help now.

. Implementing a product strategy aimed at producing a full product line is the real NICHE (way to win). A standalone small product won't be able to be differentiated and get off the dime. We have 6 companies now implementing this. Together we have the world covered.

. We share the same vision of a product strategy and they can do as much of it as they are able to. We are excited about the ability of this product to be made smaller and to go into portable products.

.We have two product companies ready to put software on their product.

. The company will not die, but will move off the dime.

. We're synergistic. They have a now product, we'll make it go to 10M by Jan. Ken will take the product breadboard now and use it in selling ECC.

. We have an exciting set of companies to work with. They would be happy with every group. They do want to know what the group looks like.

. We are pioneering a new organzitional structure.

. The rewards will be right... especially the expected return.

She (they) were worried about our whiplashing because of our inability to get back to them last week when, just the week before, we had said we would move when they wanted to. The answer is simply that I and they had been unable to convey their product ideas, hence we were looking at other alternatives! Also, we are fund raising.

They want to run their own show, but realize they need much help. They also want to learn, and feel they can with the proper mentors. It's critical to get the manufacturing and marketing going now, so this is a great time / test.

We have to assure them we won't be heavy handed, won't install a new management structure, will teach, will let them have some leaway to learn and implement the kinds of products that fulfils our corporate goals.

WHY USE THE NATIONAL CHIP?

32-bit architecture
32-bit wide data path and access to memory
Best Memory Managment
High speed floating point
VAX-like: Languages and techniques developed for VAX are applicable
VAX=UNIX like: Best implementation engine for UNIX
High likelihood of long delay for the 68020

CONCERNS
Second Source: Will Fairchild, TI or Rockwell come through?
Program development environment is immature
Design group is in Israel
To: Ken Olsen and the Board of Directors
CC: Ed Kramer, Jack Shields, Jack Smith and Win Hindle

I would like to strongly recommend that we buy an interest in Trilogy for the following reasons:

1. We can build several, significant VAX products that offer a factor of 2 to 8 increase in <u>performance</u> times the machines we are introducing in the next two years.

We have NO technology in house or in development that approaches this; we know of no technology that rivals this at IBM or in Japan.

Nearly all of our customers require significantly more computing power, and the application of very large scale, high priced computing technology to minicomputers constitutes a major breakthrough in the design of minicomputers.

2. High performance, minicomputer-priced computers, coupled with our ability to interconnect machines would hold American Bell and other customers who may leave DEC for IBM. Just the announcement of our agreement may keep customers.

3. Minicomputers built with this mainframe technology will have an order of magnitude higher <u>reliability,</u> and as such, some may NEVER fail. Sevice cost, which constitutes half the total system cost is reduced a factor of two. Service is by simple replacement at the user's convencience.

4. The technology as a whole is a breakthrough, and forms the basis of both direct descendant technology and other systems:

a.Their Computer Aided Design is the best we've seen. With it, designer productivity is an order of magnitude better than with our most advanced systems.

b. Their mainframe design techniques are useful in mini- computers. We have already learned much from the Amdahls.

c.The packaging and semiconductor technologies are state of the art, yet conservative, and extendable to another generation and probably lower cost machines. These technologies are coupled to the critical manufacturing processes development.

d.The method for achieving reliability and obtaining higher yields through redundancy is truly unique, and a breakthrough. It goes directly to the ultimate goal of building a computer that will never fail. The current state of the art only permits the diagnosis of faults.

5. The technology is being developed by Gene Amdahl, who has built great high speed computers for the last 30 years.

6. We have able designers who want to start now.

Indeed, the only reason NOT to go with Trilogy is one of risk. We believe the risk is manageable, the people are the best, and our entry will increase their likelihood of success by additional resources and a different view.

We have the opportunity to participate in a breakthrough. Let's go.

Gordon Bell
19 June 1983
Thoughts On the Low End
To Jack and Jim and Ken and Win

Why You Might Not Want To Work In the Low End
The simple answer is that anyone that's good, wants to do state of the art and relevant products. The obsolete, vanity architectures are part of the root cause. Poor products breed more poor products. Most of the products are irrelevant to the market; none have any significant market share! Good people only want to work on good products.

Other answers: it's basically an assembly operation where you take off the shelf micros and peripherals and put them together. The challenge is in the software of the applications, and good sofware folks are not encouraged to write the control software (Firmware), because this is being done by hardware folks who don't have the background.

The Engineering Environment
I've felt unwelcome, and given the activities, I've not been anxious to look at poor projects when the support for changing them is also nil. A manager just has to be crazy to enter this arena. We're lucky to have a good one now, but

he's our fourth in less than 3 years, and this should indicate something's wrong. Surely, the engineers feel the same way.

The physical envionment isn't great, and the processes for cad, simulation and software aren't there either.

The hardware and software folks are too far from one another geographically!

Base Architectures
The 8 and 11 are machines that aren't state of the art, and one simply can't build competitive software on them because of the address space! It is virtually impossible to write any modern application, in a market-practical time on either of them. We shouldn't be. We should simply support applications that exist and can be written easily within their frameworks. However, we need to go like hell on: Rainbow, UNIX (probably on all products 11, 68K and VAX), and MicroVAX! There are lots of protos going to select from.

The 8 has a bizarre addessing scheme, making it a 8/12/15-16 bit computer (pick one) and the 11 is a 16 bit computer. The 8086 is a 21 bit computer, the 286 a 24 bitter and the 68,000 and VAX are 32 bit computers. Addressing is the ONLY thing that's important in the potential production of software. This, along with the fact that DEC vanity architectures are insignificant in the market (because we didn't sell chips) means we're irrelevant.

Base Busses
There are either no busses, or so many busses that one can't build anything: CT/Q/Ubus have varying degrees of disks, crt's, comm, telephones, etc. None are going to last past 85, and ALL are incompetitive with the Multibus! This is still a mess with the dream, realities and plans being seperated too far in time.

CT
A tragedy. All of us are finger pointing. There was no mangement or review at the critical times.

The problems of the PRO are: address size, chip performance, compatiblity with the 11 (which is pretty good), and the fact that NO ONE outside of DEC is writing software for it. Maybe the biggest problem is just being late. I do have a lot of respect for it though.

DECIDE IT'S FATE. Selling like hell is clear. My gut feel is to make a J-board for the PRO (let's build the proto anyway), and NOT make a PRO out of the Qbus... requiring more boards and options etc. to be built. It makes a nice story that you can upgrade your PC to a shared system or to run any random O/S on any random Micro, but I don't think it can be done competitively, and by the time we prove or disprove it, the market will have gone.

Rainbow and Building an IBM-compatible line of computers
I wish to hell we were IBM bubble-pack compatible. I wish people would listen to Cudmore and Folsom. Their dream: build 3 machines- RB50 in Japan, a floppy based and a wini based machine. All should use the same options. These would be configured to have great performance for the WPS+ software that can now be demo'd on the Rainbow. Get market segmenation by a label if necessary... but frankly, I'd like to put our WPS+ software on the IBM PC!!!! This would get us presence and compatiblity across the DEC line.

VT's
The two products which are took two years (not 9 months) are both retread of the vt100 and vt125 with no real improvements in screen size or performance. They're cost reductions that should be done in plants (the 220 was) and appears to be pretty good. We didn't get any features (VT phone, calculator, programmability), a bigger screen, or higher performance to compete with PC's. This area is dead for many reasons including the fact that PC's are proably the way to go. Who's encouraging the design of competitive versus quick time to market products... that still take TWO years?

LA's
By mismanagement and poor factory performance, the Japanese have driven us OUT. The 12 isn't bad, but there's nothing else. The LA100 product plan is a dream, and the quality of

mine is poor. LN's are masked by the sad work in imaging on paper that we can't afford.

Bottom Line
I think the area must be fixed. It's not irrepairable, but left alone much longer, it'll be more poor products (and lower margains).
can't build a machine on the 11
anyone can do it, is it worth it
intellectually, it's an assembly operation
people who take long projects, eg vlsi'd dragon are at risk
it's not even a sw challenge
the pro proves it
tools expectation and profits are poor
close to maynard == 1/distance. get lots of help
  Maynard envirnoment is terrible
associates are poor.
expectations that everything is done instantaneously, no time to learn. software takes longer (history and address size)

you can't design any systems be cause all the energy is going into trivial busses: ct, q, none, 422, real stuff's on the ubus.
good busses build good fences but you can't build anything good
 ct=tms, u has comm and hi end disks, q has size and dream, bi has potential
qbus no good schemes to be competitive with multibus

weren't allowed to compete with the 11 RT... piss hole in the snow!
(11's a sleepy environment) Sales are minimal. Just replacement sales. in order to be competitive you have to compete
not a competitive t/j (late)... related to remoteness of engineers to market? vaxness

no 3rd party sw versus 8086/68K related to nature of market (chips)

Mr. Alec Peltier   15 August 1980
Chief of Immigrant Visas

Operations Branch
American Embassy
London
England

Dear Mr. Peltier:

I am writing to explain our situation regarding Professor Maurice V. Wilkes with whom we have made arrangements to join the staff of our Corporate Research Group.

Professor Wilkes has been a towering figure in computer engineering and computer science from the invention of computers until the present day. He is one of the small handful of men who originated the modern computer; he was personally responsible for the construction of EDSAC 1 which was working in May 1949. Some of the concepts first proposed by him, such as "microprogramming," have continued to grow in importance until today virtually all computers manufactured in the world are designed using this technique which he created.

For the last decade Professor Wilkes has been Head of the Computer Laboratory at the University of Cambridge (England), where he was previously Director of the Mathematical Laboratory for a quarter of a century. I will not attempt to list all of the honors and awards which he has received over the years; this information is available from standard reference works such as Who's Who (see copy attached). Suffice it to say that he has been one of the intellectual leaders and respected senior statesman in computing for the last three decades. He is a Fellow of the Royal Society, a Fellow of the Institute of Electrical and Electronics Engineers, a Fellow of the British Computer Society, of which he was the first President, and a foreign associate of the U.S. National Academy of Engineering. He received the Turing Award and the Harry Goode Memorial Award, two of the highest honors in American computing. He has received honorary Doctorates from five universities in three countries, together with other honors from around the world, including recently being named as a foreign associate of the U. S.

Academy of Sciences. In summary, he is a distinguished scientist and engineer of world reputation, possessing unique background and qualifications not available elsewhere.

Dr. Wilkes is urgently needed to run our research program on techniques for making computer systems more secure. This program is not only important for us as a major computer manufacturer, but also may have a significant impact on U.S. leadership in computer technology throughout the world. Dr. Wilkes' presence is necessary to move this work forward. Also, we need his interaction and leadership across all our research.

Dr. Wilkes is scheduled to leave England the last week of August and will start to work here September 2. He has made all personal arrangements including letting his house in London and renting a house here in Mass. We were lead to believe several months ago that his visa was in order but he was told by your office a few days ago that it would be 1 to 3 months before he could get his permanent visa. This is totally unacceptable. Please check into this urgent matter, expedite, and return TWX the status of this situation. Your help is most urgently requested in this matter.

I have known and interacted with Dr. Wilkes for many years. We need him here. Won't you please, please help us? What other information do you need? I will be calling you and Dr. Brewster after you have received this.

Sincerely,

Gordon Bell
Vice President, Engineering
DIGITAL EQUIPMENT CORPORATION
Maynard, Mass. 01460
Telex No: 948457

cc: Ambassador Kingman Brewster
American Embassy
London, England

Honorable Jordan Baruch
Assistant Secretary for Science and Technology
Department of Commerce
Room 3862
Main Commerce Building
Washington, D.C. 20230

Honorable Frank Press
Director Office of Science and Technology Policy
360 Old Executive Office Building
Washington, D.C. 20500

cc: Richard Goldstein
Attorney at Law
Suite 606
335 Broadway
New York, New York 10013 GB1.S5.68

FROM: GORDON BELL DATE: TUE 25 SEP 1979 9:05
PM EST
DEPT: OOD
EXT: 223-2236
TO: JIM BELL
SAM FULLER
cc: ULF FAGERQUIST
MARY JANE FORBES

SUBJECT: WILKES OFFER

Professsor Wilkes will be back to Cambridge in about 2 weeks. At that time he would like to get an offer. Could you work together and put something up that would be appealing? In many respects, I think he could be given some kind of grand title, like honorary senior scientist...but on the other hand, I feel it m might take away from the Senior Consulting Engineer title. In any case, I feel Strecker, Kotok and Cutler should be consulted. He certai has indicated a need for money.

Although I'll be out of the country, I think the letter should go out by the
end of frist week of Oct. Therefore, I can call back if you want my reaction.
I would like to have him here. he'll act as an irritant and generally be
good for us.

Command >
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* d i g i t a l *
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TO: see "TO" DISTRIBUTION DATE: SAT 28 JUN 1980 11:42 PM EDT
FROM: GORDON BELL
cc: see "CC" DISTRIBUTION DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: WILKES: PLEASE SEND STUFF AND HELP

I had a thoroughly enjoyable evening last nite with him and I am delighted that he has a place to stay. I think Sam and I should sign up for a significant amount of time to have him be
a part of our technical reviews so that he can get a feeling of
what is going on so that he can both help in defining our research
direction and do work on his own. Also, I want him to become a
critic to our environment and question us.

We also talked about the problems of coupling and what universities
and industries can do in regard to research. I am counting a lot on him to help straighten out our thinking and dealing with

our identity crisis vis a vis research, A/D, and university research (and this interface.) I described the evolution of the CMU relationship and what I think may have happened in terms of coupling, need to couple, size, ability to influence us, etc. We may try to write this down after he's here so we can help this problem.

Bob, I believe you agreed to send the poop on the IEEE standard floating point so that he can get a reading on it from David Wheeler. Please do it ASAP.

Similarly, Dave Rodgers, would you send him the Ethernet spec so that he might comment on it in light of their many years fo experience with their Ring? (He wants to make sure that it will do all the things that a ring witll do.) He also visited MIT on Friday and would have gotten them to review the spec like I had asked you to earlier. If you do not intend to do this, please get me the spec so I can send it.)

Jim and Bob,
Who is expediting the VISA? He is concerned.

I am looking forward to having him work for us for the next 15 years. We need this wisdom, ability to look at alternatives, and basic smarts.

"TO" DISTRIBUTION:

JIM BELL BOB GLORIOSO DAVE RODGERS
BOB SWARZ

"CC" DISTRIBUTION:

BILL DEMMER DICK ECKHOUSE ULF FAGERQUIST

MARY JANE FORBES   SAM FULLER   BILL STRECKER

GB1.S5.36

ID#385

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Subject: **Programmer's Workbench on VAX**

To: Ed Fauvre, MK1-2/E06
Bill Johnson, ML21-3/E87
Dick Snyder, MR1-2/E37

Date: 8 DEC 78
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

CC: Ulf Fagerquist, MR1-2/E78
Larry Portner, ML12-3/A62
Bill Segal, ML3-5/E82
Earl van Horn, ML3-2/E41

follow up 12/22/78

What's this?

What is the 10/20 doing in this regard?

Can they be combined?

GB:ljp

D I G I T A L INTEROFFICE MEMORANDUM

DIST: Ulf Fagerquist MR1-2/E78 Ed Fauvre MK1-2/E06

Bill Johnson ML21-3/E87 Larry Portner ML12-3/A62

Bill Segal ML3-5/E82 Dick Snyder MR1-2/E37

Earl van Horn ML3-2/E41

<u>FOUR WORKHORSES FOR OFFICE LOGS</u>

FOLLOW UP YES or NO

FOLLOW UP BY DATE

PRIORITY ASAP or AYC or FYI

ARCHIVE YES or NO

00 CORE DECGRAM ACCEPTED S 000220 O 13 14-AUG-82 9:59:42

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*****************
* d i g i t a l *
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TO: JACK SMITH DATE: SAT 14 AUG 1982

9:37 AM EDT

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

cc: BILL DEMMER
EMC:

MESSAGE ID: 5172535018

SUBJECT: GETTING THE WORKSTATIONS ON A WINNING TRACK!

The Workstations effort really makes me feel uncomfortable:

1. George is doing a fine job, but he really needs support and detailed supervision.
2. An Onyx engineering manager is needed in order to get the product out.
3. There are problems in implementation (eg. fiber optics) and in architecture (eg. incompatible with VT125/201). Many of the decisions lack common sense.
4. The product strategy as unfolded, doesn't go out and really deal with getting a competitive product for Appollo. It doesn't get us clear out to Scorpio and there aren't competitive metrics.
5. There's an incredibly large (25 person) A/D effort aimed at redoing the work the VMS group has done. I don't want this work done outside of the VMS control! Clearly resources to redirect.
6. The 32-bit Nebula can't use the boards as is and as such have to be redone. This may be competitive with Appollo in terms of cycles and psychology! It also helps the issue of more cycles for 780's since we got no Venus for 2 years.
8. The effort is isolated from and unsupported by both VAX/VMS and terminals.

In short: tactics, strategy and support aren't there to win.

Let's get this settled before I go on vacation on August 23.

WPS USERS - Leave HP mode and type <CR>

00 CORE DECGRAM ACCEPTED S 004038 O 331 06-DEC-82
17:05:42

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M e m o
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TO: see "TO" DISTRIBUTION
DATE: MON 6 DEC 1982
1:59 PM

FROM: GORDON BELL
cc: see "CC" DISTRIBUTION
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

MESSAGE ID:
5183917624

SUBJECT: GETTING THE WORKSTATION BEFORE IT'S TOO LATE

Am glad that Pete has been requested to facilitate this
project.
We are simply not making enough progress because:

1. There appears to be no overall direction into which the
product or product family fits.

2. The product changes definition lots (eg. one fiber optic
connection per Unibus interface, 1 mb/s versus 10 mb/s).

3. It is perceived that the design is constrained to use
fibers!

Ken has stated that the use of Fiber Optics is NOT a
constraint!
Ken wants only to have a competitive product to beat HP,
Xerox,

Appollo, Three Rivers, Symbolics and IBM (when they annouce).

4. There continues to be technical problems with the approach,
which are clearly exacerbated by a serial link: protocol, low bandwidth, inter-lock, and general complexity.

The approach, based on a high speed serial link to a high speed
dumb terminal we are now using really is looking shaky, because:

1. The inherent limit of the slow serial link means that this system will not work with the color workstation, and it may even
be marginal for the VS100! (Over a second to fill the screen.)

2. The one link per Unibus connector has driven the cost up, and
means an even higher load on a host.

3. The cost on a host of needing a dedicated Unibus, at $12K on a
780, means that this is looking more expensive and marginal.

4. I don't think we will be able to bound just what a system like
this will do when there are some number of terminals on it, due
to traffic interactions.

5. The VS100 is NOT customer installable, causing more expense.

6. Our customers wanted a standalone workstation, complete with
VAX processing all to themselves, and all we are giving them is a
shaky, dumb terminal that is expensive, slow and undefined.

7. The world, such as HP, is supplying the workstation they

want,
and on Ethernet to boot! (Maybe ESG should OEM the HP product.)

8. The next product of a MicroVAX driving a CRT is a true workstation, and we should build toward this end versus the dead
end we have taken.

Proposal:

1. Take the current Videoprocessor, lay it out and have it connect directly to the Unibus, say using 2 modules.

2. Put the Videoprocessor in the Low Cost Nebula package, giving
us a true Workstation that:
 can standalone,
 that sits on Ethernet and that can work with all VAX processors,
or that sits on Ethernet and has NO disk and can be used as a true Workstation where the files are operated remotely.

In making this, we have a worksation that fits on any VAX and can
be located at up to 2.5Km away from the host, versus tied to a
single host, and is compatible with what we will do on the VS300,
and the MicroVAX based workstation.

3. Don't offer the product on other VAXs, thereby making sure we
are able to offer a bounded, customer installable product.

"TO" DISTRIBUTION:

BRIAN CROXON PETER SMITH BILL STRECKER

"CC" DISTRIBUTION:

BILL DEMMER BILL JOHNSON KEN OLSEN
JACK SMITH

****
* d i g i t a l *
****

TO: EMC:
DATE: SUN 16 MAY 1982
9:19 PM EDT
OPERATIONS COMMITTEE:
FROM: GORDON BELL
cc: see "CC" DISTRIBUTION
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: THE NATIONAL CHIPS AS MICROVAX...

BACKGROUND

On December 1, I chartered Roy Moffa to run a task force to look at the problem of being competitive in the low end. He's worked with Cutler, Husvedt, Supnick and Strecker to come up with an aggressive set of alternatives. Jeff Kalb got us to look at National, and Ward has been a helpful sponsor.

Looking at the chart of Board, Personal Computer and multi-user System products, I think we can see that there's a big price gap caused by having the large, proprietary chips of the 11 and VAX.

1. VAX products are only in the large systems space. There's no plan to get a small processor that allows us to compete with the 68,000 at the chip, board, PC .
2. The 11 products are relatively expensive. A commodity micro is needed for lower cost products at board, controller (eg. VT200) and PC levels.

For the last few years I've maintained that the only important
variable of an architecture is the virtual memory size. The fact
that VAX provided 32 bits is why it's great. Similarly, a 48-bit
address for the System 38 is why I worry about it. The so called
16-bit and 32-bit micros are either 17-21 bits, or in the case of
a 68,000 the limit is really physical memory which is only 20-22
bits worth. Therefore, none of the emerging micros are aimed at
providing what VAX gives, except the National 16032 and 32032
which have copied VAX's paging scheme. Therefore all systems,
including the Hitachi and HP micros are going to have the
problem of address limits. Note that Appollo did a pager for
the 68,000 to get around the problem.

The 8086 is the established 16-bit standard and the 68,000 is
positioned to become the 32-bit standard with Motorola, Mostek
and Hitachi as the suppliers. The 68,000 with 32-bit data path
is coming, but the "fix" to add paging so that it can address a
large memory still isn't out in the open.

I don't think we want to let the 68,000 and the 68,000 when it
gets fixed with a 32-bit address become the sole standard.
Clearly, we can't stop them with VAX because we don't have the
design or distribution system for chips. The 11 is inadequate in
address bits. There's an important consideration of bus
standards too as the Motorola backplane is good, but not great.

The Unibus and Qbus are clearly inadequate to compete in the microprocessor market of the 80's.

ENTER THE NATIONAL 16032/32032: MICROVAX
It looks like we have a chance of getting back in the low end game by using the National chip and simply defining it to be MicroVAX for the following reasons:

1. It uses the VAX data types (byte, word, floating point and pages). Thus, all files will be VAX compatible. A higher level program will not know the difference whether it's computing on VAX or on National hardware.
2. There is less work in converting our software to be machine independent than being able to get a chip of the complexity we need for VAX. MicroVAX for PC use is about 100 man-years.
3. As we try to make higher performance machines (eg. VENUS), the complexity of the architecture means it cost more in time and to develop the hardware. This directly affects competitiveness. We are wrestling with the same issue on how to build a useful machine for DEC in Palo Alto.
4. By having portable software, VMS would get even better and easier to maintain.
6. By being portable, and machine independent at a higher level, we have the opportunity to make substantial changes to the underlying architecture for extended addressing and protection and make sure that all today's programs will run. If done right, we're buying future flexibility.

The task force is suggesting an aggressive offering providing the following:

1. Chips on the Qbus to go after board business. The software
would be an extension of Pascal and MicroPower for the real time
market!
2. Chips would be place on the CT motherboard immediately to give
us the first 32-bit Personal Computer (Hardware only). Dick
Husvedt wants to put a subset of VMS, called MicroVMS, on it so
as to run VMS programs as a Personal Computer!
3. We want to drastically increase the throughput of the bus
system. Therefore, we want to work with National and establish
BI as the new standard for microprocessor interconnect.

MICROVAX, PERSONAL COMPUTER SOFTWARE
Not everything would be converted. The goal would be to let
the programming environment be the same on the two machines.
The following languages would get MicroVAX back ends: BLISS,
Fortran, (PL/1,C,Pascal,ADA... that use the PL/1 compiler),
BASIC, ... Cobol?, Visicalc.

VMS becomes MicroVMS for Personal Computing. Here, EDT,
Mail, RTL, SORT, File utilities, debugger, DCL, Linker, and
radically different Screen manager for PC. Also, Datatrieve.

CHIPS AVAILABILITY
We could get 16032 chips now, with 32 bit data width version
called 32032 in December. The path width is irrelevant to
our needs except where it affects performance. A faster part,
the 32032A is available in early 84.

CHART OF CHIP, BOARD, PERSONAL COMPUTER AND SYSTEM PRODUCTS
VERSUS TIME

FY . 83 . 84 . 85 . 86 .

100K

sN sS/Aztec

```
40K

     sF      sJ
16K

         p350     pJ
6.3k                 pU pU+
         p325     pJ
                     pU PU+
2.5K


1.0K
             bJ
    bF       bU   bU+
400
```

notes
s= useable system; b=minimum useful board; p= Personal Computer

F=Fonz; J=Jaws; N=Nebula; S=Scorpio; U=MicroVAX=16032; U+=32032

NEXT STEPS
There are lots of issues with the above. In the long run it's likely to be cheaper as we move to a higher levels. In the short run, doing products we didn't expect will cost us.

Right now I believe that we ought to figure out how to do this MicroVAX, and if it still looks good, then go ahead.

What youse think?

"CC" DISTRIBUTION:

JOE CARCHIDI	DAVE CUTLER	BILL DEMMER
DICK HUSVEDT	JEFF KALB	ROY MOFFA
BILL STRECKER	BOB SUPNIK	STEVE TEICHER

****
* d i g i t a l *
****

TO: OPERATIONS COMMITTEE: DATE: SUN 25 APR 1982
12:32 PM EDT

FROM: GORDON BELL

cc: GEORGE A CHAMBERLAIN DEPT: ENG STAFF
JEAN-CLAUDE PETERSCHMITT EXT: 223-2236
CLAUDE SOURNAC LOC/MAIL STOP: ML12-
1/A51

SUBJECT: RECOMMENDATION OF EQUIPMENT TO WORLD COMPUTER CENTER

The Contributions Committee allowed 50% discount on the 600K 2060 these folks wanted. I believe this was quite generous and fair. The Operations Committee might consider some more help here in order to deal with the remainder in an expeditious fashion. Currently the other 50% would have to be gotten by the LSG group, or by European Marketing or by France marketing.

Every report says they are going strong there and will do well.
Mitterand is behind it and researchers and budgets are getting in place and working.

This remaining part is small to us, but could be one of the most positive marketing things that we could do in Europe and France. It would let the French Govt know we love them and we would get a number of researchers on our machines! The follow-on business when the technology gets exported will probably be worth it. In addition, they will end up buying a number of other machines too when the center gets going.

ATTACHED: MEMO;83

****
* d i g i t a l *

****

TO: JEAN-CLAUDE PETERSCHMITT DATE: FRI 2 APR 1982 3:58 PM HEC

FROM: CLAUDE SOURNAC

cc: GORDON BELL

DEPT: COUNTRY MANAGEMENT

EXT: 1848

LOC/MAIL STOP: PARIS/EVRY

SUBJECT: WORLD COMPUTER AND HUMAN RESOURCES CENTER

Following my suggestion of December 12th, 1981, I want to propose
that we make a donation to the World Computer and Human Resources
Center.

This Center, created by FranMITTERRAND and to which partici
pate famous scientists like Seymour PAPERT (MIT), Pierre BOULEZ
(France) and is headed by Jean-Jacques SERVAN-SCHREIBER as Presi
dent and Nicholas NEGROPONTE as General Manager, is going to em
ploy 100 scientists (50 from France, 50 from other countries).

In spite of a strong pressure from French bureaucracy to buy CII-
HB equipment, they decided to go DIGITAL. Their project is to buy
immediatly :

1 VAX to DEC France
30 SU VAX through MIT

and they ask us to make a donation of a DEC 20/60.

I had yesterday a meeting with Jean-Jacques SERVAN-SCHREIBER and
Nicholas NEGROPONTE and I got their committment to make publicity

for DIGITAL. I consequently see many advantages in this operation

* 100 people (of which 50 French) will permanently work and make programs on our equipment, to which we should add all the participants on a non permanent basis.

* It will be a permanent window for us.

* It will open doors with Government officers who will get a fee ling that we are somewhat privileged.

* The fact of seeing that President MITTERRAND himself has allowed the Center to use DIGITAL will give more courage to buy DIGITAL potential users belonging to Government protected market.

* Knowing Jean-Jacques SERVAN-SCHREIBER, we can be sure that a lot of advertising will be made around the Center and consequently around DEC.

* It will be an excellent publicity against competition and build a good image of DEC both in LCG group and VAX group.

* It will motivates our employees.

* Last, but not least, the Center's activities seem interesting from the human point of view and it would be good to have DEC participating to it.

Consequently, I would like to ask the Donation Committee to consider favourably their demand.

Nicholas NEGROPONTE is meeting Gordon BELL on Monday 5th. He will

mention him that he needs fast delivery. On our side, we would do
the maximum to help for fast installation of DEC 20. We are delivering a VAX 780 next week, the order of which will be confirmed end of April if we reach a global agreement.

Best regards,

GB3.S4.27
SEPTEMBER 25, 1981

Mr. Jack Worlton
U.S. Department of Energy
Office of ADP Management, MA-50, GTN
Washington, D.C.   20545

Dear Jack:

We Really enjoyed the two lectures and interaction.

See you in October.

Sincerely yours,

Gordon Bell
Vice President,
Engineering

GB:mal
ID#GB2.S8.15
****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION DATE: FRI 15 FEB 1980
4:33 PM EST

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION DEPT: OOD

EXT: 223-2236

LOC/MAIL STOP: ML12-1
A51

SUBJECT: STAND-ALONE AND SHARED WPS BUYOUT FOLLOW UP:
2/29/80

Julius is really hurting in the market for a shared system.
He is
suggesting that we look at a buyout.

Can we get a list of the possibilities and what they look
like?

Please explore the stand-alone (e.g. WP-11) too?

GB:swh
GB1.S2.2

"TO" DISTRIBUTION:

GEORGE THISSELL TOM VLACH BRUCE
STEWART

"CC" DISTRIBUTION:

STAN OLSEN ROGER CADY JULIUS
MARCUS
JACK GILMORE

****
* d i g i t a l *
****

TO: KEN OLSEN DATE: SAT 18 APR 1981
15:47 EST

FROM: GORDON BELL

DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: RE: FUTURE PACKAGING OF 278 AND 11/23

It would seem the CT crt is most ideal. It does tilt, it only is the crt and can be positioned anywhere.

I think you have a runaway situation with the cabinet. It was the goal at one time to be able to ship it in a cardboard box
through UPS and have the customer put it together like
he does a hifi. Now, through a series of minor transformations
you have incremented the thing to a stationwagon as being defined
as what portability means. I don't have a stationwagon, nor do
I intend to get one. I suuspect that there are other customers in the same boat (or without this sort of boat).

Apple is going to continue to cream us. The 278 will only help them by further draining our cash. I figure their ACE is the Apple III with lots of memory AND a Very Good WPS system which is finally possible because of the screen, the bigger memory and their expandability. Note the add in the May Scientific American.

The reason Apple will get more sales than us or Wang is the carriability (We need a word cause you have destroyed the meaning of portability) by having it associated with the 278. (As a by-product of stationwagon portability, you get a whole set of costs ... that we ignore in our costing
and thinking. Since they are there, it either means continued
negative profit on each one or continued ignoring us in the marketplace.

Damn it, We gotta have a computer that the user can use in many of the varied ways he will, it has to be carriable, assemblable and expandable. Also, it had better be big enough to get our software on (probably 128K ... not 64K as we dreamed last nite).

GB2.S6.3

****
* d i g i t a l *
****

TO: MARY JANE FORBES   DATE: THU 26 MAR 1981 21:11 EST

FROM: GORDON BELL

cc: JOHN KIRK   DEPT: ENG STAFF

EXT: 223-2236

LOC/MAIL STOP: ML12-1/A51

SUBJECT: THE 278 I HAVE; I'LL BE HOME ALL WEEKEND AND I WANT IT UP

I have been delivered a piece of disfunctional crap!

Pleae call the necessary hardware and software engineers and get the god damn thing fixed.

Paula left me a note indiceating a problem with it
in reaggard to whether it types correctly
when initiallized.

Also, it has the same bug it used to have when initialized in terminal mode. namely, I think it thinks its a typewriter.

In this regard, typing rub out evokes a backslash, not a backspace
and a delete.

It sounds, I think, noisier than the 78.

I thought this had been checked before it was delivered.

I don't know whether it works as a wps cause there is no floppy, therefore, bring a floppy.

I gotta have this system up, and I don't like being left with no operational system.

Please get people moving as I have a heavy weekend ahead and as of this instant, there is something'th that is worse than a dumb terminal staring at me.

GB2.S5.26

****
* d i g i t a l *
****

TO: MIKE GUTMAN   DATE: TUE 9 JUN 1981 9:25 EST

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION   DEPT: ENG STAFF

EXT: 223-2236

LOC/MAIL STOP: ML12-1/A51

SUBJECT: THE 278 ORG., THE LOW COST COMPUTING KEYBOARD AND JOHN KIRK

I think Ken and I unknowingly have been pulling at both ends of John. I've been working with him to go after the very low cost computing keyboard; and Ken, very concerned about the 278, has been pushing him back into the 278. This is what we'd use for building the portable and very low end wps.

Our first priority is clearly to get the 278 out, and to have it successful, including any enhancements involving John. For

starters, Mike, could you get the 278 organization clearly spelled out so there are full-time persons on the 278 with a clear organization and clear decision making? I'd like Ken (and
I) to feel comfortable with the organization. If John is essential, then let's try to get him back in full-time, otherwise, he could continue as it's primary designer and consultant as in the past.

GB2.S6.27

"CC" DISTRIBUTION:

DON GAUBATZ JOHN KIRK SI LYLE
KEN OLSEN

00 BURT DECGRAM ACCEPTED S 17002 O 13 09-MAY-81 12:33:23

****
* d i g i t a l *
****

TO: TED JOHNSON DATE: SAT 9 MAY 1981 12:29 EST
SI LYLE FROM: GORDON BELL
cc: see "CC" DISTRIBUTION DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: RE: KHO'S MAY 4 MEMO RE APRIL 18 OC MTG - 278 PROPOSAL

I sent a note to Gary Cole to present this. Please contact him to get it on the meeting agenda. I also suggest that Gary have the whole team photographed and sent to OC. We also
should put down an organization chart.

The big question: are we going to sell it in any interesting

way, or are we limited, as we have been in the past by selling
through the small, but high quality wps p/l?

Have just asked Bruce to look at things that make it better (faster). Despite Ken's enthusiasm and that of our secretaries,
I don't see it beating anyone in terms of price and performance
... and competition is just going to get worse.

Therefore, given that we have only a so-so product, we are going to be totally dependent on our proven, superb marketing.
At some point, there should be a business plan that says this is going to be done well in terms of units, profit, etc.
There just has to be a way to get the product to our own customers, otherwise, we are doomed to the current abyss!

At least the 3 wps systems I typed on at NCC seem to be faster
and cheaper to produce (Burroughs, IBM, and Wang). I suspect there were many more in the basement that the Japanese had.
This, simply means the burden is on finding some way to market
the 278, cause the product will not sell itself. If we can now, just be REALISTIC and CALM about the situation, we have a chance to do something, if we persist in pandamonium, we will continue to get creamed.

Please, please, let's start thinking and stop shouting.
We have a real, important marketing opportunity.

"CC" DISTRIBUTION:

G COLE AND O STONE STAN OLSEN HERB SHANZER
BRUCE STEWART OLLIE STONE

GB2.S6.37
00 BURT DECGRAM ACCEPTED S 16041 O 34 20-APR-81 11:00:41

****
* d i g i t a l *
****

TO: OLLIE STONE DATE: MON 20 APR 1981
10:59 EST

FROM: GORDON BELL
cc: see "CC" DISTRIBUTION DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: RE: RE: NOTE ON CONTROL OF THE 278

I don't think the 278 is going to matter very much in the grand scheme of things. Let's start now to get it under control though. I believe, probably like Ken, that the main thing is to get the 278 out. All the folks working on it would
have charged their time to something, but with the 278 as a cause they've probably worked much harder and with more focus. Thus, from a corporate viewpoint, we are probably ahead. Also, the decision to switch package
types was made by Ken, I believe, and given this, it's up to you to get the best deal we can with it. Is there anyway we can salvage the parts and use them internally?

Just get us under control as best you can... but get the product out.

"CC" DISTRIBUTION:

TOM CAMPBELL BILL JOHNSON SI LYLE
STAN OLSEN

GB2.S6.5
00 BURT DECGRAM ACCEPTED S 14901 O 25 02-MAY-81 16:12:21

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION   DATE: SAT 2 MAY 1981
16:03 EST

FROM: GORDON BELL

cc: STAN OLSEN   DEPT: ENG STAFF
    OPERATIONS COMMITTEE: EXT: 223-2236
    OLLIE STONE   LOC/MAIL STOP: ML12-
1/A51

SUBJECT: THE 278, WHAT COST, WHAT PAYOFF, WHAT RISK?

I think we had better start listening to our engineers. I'm ready to. Shall we get together this weekend, or how about early monday morning. This sounds like a potential disaster of even greater proportions.

If/when we get the new stand, it will be a megabuck project. Is this really going to get us any increase in sales? At an increased cost, I have real trouble in answering why we should do it.

"TO" DISTRIBUTION:

DAVE KNOLL   SI LYLE   KEN OLSEN

ATTACHED: MEMO;180

****
* d i g i t a l *
****

TO: STAN OLSEN   DATE: FRI 1 MAY 1981
14:16 EDT

FROM: OLLIE STONE

cc: see "CC" DISTRIBUTION   DEPT: APPLICATIONS
                                            EXT: 264-7480
                                            LOC/MAIL STOP: MK1-
1C6/1C6

SUBJECT: THE DECMATE PEDESTAL DISK SYSTEM d i g i t a l INTEROFFICE MEMORANDUM

TO: Stan Olsen

DATE: 01 MAY 81
FROM: Gary Cole
DEPT: DECmate
Product
Mgr.
EXT: 264-7478
LOCATION: MK1/1C6

SUBJ: The DECmate Pedestal Disk System

Over the last two weeks I have become increasingly concerned about this product and whether it is a viable device for CPG to commit its 100m$ plan to for 1982.

First Issue: Product Readiness

The product is not going to be ready for ship by
the end of May. UL/CSA certification will be delayed
until mid-July (nothing ships without it.) DEC 102
testing is not completed and the unit fails drop test,
FCC and static testing as of today.

Second Issue: Product Design

The product design is good in concept, but not so
good as implemented. It is virtually unserviceable by
the average terminals group field service technician.
Over an hour is required to replace a drive, twice as

long as servicing the RX78. The pedestal is mechanically unstable - top heavy, and requires an extendable front foot assembly to be used when the keyboard shelf is attached. 3) It is noisier than our existing RX78 4) Although it is not at all hard to "install", you must have an elevator and fork truck to move it (>150/LBS) which seems to be to be the wrong requirements for a customer installable product. It cannot be carried in a car without 2 or 3 people to lift it in or out.

Third Issue: Product Cost

The pedestal disk was intended to reduce our system cost by 180 dollars. Recently it has been determined that its 1982 manufacturing cost will be $435 more than a table top RX78 system and $271 more than a H978 mounted system. These figures are the most recent available from new products group in Westfield and are 40% above the engineering estimate of last month. This reduces our gross margin by 3-4 million dollars in CPG in FY '82. I consider this totally unacceptable.

Fourth Issue: Product Risk

We are putting the entire future of WPG and RPG on the line when we start delivery DECmates, I believe that we have a substantial risk of catastrophe by proceeding with the crash project production and ship of the pedestal system. I have interviewed most of the members of the 278 project team and find that most of them share this view for various specific reasons.

Recommendations:

1. DO introduce the DECmate using the RX78 tabletop floppy and H978 optional desk, as scheduled at the end of June.

2. DO NOT introduc e or commit to delivery the RX02-P pedestal disk until

   a. DEC standards are met, UL/CSA & FCC compliance is achieved.

   b. Cost is, at the very least, made competitive with the RX78/H978 and consistant with our business plan.

   c. Serviceability and quality issues are brought up to reasonable issues.

3. If it does not appear that (2) can be achieved with 6 months, then let's abandon this effort and direct the funds toward the minifloppy, which is certain to reduce cost of our system by 500$ or more.

Other than the pedestal, the 278 if fully ready to be shipped in high volume as a highly reliable, customer installable product. I recommend that we do so.

I also recommended that we reconsider making the H9780 (Cube/Desk) assembly available as an extra cost option since it is very attractive and makes a very functional workstation. The design of that product is complete, and a hundred units are in stock.

DECmate Transfer Cost Summary

FY '82 Transfer Costs. (Actual or best estimates as of 4/30/81)

Components

RX78-RA (existing tabletop RX02)	$1063	<committed>
RX02-PF (new pedestal RX02)	$1498	<estimate>[$1073 planned]
H978-AA (existing 78 stand)	$164	<committed>
VT278-AA (@10K build rate)	$1172	<committed>

2-drive systems (95% of sales)

VT278 with RX78	$2235
VT278 with RX78 with H978	$2399
VT278 with RX02-PA	$2670

4-drive systems (5% of sales)

VT278 with 2-RX78 with H978	$3562

VT278 with RX02-PF $3586

At a volume of 10,000 sales in FY '82 the use of the RX02-P will reduce gross margin by 4.3 million if H978 were to sold as an extra cost option on RX78 system or 2.7 million if the H978 was bundled into every system at constant price.

jp

Distribution:

Gordon Bell
Buzz Brooks
Tom Campbell
Don Derome
Dave Dorschel
Paul Gardner
Paul McGaunn
Dave Knoll
Si Lyle
Ken Olsen
Dick Price

01-MAY-81 14:22:22 S 11596 EMMK

"CC" DISTRIBUTION:

GORDON BELL	BUZZ BROOKS	TOM CAMPBELL
DON DEROME	DAVE KNOLL	SI LYLE
PAUL MCGAUNN	KEN OLSEN	DICK PRICE

GB2.S6.34

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* d i g i t a l *
*****************
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TO: BRUCE STEWART DATE: THU 23 APR 1981
11:17 EST

FROM: GORDON BELL
cc: STAN OLSEN DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: OUR PERFORMANCE IN MEETING 8-BASED WPS COMMITMENTS

I think it is necessary for us, Owen and Stan to meet and
discuss
history. Get a history of: date, content, commit date, and
actual
date and then we'll meet.

Stan is worried about our ability to meet dates and be
competitive in
the 8 area. Let's discuss this.

Also, we should discuss why this is not going to be the case
in the
16-bit area. What's different? We want a very responsive
development/introduction cycle that is much better than the
278 in
order to be competitive. What's the best we can do here?

GB:swh
GB2.S5.39
DO TO A PROBELM WITH CLEM, YOU DID NOT RECEIVE THE FIRST
ISSUE OF THE FOLLOWING MESSAGE:

FROM: GORDON BELL DATE: FRI 18 JAN 1980
12:47 PM EST
DEPT: OOD
EXT: 223-2236
TO: STAN OLSEN

BOB GRAY
BILL JOHNSON
SI LYLE
JACK GILMORE
BOB DALEY
BOB TRAVIS

CC: BRUCE DELAGI
DON ALUSIC
ROGER CADY
GEORGE PLOWMAN
STAN PEARSON
BILL PICOTT @MR16
OOD:
OOD: @CLEM
OPERATIONS COMMITTEE:
OPERATIONS COMMITTEE: @CLEM
OPERATIONS COMMITTEE: @MR16
PMC:
PMC: @MR16

SUBJECT: WPS ORGANIZATION FOR ENGINEERING AND PROGRAM MANAGEMENT

As part of the evolution and expansion of Word Processing within Digital, we are planning on making the following organizational moves within the engineering and product management function. It is not anticipated that there be any structural changes within the various organizations, except expansion to meet the product development needs. The groups will remain located in Merrimack.

1. Jack Gilmore and the Program Management function for Word Processing will report to Si Lyle as Program Manager for Office Information Systems, OFIS. This will include the current and future Word Processing products, various editors with

word
processing capabilities and the Electronic Mail System under
development and future office applications.

2. Bob Travis's Word Processing Software Engineering organization
would become part of the Software Engineering organization in
Merrimack and report to Bruce Stewart.

3. Bob Gray's Word Processing Hardware Engineering organization
would become part of the Engineering Organization in Merrimack
and report to Brian Fitzgerald.

This move is designed to give greater emphasis on OFIS products
within our basic central products, especially their availability
on the 11 and VAX products. This follows direction from last
year's Product Strategy. Also, there will be greater
emphasis on converging current, standard editors to be part
of the OFIS system in a compatible fashion to build off the
strong field sales support and customer base and the WP
Product Line.

The current and planned hardware and software developments will
continue on the 8 based systems agressively, since the 8 will be
the mainstay WPS product for the foreseeable future!

GB:swh
GB1.S1.27
00 BURT DECGRAM ACCEPTED S 10796 O 56 14-FEB-81 14:53:37

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION
14:50 EST

cc: JOHN LAI
JACK SMITH

DATE: SAT 14 FEB 1981

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: GETTING THE WPS MARKET; COMMENTS BY REDPATH (AND GB)

Fundamentally we have a paradox now within DEC when we have a product line that's fundamentally a very high volume product because by definition:

Winning as a product line means losing the market!

In the 2 cases of channel/product, product lines we have to lose cause we can't get the necessary coverage to get market share. Product goodness is generally irrelevant because better products wouldn't get us much more total market share. We should clearly recognize this dilema and set about to constructively solve it by beefing up the Product Lines that provide us the natural learning and feedback mechanisms and focus that we must have to make and tune the products. All I want is a way to "get the market share".

Plan I

On Thursday, I hope to get from Bruce a collection of packaged systems we can make out of parts in inventory (eg. 11/34's, RK's of various types, and VT100's) that we can deliver starting in FY82 in high volume so that potentially we can PUSH OUT SOMEWHERE BETWEEN 250 AND 500 MILLION $ IN REVENUE TO THIS MARKET, SO AS TO BECOME A SIGNIFICANT SUPPLIER! This only means about 10% more NES and everyone selling! This would be organized as some sort of task force to get the right, fixed configurations so that we minimize the paperwork, order

processing, etc. in a streamlined fashion for the field folks.
If we can put together these systems from inventory, we have the potential to solve one big part of the inventory problem and at the same time, get the market. In such an exlosive environment, Buzz, will by any means, end up as a heroic Product Line, and furthermore as a PL entity will be essential for expertise.

Before we go off in any direction to push this, the first 2 steps would seem to be: can we get the products (Buzz and Bruce); and then test within the folks we have whether we are convinced we have the products to do this. Here, I'd like to get a few key veterans to look at this, like Ray Redpath, and ask them for a gut reaction. Then, we go into the 3rd phase, looking at how we'd partition the business to maximize ALL EXISTING SALES AND PRODUCT LINE CHANNELS. This would be done under Buzz's leadership, with some arbiters.

If I'm wrong in any of this, then I say we should relook at the whole mess, and then, I submit we should probably look at going about the business this way. This is plan II.

I'm confident the OFFICE products approach is going to be very good and competitive, thus I want us to be ready for them too. Also, from an engineering perspective, we are spending about $10M/year (and with engineering overhead this amounts to $20M/year). Since this is representative of the 8% corporate engineering number, then we should be getting about $240M/year in NOR. I believe with these products, we can easily get this amount, and I'd like to see us go for it.

Given, this feeling about the products, it seems essential that we ask for an independent assessment by the sales, marketing folks and perhaps an outsider. Clearly what I'm advocating is a radical change in our thinking, and that alone is probably a reason to reject it and go back to our old way of waiting to see if the customers beat our doors down to buy the product, then running around like crazy to see if we can deliver them. (Here, this approach is probably not going to work cause there's no way for them to find out that we have any products.)

As officers and members of the marketing committee, we ought to try to sort these issues out calmly. The time is right!
Can we discuss it on Thursday?

"TO" DISTRIBUTION:

BUZZ BROOKS MARKETING COMM: BRUCE STEWART

GB2.S4.26
****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION DATE: WED 16 JAN 1980 10:13 PM EST

FROM: GORDON BELL

cc: WIN HINDLE DEPT: OOD
BILL THOMPSON EXT: 223-2236
LES STRAUSS LOC/MAIL STOP: ML12-1 A51

SUBJECT: LET'S WRAP THIS UP TOMORROW!!

I am sending you a copy of the document that Stan and I should co-author and send to the developers. I expect Stan to reply to it by making changes and/or additions to strengthen the support for current direction. Then, we'll send it to the troops tommorrow, followed by our visiting with them and reassuring them that we mean that WPS really is important (VITAL) to DEC. We can't lose anymore programmers in the 8 and WPS domain....

"TO" DISTRIBUTION:

STAN OLSEN LARRY PORTNER BILL JOHNSON

ATTACHED: MEMO;22

****
* d i g i t a l *
****

TO: GORDON BELL* DATE: WED 16 JAN 1980 8:20 PM EST

FROM: BILL THOMPSON

cc: LES STRAUSS DEPT: CORPORATE CONTROLLER

EXT: 223-3779

LOC/MAIL STOP: MS C12

SUBJECT: WP

DISCUSSED WP WITH LES THIS EVENING HE HAS ALREADY CALLED B-J BEGGING FOR HELP. THE SITUATION FROM A PRODUCT VIEWPOINT GETS WORSE BY TH HOUR!

IN ADDITION TO YOUR EMS TO STAN THIS EVENING PLEASE BE SURE B-J HAS A SENSE OF URGENCY. WE CURRENTLY CAN NOT SHIP PRODUCT,
HAVE 250+ SYSTEMS IN THE FIELD, AND AN UNCERTAIN GET WELL DATE.
B-J IS ON VACATION NEXT WEEK SO AN ADDITIONAL REASON TO BE SURE
WE ACT ASAP.THANKS!

GB1.S2.20
****

* d i g i t a l *
****

TO: see "TO" DISTRIBUTION DATE: FRI 15 FEB 1980
4:42 PM EST

FROM: GORDON BELL
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1
A51

SUBJECT: WPS P/L AND PRODUCT DIRECTION

Stan is considering two WP product line groups: stand-alone and
shared.

Over the next two years the product directions look like (in priority):

1. Fix the shared systems; make the enhancements that are morally, legally and business-wise necessary. Sell it! Don't do combined WP + Data Processing using Dibol - do only WP.

2. Get the 278 out and aggressively cost reduce it to get the big stand-alone market. Incorporate the functional enhancements of the shared systems into the 278 that are easy to do.

3. Plan and implement the OFIS program for large, shared systems on non-8 standard sytems ASAP in a WPS compatible fashion. This includes EMS.

GB:swh
GB1.S1.75

"TO" DISTRIBUTION:

STAN OLSEN GEORGE THISSELL ROGER CADY
JULIUS MARCUS HERB SHANZER OLLIE STONE
JACK GILMORE TOM VLACH BRUCE
STEWART
BRIAN FITZGERALD GARY COLE VIA OLLIE STONEMARKETING
COMMITTEE:
MARKETING COMMITTEE: @CLEMMARKETING COMMITTEE: @MR16
OOD:OOD: @CLEM
****
* d i g i t a l *
****

TO: BUZZ BROOKS DATE: THU 29 JAN 1981
8:21 EST
KEN OLSEN FROM: GORDON BELL
STAN OLSEN DEPT: OOD
JACK SMITH EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: WPS PRODUCT LIST

WPS Product List

WPS 78 System
    WPS 78
    LA 120 or LA 180 or LA 34 draft printer
    DP03 (1200 baud modem) (announce 4/27, FCS 5/15--likely to
      slip a month)
    LQP01 Letter quality printer

WS200
    Base system, with LQP and LA180 printers, modem
    Add on RL01's
    Add on multi terminals VT100 (WPS version)

WS278 (being introduced 4/81, and fcs 4/81)
    Base system, with LA34, LA120 or LA180 draft printer
    DF03 modem
    LQPSE serial printer, LQP02 Later (Q2 '82), Auto Sheet Feeder
    option on both

DECWORD 11 (introduced 6/81, and fcs 8/81)
    Base systems are 11/24, 11/44, 11/23, 11/70
    Extra VT100W's
    DF03's

Add-on DECWORD to standard RSTS Systems (same as DECWORD 11), and
    sold as bounded system through PL40

Electronic Mail (introduced ?, and fcs 2/82)

GB2.S1.33

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION   DATE: MON 9 JUN 1980 9:10 PM EDT

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION   DEPT: OOD

EXT: 223-2236

LOC/MAIL STOP: ML12-1/A51

SUBJECT: WPS STRATEGY, ESPECIALLY THE 200

Our meeting tonight seemed to focus on the issues of whether to continue on with the 200. More than ever, it has to be a marketing commitee approval as to whether to continue to sell it.

My position on the 200 is still the same: Engineering- it will

require more enhancements both for market viability (to comm. with other systems, and all the other things that got us the long list of enhancement needs), and for Europe. It has different
code than the 78/278 hence it will take our resources. It is definitely interim and I can not see blowing any more resources
on a direction that we don't want to go in.

Customer/sales perspective- given the interim nature of the product and likelihood of needing communications or extra processing capability as my wps people get more sophisticated,
I can't see selling it (buying it if I think customer wise) when
it has such a clear, limited life.

Field service perspective- 8's just don't have the spares, the
training, the diagnostics and the overall learning that is needed to make this a really solid product. Also, the power density of 3 RL's in a cabinet makes me wonder about it and certainly makes me make sure it gets the DMT it must have.

Overall, I don't believe it is in our best interest or our customer's to sell it.
It morgages our future, gives dreams that won't be fultfilled (I still believe customers are buying futures as they know computers evolve and get more feature with time), and will not
perform. Worst of all, it is interim and takes us in a direction
we don't want to go.

I STILL CAN STILL UNDERSTAND THAT WE BELIEVE WE MIGHT HAVE TO SELL IT TO GET MORE PEOPLE ON TO OUR SYSTEM BASE ... but this has to be really quantified against the above risk.

We have to come forward with the alternative that is part of the long range which puts the DX filing capability on RSTS and other systems to be the multi-terminal alterhnative. This

would give us the capabilities including the communications ones and have us use a base that can be built on.
Furthermore,
we can sell future because we are planning to put a multi-dumb
terminal version out. In this way, we could sell the 78 and 278 and then evolve nicely into the multi-dumb terminal version
whether it be with DPD or our own. This is completely aligned
with our current direction and it doesn't represent an alternative
interim product that we will have to back out of.
Furthermore,
we can sell any number of existing users of RSTS users on our current WPS stand along systems with confidence. It will also let us reference sell the DPD system.

Tom and Bob,
We are asking for the status of the RSTS DX package that we have and when we could have this part of our product direction
done. It would be mandatory to be able to demo this pretty quick and to have a clear direction that we could sell. The product is quite low risk, but we do need to be able to give a strong message and direction.

"TO" DISTRIBUTION:

BUZZ BROOKS   BOB DALEY   TOM VLACH

"CC" DISTRIBUTION:

DICK CLAYTON   JACK GILMORE   BILL
JOHNSON
STAN OLSEN   LARRY PORTNER

GB1.S5.5
+--------------------------+
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+---------------------------+
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SUBJ: Attached WPS Tree

TO: Buzz Brooks, MK1-2/H32 Date: 6/30/80 Mon
Bob Daley, MK1-2/E06 From: Gordon Bell
Jack Gilmore, MK1-1/C12 Dept: OOD
Si Lyle, ML12-1/T39 MS: ML12-1/A51 Ext: 223-2236
Bruce Stewart, MK1-2/E06 EMS: @CORE
Bob Travis, MK1-1/J14
Tom Vlach, MK1-1/N34

I made this from Jack's history and trees. Jack can you and Bob Travis clean up the history, and clearly define future parts showing the relationships of various versions to one another and possibly noting releases? Also, we might show "look alikes" on another line. I think we can use it to define future scenarios. Also, it is vital to understand from where we came.

Jack I'd also like a semi-log graph showing cost, and cost/terminal vs. time. This would also have competitor products and futures. These are critical to our future planning. These would be part of the history update.

GB:swh
GB1.S5.17

Attachment - WPS Slide
Thoughts on the dilema of introducing 3 PC's, particularly the 8.

TECHNICALLY it's suicidal to continue with the 8 and do enhancements because the 8 addressing causes inherent complexity in what would be very simple programs. I can explain this in 10 minutes and would like to because it's something all of us MUST understand. It's also the reason why the 11 bottoms out when compared with VAX or the 68,000. What the technical limits mean are simply:

.WE CAN NOT BUILD, LARGE, RELIABLE SOFTWARE ON THE 8!
.THE COST TO BUILD SOFTWARE IS OUT OF SIGHT. WPS has cost us

in the neighborhood of 10 million for 100K instructions. I think this could have been done in less work (due to complexity). This means the cost per instruction is 100-200.
.The cost to add new instructions is also prohibitive. 2 milllion for less than 10,000 instructions, or 200 per instruction.
.The complexity also means unreliability, hence not being able tor produce in volume. Note the problems and dear Ken's surrounding the old WPS 200 that we are still experiencing. Ken vibrates on his own 200 there and its unreliability (and sharedness). This is simply a volume issue too. CSSE doesn't know how to cope with it.
.Worst of all, we program so slowly, the features makes us uncompetitive. No way can we track IBM who programs in PL/M and uses the 8086 for their stand alone WPS.
.There are a small supply of machine language programmers
.The benchmarks say that you can get work done faster on a Wang, independent of what we and our secretaries say.

BUSINESS-WISE, it's suicidal to continue it in anything but hyping it as a Word Processing terminal for shared system or a typewriter in the office market. Large disks, all the other things mean more expense and loss per system. From all appearances, a WP System seems to be regarded as a computer in that people expect enhancements.

I don't see why we can't use the CAT and do all the things the 8 would do and at the same cost. This would give us a good WPS base, rather than a flaky one. Of course, our long term strategy is a code that could run on CT and VAX. Maybe this could be extended to CAT since it's in a higher level language, albeit our own.

EXTENDING THE 8 INTO THE SMALL BUSINESS MARKET IT PROBABLY EVEN MORE SUICIDAL I don't see any way to get the kind of software that the market says it wants without really coupling into the software publishing world. The CP/M card may be a possibility, if the quality is there vis a vis interacting with the 8.

For the newcomer, the 8 is not the beginning, just the beginning of the end ala TRAX! A few customers could really give us a black eye in the same way TRAX did. There will eventually be expectations when all the limits get hit and all the cases get tried.

Bottom line
We are on a slow, expensive, road to nowhere. If anyone follows us, they will be sorry (and very angry with us).

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* d i g i t a l *
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TO: see "TO" DISTRIBUTION DATE: SUN 12 APR 1981 13:42 EST

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: WE HAVE TO HAVE A WORKING 278 BEFORE WE CAN SHIP IT!

I don't believe the 278 is anywhere near being ready to produce.
It doesn't have the quality, nor does it appear to have been adequately tested prior to it being available to me as a test site. It seems to have all the old problems. The package is disappointing too. I trust these will be solved by the new Gonzales/Olsen package.

Something is wrong with the software/firmware:
.the auto-repeat when you hold down the keys is simply not acceptable and THE PRODUCT WILL NOT BE SHIPPED UNTIL THIS GETS FIXED! I'm tired of these kind of sloppy products, so get it fixed. The VT173 editor on VAX works right, ie. when you hold down the key, the cursor takes off and moves slowly at first, gets faster and in no case moves faster than it can execute. In the 278, holding down the key executes a bunch of commands and eventually they get executed, but it's too late. In the case of the editor, it would seem that you have to remove the function from the terminal macrocode, hand it to the editor to deal with. This auto-

repeat
can work very well, but it has to be designed, not a free for all between the hardware and software folks.

.The cursor seems to be the wrong shape, and I find it disruptive. This was mentioned before. We have some folks who can help immediately on this one, get help.

.This particular keyboard sticks. I thought we got all these out
of the system. If a customer gets one, he'll simply by Wang next time. I hate to think of all the customers who ended up with these keyboards on VT100's and LA's who thought they were
buying quality products.

.When you come up in terminal mode, it could simply report that
it's a vT100, assuming it is. This one drives me crazy cause EMS thinks it's a printer, and I get backslashes instead of backspaces.

.Our WPS Polish Editor. It is increasingly clear to me that this editor is sure costly in terms of the way one deals with the page and cursor. Recall that a Polish editor is one that instead of positioning the cursor to find something, positions
the page. Several months ago I requested that we
try an experiment and build the changes so that it works decently. We know how! EDT, the VT173, the VT134 editor, etc.
all work fine. Let's have a trial change fix for this within two weeks. If you don't have the proposed change, then let me
know.

.The machine I have occasionally produces flaky patterns on the screen. Under certain circumstances, there are random marks that go across the screen. This ain't quality.
Is the machine electrically screwed up? Is it a timing bug where the machine can't keep up with the real time and hence paints garbage? (If there is a timing problem,

then let's figure out how to put up something decent, or to blank the screen for a whole cycle. If the software knows when something is missed, then it would be best to simply turn off the display for the rest of the scan.) Again, do you know about this problem?

.Glare. I trust Ken is solving this one. iIt has to be solved.

.I like the printer, though am anxiously awainting the LA24.

PACKAGING
.I hope Ken has a place for the modem, spare floppies, the manuals (we haven't given him this requirement), a place for often
used information (phone numbers, instructions) and paper.
It would seem that if we have the two floppy case, the extra two floppies could be dummies and be replaced by drawers. Is there enough room to store papers, floppies?

Frankly, I am extremely disappointed in the 278 I have, cause we spent
an incredibly long time last summer in trying to work on all these
details with the Industrial Design group. The 278 is only attended to
superficially. MORE THAN EVER, I WANT THE INDUSTRIAL DESIGNERS OF THE
PRODUCT TO CO-LOCATE WITH THE PRODUCT DESIGNERS, NOT WITH THEMSELVES.
DICK SCHNEIDER AND JOHN HOLMAN, IS THIS CLEAR?

We can take several attitudes about the system (a rehash of what we
discussed last summer when we swore we would stop designing crappy
products:

1. build components, they are small, unobtrusive and it's up to the
user to make it into a clean system and be something useful

2. build it as a system as good as we know how. Unfortunately, like
the 278, this may take up a lot of space, solve many problems
but doesn't go all the way. The user has to deal with the manuals,
floppy storage, paper holder. If I use the 278 I have for
very long, then'll try to get sound deadener (auto parts store), a
good paper holder somehow, put a drawer in it for floppies, and put
a book shelf under it where my legs go. The modem and telephone on
top of the crt though kludgy looking is functional as hell. (Note,
I have to solve Ma Bell's problem cause the modem carrier rings in
my ear... I simply can't believe that Ma Bell has any notion of
quality! We should all laugh when we hear that Ma Bell thinks it is
going to, should or can compete with IBM.)

3. build a set of modules so that the user can build a good system
without having to be a total designer (like case 1), nor a redesigner.
Frankly, I would hope we could take approach 3 with the NEW 278. Ken
believes this is what we have in the new 278.

I hope we are designing for the Dreyfus average man. As one who is
only about 4# heavy in regard to the average, I hope we get these
problems solved before we deliver the product.

Am anxiously awaiting the next version.

It's clear we have the knowledge to build a great product,
now let's get the details completed so we really have one.

"TO" DISTRIBUTION:

GARY COLE AND STEWART   RICHARD GONZALES   JOHN HOLMAN
JOHN KIRK   KEN OLSEN   OWEN FISKE
AND STEWART
DICK SCHNEIDER   HERB SHANZER   BRUCE
STEWART

GB2.S5.64
****
* d i g i t a l *
****

TO: KEN OLSEN   DATE: WED 15 APR 1981
19:40 EST

FROM: GORDON BELL
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: RE: NOVEMBER 1981 FIVE YEAR PLAN MEETING

There are lots of folks involved with the 278.
This was a golden rule project. In retrospect, I goofed by agreeing to do it. It was a typical, kamakazee job like all the others in the low end, done with a small crew of hardware folks, for an inadequate amount. We spent millions in software though in a completely unbalanced way.

Remember the cast of thousands are the ones who are doing the engineering on the products so that we can have profit
enough so that you can sponsor these idiotic projects with Stan. If Stan's P/L's didn't get the revenues from the other products, (like the 100, 120, etc.) sold as part of the large systems, there would be no money to build these marginal products in a half-baked fashion.

I do hope you understand this whole mechanism a bit... just which side our bread is buttered on and who is bringing home the bacon and who is spending the bread money on betting at the races and at the lottery.   Sometimes I think you don't totally understand this. Tell me you do and that it's just an act.

Your drive for interim products at a time when we have an incredible array of mid-life kickers and interim products in order to live tomorrow really blows my mind. I don't believe you bought into Win's corporate Quality push. The crap you are advocating is all very marginal, in terms of cost-effectiveness. It is low in quality, and in no way can 3 half-baked products sell like one average one.

We really can only afford great products, and when we fail at these by making pretty good ones we may be able to skim by. But to start by building average ones is pre-ordained and continued failure.   I want to stamp out average-ness... you get this for free when trying to be above average.

I came to DEC several thousand years ago because there was a notion that it was going to build very good products and I can remember spending lots of time in the hiring process cause we only wanted to hire very good people.

I remember explaining this philosphy to others and they would always ask, where do you get the average people that the world needs to really make things go? At one point, someone told me or I figured it out that the average is something you get as a mistake when you don't make the best. So you really never should hire these folks, you get them for free as errors in hiring really good people.

Products are like this. I don't ever want to be involved in building an average product, and normally if I see one I avoid it too. I really can't stand to worry about them either cause there are so many of them

around and I'd go crazy if I ever thought very long
about them ... it's like trying to keep squirrels away from
the bird food. I view you often are out giving pep pills
to the squirrels... which is ok by me, cause I normally don't
notice squirrels. What I don't want to happen is to
demotivate
the giants who gather our food at the same time we feed the
squirrels who only seem to eat away at it.

GB2.S5.67
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* d i g i t a l *
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TO: GORDON BELL*   DATE: FRI 8 FEB 1980
9:16 AM EST

FROM: DON ALUSIC

cc: see "CC" DISTRIBUTION   DEPT: DISTRIBUTED
SYSTEMS

EXT: 264-5187

LOC/MAIL STOP: MK1-1
N34

SUBJECT: DATAPOINT'S ENTERING INTO THE OFFICE AUTOMATION
MARKETPLACE

1.49
* * * * * * *
d i g i t a l   E M S   M E M O R
A N D U M
* * * * * * *

TO: Gordon Bell   DATE: 8 FEB
1980

FROM: Don
Alusic

CC: Larry Portner   DEPT: D&MS
     Dick Clayton   EXT: 264-
5187
     Roger Cady   LOC-MAIL
STOP:

Julius Marcus MK1-1/N34
Bill Johnson
Bill Demmer
George Plowman
Mary Breslin
Jack Gilmore
Tom Vlach
Bob Travis

SUBJ: Datapoint's Entering into the Office Automation Marketplace

There are a number of things about Datapoint's recent entry into the office automation marketplace that are extremely disturbing to me. First, Datapoint's history has been one of an innovator in both concepts as well as in market development. For example, Datapoint was first to pick up on distributed processing which other people then followed, and today it is a major industry topic. Next, about two years ago Datapoint came up with a concept of a local area network called ARC with up to 255 nodes on a local system. We are beginning to evolve into that direction as well as people like Xerox, etc. I expect that we are on the order of 2 years from a product in this area. However, Datapoint has had a product for at least 2 years.

Datapoint then stated that their entry into the integrated office automation was an evoulution of their ARC local area network. It seems to me that if their evolution parallels our evolution,

we are in
the order of 4 years behind them in the local area networking tech
nology and that if our integrated office of the future approach also
builds on local area networks that we are at least a couple of years
beyond that. If our history effort parallels theirs, and it certainly
has in the area of distributed processing and local area networks, it
appears to me that we are in the order of 4 to 5 years from having a
truly integrated office approach.

Datapoint is now working on storing forward voice and other issues
over their network. Those will be even later in our development. It
really seems to me that the integrated office will be the topic of the
eighties from the point of view of Digital and it will be at least the
mid 1980's before we have a major offering if our evolution parallel's
Datapoint's which it seems to have in the past. If the market will
wait for us, then we will be in fine shape, otherwise we will miss out
as others beat us to the punch. I'm concerned that the market won't
wait.

/sr

"CC" DISTRIBUTION:

LARRY PORTNER	ROGER CADY	JULIUS MARCUS
BILL JOHNSON	BILL DEMMER	GEORGE PLOWMAN

JACK GILMORE TOM VLACH BOB TRAVIS

00 BURT DECGRAM ACCEPTED S 2044 O 20 06-FEB-80 22:06:39

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* d i g i t a l *
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TO: OOD: DATE: WED 6 FEB 1980
7:39 PM EST
OOD: @CLEM

FROM: GORDON BELL
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1
A51

SUBJECT: SPACE GUIDELINES FOR TOMORROW MEETING

Excuse the poor form as I couldn't go back and edit the draft I sent to John.
One sure gets an appreciation of what systems should be designed like
in using this...but I digress.

The attached is a starting point. In addition, I feel we may be
going wrong direction in SS by having it co-locate in Hudson. Namely,
Hudson is going to expand too in the chips area and I don't understand
where they are going to go. Why don't we just let them expand there
as a semi operation, and not make them go somewhere else because their
site is all used up with hangers on?

We need some really good thinking in this whole area... and it will have
to be done by a good team that will be in constant communication with
us. It will be intense for a month or so while this gets done. Let's
persevere... it is really the design of our organization...

and is
our job.

ATTACHED: MEMO;53

****
* d i g i t a l *
****

TO: JOHN HOLMAN DATE: TUE 5 FEB 1980
5:34 PM EST

FROM: GORDON BELL
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1
A51

SUBJECT: GUIDELINES ON SPACE PLANNING (DRAFT FOR YOU)

In order to get our space plan to meet the 1990 constraint, it is necessary to add some guidelines that we feel will meet the corporate desire to have only 20% of the poplulation in Massachusetts. Rather than require a corporate bogie, we are going to take the position of putting together the most aggressive plan possible...and then see what this is in terms of the effect.

To me, the ideal is reasonably clear: make 495 the highway to connect all sites and to have these sites as close as possible.
Coming off the ideal then, here's the guidelines I'd like each
OOD member to use:

1. No growth in Massachusetts.
2. NH is already commited to an aggressive growth. Grow the Comml and Computer Products Groups in accordance with their growth rates. Leave SR2 as space for growth of SR1. Leave Dist. Processing in TW.
3. Grow systems groups in various volume plants to assist in the move to Dock Mergeable products.
4. Establish a major engineering site in SW for terminals, with
residual in Mass at no growth.
5. Establish a major engineeing site in NE co-located with Mfg. for Mass storage. I.e. this would be the growth site. Furthermore, NH and Mass would be off limits for growth.

6. Plan an organizational move to RI in this go around.
7. Cap building 12 as OCE (office of Central Enginnering) for LP,GB,JM,SF, and MK.
8. TOPS to co-locate in a fixed, no growth building with Will.
As this support and central part of this organization grows, it
would co-locate with systems customers and prototype plants.
9. Consider co-location of low end mass store with low end systems.
10. Point 1, would be subject to allowing only growth for LES (not Terminals) into Hudson 2 as planned.

If we can base a plan on these concepts, I think we have the potential for a better organization with more dispersal to Mfg.
and which starts seed operations in the SW, in RI, and somewhere
else in NE for Mass storage (the growth/product portion).

00 BURT DECGRAM ACCEPTED S 2807 O 75 08-FEB-80 11:17:17

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION   DATE: FRI 8 FEB 1980
11:13 AM EST

FROM: GORDON BELL
cc: LARRY PORTNER   DEPT: OOD
DICK CLAYTON   EXT: 223-2236
LOC/MAIL STOP: ML12-1
A51

SUBJECT: ARE OUR PRODUCTS/INTRO STRATEGY WRONG IN LE?

Have just learned that one can't buy an 11/23 in Europe because P/L's and Europe have determined that small systems are too expensive to sell. DCG is the only outlet and it is OEM mainly. Some of my university friends would like them and I think there would be eventual payoff by letting them know that DEC does build microcomputers, something that they would never otherwise know. There outlet is via the reseller.

It seems to me we ought to consider the following:
1. Stop development of small systems because they clearly can't be marketed through our current channels.
2. Build a channel for small system and only or predominantly sell them through this channel.
3. Treat this as a special case of good times, and not introd.
the product at the systems level at all. Let the resellers eg. Plessey have all the 23 modules and let them sell the 23's instead.
4. Offer 02's at the systems levels (apparently they exist) and
then price an upgrade kit to 23's when the board becomes avail.

Given that the recent set of poor market showings in PDT, 78??, 03's?, and now 23's at systems levels, should we do some rethinking? Eg. form a low end product line? Make only a single PL responsible for a product (eg. Minc)?

I am experiencing the same proble in the introduction of the personal VAX...namely ESG is clearly the lead P/L, and it would
be good to introduce it there first. Also, I think in this case
we have a real leadership product as the Personal Professional
Computer for the serious computer user with a big problem or work that they want to run.

Someday we ought to discuss these issues calmly.

"TO" DISTRIBUTION:

JACK MACKEEN @MR16   MARKETING COMMITTEE: MARKETING COMMITTEE: @CLEM

****
* d i g i t a l *
****

TO: GORDON BELL*
10:37 AM EST

DATE: FRI 8 FEB 1980

FROM: DICK ECKHOUSE

cc: JIM BELL
GROUP
    SAM FULLER

DEPT: CORP RESEARCH

EXT: 223-8706
LOC/MAIL STOP: ML3-2
E41

SUBJECT: RE: RE: UNIVERSITY CONSULTANTS

I've found a willing consultant who will take the VAX machine after he
satisfies our consulting needs. I've sent Nat Parke a copy of his resume.
His name is Larry Wittie, and Any Knowles group has supported him in the
past to build a micro-net using LSI-11's and an Ethernet interconnect
protocol.
.

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*****************
* d i g i t a l *
*****************
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TO: JIM WILLIS DATE: FRI 8 FEB 1980
11:22 AM EST

FROM: GORDON BELL
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1
A51

cc: see "CC" DISTRIBUTION

SUBJECT: WPS ON AN 11 THAT'S COMPATIBLE WITH THE 8

I understand you are contracting to bring in a WPS on an 11 that's
compatible with the 8.

Can we make arrangements for the QC and tester to insure compatibility? This sounds great to get WPS in the very small 11
area...but we need the compatibility to take advantage of the training, documentation, sales, and customer (MSR) support we have now
on WPS. Let's keep up the momentum.

Can you give Jack Gilmore or myself a call?

GB:swh
GB1.S1.56

"CC" DISTRIBUTION:

IRWIN JACOBS	ROGER CADY	JULIUS MARCUS
JACK GILMORE	BOB TRAVIS	BRUCE STEWART

00 CORE DECGRAM ACCEPTED S 000304 O 56 21-AUG-82 13:04:43

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* d i g i t a l *
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TO: see "TO" DISTRIBUTION DATE: SAT 21 AUG 1982
12:43 PM EDT

FROM: GORDON BELL

cc: BILL AVERY DEPT: ENG STAFF
JACK SMITH EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

MESSAGE ID: 5173246145

SUBJECT: PHASE 0 OF A POINT PRODUCT TO GET A DECENT WPS

I just typed on the CT300 with the bounded system. It was great (especially to have an editor that was responsive and didn't scroll the part off the screen I wanted to work on). The only problem with it is that CT is awfully expensive. We have to go into cost reduction to get CT competitive across the boards don't we?

Julie, Stroll, Fernald and I want this product as part of the next office set. It's the same applications software that runs on VAX and CT, so it's compatible with them fully.

I don't see that there's any problem of the fact that the bounded kernel that runs the application is not ctab because this is strictly a bounded product that ONLY runs this software ((Whatever's written in Koala). The only touchy problem is how much interconnect it has. I'm happy with the ultimate minimum... the terminal emulator! Anything else would be done using the CT350. In this regard, it wouldn't even be capable of document transfer to VAX, if we really want to bound it. It would have CX (terminal emulation).

Let's get on with it, but let's REALLY bound it to the above to avoid having the kernel grow to a full blown operating system that handles all communications, disks, etc.

I'd sure like to be a test site when it has some rulers and if it has CX... this is all I ever use. (I love the Digicalc it has and would probably use that and the HP calc it has too). Please, please, please get one for me. It's the least you guys could do for being such a longtime WPS user!

"TO" DISTRIBUTION:

BOB DOCKSER	BILL JOHNSON	AVRAM MILLER

WPS USERS - Leave HP mode and type <CR>

00 BURT DECGRAM ACCEPTED S 21063 O 38 14-SEP-80 13:15:29

****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION   DATE: SUN 14 SEP 1980
1:03 PM EDT

FROM: GORDON BELL
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: WPS/EMS/KO DIRECTION AND STATUS

The attached is indicative of the high degree of confusion and unproductive hassle surrounding the WPS/OFIS/KO program across the Corporation. I believe we must do everything necessary to focus management attention on the critical issues and to limit the level of hassle wherever possible. The following is a brief statement of our current Engineering strategy which I propose we use to help clear the air and focus management attention across the Corporation.

1. Foundation Strategy

The KO project has become the top priority project toward the achievement of the Foundation Strategy approved by the Marketing Committee on 25 August 1980. The first version of OFIS on KO will be a single user, "minimum" implementation of Word Processing on a sound architectural base. Clean architecture and time to market are the critical success factors. The functionality of V1 will be defined by Engineering and reviewed with the Marketing Committee.

We will follow KO V1 with greater functionality in V2. We will also be moving later versions to multi-user operating systems. At present, I believe we should do only this for VMS. At this time, I don't want Engineering to be quoting schedules or functionality on any activity beyond KO V1. I want to focus their attention exclusively on the V1 KO project. We will continue to accept product requirements for future versions through our Product Management organization (Si Lyle's group). I do not want Engineering responding to these requirements until the schedule, functionality, and architecture of KO V1 software is well established and deep into the implementation phase.

2. WORD-11

It was also agreed at the 25 August Marketing Committee meeting to begin immediately negotiating with DPD in an attempt to bring WORD-11 into DEC as a corporate product on RSTS. Buzz Brooks has the action item to report back to the Marketing Committee on how WORD-11 will be sold and supported by WPG and the end-user product groups. I am assuming that if we are successful in bringing WORD-11 in house, we will stop selling the WS200 multi-user PDP-8 system. In addition, I am hoping that the Electronic File Cabinet (EFC) will be unnecessary with the acquisition of WORD-11 as a corporate product, in that a bounded version of WORD-11 will accomplish similiar functionality.

3. Electronic Mail

Engineering still has a commitment to produce an Electronic Mail capability (DECMAIL) on VMS and test market this product on VMS as soon as possible. I am giving the above two activities (KO and WORD-11) top priority within Engineering, and I want to defer (temporarily) planning activity on DECMAIL until the organizational and technical issues surrounding KO and WORD-11 are sorted out. Once this is accomplished, we will provide a firm schedule for the test marketing of DECMAIL under VMS.

I hope this clarifies the Engineering strategy for Word Processing and Electronic Mail as it has evolved rapidly over the past several weeks. I need your support to focus management attention and critical resources toward the successful completion of these critical projects. We need now to strengthen our resolve, focus our management attention, and curb our insatiable product/feature appetites until we establish a firm base upon which we can build. Unless we begin to get an underlying technical base, there will be no basis for building anything!

Meetings and memos do not produce products.

I would hope the people who are moved to continue meeting on product direction and requirements would temporarily suspend their meetings and consider how we might sell the products we have and are trying to buy. Please let me congratulate you on the admirable job you have done in stating the product requirements.

I am personally involved in the design of the base
architecture
and feel we are addressing the requirements.

We will not operate in a vacuum, but will have review in a
well
defined fashion. Furthermore, there will be progress reports
as
we proceed with the design. Bruce Stewart, Bob McKenzie and
Bob
Daley will outline the detailed process this next week.

"TO" DISTRIBUTION:

BUZZ BROOKS   TOM CHISHOLM   BOB DALEY
ROSE ANN GIORDANO   OPERATIONS COMMITTEE: LARRY
PORTNER
GLENN REYER   BRUCE STEWART   TOM VLACH
TED WEBBER

ATTACHED: MEMO;153
****
* d i g i t a l *
****

TO: see "TO" DISTRIBUTION   DATE: FRI 5 SEP 1980 2:19
PM EDT
                                     FROM: JOAN ROSS
                                     DEPT: TECHNICAL GROUP
ADMIN
                                     EXT: 231-5037
                                     LOC/MAIL STOP: MR1-1/A65

SUBJECT: OFIS STRATEGY NOT MEETING MAJOR TG NEEDS

As I understand it the OFIS strategy has evolved into the
following series of products:

1. WORD-11 on RSTS Q1 FY82 or earlier

2. DECMAIL on VMS Q1 FY82 or earlier

3. OFIS FOUNDATION WP/EM on VMS, and then other op sys Q1 FY83

In addition there is now a new systems level product, KNOCK OUT, which is in some way tied to OFIS strategy.

KNOCKOUT a small personal computer that can be:

Version 1 - 9 months limited WPS
Version 2 - 24 months with full WP

The Technical Group has concerns relating to the OFIS strategy and the new systems level product.

For 5 months TG has asked for the following requirements to be included in the OFIS strategy. Our concern is that these requirements are not being met by Version 1 of OFIS Foundation nor Word-11.

TECHNICAL GROUP OFIS REQUIREMENTS

SHORT TERM (0 - 18 MONTHS)

- o Layered Word Processing on RSX by Q1 FY82

LONG TERMS (18 - 24 MONTHS)

- o Layered Word Processing on VMS by Q1 FY83. WP must include:

  + Optional Character Set -- Scientific
  + Math -- Including formula facilities
  + Ability to embed Graphics in text -- WP hooks into GIGI and other graphic programs
  + Editor for WP and DP must be the same

- o Layered Electronic Mail with the ability to handle graphics, text and data.

- o Layered WP/EM/Adm Function Products which interface with the software bus of LDP's Total Lab Computer

- o Operating System Priorities

  1. VMS
  2. RSX
  3. RSTS
  4. RT (not for EM)
  5. TOPS 20/10

These needs are a must for TG because we have a large market demand to be met over the next three years. If we had the above products today we could sell the following number of packages.

TG LAYERED PRODUCTS MARKET POTENTIAL
(Number of Packages Sold)

	FY82	FY83	FY84
WORD PROCESSING			
VMS	970	1600	2400
RSX	450	700	700
RT	1000	1200	?
RSTS	150	300	150
TOPS 10/20	150	120	80
ELECTRONIC MAIL			
VMS	670	1350	1900
RSX	280	500	400
RSTS	50	100	40
TOPS 10/20	70	70	30
GRAPHICS TERMINALS to use graphics/text interface			
GIGI	14000	16000	20000
VT125	6000	10000	14000

o This worldwide forecast assumes that we had the

VMS, RSX, RSTS, and RT product available Q1 FY82. It also assumes that the RT system is a subset at $2K, versus $10K for the others.

There is a need for the following OFIS action items to occur.

1. Version 1 of OFIS Foundation must include SCIENTIFIC CHARACTER SET, FORMULA FACILITIES, ABILITY TO EMBED GRAPHICS IN TEXT.

2. I understand that Knock Out is likely to delay OFIS FOUNDATION delivery date of Q1 FY83. If this is so, we need to explore with DPD getting WORD-11 on VMS and/or RSX as an actual product.

3. Also DEC needs to solve 1 year incongruity of WP on RSTS and EM on VMS.

TG needs to understand the KNOCK OUT product with the following action items to occur.

1. KO need to formally clarify impact on OFIS FOUNDATION product.

2. TG should be thoroughly informed about the KO product strategy.

3. TG needs the opportunity to position KO product in terms of our own market strategies.

4. TG needs to meet with KO project team to discuss how it fits our market needs and raise issues of concern.

05-SEP-80 14:34:35 S 2365 MLDP

"TO" DISTRIBUTION:

BARBARA CHAPIN @MR11 PAUL BAUER GORDON BELL
BILL MESERVE @MK12 BOB MCKENZIE @MK12 TOM
CHISHOLM

STEVE COLEMAN BOB DALEY DON GAUBATZ
@MP30
BERNIE GEAGHAN JACK GILMORE ROSE ANN
GIORDANO
BILL HEFFNER HARRY HERSH IRWIN
JACOBS
JACKIE KAHLE BILL KEATING ANDY
KNOWLES
SI LYLE CAROLYN MCINTIRE WENDY MELA
AVRAM MILLER RON OLSON BOB PUFFER
RANDY GRIFFIN @MK12 GLENN REYER HERB
SHANZER
DIANE STANNARD BRUCE STEWART BILL
STRECKER
ROGER STRICKLAND TGMC MEMBERS: BOB TRAVIS
TOM VLACH TED WEBBER

GB1.S7.7
00 BURT DECGRAM ACCEPTED S 23137 O 72 27-JAN-81 02:02:31

****
* d i g i t a l *
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TO: BUZZ BROOKS DATE: MON 26 JAN 1981
23:06 EST
TED JOHNSON FROM: GORDON BELL
cc: MARKETING COMM: DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: GETTING CHARTERS AND ORGAINZED TO SELL WPS PRODUCTS

We are about to get our product acact really together here.
Now
I'm concerned that we may not be able to get the market.
Please
tell me it ain't so. But here's how I see it:

We have to win in the WPS and Office Marketplace. The only
way I

know how is to get the whole DEC sales force turned on in a co-operative fashion. I predict the new line of products will
only get us less marketshare, given our present Gerrymandering of
the products and customers among salesman and marketers.

We currently sell:

78(stand alone); and

the DATAPRO award winning WS200. The 200 is unsuccessful
because it is an 8 and also because the large WPS market
has evolved to be like computing whereby there are new
releases and new features... hence it is limited.

We are shortly introducing and have:

278, and 278 RL as standalones;

WS200s in inventory;

WS200 replacements based on DPD ... call it WS200A;
this is bounded to only do WPS

WS200FC, the file cabinet;

WS200WP/DP, the layered DPD product; and

potentially a terminal only version of the 278; and

the Electronic Mail/Office Automation story.

We have no forecasts of the 278 to speak of, no forecasts of the
WP200A, 200FC, or 200WP/DP, and little experience of the other
groups to sell WPS. We have a competitor that has grown at 70%
per year, and we have the capacity to build 278's. We will
introduce the above. It will:

1. Get the WP salesman their bookings based on large systems. Now they can become an old boy.
2. Get some interest in the other P/L's so these sales persons can feel good. This gets us a large backlog in both the P/L's and in WPS P/L's.

3. Create inventory in old 200's and 278's. The sales
and marketing groups will have conspired to reach Nervana
... big, unshippable, backlog in our standard mid-range
systems.
4. Get continued, negligible market share.

I suggest a radical restructuring of the P/L charters along the lines Ken has been advocating BEFORE the WPS Sales meeting next month. It would give these charters:

WPS- sell all WPS products, excluding layered WP/DP!
End user- sell any products they want. (I know they can't afford to get involved in the 278 or the 200.)
TPG- Use the terminals resellers to sell the 278 electronic only version as a pre-programmed terminal, as part of the VT100, Smart terminal series. It is infinitely better than the kludge they will introduce as the VT131!

Frankly, I would like to see Digital and our customers win for a change by letting the customers buy the product they need, independent of P/L. The above proposal would:

1. Get WPS P/L business automatically by drag-along sales and by non-participating P/L's.
2. The key P/L's would learn about WPS and would sell them directly, rather than having to have to call in their WPS colleagues, giving us a cheaper cost to book.

My admittedly limited view in the field is to see a salesforce groaping with how to sell low cost systems with no tools or leadership from the folks back at the ranch (ie marketing, cause they are spending all their time praying, wrenching their hands and talking to the engineers).

If we persist in the Gerrymandering, then all we will get is a
backlog, unhappy customers, continued complaining salesfolks,
continued ignorance about WP systems by every salesperson,
continued needs for having two salesperson covering a customer,
continued inexperience on how to distribute low cost systems, and
continued diddly marketshare. Remember: the bulls make money and
the bears make money, but the pigs get slaughtered.

I think we have the products and I would like to win!
(The above proposal let's everyone win!)

What you say?

Gordon
PS
Independent of how the corporation measures this, I only intend
to measure us on total marketshare. It's irrelevant who
distributes the product!

Buzz, you could help here by forcing this radical proposal that
will get you more business.

Ted, please help.

GB2.S4.18

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* d i g i t a l *
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TO: see "TO" DISTRIBUTION DATE: TUE 9 JUN 1981 8:49 EST

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION DEPT: ENG STAFF

EXT: 223-2236
LOC/MAIL STOP: ML12-
1/A51

SUBJECT: LOWEST COST WPS, ETC. USING LA'S AND COMPUTING
KEYBOARD

The recent proposal to make the smallest wps system based on the
following needs filling out, and Ken and I would like to move:

- LA12, a portable system not unlike the TI terminal
- LA24, a super, editing typewriter... WE MUST (like Avram suggests) position the LA24 as a device SUPERIOR to a daisy wheel, in that it has better quality and much more functionality, letting us do line drawings too!
- VT200, half and full page, giving us a WPS in a terminal and based on the fact that a version of our WPS will run in 64Kb
- John Kirk's portable, computing keyboard

BATTERIES, 64KBIT CMOS RAMS, AND LCD'S WILL DRIVE IT
In FY83 the world will be supplying really high quality lithium
batteries with 10 year lives AND 64 KBit, low power, CMOS rams
enabling us to have 2 pages of storage in a terminal for only a
cost of $10. We can also make portable cartridges with the chip
and battery in them that will take the place of floppies for some
applications. Also, LCD's are getting bigger and better. A
display to look at several lines is probably adequate.

I suggested the first two, and thought that we might want to
offer as an option, a simple crt monitor or tv interface so that
the user could do more editing based on looking at more of

the
page. It is interesting to note that we will be facing many
competitors of electronic daisy wheel typewriters in the
future
who also can do all of the functions, buy arbitrary character
sets and line drawing. Inevitably, the market will pull them
to
first have more and more page storage ala the IBM memory
typewriters and then an interface to computers and TWS/telex.
Therefore,

LET'S BE NUMBER ONE IN LOW COST WPS TERMINALS!

WHAT WE NEED TO DO:

. Resurrect one of the many hardcopy-only editors that we used for many years before (circa 65-75) we had crts (e.g. SOS, the BSR editor we used in the LA36, the TI editor) and decide which one is adequate (maybe it's TI, due to base). BRUCE, please use Kaola to program us several of these editors so we can specify the editor experimentally.
. Look at the requirements to add this into both the LA12 & 24 (I trust this is an add-on due to schedule interference!)
. Look at the requirements to add a CRT to both the LA12 & 24
. Make sure the computing keyboard will do this job
. Determine the take away files by allowing a user to attach a standard tape recorder or dictating machine and having the embedded modem for each of the above systems directly drive the tape recorder for file storage ... maybe as simple as one document per cartridge.

Can we get a plan together from the various quarters to do
the

experiments to see just what we have and what we need?

GB2.S6.26

"TO" DISTRIBUTION:

DON GAUBATZ BILL PICOTT BRUCE STEWART

"CC" DISTRIBUTION:

TED JOHNSON JOHN KIRK SI LYLE
AVRAM MILLER KEN OLSEN LARRY PORTNER

****
* d i g i t a l *
****

TO: BUZZ BROOKS DATE: SUN 29 JUN 1980 12:03 AM EDT
JACK GILMORE FROM: GORDON BELL
cc: see "CC" DISTRIBUTION DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: SLAVED TUBES ON WPS FOR FORGRD/BACKGROUND AND SECT./MGR USE

Your idea of slaving two slopes together for the manager can best be solved by taking two 100's and paralleling the inputs and outputs so that either scope can be used.

Stan and I were discussing a similar system where it would be great if his secretary had a two channel wps system, like a 2 push button phone. Either terminal could communicate with either channel. One wouldd be set up for viewing or mail for the manager (who is presumably less adept at doing these things) by the secretary and then control passed in the same way that a telephone call is passed. The manager would go through the mail or wps message log by hitting a few keys and there would be conventions.

MJ...let's get some switches for our terminals and try this, given
that we have a wps200 and we can operate 2 channels in parallel or
switch to one another.

Also, typed messages would be passed to the manager via the wps in this way. We would have to figure out simple ways to pass message back, but in some respects, just having Stan or Julie do plain old wps editing by typing Y or N for most of the things would go a very long way to working.

Well folks, let's try it. It would be a big help to MJ and I and I suspect it would work well in both the single and dual channel systems.

Any comments. (Jack will you get the hardware switches together
for us to connect right into our terminals?)

As a seperate nifty device a user could use this switch so that they could do foreground and background processing. Often
times I want to simply interrupt a wps or ems i/o and go to another
channel to send off a wps or write down a letter or note without
changing context. Also, this would let a person initiate a long
list processing job and switch to another context.

The awful beauty of this is that it is a simple hardware mod and requires absolutely NO software... Yet it potentially gives us
a really useful capability for either single or multi-user systems.

Another reason why a multichannel system can be made to be useful.

"CC" DISTRIBUTION:

BOB DALEY MARY JANE FORBES JULIUS
MARCUS
STAN OLSEN BOB TRAVIS TOM VLACH

GB1.S5.37

00 CORE DECGRAM ACCEPTED S 005505 O 513 16-NOV-82
20:10:15

****
* d i g i t a l *
****

TO: FOREST BASKETT DATE: TUE 16 NOV 1982
1:01 PM EST
SAM FULLER FROM: GORDON BELL
cc: BRUCE DELAGI DEPT: ENG STAFF
EMC: EXT: 223-2236
MAHENDRA PATEL LOC/MAIL STOP: ML12-
1/A51

MESSAGE ID:
5181987933

SUBJECT: WRL CHARTER

GB3.S8.54

After visiting the bay area and Stanford, it's clear that the
Lab was
a great idea and represents an incredible opportunity.

1. LISP

I hope that it will provide a home until development
groups reach critical mass; e.g. Mahendra needs an interface

(Xerox, Teknowledge, Stanford, . . . TSI) to do the LISP work.

2. Print Service

The opportunity to get a decent graphics and printer interface with Brian Reid sounded very good.

3. General lab for ideas

In fact, it would be nice to have enough lab space so that we fabricate hardware for various faculty (consultants?)

4. Stanford CS/AI Project

Similarly, if and when Bruce Delagi et al get a design for an AI Semantic Net Machine, it might be worth doing the work there -- (my current feeling is that universities should work on the design, and the detailed engineering and fabrication should be done by companies (to transfer technology and save university resources).

5. University-Engineering Net Gateway

Berkeley asked to have a link to us. Is it possible to make a "safe gateway" at your site so that mail can be sent, and logins can be filtered out? Sam, shouldn't you propose links of this type into our engineering net?

6. SRI Graphics Work.

Titan looks like a great machine to breadboard various graphics algorithms on.

7. Lawrence Livermore Labs -- Packaging

LLL looked much more active than it had in the past. We have an opportunity to cooperate on packaging -- their S1

(Mark
III). (Lowell and Tom are looking for an invitation.)

8. LLL -- mP.

I offered to get them 50% on a 784 (4Pc - shared Mp) for two projects: software to test multiprocessors before they get their Cray 2 (mP) and the S1 (mP); and the dataflow simulation. This later experiment would allow the basic work on dataflow that I think is going to payoff -- the language to drive large mP.

9. AI Applications Group

This could start at WRL, but should move out when it gets larger.

Gordon

P.S. Mostly right now I'm excited about the group because we badly need Titan.

16	WS102 20				
		1/22/79		NO/DA/TE	3
	1	0:00	0:00		
15	TU59 Spec. - To: John Kevill				
		1/22/79		1/22/79 9:15	3
	1	0:06	0:06		
14	China Junket Opportunity -- To: OOD				
		1/19/79		1/22/79 9:20	4
	7	0:00	0:03		
13	Resume' - T. S. Hermann, Ph.D. from CMU				
		1/19/79		1/19/79 3:09	2
	1	0:17	0:17		

12 Prof. Lee's MIT LSI-11 Microcomputer Lab, To: Johnson, Ted et al

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                         1/19/79                   1/19/79 2:33  6
      2                  0:18     0:22

11          Prof. Lee and China  To: Janzen, Carl et al
                         1/19/79                   1/19/79 1:36  3
      1                  0:07     0:07

10          comm line/option handler problem
                         1/17/79                   1/19/79 2:41  8
      8                  0:02     0:21

9           arpa/halio/rupp
                         1/17/79                   1/17/79 12:44
     2                     1      0:03             0:03

8           follow up notice
                         1/17/79                   1/17/79 10:57
     5                     1      0:05             0:05

7           temp
                         1/16/79                   1/18/78 0:34  4
      19                 0:01     0:19

6           editors
                         1/16/79                   1/16/79 11:52
     5                     1      0:05             0:05

5           christiansen
                         1/16/79                   1/16/79 11:47
     2                     2      0:01             0:02

4           oc salary review
                         1/16/79                   1/17/79 11:55
     5                     5      0:01             0:26

3           gus ashton--ad
                         1/16/79                   1/17/79 11:45
     2                     2      0:00             0:01

2           blake
                         1/16/79                   1/17/79 12:39
     2                     5      0:00             0:06

1
                         1/16/79                   1/22/79 12:33
```

FROM: GORDON BELL DATE: SUN 3 FEB 1980 5:57 PM
EST
DEPT: OOD
EXT: 223-2236
TO: STAN OLSEN
BRUCE STEWART
cc: LARRY PORTNER
SI LYLE
JACK GILMORE
BOB DALEY

SUBJECT: WS200 VS WD200

I just read the based techinical brochure on the WD200 and I am scared to
death. If we have 100 in field that are commits, we have a major problem.
No way, can I see this being a viable product. Certainly we have to decommit.
I don't even think we want to admit that it can be run as either wps or as a
dp (shared system), cause we don't have any support for the shared version.

Given the small number out there, only $5M, I believe the best thing might
be to use some system like RSTS as the host and use the DX software to get the
sharing and to go back to a different form of shared system.

Right now, I'm also very sceptical of how many offices really want the
shared system anyway. Jack, you have to lead us through a segmentation method-
ology so we can understand where it would work and why? I can't see the average
set of secretaries having this machine in their midst. It has all sorts of
lokc-ups when stuff is improperly assigned, it will have file back-up/ roll

back, etc. problems that are implicit in managing installations. Somehow
fixing these seems like a never ending task, and it's another operating system.
As far as I can tell, the people who really want them are the DP managers so as
to insure tenure by making others depend on them for system support and possbily
programming (DP) which will insure lock-in.

Clearly we have to get out of the WD. For the people who might suit us, I
think giving them a system that does DP, and stores their WP files may be the
best and cheapest way out. Let's be quite open about the possibilites--let's
not try to design our way out of this one, the 8 is well beyond its depths now.

GB1.S1.55
a
Wulf has worked in two major areas of computer science:
machine architecture and operating systems; and
compilers for a broad class of languages and machines.

Wulf was the main architect and leader of an effort that built one of the early multiprocessors, C.mmp, using the Hydra Operating System at Carnegie Mellon University. This work, circa 1970, triggered much of today's work on parallel processing (currently 50 research efforts and about a dozen products are predicated on multiprocessors). In 1969, Wulf participated in and contributed to the design of the PDP-11 instruction set (architecure) especially in regard to programmability.

Wulf's main work for the last 10 years has been in the science and technology of compilers that are capable of handling a large range of languages and machines. The techniques have been reported for others. In addition, his first language, BLISS, has been the implementation language for Digital Equipment Corporation for 10 years. This compiler proved that machines could consistently produce results that were better than system programmer code. Three years ago, Wulf and several associates established Tartan Laboratory to "productize" this knowledge of Production Quality Compiler Compiler (PQCC), ie a compiler capable of generating other compilers from a description of the machine and the languages. The first compilers are now available and live up to the quality, efficency and cost goals. Tartan has the potential to revolutionize the compiler/language industry into an engineering based discipline.

b
I believe Wulf is the best compiler person.

c
As a professor of Computer Science at Carnegie Mellon, Wulf has contributed to the training and body of knowledge.

d
Wulf's contribution has been as projectleader, main idea generator, principle author and principle programmer.

Digital **Interoffice Memo**

Subject: **__Xerox: Buying from, Selling to, and Competing with__**

To: OOD
Ed Corell
Jack Gilmore
Win Hindle
Bill Long
Dennis Martin
Stan Olsen

Date: 1 NOV 76
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 EXT.: 2236

F/U 11/8

I've just spent several hours interacting with several people from Xerox's Research Lab at Palo Alto. Overall, Xerox is paranoid about IBM and Kodak as competitors; and they've been fairly unsuccessful at getting more than the copier in the office. Their acquisitions included publishing houses, Diablo, Versetec, and Xylonetics (a precision plotter company). They're trying to sell word processing systems.

The Palo Alto Lab has probably the biggest collection of bright computer engineers and scientists I know of, and they've put together some quite significant systems that could revolutionize the office.

In contrast we're doing a number of evolutionary products, trying to get the market to adopt them, and we'll learn from and build better ones. I suspect we'll get there much before they do...if only because Xerox may fundamentally just be a company that was very lucky with the copier patent and smart enough to promote it! At $5B, it's hard to think they can make any movements in Manufacturing-Sales-Engineering...and they're afraid to take risks.

<u>Sales</u>
I'd like us to visit them at Stanford to try to sell them office computers. They're putting computers in their word processing equipment and in the fancier copiers. If we wait, they'll do their own thing. Bill/Win, would you join me? There are sales everyplace else (e.g., in Engineering and R/D). Are we selling to them now? I have an idea of organization. Who's the National Accounts person(s)?

<u>Purchase</u>
Also, I'd like to get them to make copier technology available as printers as alternatives to what we use in the form of line printers. (In house use, for example, could be quite useful.) Ed/Bob, should we go?

We should use the Versetec in house.

GB:ljp

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* d i g i t a l *
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TO: see "TO" DISTRIBUTION DATE: SUN 14 JUN 1981 14:11 EST

FROM: GORDON BELL

DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: XEROX MAY BE A COMPETITOR...

I was wrong. I didn't think they could move fast enough or use their research output in products. Now it appears because of the small size of their startup office products group, they can really move rapidly and get things manufactured quickly... just like a small company. Furthermore, they do have stores and salespersons to sell very low cost products. Probably the secret is they sell very large quantities to a few users to get high ticket orders, just like our salespersons do.

Sounds like another reason we will want to roll over and play dead!

As a counterproposal:
Let's have an aggressive product announcement of the
 .278 for standalone use and as terminal emulation
 .Shared systems with all the bells and whistles
 .Shared systems with Dataprocessing
 .EMS
 .DECset

All these exist, are compatible and have to get to the market!

When can we start behaving as though we want to supply products for this use?

"TO" DISTRIBUTION:

BUZZ BROOKS SI LYLE AVRAM MILLER
OPERATIONS COMMITTEE: LARRY PORTNER BRUCE

STEWART

ATTACHED: MEMO;83

```
*****************
* d i g i t a l *
*****************
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TO: see "TO" DISTRIBUTION
22:43 EST

cc: GORDON BELL
BOB MOORE @MSXX

DATE: FRI 12 JUN 1981

FROM: BOB ERICKSON
DEPT: OIS
EXT: 223-3514
LOC/MAIL STOP: PK1/F60

SUBJECT: SCORE ONE FOR XEROX

You all missed an interesting product presentation by Xerox today. As disapointed as I was by the IBM Displaywriter, I am impressed with the 820 and Xerox`s family of Ethernet products.
The presentation today focused on the Xerox 820. Key points on this product:

-Price $2995 includes display, keyboard and two 5" floppies.

-By using th CP/M operating system Xerox can offer a complete set of applications on the 820 due to the software existing on CP/M.

-In addition to WP they are offering a Supercalc(?spelling) which is a row/column table capability.

-When the chip is available from Zilog the 820 will tie directly to an Ethernet cable.

-The story is Gordon that Xerox started the design in January of this year and by April they were gearing up the manufacturing capibility.

What I like about the Xerox offerings is that they are offering a family of products for the office. They now have a series of personal computers in the 820, 860 and Star and within a few months an electronic typewriter. These all will connect to an Ethernet which can provide a file server, a print server, a comm server and within a few months an interface to the 5700. This is a set of equipment that we need to get some experience and I believe we should proceed with our plans for an Ethernet pilot in Tewksbury.

Given that it is going to be at least three years before Digital has a set Ethernet based products I believe that DIS should make available to the internal users the family of Xerox based office products as a second source to the DEC office products. Two points here the 820 is not that much more than the WPS-8 and as I see the value of an Ethernet concept is in the ability to have a multi-vendor highway. In the long run I see more opportunity for DEC and Xerox to get their systems to have a good interface on Ethernet. All the two vendors have agreed on so far
is the lowest level interface. If we bring in Xerox based Ethernet office equipment I believe DEC will understand better
how to build its local area network products.

I have also asked Kevin to submit a purchase order for six 820s for internal pilot use. I would like to see Gordon Bell, Ed Krammer and a few of the other individuals interested in office products experiment with this product.

Xerox will also be willing if some top managers from DEC want to view the 820 and Star to give a demo in New York or with a little arm twisting will bring the systems to Maynard if I have a couple DEC VPs on the list.

I now believe that Xerox will sell the idea of a local area network and I recommend that

DEC take advantage of an opportunity to obtain
some good tools for internal use and at the same time
learn how to build better office products.

"TO" DISTRIBUTION:

MURRAY COPP AL CRAWFORD JACK
GILMORE
ROBERT MCKENZIE BRUCE STEWART

GB2.S6.71

GB0002/32

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| | | | | | | |
| **d** | **i** | **g** | **i** | **t** | **a** | **l** | **i n t e r o f f i c e m e m o r a n d u m**
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+---------------------------+

Subject: **MORE ON XEROX ORGANIZATION**

To: Sam Fuller, TW/A08
Bill Johnson, ML3-5/H33
Andy Knowles, ML10-2/A52
Joe Meany, PK3-1/M86
Bob Metcalf, TW/A08
Bill Wise, PK3-1/M86

Date: April 20, 1979
From: Gordon Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

It would be helpful if we could get an organizational map of Xerox. I met Bob White, who is A / The Vice President of Engineering of Xerox in Rochester. He knew that we were interested in licensing Ethernet, for example. I also asked him to speak on our behalf to the issue of why not standardize on the PDP-11 and VAX-11 architectures within Xerox. He said he'd raise the issue and get us a hearing somehow. He also said there is a new person in charge of all these products that are relevant and that we should make hay now, while there is a 6 mos. honeymoon and the person can make decisions. The new person is John Titsworth, formerly in charge of operations at CDC. I feel comfortable enough about calling him if there is a need.

GB:swh

D I G I T A L INTEROFFICE MEMORANDUM

DIST:

Sam Fuller TW/A08 Bill Johnson ML3-
5/H33

Andy Knowles ML10-2/A52 Joe Meany PK3-
1/M86

Bob Metcalf TW/A08 Bill Wise PK3-
1/M86

EMS 15-MAR-79
12:04:18 150 1
To: Roger Cady, Julius Marcus
From: Gordon Bell
Date: THU 15-MAR-79 12:04:18 EDT

We've got to get in bed with someone on this. May I suggest we make it the
#1 corporate target to have it be ATT! Let's sell them on our equipment.
We're their friendly, helpful, non-competitive Mini supplier. And we'll
license, co-develop LSI VAX, etc.

Forwarded message:

EMS 8-MAR-79
09:24:43 510 1
To: Richard Loveland
CC: Jack Gilmore, Gordon Bell, Don Alusic
From: Ralph DeMent
Date: THU 8-MAR-79 09:24:43 EDT
Subject: XTEN Petition by XEROX

I will be happy to send you copies of the Petition. I am also

sending copies
to the reset of youas you might find the market projections for EMS type
services interesting. Dick, the only other info is a 4 page glossy that adds
nothing. I don't have a copy. If the Yankee Group Conf is held on March 21,22
I will bring back what ever info I get and make it available. The seminar
may not be held as Xerox might back out and not provide a key speaker.
Network Analysis Corp is doing a lot of work for Xerox on XTEN, however are
under the tightest non disclosure agreement I've ever seen. An interesting
twist is that XTEN could become SBS's biggest customer if the price were
right. Under such an arrangement, their services wouldn't compete but would
complement. SBS getting the F100 and XTEN going after the rest who can't
afford the earth station start up investment but could afford a roof top
microwave investment.

Command:

00 BURT DECGRAM ACCEPTED S 3930 O 45 27-SEP-79 14:45:46
FROM: GORDON BELL DATE: THU 27 SEP 1979 2:43 PM EST
DEPT: OOD
EXT: 223-2236
TO: JIM BELL
GEORGE A. CHAMBERLAIN
JIM MARSHALL
SAM FULLER
JERRY WITMORE @MR16

SUBJECT: YALE CONTRIBUTION

Dick Eckhouse:

Please contact Alan Perlis at Yale 203-436-8160 to see if we can help them
ins some way on their order for 220K VAX for which they have only 120K.

They have an asst professor , Josh Fisher who is wanting to do Research
on converting vertical microcode to horizontal microcode. He has
apparently done this already to some extent and vax looks good to extend
the work. I said we needed his work and/ or his consulting talent and
we should contact him (Wayne Rosing should?)

Command >

00 BURT DECGRAM ACCEPTED S 8790 O 44 28-SEP-79 15:02:53
FROM: GORDON BELL DATE: FRI 28 SEP 1979 3:01 PM EST
DEPT: OOD
EXT: 223-2236
TO: JIM BELL
GEORGE A. CHAMBERLAIN
BOB PUFFER @CLEM
JERRY WITMORE @MR16
cc: JIM PITTS: @SCTB

SUBJECT: YALE

I have a lot of personal respect for Alan Perlis and the
Yale CS Department is improving. Yale is generally regarded as
a plum, especially to IBM too. The 2 x 2060's are taking over IBM.
It also seems the CS Department is trying successfully to
displace the CC (which is IBM dominated) and this is another straw. Hopefully,

we can support them in various ways to continue our stronghold.

Gordon

Command >

00 CORE DECGRAM ACCEPTED S 005514 O 516 16-NOV-82
20:11:44

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* d i g i t a l *
****

TO: see "TO" DISTRIBUTION   DATE: TUE 16 NOV 1982
1:05 PM EST

FROM: GORDON BELL

cc: see "CC" DISTRIBUTION   DEPT: ENG STAFF

EXT: 223-2236

LOC/MAIL STOP: ML12-
1/A51

MESSAGE ID:
5181987944

SUBJECT: YALE CS DEPT. VISIT:SEVERAL OPPORTUNITIES TO
LEARN/INTERACT

I spent the day in New Haven and found interesting work.
Also, they'd
like to interact with us.

PARALLEL COMPUTATION

Prof. Josh Fisher is heading this. They have three
interesting
activities:

1. A compiler for building dataflow graphs that can be

executed in parallel. I see this as an interesting program for our own PPA. They are currently using it to compile fast microcode for the FPS 164 (see below). The source is T(iny) Lisp, and eventually Fortran. Also, they compile ELI as it's designed.

2. The ELI (Extra Long Instructions) machine is being designed. Consider it as either an ILLIAC IV-like machine with control of all units or a microprogrammed machine. A long, 500 bits or so, instruction controls several (say 20) arithmetic/primary memory units. They want to finish the design and then get someone to build it. I said we might want to build it if someone would pay us to do it,

providing
it looks good.
(Incidentally, we need to build much, much more hardware to
get the experience and learning curves!)

3. CAD is exciting, different but similar to our work on the
2080. It's written in LISP and starts as a data-structure.
They're doing display programs that "view" and operate on
this structure as needed. This is totally different than our
CAD which starts with a display input. Also, they're working
on automatic design across levels.

LISP

John O'Donnell (203-432-4666) heads their center and is remarkable in
his understanding of hardware and software. His group is doing
T-LISP, and they are quite concerned about a really good LISP on VAX.
They may be a resource.

PROF. MARTIN SCHULTZE (APPLICATIONS)

Is doing programs for Numerical Analysis of Scientific problems (CAD,
CAM, Scientific Dataprocessing) including VLSI. ESG's supporting his
work. They're building a large memory for the FPS 164 and it also
attaches to VAX simply. He said the problem with a Cray is simply not
enough memory. He thinks an FPS (or even a VAX) with 100 Mbytes will
outperform it due to I/O limitations. This means PPA should

have 128
Mbytes! (Only a $128K at current prices.)

He's like to work with us on microcode for the 780. Their compiler
really addresses the difficulty in programming the 164. Shouldn't we
simply build the large primary memory for the system, and market: a
780, large memory, the FPS 164, and their compiler?

ROGER SCHANK, DEPT. HEAD (436-0606) AND AI RESEARCHED

ROGER SCHANK, PRESIDENT, COGNITIVE SYSTEMS INC. (203-773-0726)

They have 15 or so programmers and want to build and sell an AI-based
Small Business System. They're leaning toward Appollo. Julius had
better get Bob Daley, Bill Noyce, Norma Abel, John O'Keefe et al there
to persuade them to use our VAX (LISP) since he wants to decide within
a month. The goal is a less than $50K system for 6 users and LISP and
a good database system. The Appollo will be down to $20K in a year.
Let's sell VAX!

The breadboard of this system is quite impressive and convincing!

"TO" DISTRIBUTION:

NORMA ABEL	SAM FULLER	TOM GANNON
ARNY GOLDFEIN	BILL KEATING	ALAN KOTOK
JESSE LIPCON	BILL LONG	JOHN MANZO
JULIUS MARCUS	MAHENDRA PATEL	PETER SMITH
BILL STRECKER	BOB TROCCHI	

"CC" DISTRIBUTION:

ULF FAGERQUIST   BOB GLORIOSO   WIN HINDLE
BILL JOHNSON

GB3.S8.60

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a n d u m
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Subject: **Your trip to the West**

To: Dick Clayton, ML12-2/E71   Date: 6/17/79
From: Gordon and Gwen Bell
Dept: OOD
Loc: ML12-1/A51 Ext: 223-2236

Here's some comments on your request: (Where Gwen and I differ we have made a special note.)

Avoid Fiji like the plague, don't let anyone talk you into it including a travel agent with a deal. It combines the worst of the English and the Indians (who are now the majority of the population). The important thing is there are great alternatives in that part of the world described below.

I don't see how you can possibly see Japan and Australia in this single trip and in a three week time frame. Would certainly drop Japan because it's clear that we'll all spend a lot of time there on business in the future. Have lots of places to go there, but won't mention them here.

The itinerary would look something like this:

Days 1-2: Boston - Honolulu: Kuilima Hyatt on the far side of Oahu. On travelling across the time zones it is important to have breaks to get acclimated and rested. The Kuilima Hyatt is where we stayed and where the natives go to get away from Waikiki. Renting a car at the airport you can see the island and get there

-- a very pleasant resort and a opportunity to see the island, go diving or go surfing, and rest.

Days 3, 4, 5: Taiwan -- time for the office and to see something. (Gordon thinks this could be two nights and not three.)

Days 6, 7, 8: Hong Kong: Repose Bay Hotel (do not let the people at the DEC office talk you into staying in the city.) This is 45 minutes from the downtown on the opposite side, over the wonderful cliff. The hotel is where "love is a many splendored thing" was filmed. It is the classic English colonialist hotel: big verandas, tea served properly etc. You can always eat in the Chinese restaurants etc. but live in old colonial style.

Days 8, 9, l0: Bali: KLM flies there from Hong Kong with a stopover in Djarkarta. If you want extra days for a vacation this is the place to do it. There are reefs for snorkeling, diving; temples and dancing for sightseeing; and excellent Indonesian food. Indonesia also has the advantage that of all the places they still have local crafts centered in Bali with batiks and jewelry and things that one might want to purchase, without being the kind of warehouse that Hong Kong is. (Gwen though, in Indonesia on a UN mission just couldn't go on a vacation -- had to return for Gordon's parents anniversary and this is on our life list as a must to see.)

Days ll, l2: If you are lucky you can fly Bali-Djarkarta-Darwin-Alice Springs in one day. If you are not you may have to stop over in Darwin -- not particularly worth seeing. Alice Springs is the desert outpost and really the place to get the flavor of the Australian outback. One whole day is plenty to see it.

Days l3, l4, l5: Sydney.

Days l6, l7, l8 : Christchurch.

Days l9, 20, 2l: Christchurch, Auckland, Tahiti in one day. Stay at the Travellodge. We stayed there. On every Saturday noon they have a local group of real dancers perform. We saw a church group from one of the small islands and it is really seeing good folk dancing. (The dancing at the Club Mediterranee in contrast was an absurd put on.) It is convenient to the airport, snorkeling, a rent-a-car around the island one day is easy and fun. Tahiti has the advantage (over Fiji) of being Polynesian in stock (not Melansian) and then having the French (not the British) as colonists. The Chinese are in there too to get the gardening and trading and work done. There is nothing to buy there in way of native crafts but the people are open and friendly in contrast to any of the other resort areas like the Caribbean. Make reservations to get a room over water in one of the huts...i.e. don't stay in the main building.

Day 22: The direct flight from Tahiti to L.A. goes at night and then you arrive in Boston the middle of the next day. (Anyway with the dateline you gain and loose a day and it all comes out even in the end.)

If you are planning three weeks with an extra weekend thrown in then you have one day to play with and add to something of your choice. We feel that you might just live through this but there really isn't time for any rest.

You could probably give up 1 day in Tahiti for more Bali time, but the stop is easy and worth it. Alternatively, if you gave up Bali (not advised), then you could get to a couple of the islands like Bora Bora (see Hurricane where we saw the movie being filmed) and Moorea and just use the Club Meditaranee, tacky but cheap and lots of diving, swimming, etc. facilities. There's a really stoggy, expensive Hotel Bora Bora to get rest if that's what you want.

Decide on the exact itinerary before hand and don't make any changes! Spending time in that part of the world getting air or other hotel reservations is a drag. Recommend the Brooks Brothers summer suits that are now supposedly on sale that are wash and wearable. Go out of your way to not take very much...certainly less than 40 #'s per person and only 1 bag plus light carry ons.

GB:swh

December 19, 1978

Rodnay Zaks
President
SYBEX Incorporated
2020 Milvia
Berkeley, California 94704

Dear Mr. Zaks:

In reference to your letter of November 2, 1978, sorry I'm not going to be able to review your books on microprocessors, although I have perused them briefly.

I'm sending you a copy of our recent book, Computer Engineering, which might contain information of use for future updates.

Sincerely,

Gordon Bell
Vice President,
Engineering

GB:ljp
January 12, 1981

President of Zebco
P.O. Box 270
Tulsa, OK 74101

Maybe you can read the words: "American Craftsmanship" on the Zebco reel. Notice the lack of winder and holding nut. The reel on the left was made somewhere in the Far East.

Enclosed is a photo that was taken last summer on a rafting trip on the Snake River.

Since I'm not an avid fisherman, I was only mildly irate that

I couldn't fish for 3 days. Since I fear and understand the Japanese as competitors, I can sympathize with our dilemma of being able to design and build competitive products in America.

In this case, like many products, it's probably just poorly engineered - not totally the problem of craftsmanship.

Sincerely yours,

Gordon Bell
Vice President, Engineering
Digital Equipment Corporation

GB:swh
GB2.S1.23

Enclosure - photo

****
* d i g i t a l *
****

TO: *GORDON BELL
16:15 EST
BRIAN CROXON
BILL DEMMER
SAM FULLER
JOHN O'KEEFE

DATE: FRI 19 JUN 1981
FROM: BILL STRECKER
DEPT: VAX ARCHITECTURE
EXT: 247-2130
LOC/MAIL STOP: TW/A08

SUBJECT: LICENSING OF THE VAX ARCHITECTURE

I have had several phone conversations with Bernard Pueto and John Banning of ZILOG. They are interested in licensing the VAX
architecture for use in their next generation 32-bit microprocessor.
Pueto was reluctant to discuss the microprocessor without a non-
disclosure agreement, but I extracted the following

information:

1. Single chip processor plus optional floating point chip.

2. Available in 10K/month volumes late CY83/early CY84 (18 months).

3. 2-3 MIPS. We had some discussion about what a MIP is and concluded that the processor performance goal was 2X - 3X 11/780.

4. Would implement (with the FP chip) the full VAX architecture including memory management and excluding the decimal instructions. The exclusion is due to an on-chip microcode space limitation.

5. Is implemented in a proprietary "non-memory type" technology.

6. If they did not get a VAX license they would implement the MCF Nebula architecture (a VAX derivative).

Because ZILOG has a severe time constraint they would like a quick answer from us.

I think we should seriously consider this proposal. As you know, I have repeatedly suggested in the past (with little success) that we more aggressively license/offer as a standard our architectures. I believe that we are rapidly approaching an era in which traditional hardware architectures are going to be dominated by official and de-facto standards and most cost effective hardware is going to be built to these standards.

I also believe we should seriously consider the product implications of the ZILOG processor. Assuming the availability/performance goals are met (clearly we should be skeptical) a gate array NAUTILUS in FY85/86 is a loosing product technologically. Another cut is that in a single/dual processor version, the ZILOG processor would cover the entire current and planned VAX product space. Maybe we should concede the low/mid range to the microprocessors and focus on Hypervaxes and software.

I would like your help on how we proceed to give ZILOG an answer.

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* d i g i t a l *
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TO: *GORDON BELL DATE: TUE 23 JUN 1981
9:55 EST

FROM: ANDY KNOWLES

cc: GVPC: DEPT: TECHNICAL GROUP
ADMIN

EXT: 231-6312
LOC/MAIL STOP: MR1-
1/A65

SUBJECT: ZILOG CHIPS TO IMPLEMENT VAX

Let's be careful! I don't agree with Strecker. Licensing the
-11
would have done us no end of harm from the vultures. I do not
see
what advantage licensing VAX would give us. We have taken a
strong
position patent wise.

Tell me why we need Zilog?

****
* d i g i t a l *
****

TO: ANDY KNOWLES
DATE: WED 24 JUN 1981
8:21 EST

FROM: GORDON BELL
cc: GVPC:
DEPT: ENG STAFF
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: RE: ZILOG CHIPS TO IMPLEMENT VAX

Agree we should be very careful and I don't see how we could license VAX. Although I think the times (competition from Semi-computer companies and IBM) may be very different than in 75-80.

I think we could construct some deal where we both could win, provided they can deliver anywhere near what they say.

We may need Zilog, like we needed Western Digital.

I say we should listen to anyone who promises a chip that's 2 - 3 times a 780. This combines Scorpio, Nautilus and Venus in 1 chip... probably too good to be true, but clearly doable in the next 5 years! I say listen for a little while.

WPS USERS - Leave HP mode and type <CR>